NDAQ Electronics Box Front-Panel Interfaces

Table Of Contents

General Information:

File Reference:

Word Doc: /net/isff/doc/ndaq/Schematics_Layouts_ExpressPCB/NDAQ_Interface_Panels
Web Doc: /net/www/docs/rtf/facilities/isff/ndaq/NDAQ_InterfacePanels
NDAQ_InterfacePanels_files, Serial2, NDAQ_InterfacePanel1

Power Connections: All boards have both an inner ground and an inner power plane. These are supplied by or are available to 2 types of connectors: a 15-Amp rated Molex (Digikey p/n WM5872-ND, and WM5862-ND) and 8-Amp rated Molex (Digikey p/n WM5624-ND, and WM5605-ND). Each of these connectors has a choke coil between its ground pin and the internal ground plane of the board. All Bulgin connectors have pin-8 (the middle pin) directly connected to the ground plane of the board. Each shield (Bulgin pin-2) can be connected to the ground plane via a jumper. Signal-Ground lines (Bulgin pin-7) are carried to the serial/analog boards via the ribbon header, and have a 1mF coupling capacitor to the ground plane of the board.

Ground Bonding: The ground plane of the boards can be bonded to earth through an aluminum electronics box via the mounting screw hole pads.

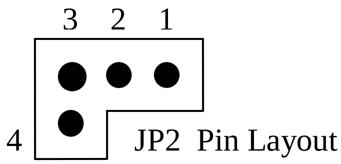
Fuses:
Fuses are LittleFuse SMF OmniBlocks. All fuses have internal resistance which provides the self-heating needed to produce failure. Larger fuse sizes have less resistance, and fast-blow have less than slow-blow types. Resistance and thus voltage drop across the fuse is roughly linear until approaching the fuse's rating. Measured voltage drops:

Fuse Size Rating	Current – Amps	Voltage Drop - mV
500mA (Fast Blow)	.1	40
	.2	85
	.3	136
	.4	205
	.5	300
1 Amp	.2	30
	.5	88
	.7	141
	.8	173
	.9	215
	1.0	267
3 Amp	.5	44
	.75	66
	1.0	88
	1.5	126

Board Layouts: were done using ExpressPCB software and as the manufacturer.
4-layer board. 3.5"x6.6", 1.25oz copper.
Tests were performed on the boards for current handling and exceeded those expected.

Sensor Power / FETs:

Each Bulgin connector has 2 options to provide +Vcc to the external device. These are enabled by use of jumper Pads JP2 (See panel layouts). ***This is true for all external connections on both the Serial/Analog and Viper Interface boards***:



1= + Power from FET
2= Power Distribution to Bulgin
3= Vcc Plane Connection
4= FET controlled Vcc Output

Option 1: None = No Power to Bulgin Pin-1: All JP2 Jumpers Removed
Option 2: Vcc = Continuous Vcc (Battery): Jumper JP2, 2-3
Option 3: FET = FET controlled output: Jumper JP2, 3-4, 1-2

When using the FETs, a pullup resistor is used to enable the output. The data system must turn off the FET by pulling the lines low, floating lines will be pulled high. CHECK THESE DEFAULTS WITH ACTUAL BOARDS/CODE! THE REDBOOT SAYS OUT0-2 COME UP AS LOGIC '0'

Sio Board:	*Diamond Emerald …*	
All Ports	Pin-10 (Dio-X) on selected Port	CHECK GM / MANUAL
Viper Board: COM1	*PL9 GPIO Connector*	
COM1	Pin-11, OUT-0, PXA255 GPIO20	Bootup Default = OFF
COM2	Pin-18, OUT-5, PXA255 GPIO21	Bootup Default = On
COM3	Pin-20, OUT-7, PXA255 GPIO22	Bootup Default = On
COM4	Pin-16, OUT-3, PXA255 GPIO23	Bootup Default = On
COM5	Pin-14, OUT-1, PXA255 GPIO24	Bootup Default = OFF
USB	Pin-15, OUT-2, PXA255 GPIO25	Bootup Default = OFF
Ethernet-1	Pin-19, OUT-6, PXA255 GPIO26	Bootup Default = On
Ethernet-2	Pin-17, OUT-4, PXA255 GPIO27	Bootup Default = On

FET Misc. Info:

IPS521G	*Recommended Value*	
Max. Continuous Current	1.6A	Most sensors will be well below this even, Li7500
High-Level, ie turn-on voltage	4.0-5.5V	
Low-Level, ie. turn-off voltage	-0.3-0.9V	
	Measured Value	
Actual Turn-On Voltage	2.4V	
No-Load Leakage Current w/+5 10K pullup, ie 'On'	.83mA @ 12.v = 10mW	For one FET. This is what we need to consider
Leakage with floating input	.016mA = .1mW	Ie FET 'Off'
Leakage with +12 source disconnected	.06mA = .7mW	Ie +5 still on, but no Vcc supply
+5V current when 'On'	.055mA = .3mW	To drive gate

Speed vs NDAQ Cable Lengths:
See the notes below about 'NDAQ' serial cable purchased and Ethernet issues in viper section.

Preliminary tests were performed using the SIO interface board and standard cables to observe the signal characteristics for various data rates over both a short and longer-than-expected cable run. Tests were done both with and without addition of an extra .01microFarad filtering capacitor on the PCBoard. The intention of the capacitor was/is to quiet any noise and help reduce spurious resets of the system. At lower speeds the effect of the capacitance is not critical, however *at speeds above 38400bps the capacitor loads the line excessively and should not be used*. This value of capacitance adds approximately 500' (155m) of equivalent cable length to the run. Smaller caps could be used instead (ie .001 microFarad would add ~50' of equivalent cable while retaining some of the filtering capability), but this has not yet been tried.
Tests were performed using Procomm scripts on a PC running through the primary COM1 port:

RawIOloopbackTest.was	Sends an alternating 1/0 character as fast as possible and checks for loop-back receive results.
MessagePatternSendTest.was	Sends a 12 char message out at nominal message frequencies (~50hz in this case) and checks for loopback receive results.

Specific Sensors: TRH,CSAT were also examined, powered by a power supply via the interface cable and transmitting data into the PC.

Tests using the Viper CPU board have not been done as of June-05

The title of the images linked below indicates what the conditions were: ie 'with-caps' or otherwise without; 80m cable length. NOTE because these were loopback tests, an 80m test was actually going through 160m of cable, with 1 leg at 24.6pf and the other at 17pf per foot.
Above 38400, the PC was unable to keep up with the maximum transmit rate (ie bps) and topped out at roughly 47kbps, due primarily to Procomm timer granularity and driver interface latency. Below that rate everything was OK. Tests were also performed using both no flow control, soft (^s^q) and hard (RTS,CTS) flow control. Generally the hard flow control produces less throughput.

NDAQ Cable Capacitance/Length Speed Test Images

The tests roughly indicated in a lab environment: (NOTE I need to confirm these and log the data !!!!)

BPS	<=20m	<=20m WithCaps (.01mf)	80m	80m WithCaps (.01mf)	80m WithCaps (.001mf)
9600 CSAT	OK	OK	OK	OK	OK
9600 TRH	OK	OK	OK	OK	OK
9600	OK	OK	OK	OK	OK
19200	OK	OK	OK	OK	OK
39400	OK	OK	OK	Data OK,	OK
57600	OK	Data through, lousy signal	Data through	Data through, lousy signal	Data through
115200	OK	No	Data through, lousy signal	Nope: yeow!	Data through, lousy signal

Background: The following rough Rule-of-Thumb guidelines are primarily for differential signal standards, RS422/485 with cables having 16pF/ft. capacitance. For NDAQ cables which have slightly higher capacitance the performance should be slightly more conservative. Also, for RS232 with higher signaling levels than RS485, the effect would probably be greater, depending upon the performance and threshold level of the transceivers used for specific devices.

1) For Short-Cables (<10m): The influence of the wires can be neglected and the limiting factor is the transceiver specifications
2) For Medium-Cables (<100m): The wire losses caused by skin effect where current is flowing on the conductor surfaces.
3) For Long-Cables (actually all): Speed is limited by the impedance of the lines. The Maximum impedance of the line should be less than 100ohms.

Rule-of-Thumb for Line Capacitance and Speed for RS422/485 (Differential Cabling)
*Speed (Mbits/sec) * Cable-Meters <= 10^8.* Ie. a 100-m cable would be able to handle 1-Mbps.

However, one Reference suggests a value roughly 1/3-times the above 'rule'

Speed-bps	1200	56Kbps	128Kbps	256Kbps	512Kbps	1Mbps	2Mbps	
Cable Length Max.	914m	488m	244m	122m	61m	30m	15m	

While another Reference indicated the following far more conservative values: (Note max. length for RS422 specification is 4000')

Speed-bps	4800	9600	19200	38400	57600	115200	
Max. Capacitance	60nf	30nf	15nf	750pf	500pf	250pf	
NDAQ 24ga wire (24.6pf/ft.)	2440'	1214'	310'	30'	20'	10'	Simple math per above
NDAQ 22ga wire (17pf/ft)	3529'	1765'	882'	44'	30'	15'	Simple math per above

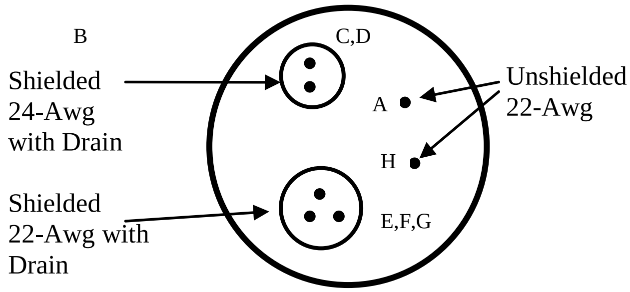
Serial Driver Output Voltage Specification Limits:

Protocol	Voc Max. Spec.	V-loaded Max Spec.
RS232	+/- 25	+/- 15
RS422	+/- 10	+/- 7
RS485	+/- 6	+/- 5

Standard DE-9 RS232 Pin Definitions / Signal Directions:

DTE pin	Signal	DCE - DTE (PC)	DCE=Sensor/Modem DTE=PC/Computer
1	DCD	→	DCE announces that a connection is established
2	Rx	→	Data received; 1 is transmitted "low", 0 as "high"
3	Tx	←	Data sent; 1 is transmitted "low", 0 as "high"
4	DTR	←	DTE announces that it is powered up and ready to communicate
5	Gnd		
6	DSR	→	DCE announces that it is ready to communicate
7	RTS	←	DTE asks DCE for permission to send data
8	CTS	→	DCE agrees on RTS
9	RI		DCE signals the DTE that an establishment of a connection is attempted

NDAQ External Cable:



Cable	Bulgin	Color	Nom.Sig.	A
A	1	Red	+12	
B	2	Bare	Shield	
C	5	White		
D	4	Black		
E	3	Brown		
F	6	Orange		
G	7	Yellow	SigGnd	
H	8	Black	Ground	

Signal Line	**Wire Gauge**	**Capacitance/ft.**	**Resistance/1000-ft.**	
A	22	17.0 pF	18.1 Ohms	+12
B				Shield
C	24	24.6 pF	28.7 Ohms	
D	24	24.6 pF	28.7 Ohms	
E	22	17.0 pF	18.1 Ohms	
F	22	17.0 pF	18.1 Ohms	
G	22	17.0 pF	18.1 Ohms	
H	22	17.0 pF	18.1 Ohms	Gnd

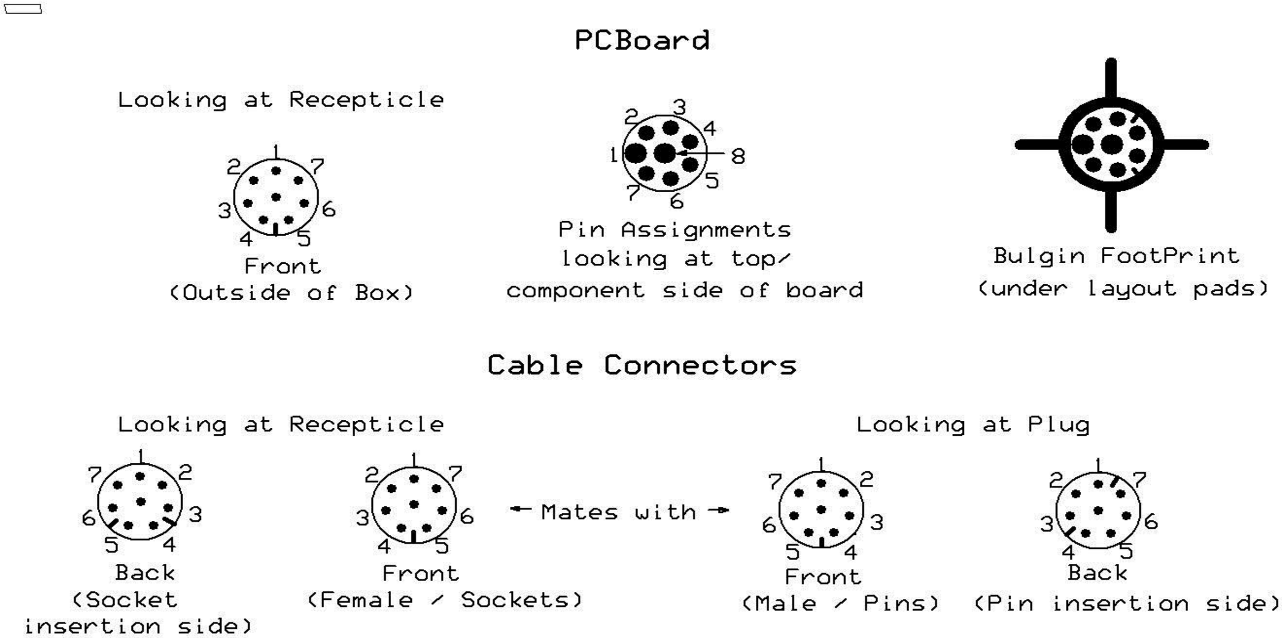
NDAQ cable does not meet specifications for Ethernet 'cat5+' (primarily the 13-17pf/foot capacitance) and as a result works suboptimally if at all for higher distance/speed/loading. It will work straight to the viper/interface panel at 100'. See Ethernet in viper section.

NDAQ Cable Power vs Voltage Drop:

Current Rating of 22AWG used for +/- : 5A absolute max derated by .004/degC and inside jacketing.
Resistance for 22AWG copper: ~60ft/ohm at 77degF.

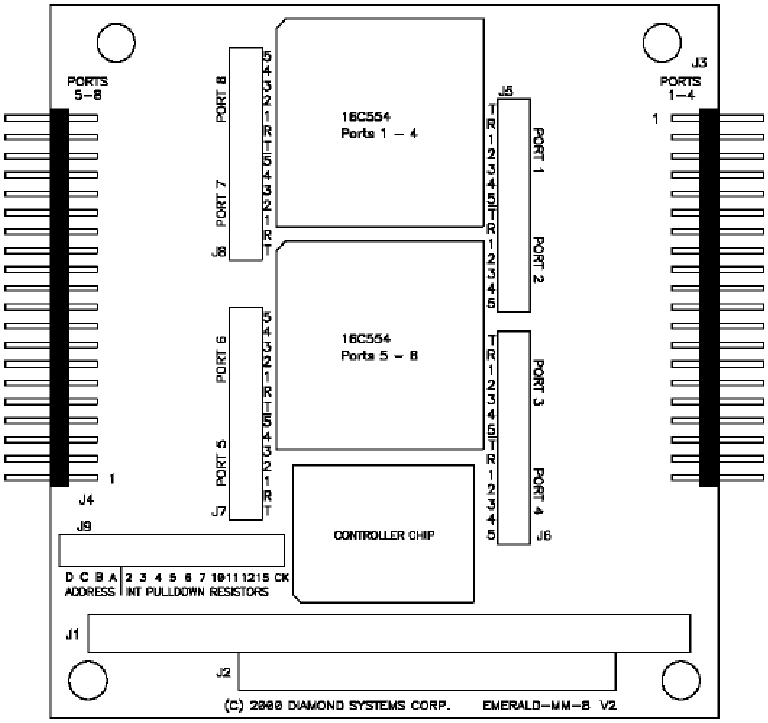
Thus: for 30m cable = 3.28 ohms … 30*3.28(ft/m) = 98 * 2 (goes up/down) = 196/60 = 3.28
so for a ~1.2A load and 12.2Vin - 3.8 (IRloss) ~=8.4Volts at licor sensor for example.

Bulgin Pin Assignments:



Serial / Analog Panel:

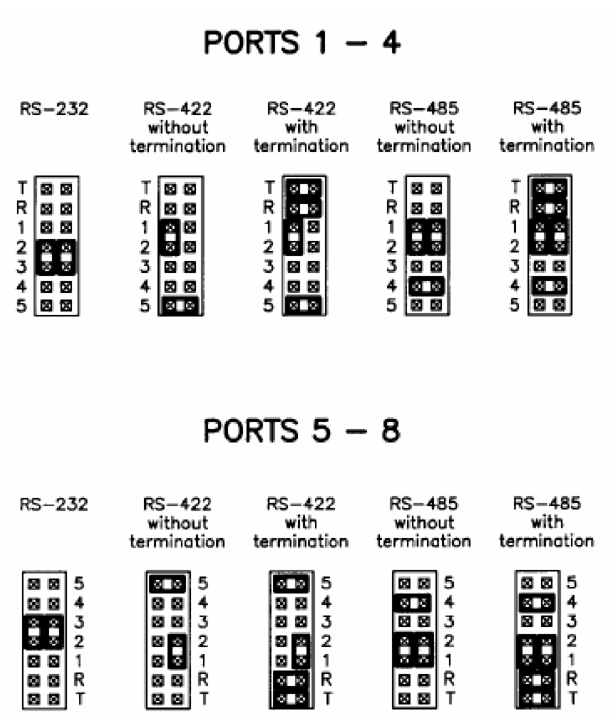
Emerald DMM-8 Board Layout / Jumpers



6.4 Serial Protocol Selection

Jumper blocks J5 through J8 are used to select the protocol for each serial port. Each jumper block configures two ports. Each port may have its protocol set independently of the others. Note that the orientation of jumper blocks J7 and J8 (ports 5 – 8) is rotated 180 degrees from that of J5 and J6 (ports 1 – 4). Configuration drawings are provided below for each group of ports to avoid confusion.

Two configurations are shown for RS-422 and RS-485, with and without line termination.



Sensor Specific Wiring:

CSAT-3 Sonic

Note: the CSAT electronics box was modified to bring power out to the CSAT comm./serial connector to avoid using a second connection: the 'factory' power connector.

CSAT-3 Signal	CSAT-3 Connector Pin	Bulgin Pin	Cable-Wire 'GreenJacket'	Cable-Wire 'Thick-Gray (tape color)'
Transmit Data from CSAT to PC	B	5	C = White, with…	White
RTS	G	4	D = Black	Purple
CTS	H	3	E = Brown	Brown
Receive Commands from PC	C	6	F = Orange	Orange
Ground	E	7	G = Yellow	Yellow
+12 VDC	D	1	A = Red	Red
Ground	F	8	H = Black	Gray
		2	B – no connect	-

Garmin GPS

4800bps for standard NMEA messages.

GPS Signal	Bulgin Pin	Garmin Cable-Wire Color
+12 VDC	1	Red
Shield	2	Bare Shield
1-PPS signal	3	Gray
	4	n/c
Transmit Data-1 from GPS to PC	5	White
Receive Commands-1 from PC	6	Blue
	7	n/c
Ground	8	Black

MaxStream XBee / Xtend Radio Modems

The maxstream will work on the generic sio interface or the Viper ports, per note 'dtr' below.

DE-9 Male-pins	Signal	(Max) DCE - DTE (Viper)	Bulgin Pin	DCE=Sensor/Modem DTE=PC/Computer
1	DCD	→	n/c	
2	Rx	→	5	Radio Output to Viper
3	Tx	←	6	Radio Receive from Viper
4	DTR	←	7	Used to Enable Power Down Mode on Radio. Note: DTR is only available on Viper ports COM1 and COM4. On SioPanels, DTR is on Bulgin pin-3 and must be selected by jumper.
5	Gnd		8	
6	DSR	→	n/c	
7	RTS	←	4	RTS Flow Control, or enter Command Mode of Radio
8	CTS	→	3	CTS Flow Control,
9	RI	←	1	Used for POWER in our application

Niwot08 TelosB PAR-Mote-Box, Tsoil-Mote-Box, Mote-Repeater-Box

MiniDin pins	Signal	(Max) DCE - DTE (Viper)	Bulgin Pin	DCE=Sensor/Modem DTE=PC/Computer
1	Rx	⟶	5	TelosB Output to Adam
2	Tx	⟵	6	TelosB Input from Adam
3,5	+12 VDC		1	
4	Gnd		8	
6	Reset	⟵	4	RTS, Remove Jumper J9 on Mote-Board to Disable

RMY 9101 PropVane Anemometer

The sensor has only Serial RS485 or analog speed/direction output. They were programmed to conform to the NCAR – SBUS protocol. For NDAQ, primary use is expected to be with the 1-second continuous data output option; otherwise a polling mechanism for SBUS messages is needed….#12ODf<EOT> where the 'f' is a checksum equivalent, EOT=0x04 and 12 = RMYaddr

Signal	**RMY 9101 Pin**	**Wire Color**	**Bulgin Pin**	**Cable-Wire**	**Cable-Wire Color 'GreenJacket'**
RS485-	B	Blk	4	D	Black, bundled with…
RS485+	A	Wht	5	C	White
Sig-Gnd	Ref (common)	Yel	7	G	Yellow, bundled with…
			3,6	E,F – no connect	Brown, Orange
+12 VDC	Pwr	Red	1	A	Red, non-shielded
Ground	Earth (common)	Blk	8	H	Black, non-shielded
			2	B	Bare Shield

PORT Connection: ttyS4, Viper Panel COM-5 can be used for the Prop-Vane.
Important: Make sure Viper board LK6-7 are in the RS485 position as noted in the ViperCPU photo

RMY9101 Manual.pdf RMY9101 Old-PAM Notes.pdf

NCAR TRH

Note: Internal Jumpers
The sensor is capable of either RS232 or RS485, however both a jumper wire and a jumper header must be set up to select between these two options inside the TRH.
For RS232: J3-1 blue wire to Bulgin-4; Jumper header J5: 2-3 (toward sensor end of board)
For RS485: J1-1 white wire to Bulgin-4; Jumper header J5: 1-2 (toward connector end of board)

Note: Sensor Setup
The TRH is capable of either 'SBUS' or 'Interactive' operation. With NIDS/NDAQ there is no sbus interaction software. There are 2 ways to enter interactive mode:
1) 'esc-esc-esc' while communicating with an sbus device
2) change the default operation. To setup default interactive mode establish a session on EVE most likely with EVE or else use the sequence in 1 above; then use the following basic command sequence after getting into 'PH' help:
'EE' enter eeprom submenu
'protocol=1' turns off sbus, on interactive mode ('=0' is sbus)
'mode=1' turns on auto output mode ('=0' is polled)
'EE' exit eeprom submenu

‘MR’ reset

TRH Quick Reference

Signal	**TRH Berg Pin**	**Wire Color**	**Bulgin Pin**	**Cable-Wire**	**Cable-Wire Color ‘GreenJacket’**
RS485+	J1-1, jmp select	Wht	5	C	White, bundled with
RS232 – Tx Data from TRH to PC	J3-1, jmp select	Blue	5	C	White, bundled with
RS485-	J1-2		4	D	Black
RS232 – Rx Cmds from PC	J3-2		6	F	Orange, bundled with…
			2,3	B,E - no connect	Bare, Brown
SigGnd	J3-3, intern short with		7	G	Yellow
Shield	J1-3		7	G	
+12 VDC	J2-1	Red	1	A	Red, non-shielded
Ground	J2-2	Blk	8	H	Black, non-shielded

Generic Serial Wiring:

Power Options

Option	Jumpering	FET Status	FET Control
Vcc	JP2: 2-3	FET disabled (JP4 Out)	n/a
FET	JP2: 1-2, 3-4	FET enabled (JP4 In)	DIO-x (for portx) emerald_dio /dev/ttyD5 0,1
None	JP2: all removed	FET disabled (JP4 Out)	n/a

TVS Use / Shielding

Option	TVS Array Used	Shielded Pair 4,5 – C,D	Shielded Triad 3,6,7 –E,F,G
RS232	VS10P15LC	Rx/RTS	Tx/CTS/SigGnd
RS422	VS10P08LC	Tx+/Tx-	Rx+/Rx-/SigGnd
RS485	VS10P08LC	Tx+/-, Rx+/-	SigGnd

RS232

Cable-Wire	Bulgin	Ribbon-10 to PC104 line	Protection / Interface
A = Red	1 (Power +Vcc)		TVS SMC, RLC Choke/Filter -Gnd
B = Bare	2 (Shield)		Jumper to Ground Plane
H = Black	8 (Ground)		Direct connect to Ground Plane
		1 = DCD, 2=DSR, 8=RI (n/c)	
C = White	5	3 = Rx (Input data to PC)	TVS array, .01mF Filter Cap.-Gnd
D = Black	4	4 = RTS	TVS array, .01mF Filter Cap.-Gnd
F = Orange	6	5 = Tx (Jmp-3 Select `232')	TVS array, .01mF Filter Cap.-Gnd
E = Brown	3	6 = CTS	TVS array, .01mF Filter Cap.-Gnd
		7 = DTR (n/c Jmp-3 De-select)	
G = Yellow	7 (SigGnd)	9 = Gnd	1mF Filter Cap.-Gnd
		10 = DIO (FET power ctrl)	

RS422

Cable-Wire	Bulgin	Ribbon-10 to PC104 line	Protection / Interface
A = Red	1 (Power +Vcc)		TVS SMC, RLC Choke/Filter -Gnd
B = Bare	2 (Shield)		Jumper to Ground Plane
H = Black	8 (Ground)		Direct connect to Ground Plane
		1,2,8 = (n/c)	
C = White	5	3 = Tx+	TVS array, .01mF Filter Cap.-Gnd
D = Black	4	4 = Tx-	TVS array, .01mF Filter Cap.-Gnd
		5 = Gnd (n/c Jmp-3 De-select)	
E = Brown	3	6 = Rx-	TVS array, .01mF Filter Cap.-Gnd
F = Orange	6	7 = Rx+ (Jmp-3 Select '422')	TVS array, .01mF Filter Cap.-Gnd
G = Yellow	7 (SigGnd)	9 = Gnd	1mF Filter Cap.-Gnd
		10 = DIO (FET power ctrl)	

RS485

Cable-Wire	Bulgin	Ribbon-10 to PC104 line	Protection / Interface
A = Red	1 (Power +Vcc)		TVS SMC, RLC Choke/Filter -Gnd
B = Bare	2 (Shield)		Jumper to Ground Plane
H = Black	8 (Ground)		Direct connect to Ground Plane
		1,2,8 = (n/c)	
C = White	5	3 = Tx+ / Rx+	TVS array, .01mF Filter Cap.-Gnd
D = Black	4	4 = Tx- / Rx-	TVS array, .01mF Filter Cap.-Gnd
		5 = Gnd (n/c Jmp-3 Removed)	
E = Brown	3 (Available)	6 = (n/c)	TVS array, .01mF Filter Cap.-Gnd
F = Orange	6 (Available via jumper)	7 = (n/c) (Jmp-3 Removed)	TVS array, .01mF Filter Cap.-Gnd
G = Yellow	7 (SigGnd)	9 = Gnd	.01mF Filter Cap.-Gnd
		10 = DIO (FET power ctrl)	

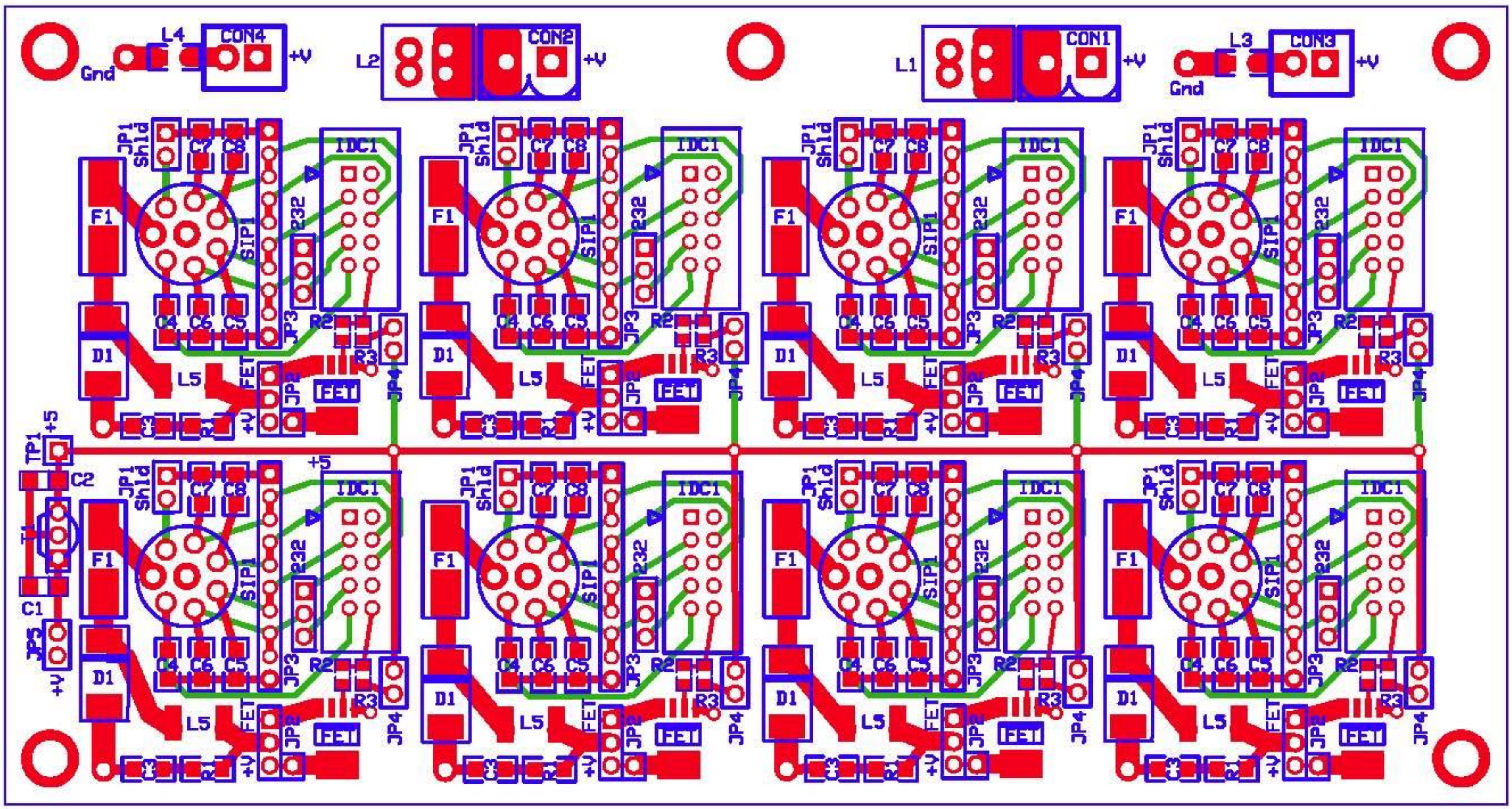
SIO Interface Panel – Component Current / Power Capacity:

Current capacity of the board is dictated by various components on it and the power distribution from the main 'dc-dc' panel.

It is also dependent upon overall board and component temperature. In general current capacity goes down with temperature for lans/wire, but improves for components that are limited on internal junction temp/heat sinking.

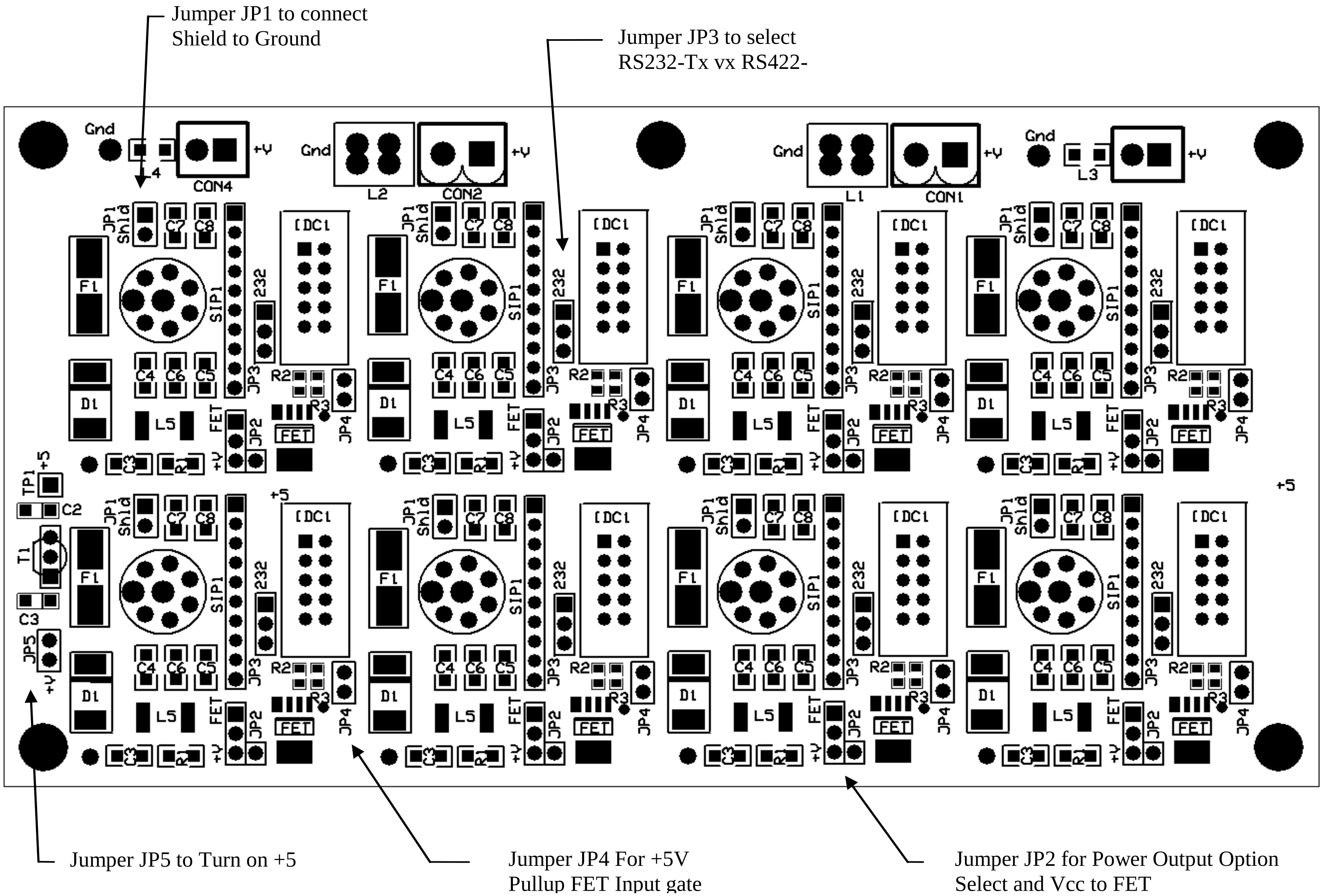
Component	***Rating***	***Comment***
Bulgin Pins	5A	Max for Pins/Sockets (p/n 3347 and 3348)
22AWG Wire for +/- to Sensors	5A	Absolute max derated by .004degC and inside jacketing
AWG Wire for +/- to board from Power Panel		
Board Connectors	15A	5mm Black 2-pin Molex (wm5872-nd, wm5862-nd)
	8A	3.5mm Black 2-pin Molex (wm5624-nd, wm5605-nd)
PCB Total	8A ?	Measured once at room temp but should redo at cold (lower capacity). Board has internal power/ground planes, so 'really big lan'.
Board LANs	~0.7A@-10degC ~1.5A@0degC ~2.0A@10degC ~4.0A@45degC	.080" x 1.25 Oz./ft^2 copper trace through coil, fuse to Bulgin connector. Tested to much more temporarily at room temp.
FET	1.4A @ 125degF 2.0A @ 75degF 2.6A @ 25degF 10A peak	IRL IPS521G part. Max continuous current is dictated by Junction Temperatures. These improve with lower ambient temps. and better heat sinking on chip or lan. The NDAQ board was not designed with any special heat sinking capabilities.
Coil, power choke.	3.4A @ 45degC	Panasonic (pcd1362ct-nd). Dependant on part temp.
Pin on +12 Distrib.	3A	Sullens .1" breakaway (s1011-35-nd)
Shunts on PowerPin	3A	Sullens .1" (s9000-nd)
DC-DC converter	1.8A	For providing +15VDC to board, used for Ethernet on viper in particular. (20W module)

PCBoard:



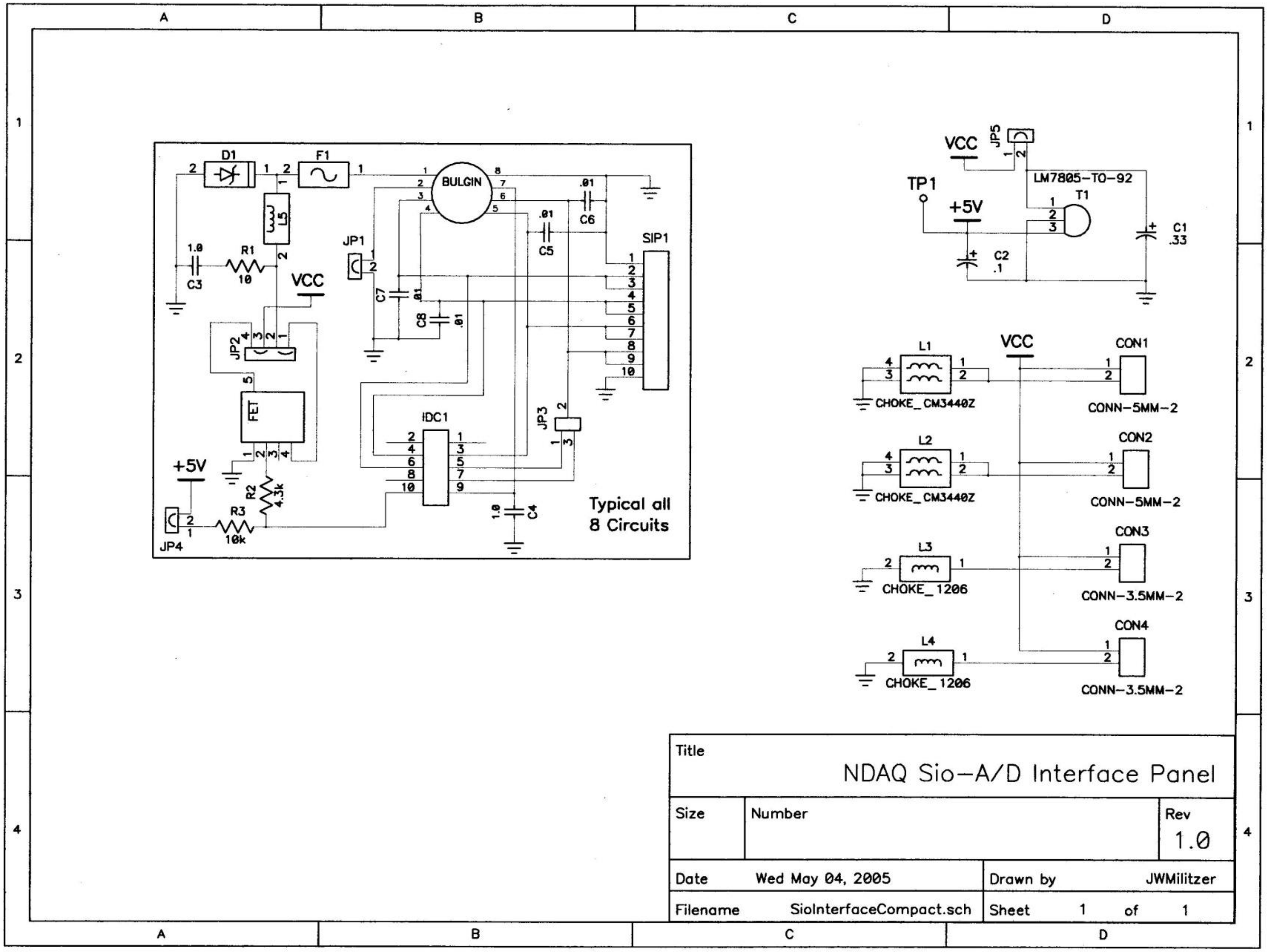
L4
CON4
Gnd
+V
L2
CON2
L1
CON1
L3
CON3
JP1
Shld
C7
C8
IDC1
F1
SIP1
232
C4
C6
C5
JP3
R2
R3
D1
L5
FET
JP2
JP4
C3
R1
TP1
+5
C2
T1
C1
JP5

Layout:



Jumper JP1 to connect
Shield to Ground
Jumper JP3 to select
RS232-Tx vx RS422-
Jumper JP5 to Turn on +5
Jumper JP4 For +5V
Pullup FET Input gate
Jumper JP2 for Power Output Option
Select and Vcc to FET

Schematic:



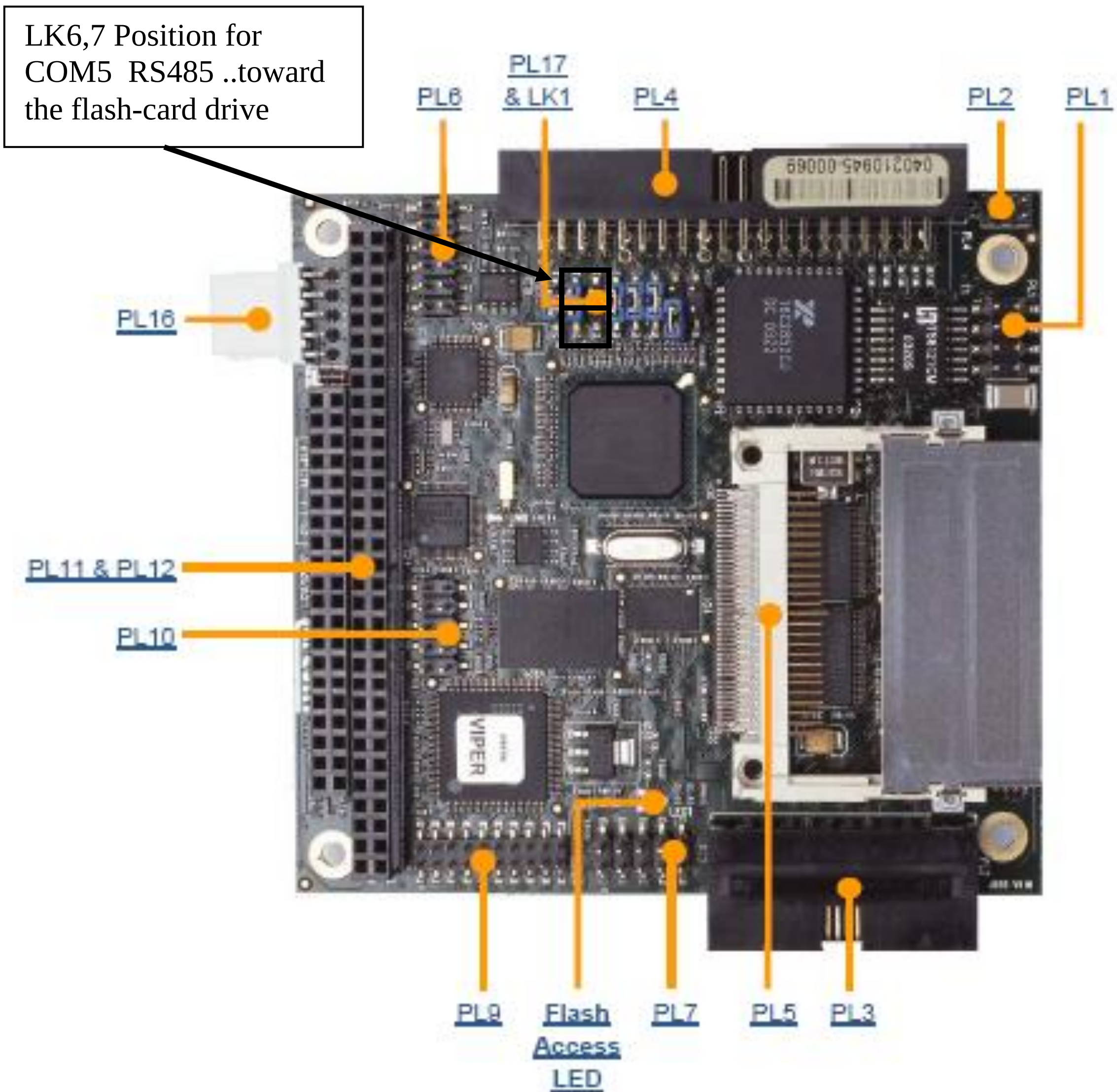
D1
F1
BULGIN
L5
R1
10
C3
1.0
VCC
JP1
C7
.01
C8
.01
C5
.01
C6
.01
SIP1
JP2
FET
+5V
R2
4.3k
R3
10k
JP4
IDC1
JP3
C4
1.0
Typical all
8 Circuits
VCC
JP5
TP1
+5V
LM7805-TO-92
T1
C1
.33
C2
.1
L1
CHOKE_CM3440Z
CON1
CONN-5MM-2
L2
CHOKE_CM3440Z
CON2
CONN-5MM-2
L3
CHOKE_1206
CON3
CONN-3.5MM-2
L4
CHOKE_1206
CON4
CONN-3.5MM-2
Title
NDAQ Sio-A/D Interface Panel
Size
Number
Rev
1.0
Date Wed May 04, 2005
Drawn by JWMilitzer
Filename SioInterfaceCompact.sch
Sheet 1 of 1

VIPER CPU Panel:

Arcom VIPER Board Layout / Jumpers

Connectors, LEDs and jumpers

The following diagram shows the location of the connectors, LEDs and jumpers on the VIPER:



Device Specific Wiring:

System Console to PC

Note: This is a 'null modem' for PC to Viper, COM1 = /dev/ttyS0.
The same wiring would work on the other ports as well, however, to connect a true DCE such as a sensor you need to swap 5-6 (Tx/Rx) and 3-4 (RTS/CTS) and the Viper becomes the DTE.

DE-9 pin	Signal	(Viper) DCE - DTE (PC)	Bulgin Pin	DCE=Sensor/Modem DTE=PC/Computer
1	DCD	→	n/c	
2	Rx	→	6	
3	Tx	←	5	
4	DTR	←	7	Note: DTR is only available on Viper ports COM1 and COM4. Don't connect this on other ports because pin-7 is used for siggnd which could harm PC
5	Gnd		8	
6	DSR	→	n/c	
7	RTS	←	3	
8	CTS	→	4	

Terabeam EtherAntIII-LR

Note: This is an ethernet Cross-Over cable for the Viper, Eth1 port

Cable-Wire 'GreenJacket'	**Bulgin EantIII (xover)**	**Bulgin TPOP (straight)**	**Signal**	**Switchcraft Connector (SC1163-ND) (EtherAnt)**	**Protection / Interface**
A = Red	1	1	Power +Vcc	5	
B = Bare	2	2	Shield		Jumper to Ground Plane
C = White	3	5	Tx+	1 (has dot)	
D = Black	6	4	Tx-	2	
F = Orange	4	6	Rx -	4	
E = Brown	5	3	Rx+	3	
G = Yellow	7	7	Optional LANGnd		
H = Black	8	8	Ground	6	Connection to Ground Plane

Signal Engineering SE12xx GOES Transmitter

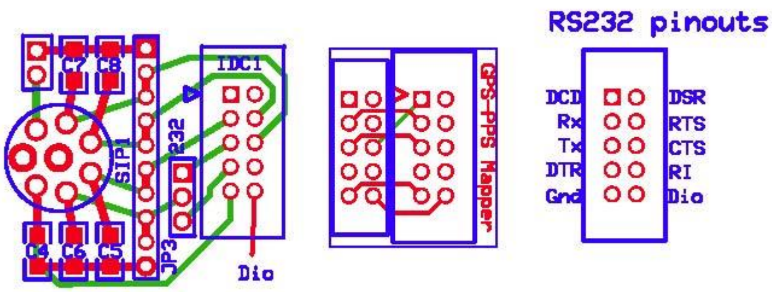
Note: This works for Viper COM4, or the generic Emerald RS232 panel. RTS/CTS are required. DCD/DTR/DSR/RI not needed.
Note: For ADAM-Box Internal Wiring use 'FrontPanel-Ribbon10' to 'Goes Ribbon14 or 10'.

Signal	(Viper) DCE - DTE (PC)	Bulgin Pin	Front Panel: Viper/ Emerald Ribbon-10	Ribbon-14, SE120 or SE1200	Ribbon-10 OmniSat
Rx	From GOES to PC 'Viper/Diamond'	5	3	14	3
Tx	To GOES from PC	6	5 (via JP3)	13	5
Gnd		8	9	2,4,6	9,10
RTS	To GOES from PC	4	4	11	4
CTS	From GOES to PC	3	6	12	6

Garmin GPS – With PPS Mapper

4800bps for standard NMEA messages.

GPS Signal	Bulgin Pin	Garmin Cable-Wire Color	Ribbon-10 on Viper Panel COM4	Ribbon-10 on Mapper board CTS-DCD	Viper PL4 – COM4
+12 VDC	1	Red			
Shield	2	Bare Shield			
1-PPS signal	3	Gray	6 = CTS	1=DCD	21
	4	n/c			
Transmit Data-1 from GPS to PC	5	White	3 = Rx	3=Rx	23
Receive Commands-1 from PC	6	Blue	5 = Tx	5=Tx	25
	7	n/c			
Ground	8	Black			

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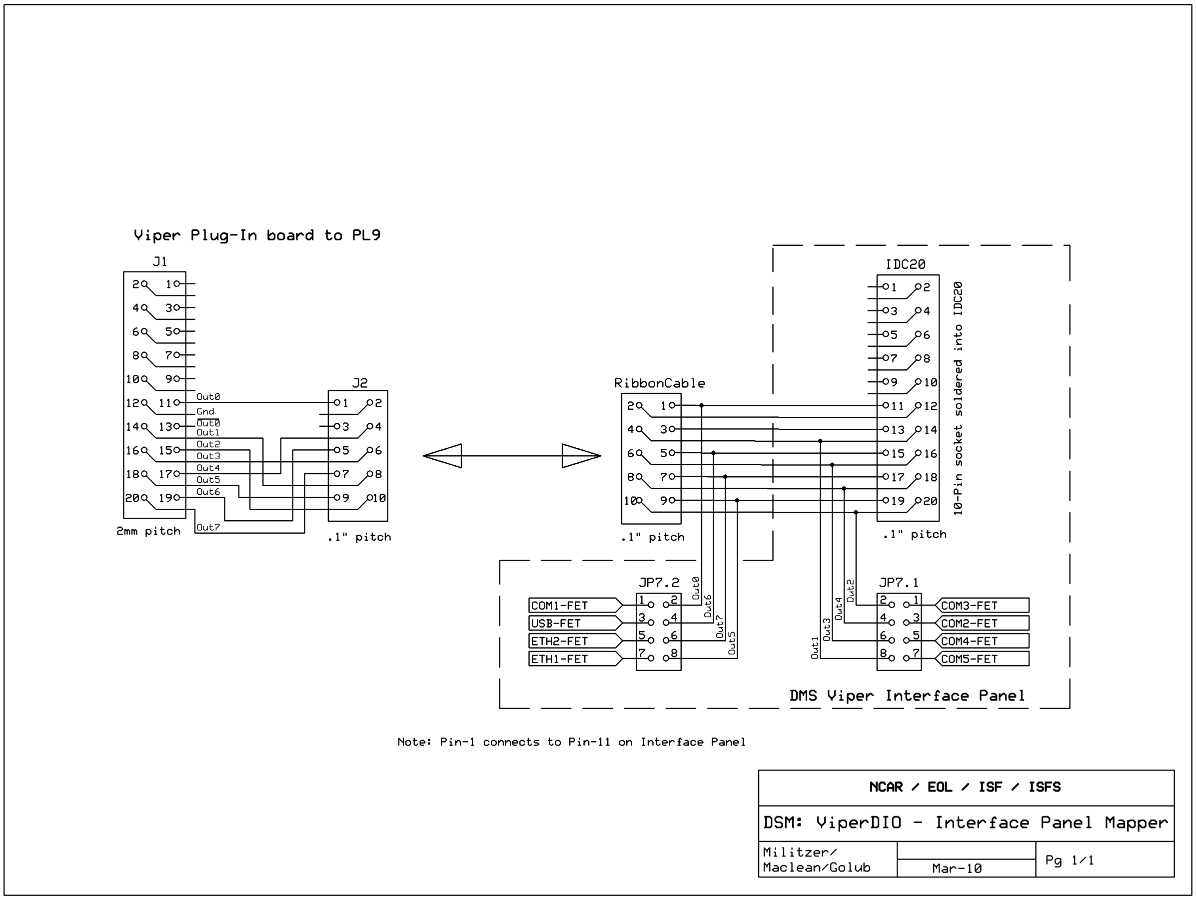
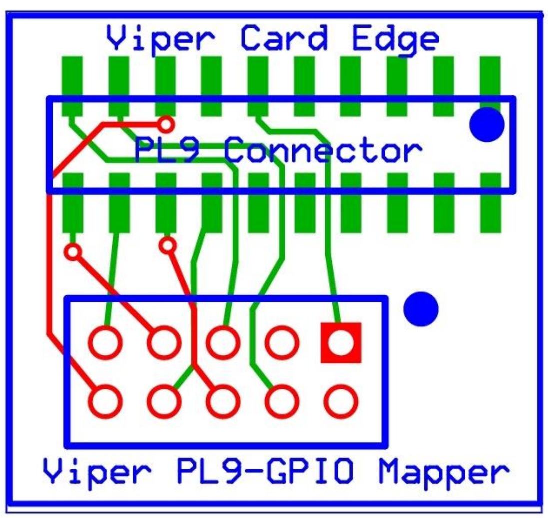
Garmin - Bulgin Pins
Bulgin   Ribbon-10          Maps-To

1 = +12    = fuse
2 = shield
3 = PPS    = 6 (CTS)        = 1 (DCD)
4 = n/c
5 = Tx     = 3              = 3 (Rx)
6 = Rx     = 5 via jmp      = 5 (Tx)
7 = n/c
8 = Gnd    = board layer
```

Viper DIO Interface Mapper





Viper COM-Ports: The Viper has 5 COM ports available on a 40-pin , .1" IDC header named PL4. These are split out into 4 individual 10-pin receptacles for distribution to the interface board headers.

COM-1:
Console: RTS/CTS/DTR; /dev/ttyS0

TVS Array	FET Power Control	Shielded Pair 4,5 – C,D	Shielded Triad 3,6,7 –E,F,G
PLCDA15C-6	OUT-0 (Viper PL9-11)	Rx/RTS	Tx/CTS/DTR

Notes: SigGnd wire 'stolen' to provide protection for DTR on Bulgin pin-7

Cable-Wire 'GreenJacket'	Bulgin	Ribbon-10	Viper PL4	Protection / Interface
A = Red	1 (Power +Vcc)			TVS SMC, RLC Choke/Filter -Gnd
B = Bare	2 (Shield)			Jumper to Ground Plane
		1 = DCD (n/c)	31	
		2 = DSR (n/c)	32	
C = White	5	3 = Rx	33	TVS array, .01mF Filter Cap.-Gnd
D = Black	4	4 = RTS	34	TVS array, .01mF Filter Cap.-Gnd
F = Orange	6	5 = Tx	35	TVS array, .01mF Filter Cap.-Gnd
E = Brown	3	6 = CTS	36	TVS array, .01mF Filter Cap.-Gnd
G = Yellow	7	7 = DTR	37	TVS array, .01mF Filter Cap.-Gnd
		8 = RI (n/c)	38	
H = Black	8 (Ground)	9 = Gnd	39	Direct connection to Ground Plane
		10 = (n/c)	40	

COM-2:
RTS/CTS; /dev/ttyS1

TVS Array	FET Power Control	Shielded Pair 4,5 – C,D	Shielded Triad 3,6,7 –E,F,G
VS10P15LC	OUT-5 (Viper PL9-18)	Rx/RTS	Tx/CTS/SigGnd

Cable-Wire 'GreenJacket'	Bulgin	Ribbon-10	Viper PL4	Protection / Interface
A = Red	1 (Power +Vcc)			TVS SMC, RLC Choke/Filter -Gnd
B = Bare	2 (Shield)			Jumper to Ground Plane
H = Black	8 (Ground)			Direct connection to Ground Plane
		1 = Tx3	11	
		2 = Rx3	12	
C = White	5	3 = Rx2	13	TVS array, .01mF Filter Cap.-Gnd
D = Black	4	4 = RTS2	14	TVS array, .01mF Filter Cap.-Gnd
F = Orange	6	5 = Tx2	15	TVS array, .01mF Filter Cap.-Gnd
E = Brown	3	6 = CTS2	16	TVS array, .01mF Filter Cap.-Gnd
		7 = Gnd	17	
		8 = Gnd (n/c)	18	
G = Yellow	7 (SigGnd)	9 = Gnd	19	.01mF Filter Cap.-Gnd
		10 = (n/c)	20	

COM-3:
Tx/Rx Only; /dev/ttyS2

TVS Array	FET Power Control	Shielded Pair 4,5 – C,D	Shielded Triad 3,6,7 –E,F,G
VS10P15LC	OUT-7 (Viper PL9-20)	Rx	Tx/SigGnd

Cable-Wire 'GreenJacket'	Bulgin	Ribbon-10 (with COM2)	Viper PL4	Protection / Interface
A = Red	1 (Power +Vcc)			TVS SMC, RLC Choke/Filter -Gnd
B = Bare	2 (Shield)			Jumper to Ground Plane
H = Black	8 (Ground)			Direct connection to Ground Plane
F = Orange	6	1 = Tx3	11	TVS array, .01mF Filter Cap.-Gnd
C = White	5	2 = Rx3	12	TVS array, .01mF Filter Cap.-Gnd
		3 = Rx2	13	
D = Black	4 (n/c)	4 = RTS2	14	
		5 = Tx2	15	
E = Brown	3 (n/c)	6 = CTS2	16	
G = Yellow	7 (SigGnd)	7 = Gnd	17	.01mF Filter Cap.-Gnd
		8 = Gnd (n/c)	18	
		9 = Gnd	19	
		10 = (n/c)	20	

COM-4:
RTS/CTS/DTR; /dev/ttyS3

TVS Array	FET Power Control	Shielded Pair 4,5 – C,D	Shielded Triad 3,6,7 –E,F,G
PLCDA15C-6	OUT-3 (Viper PL9-16)	Rx/RTS	Tx/CTS/DTR

Notes: SigGnd wire 'stolen' to provide protection for DTR on Bulgin pin-7

Cable-Wire 'GreenJacket'	Bulgin	Ribbon-10	Viper PL4	Protection / Interface
A = Red	1 (Power +Vcc)			TVS SMC, RLC Choke/Filter -Gnd
B = Bare	2 (Shield)			Jumper to Ground Plane
		1 = DCD (n/c)	21	
		2 = DSR (n/c)	22	
C = White	5	3 = Rx	23	TVS array, .01mF Filter Cap.-Gnd
D = Black	4	4 = RTS	24	TVS array, .01mF Filter Cap.-Gnd
F = Orange	6	5 = Tx	25	TVS array, .01mF Filter Cap.-Gnd
E = Brown	3	6 = CTS	26	TVS array, .01mF Filter Cap.-Gnd
G = Yellow	7	7 = DTR	27	TVS array, .01mF Filter Cap.-Gnd
		8 = RI (n/c)	28	
H = Black	8 (Ground)	9 = Gnd	29	Direct connection to Ground Plane
		10 = (n/c)	30	

COM-5:
RS485 (half-duplex) /422; /dev/ttyS4

Note: DC-DC Auxiliary Power
An additional *Sensor Power Option is available* via CON5 intended to feed to and back from a separate DC-DC converter.
Note that because of this, *2 jumpers are needed to provide power* to the external device/s

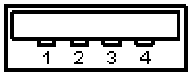
Note: Viper Setup for Half-Duplex RS485
Viper Jumper selections: LK6,LK7 to position A=RS485, to position B=RS422 (see figure above or technical manual)

Note: See TRH Setup Above for Interactive Mode / RS485. See RMY9101 for more about wiring.

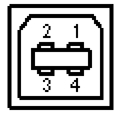
TVS Array	**FET Power Control**	**Shielded Pair 4,5 – C,D**	**Shielded Triad 3,6,7 –E,F,G**
VS10P08LC	OUT-1 (Viper PL9-14)	Tx+/- (RS422) Tx+/-,Rx+/- (RS485)	Rx+/-,SigGnd (RS422) SigGnd (RS485
Sensor Power Option	**Jumpering**		
Vcc	CON5: 1-2 JP2: 2-3	FET disabled	JP4 Out
FET	CON5: 1-2 JP2: 1-2, 3-4 JP2: 1-2	FET enabled	JP4 In
+15SubModule	JP2: 2-3	FET disabled	JP4 Out
None	JP2: all removed	FET disabled	JP4 Out

Cable-Wire 'GreenJacket'	**Bulgin**	**Ribbon-10**	**Viper PL4**	**Protection / Interface**
A = Red	1 (Power +Vcc)			TVS SMC, RLC Choke/Filter -Gnd
B = Bare	2 (Shield)			JP1, Jumper to Ground Plane
H = Black	8 (Ground)			Direct connection to Ground Plane
		1 = n/c	1	
		2 = n/c	2	
		3 = n/c	3	TVS array, .01mF Filter Cap.-Gnd
		4 = n/c	4	TVS array, .01mF Filter Cap.-Gnd
C = White	5	5 = Tx+ (422) Tx+/Rx+ (485)	5	TVS array, .01mF Filter Cap.-Gnd
D = Black	4	6 = Tx- (422) Tx-/Rx- (485)	6	TVS array, .01mF Filter Cap.-Gnd
F = Orange	6	7 = Rx+ (422)	7	
E = Brown	3	8 = Rx- (422)	8	
G = Yellow	7 (SigGnd)	9 = Gnd	9	C4 - 1mF Filter Cap.-Ground Plane
		10 = Gnd	10	

USB Errata:

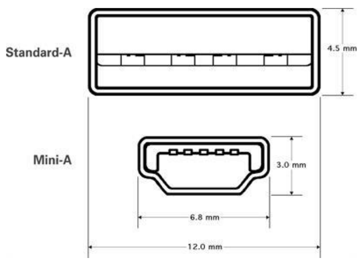


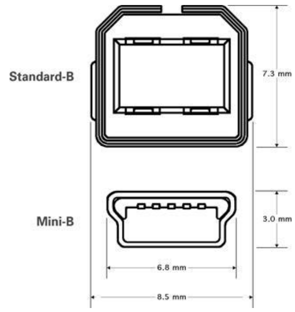
Type-A Connector
Located on Host/Hub

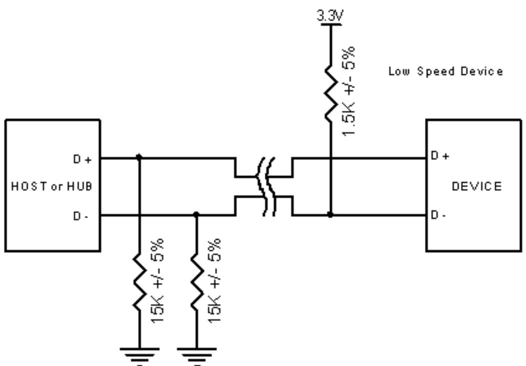


Type-B Connector
Located on Device (Slave)

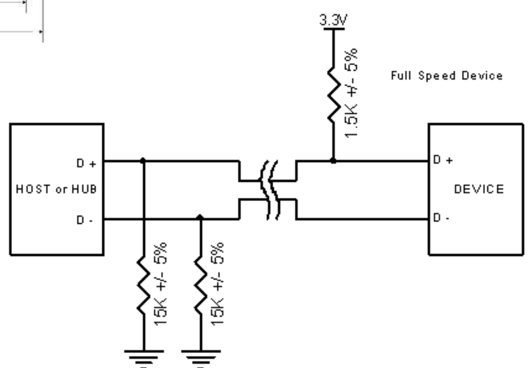
Pin Desc.
1 = Vbus (+5)
2 = D-
3 = D+
4 = Gnd







Low Speed Devices have a
pull-up resistor on D- to
identify themselves to a host



High Speed Devices have a
pull-up resistor on D+ to
identify themselves to a host.
USB-2 = 480Mbits/sec

Operating Speeds:

Low Speed = 1.5 Mbps (can use non-shielded cable)
Full Speed = 12 Mbps (USB1.1, requires shielded cable)
High Speed = 480 Mbps (USB2.0 and above)
This includes overhead so actual rates will be slightly lower.

Speed Identification

Devices identify to a host whether they are slow or full by pulling one of the data lines.
These are also used by the host to identify when a device is connected.
Full speed: pulls up D+ to 3.3
Some devices use programmable pull-ups so that they can initialize themselves before notifying the host of their presence.

Electrical

Differential Data transmission, NRZ1 with bit stuffing
Low/full speed devices: 1 has D+=>2.8V, D-=<.3V; 0 has D+=<.3V,D-=>2.8
Receiver needs differential ‘1’ as D+ 200mV>D- and vis-versa
Signal polarity reversed based on speed of bus: ‘J’=logic levels and for low speed ‘J’is differential 0, in high speed ‘J’ is a differential 1

Power: +5V operation

System Configuring: All devices include internal information specifying various parameters including the amount of power they'll consume from the bus.

Voltage, operating = 4.75 – 5.25V

Max. voltage drop = 0.35

Min. config voltage = 4.4 (min. voltage to send config. On bus but other functions don't need to be operating at that low a value)

Low, Bus Powered functions 100mA max. (1-unit load) for between 4.4-5.25V, device draws all power from bus.

High, Bus Powered functions 100mA max at startup, 500mA max. After startup/configure period, it may draw up to 500mA, or less depending upon what it declares in it's descriptor.

Self Powered functions 100mA max., device draws all remaining power internally.

Suspend Mode .5mA max. Note, implementation is complicated by the pull-up identifying resistors in the design.

Cabling / Lengths:

Shielding: should only be connected to ground at Host! No device should do it.

Shielded Cable: 28AWG twisted

Power: 20-28AWG non-twisted

Max. Length: 28 = .8m
26 = 1.3m
24 = 2.1m
22 = 3.3m
20 = 5m

Decoupling Capacitance: 1microF recommended between Vbus-Gnd in a device. This relates to limited specification of in-rush current. The maximum for a device is 10microF.

USB-OTG: On-The-Go

Supplement to the Specification released Dec-2001.

Introduces idea of devices being allowed to be sometimes a host or slave in order to permit connectivity without the need for a main PC host. Example: digital cameras talking directly to a printer

Connectors added: Mini-A, Mini-B, and Mini-AB (for dual-role devices)

Wireless USB-OTG: big emerging market

2.4Ghz, DSSS, much less complex than Blue-Tooth or Zigbee

Not a multi-tiered net, small packet data, doesn't require periodic net sync.

Cable replacement, up to 62.5kbps

10-50m

Cypress Semiconductor developed this capability and offers starter devel. Kits., SPI intf. to micro

USB-1, USB-2 Cabling:

The Viper has 2 USB ports. Both are routed to the interface panel but only 1, USB-2 is taken to the outside via the Bulgin connector. This decision allowed the power supply circuit to still be available on the Bulgin connector rather than having both USB's on it instead.

TVS Array	FET Power Control	Shielded Pair 4,5 – C,D	Shielded Triad 3,6,7 –E,F,G
SRV05-4	OUT-2 (Viper PL9-15)	DNEG-2/DPOS2	VBUS2/Gnd

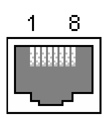
Notes:

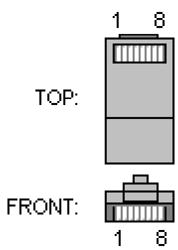
Cable-Wire	Bulgin	Ribbon-10 - Viper PL7	Protection / Interface	On-Board USB Type-A Conn.
A = Red	1 (Power, +Vcc)		F1, TVS SMC, RLC Choke/Filter - Gnd	
		1 = VBUS-1	TVS/Diode array1, 1mF Cap.-Gnd	USB-1, Pin-1
E =	3	2 = VBUS-2	TVS/Diode array2, 1mF Cap.-Gnd	USB-2, Pin-1
		3 = DNEG-1	TVS/Diode array-1	USB-1, Pin-2
C =	5	4 = DNEG-2	TVS/Diode array-2	USB-2, Pin-2
		5 = DPOS-1	TVS/Diode array-1	USB-1, Pin-3
D =	4	6 = DPOS-2	TVS/Diode array-2	USB-2, Pin-3
H = Black	8 Ground Plane	7 = Gnd	C4 - 1mF Filter Cap.-Gnd Plane	USB-1, Pin-4
G =	7	8 = Gnd	C4 - 1mF Filter Cap.-Gnd Plane	USB-2, Pin-4
F =	6 (n/c)	9 = Shield		
B = Bare	2 (Shield jump to ribbon)	10 = Shield		

Ethernet Cabling:

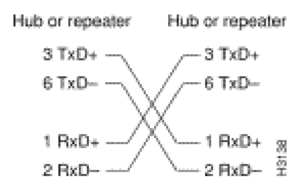
Twisted-pair Ethernet (10BASE-T, 100BASE-T, or 1000BASE-T) uses an RJ-45 connector, which is an eight-pin modular connector

1 = Tx+
2 = Tx-
3 = Rx+
4 = (n/c)
5 = (n/c)
6 = Rx-
7 = (n/c)
8 = (n/c)





Cross-Over Cable

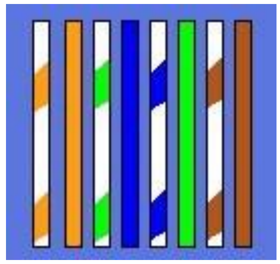


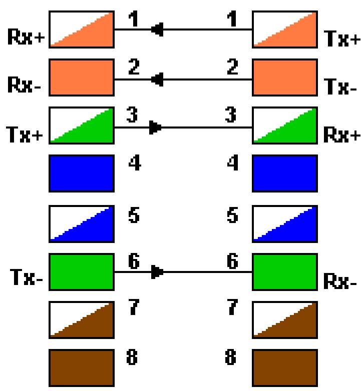
CrossOver: Two Ethernet stations can be directly attached to each Other but the cabling will be wired differently than a normal 10BASE-T Ethernet network connection. The 802.3 specification refers to this direct connection between two stations as a crossover function. The crossover function is accomplished by simply wiring the receive pins to the transmit pins as shown above.

CAT6 essentially obsoletes the CAT5 standard and will obsolete the CAT5e standard. CAT6 was introduced with the publication of the TIA standard 568-B2-1 (June 20, 2002). The bandwidth is more than doubled from 100MHz to 250MHz and the connector insertion loss and the crosstalk is improved.

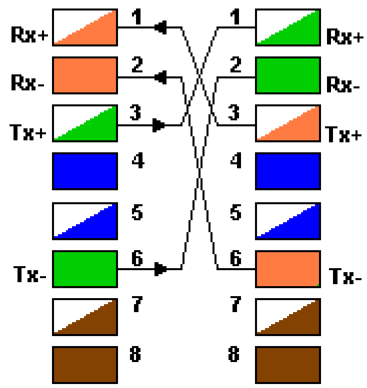
CAT 5: 4 Twisted Pairs at 24 AWG

pair 1: blue
pair: 2 orange
pair: 3 green
pair: 4 brown
(twisted about 3 times per inch)





Straight Ethernet Cable



Cross-Cable

Ethernet uses only pair 3 (green, on pins 1 and 2), and pair 2 (orange, on pins 3 and 6).

EIA/TIA specifies RJ-45 (ISO 8877) connectors for UTP cable (unshielded twisted pair).
Impedance: 100 Ohms
Max length of a segment: 100 meters/330 feet
Frequency rating: 100MHz
Capacitance 13.5 to 17 picofarads per foot
Attenuation 23 to 67dB per 1000 feet
Crosstalk 32 to 51 dB at 1000 feet

CAT 5 Cable Specifications:

Frequency	Max. Attenuation per 1000 ft/ 304 m	Resistance per 1000 ft/ 304 m	Capacitance	Impedance
4 MHz	13 dB	28,6 ohms	14 pF/ft	100 ohms
10 MHz	20 dB	28,6 ohms	14 pF/ft	100 ohms
20 MHz	28 dB	28,6 ohms	14 pF/ft	100 ohms
100 MHz	67 dB	28,6 ohms	14 pF/ft	100 ohms

CAT 3, 4, 5, 5e, 6, 7 Cable Specifications:

Category	Type	Spectral B/W	Length	LAN Applications	Notes
Cat3	UTP	16 MHz	100m	10Base-T, 4Mbps	Telephone Cables
Cat4	UTP	20 MHz	100m	16Mbps	Rarely Used
Cat5	UTP	100MHz	100m	100Base-Tx,ATM, CDDI	LAN
Cat5e	UTP	100MHz	100m	100Base-T	LAN
Cat6	UTP	250MHz	100m	1000Base-T	LAN
Cat7	ScTP	600MHz	100m	1000Base-T	LAN

CAT 5, 5e, 6 Detailed Cable Specifications:

	CAT 5	**CAT 5e**	**CAT 6**
Frequency	100 MHz	100 MHz	250 MHz
Attenuation (Min. at 100 MHz)	22 dB	22 dB	19.8 dB
Characteristic Impedance	100 ohms ± 15%	100 ohms ± 15%	100 ohms ± 15%
NEXT (Min. at 100 MHz)	32.3 dB	35.3 dB	44.3 dB
Return Loss (Min. at 100 MHz)	16.0 dB	20.1 dB	20.1 dB

Cat5 Wiring Standards, Listed

Pin	**EIA/TIA 568A**	**AT&T 258A, EIA/TIA 568B**	**10Base-T 10Mbps Cat3**	**100Base-TX 100Mbps Cat5**	**100Base-T4 100Mbps Cat3**	**100Base-T2 100Mbps Cat3**	**1000Base-T 1Gbps Cat5+**
1	white/green	white/orange	TX+	TX+	TX D1+	BI DA+	BI DA+
2	green/white	orange/white	TX-	TX-	TX D1-	BI DA-	BI DA-
3	white/orange	white/green	RX+	RX+	RX D2+	BI DB+	BI DB+
4	blue/white	blue/white	na	na	BI D3+	na	BI DC+
5	white/blue	white/blue	na	na	BI D3-	na	BI DC-
6	orange/white	green/white	RX-	RX-	RX D2-	BI DB-	BI DB-
7	white/brown	white/brown	na	na	BI D4+	na	BI DD+
8	brown/white	brown/white	na	na	BI D4-	na	BI DD-
BI=BI directional data RX=Receive Data TX=Transmit Data							

10BaseT and 100BaseT Cross Cable			
Pin	**Color Code**	**Color Code**	**Pin**
1	White/Orange	White/Green	1
2	Orange	Green	2
3	White/Green	White/Orange	3
4	Blue	Blue	4
5	White/Blue	White/Blue	5
6	Green	Orange	6
7	White/Brown	White/Brown	7
8	Brown	Brown	8

Ethernet-1

Note: An additional Sensor Power Option is available via CON5 intended to feed to and back from a separate DC-DC converter.

TVS Array	**FET Power Control**	**Shielded Pair 4,5 – C,D**	**Shielded Triad 3,6,7 – E,F,G**
SRV05-4	OUT-6 (Viper PL9-19)	Tx+/-	Rx+/-,LANGnd
Sensor Power Option	**Jumpering**		
Vcc	CON5: 1-2 JP2: 2-3	FET disabled	JP4 Out
FET	CON5: 1-2 JP2: 1-2, 3-4 JP2: 1-2	FET enabled	JP4 In
+15SubModule	JP2: 2-3	FET disabled	JP4 Out
None	JP2: all removed	FET disabled	JP4 Out

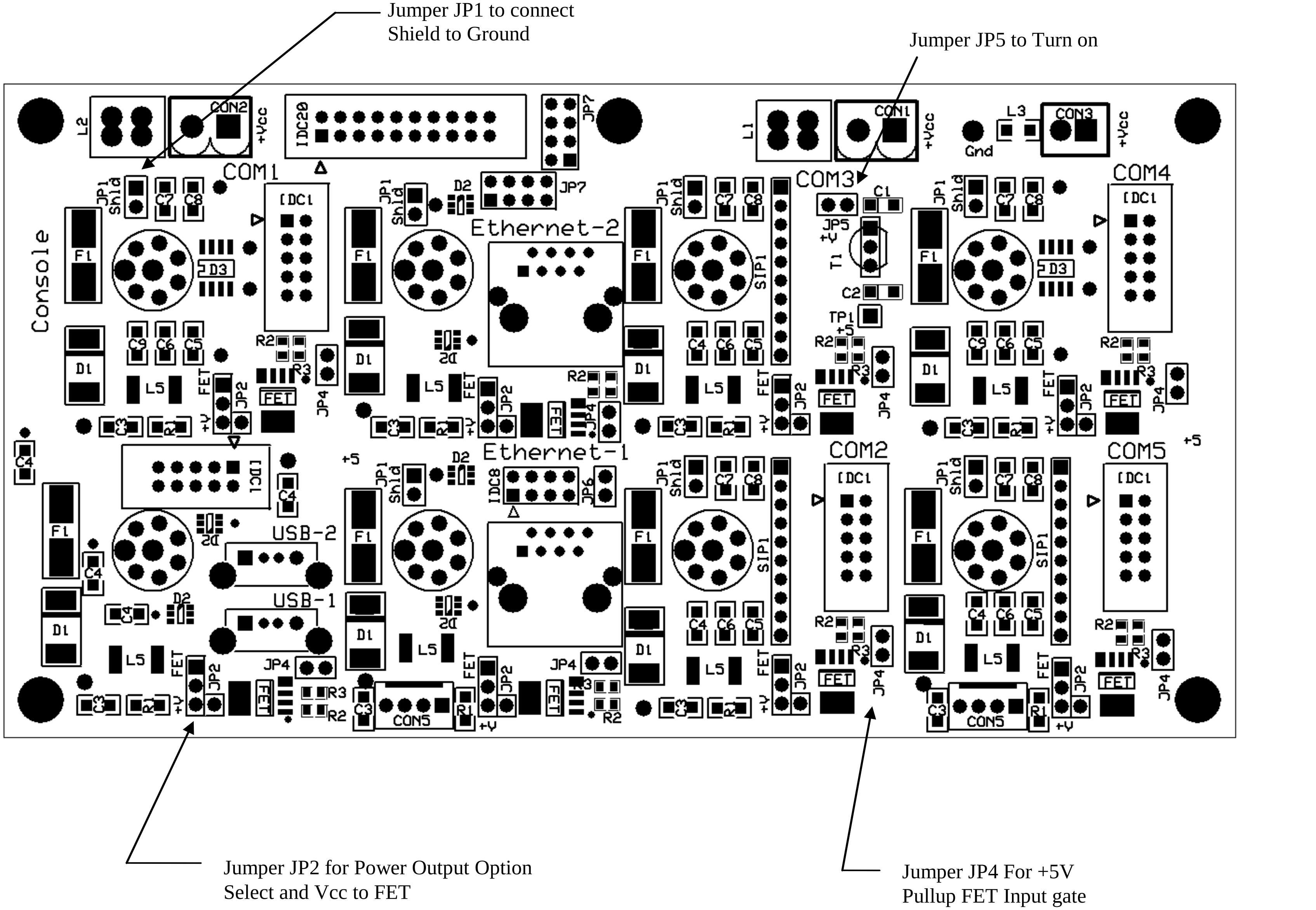
Cable-Wire **‘GreenJacket’**	**Bulgin** to External	**Ribbon-8 - Viper PL1**	**Protection / Interface**	**On-Board Eth. Modular Jack**
A = Red	1 (Power +Vcc)		F1, TVS SMC, RLC Choke/Filter - Gnd	
B = Bare	2 (Shield: jumper to gnd)		JP1, Thermal Pad to Ground Plane	
H = Black	8 Ground Plane		Thermal Pad to Ground Plane	
C = White	5	1 = Tx+	TVS/Diode array1	ETH1, Pin-1
D = Black	4	2 = Tx-	TVS/Diode array2	ETH1, Pin-2
E = Brown	3	3 = Rx+	TVS/Diode array-1	ETH1, Pin-3
		4 = RJ-2		
		5 = RJ-2		
F = Orange	6	6 = Rx-	TVS/Diode array-2	ETH1, Pin-6
G = Yellow	7 (JP6 jump to Gnd)	8 = LANGnd		

Ethernet-2

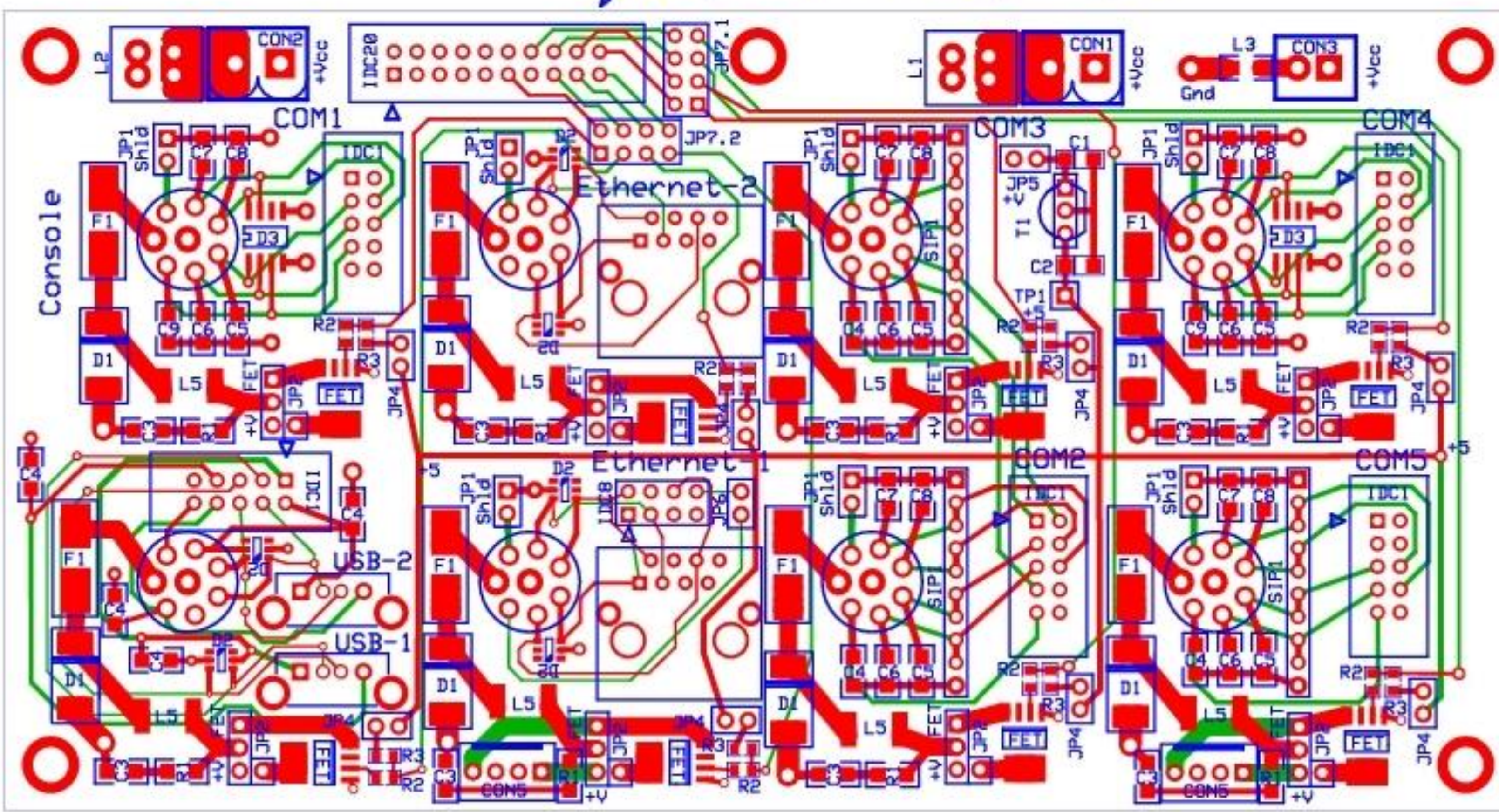
TVS Array	FET Power Control	Shielded Pair 4,5 – C,D	Shielded Triad 3,6,7 –E,F,G
SRV05-4	OUT-4 (Viper PL9-17)	Tx+/-	Rx+/-

Cable-Wire	**Bulgin** to External	**Ribbon-8 - Viper PL1**	**Protection / Interface**	**On-Board Eth. Modular Jack**
A = Red	1 (Power +Vcc)		F1, TVS SMC, RLC Choke/Filter -Gnd	
B = Bare	2 (Shield: jumper to gnd)		JP1, Thermal Pad to Ground Plane	
H = Black	8 Ground Plane		Thermal Pad to Ground Plane	
C =	5		TVS/Diode array1	ETH2, Pin-1
D =	4		TVS/Diode array2	ETH2, Pin-2
E =	3		TVS/Diode array-1	ETH2, Pin-3
F =	6		TVS/Diode array-2	ETH2, Pin-6
G =	7 (n/c)			

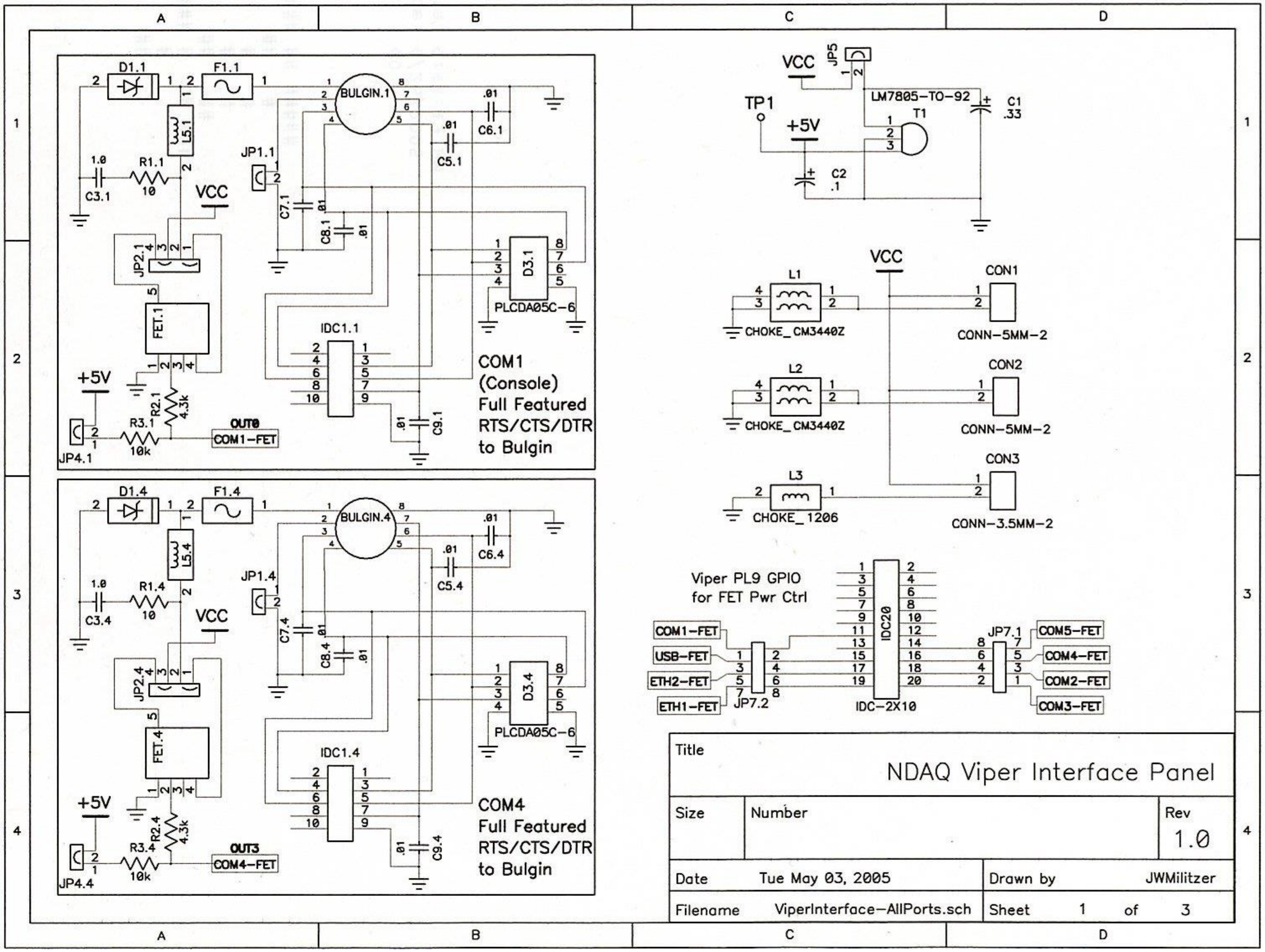
Layout:

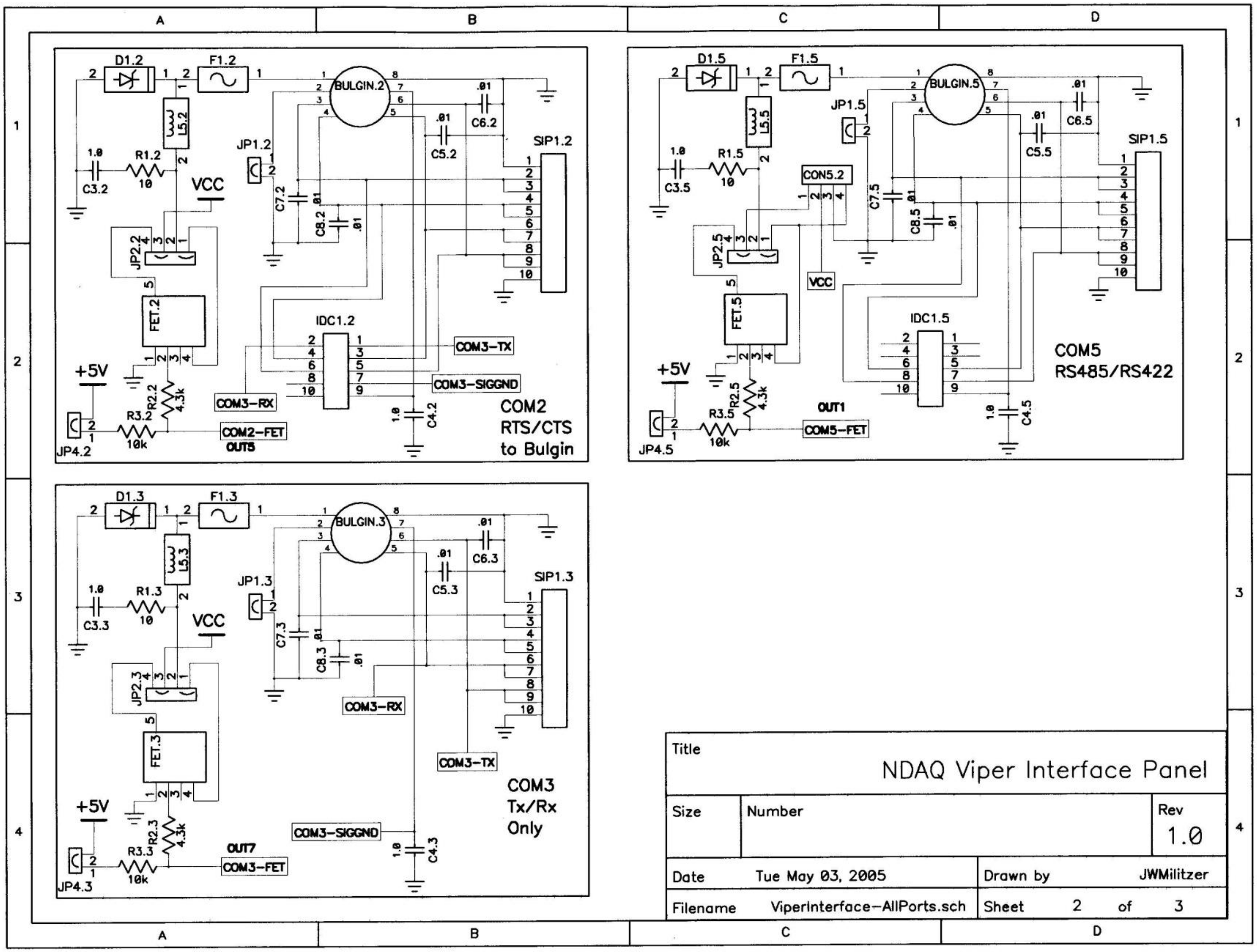

Jumper JP1 to connect
Shield to Ground
Jumper JP5 to Turn on
Console
COM1
COM2
COM3
COM4
COM5
Ethernet-2
Ethernet-1
USB-2
USB-1
Jumper JP2 for Power Output Option
Select and Vcc to FET
Jumper JP4 For +5V
Pullup FET Input gate

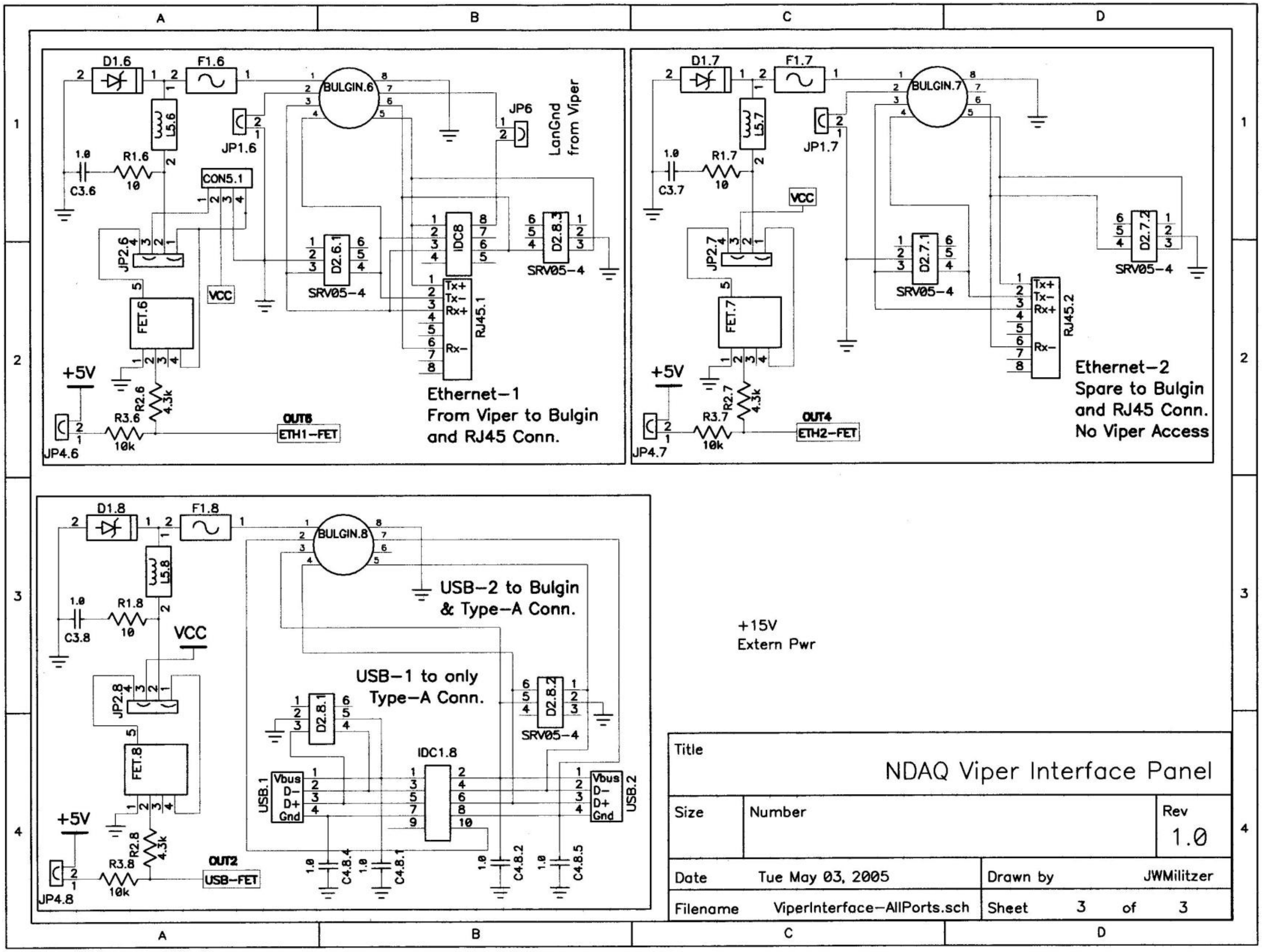
See Viper DIO Interface Mapper - 10pin



Schematic:


COM1
(Console)
Full Featured
RTS/CTS/DTR
to Bulgin
COM4
Full Featured
RTS/CTS/DTR
to Bulgin
LM7805-TO-92
CHOKE_CM3440Z
CHOKE_1206
CONN-5MM-2
CONN-3.5MM-2
Viper PL9 GPIO
for FET Pwr Ctrl
IDC-2X10
Title
NDAQ Viper Interface Panel
Size
Number
Rev
1.0
Date
Tue May 03, 2005
Drawn by
JWMilitzer
Filename
ViperInterface-AllPorts.sch
Sheet
1
of
3


D1.2
F1.2
BULGIN.2
L5.2
R1.2
C3.2
JP1.2
C7.2
C8.2
C5.2
C6.2
SIP1.2
VCC
JP2.2
FET.2
IDC1.2
COM3-TX
COM3-SIGGND
COM3-RX
COM2-FET
OUT5
+5V
R2.2
4.3k
R3.2
10k
JP4.2
C4.2
COM2
RTS/CTS
to Bulgin
D1.5
F1.5
BULGIN.5
L5.5
JP1.5
R1.5
C3.5
CON5.2
C7.5
C8.5
C5.5
C6.5
SIP1.5
JP2.5
VCC
FET.5
IDC1.5
COM5
RS485/RS422
R2.5
R3.5
OUT1
COM5-FET
JP4.5
C4.5
D1.3
F1.3
BULGIN.3
L5.3
R1.3
C3.3
JP1.3
C7.3
C8.3
C5.3
C6.3
SIP1.3
JP2.3
FET.3
COM3-RX
COM3-TX
COM3
Tx/Rx
Only
COM3-SIGGND
R2.3
R3.3
OUT7
COM3-FET
JP4.3
C4.3
Title
NDAQ Viper Interface Panel
Size
Number
Rev
1.0
Date
Tue May 03, 2005
Drawn by
JWMilitzer
Filename
ViperInterface-AllPorts.sch
Sheet
2
of
3


D1.6
F1.6
BULGIN.6
JP6
LanGnd from Viper
L5.6
JP1.6
R1.6
C3.6
CON5.1
JP2.6
VCC
D2.6.1
SRV05-4
IDC8
D2.8.3
SRV05-4
RJ45.1
Tx+
Tx-
Rx+
Rx-
FET.6
+5V
R2.6
4.3k
R3.6
10k
JP4.6
OUT6
ETH1-FET
Ethernet-1
From Viper to Bulgin
and RJ45 Conn.
D1.7
F1.7
BULGIN.7
L5.7
JP1.7
R1.7
C3.7
VCC
JP2.7
D2.7.1
SRV05-4
D2.7.2
SRV05-4
RJ45.2
FET.7
R2.7
R3.7
JP4.7
OUT4
ETH2-FET
Ethernet-2
Spare to Bulgin
and RJ45 Conn.
No Viper Access
D1.8
F1.8
BULGIN.8
L5.8
R1.8
C3.8
VCC
USB-2 to Bulgin
& Type-A Conn.
JP2.8
FET.8
+5V
R2.8
R3.8
JP4.8
OUT2
USB-FET
USB-1 to only
Type-A Conn.
D2.8.1
D2.8.2
SRV05-4
IDC1.8
USB.1
USB.2
Vbus
D-
D+
Gnd
C4.8.4
C4.8.1
C4.8.2
C4.8.5
+15V
Extern Pwr
Title
NDAQ Viper Interface Panel
Size
Number
Rev
1.0
Date
Tue May 03, 2005
Drawn by
JWMilitzer
Filename
ViperInterface-AllPorts.sch
Sheet
3
of
3

Power Distribution Panel:

Description: This board was laid out for interfacing the NDAQ to the external station power cabling using AMP 4-pin CPC series connectors. These were selected to be compatible with existing PAM-III cabling.

4-layer board. 3.5"x4.0"
1.25oz copper
ExpressPCB layout and manuf.

Nominal Current Capacity for various trace sizes. The table below gives rough guidelines of how wide to make a trace for a given amount of current. Elevated temperatures reduce trace capacity.

0.010" 0.3 Amps
0.015" 0.4 Amps
0.020" 0.7 Amps
0.025" 1.0 Amps
0.050" 2.0 Amps
0.100" 4.0 Amps
0.150" 6.0 Amps

When placing a trace, it is very important to think about the space between the trace and any adjacent traces or pads. You want to make sure that there is a minimum gap of 0.007" between items, 0.010" is better. Leaving less blank space runs the risk of a short developing in the board manufacturing process. It is also necessary to leave larger gaps when working with high voltage.

Power Connections: The board has both an inner ground and an inner power plane. These are supplied by or are available to 6 connectors: 3-each 15-Amp rated Molex (Digikey p/n WM5872-ND, and WM5862-ND) and 2-each 8-Amp rated Molex (Digikey p/n WM5624-ND, and WM5605-ND). These connectors do not have a choke coil between its ground pin and the internal ground plane.
Power to the board is routed through AMP connector labeled "MAIN", through a TVS array, Choke and filter to another Molex connector to a 8A rated M-Series Breaker / Switch from Carling Technologies (MD1-B-34-460-1-A16-2-C).
High current ferrite-beads are used as common-mode chokes on both ground and +Vout to suppress noise and assist the TVS protection.

Ground Bonding: The ground plane of the board can be bonded to earth through an aluminum electronics box via the 5 mounting screw hole pads.

Auxiliary Outputs for external equipment: AUX1, AUX2

PORT	**Supply Power Option**	**Jumpering**			Viper Control
AUX1	Vcc	JP2: 2-3	FET disabled	JP4, JP7 Out	
	FET	JP2: 1-2, 3-4 JP4: 1-2	FET enabled	JP7 =	OUT-0
AUX2	Vcc	JP2: 2-3	FET disabled	JP4, JP7 Out	
	FET	JP2: 1-2, 3-4 JP4: 1-2	FET enabled	JP7 =	OUT-2

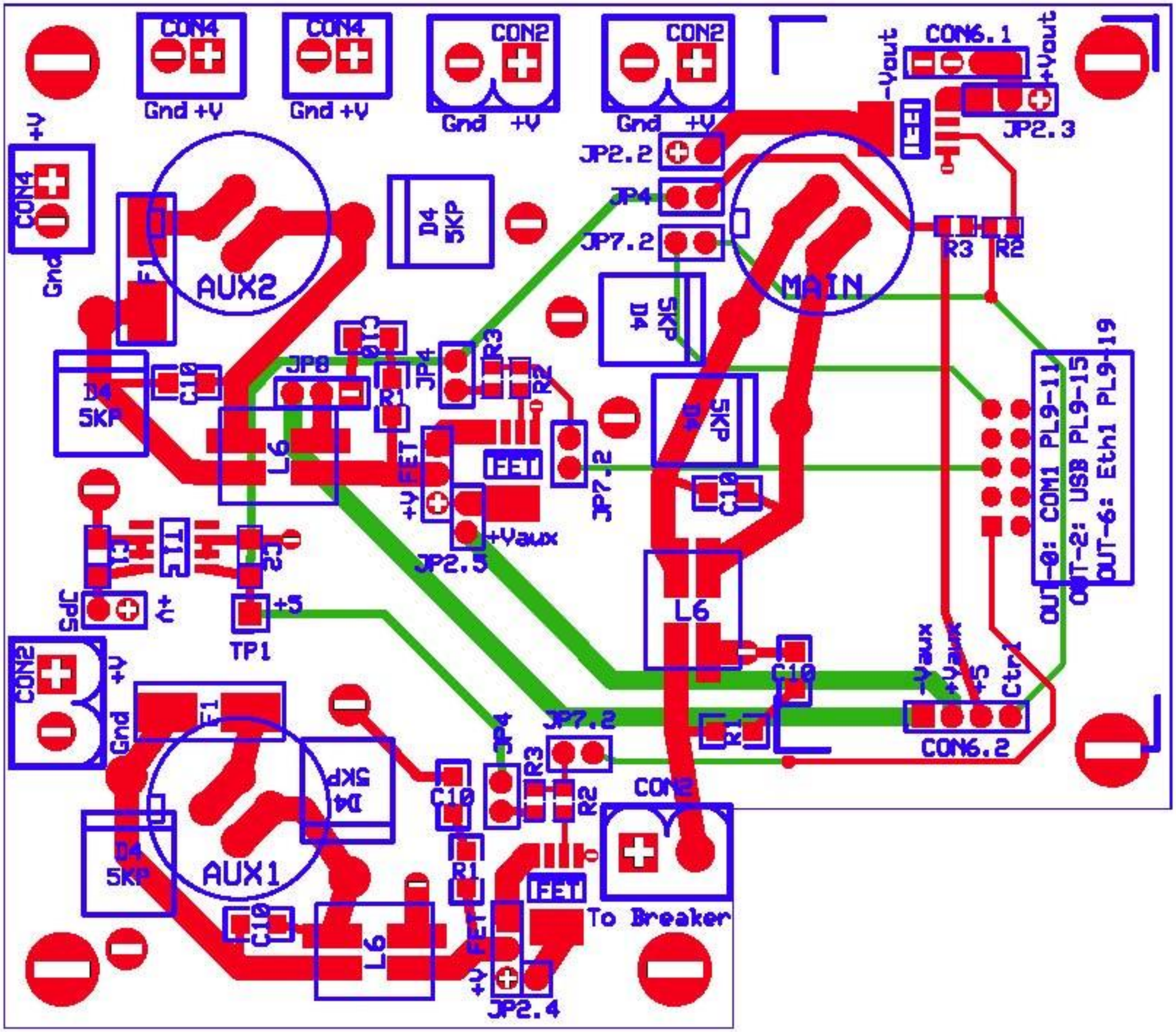
	+15SubModule	JP2: 2-3, 4-5 JP4: 1-2	FET enabled	JP4	
	Module Ctrl:				OUT-6

Power Panel – Component Current / Power Capacity:

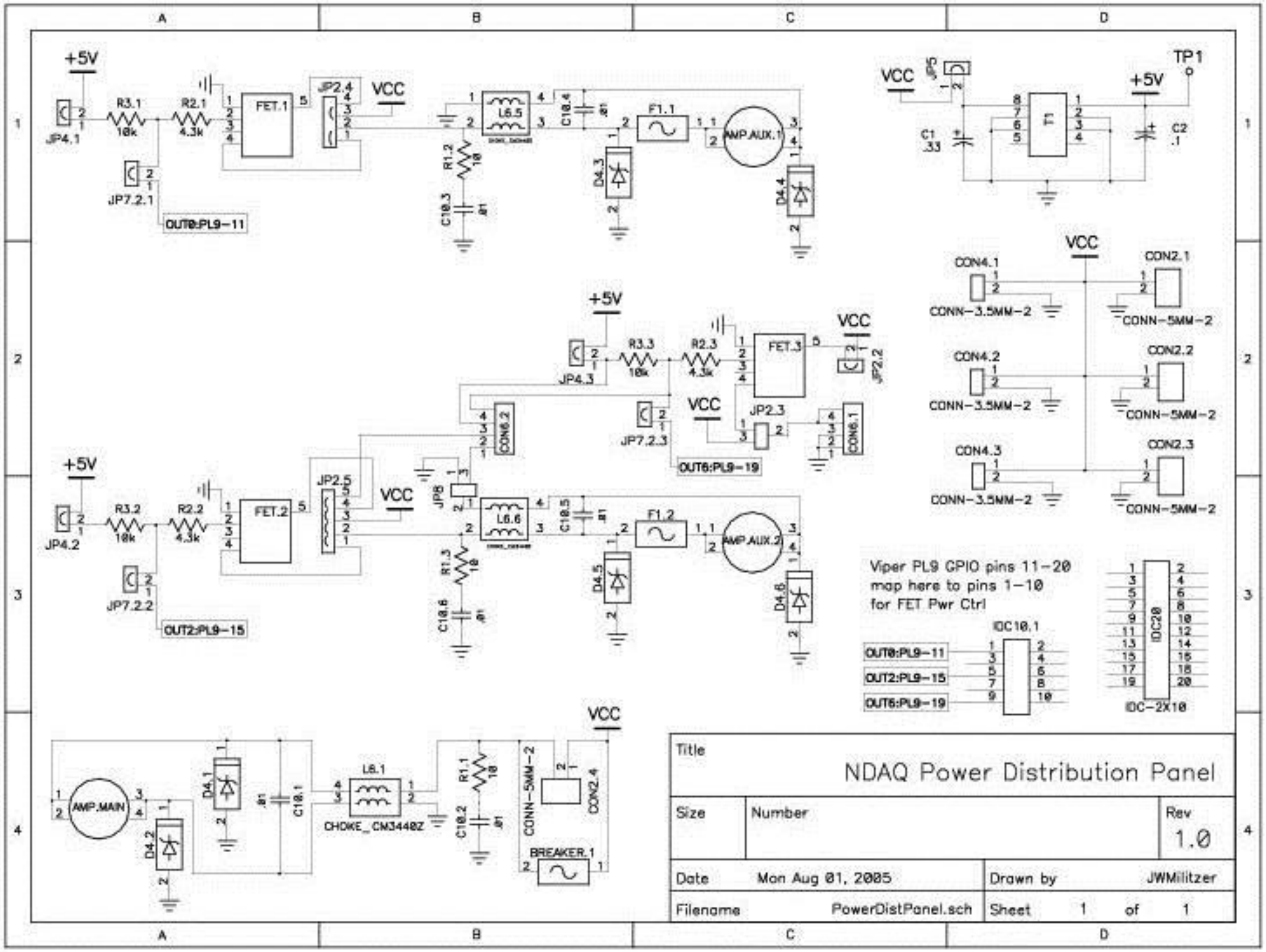
LIMITATION: Board LANs from 'Main-In' to the internal power plane.
It is also dependent upon overall board and component temperature. In general current capacity goes down with temperature for lans/wire, but improves for components that are limited on internal junction temp/heat sinking.

Component	***Rating***	***Comment***
AMP Pins	13A? per pin *2	Mentioned on one note in digikey catalog
16AWG Wire for +/- to board from Power Panel	13A per wire	Note temp./insulation deratings reduce these
Board Connectors	15A	5mm Black 2-pin Molex (wm5872-nd, wm5862-nd)
	8A	3.5mm Black 2-pin Molex (wm5624-nd, wm5605-nd)
PCB Total	See LAN ….	Board has internal power/ground planes…need to measure.
Board LANs THIS IS THE PROBLEM from Main thru Switch to Power Plane	~0.7A@-10degC ~1.5A@0degC ~2.0A@10degC ~4.0A@45degC	.080" x 1.25 Oz./ft^2 copper trace through coil, fuse to Bulgin connector. Tested to much more temporarily at room temp.
Power Switch/Brkr	8A	Rated
FET for Aux1,2	1.4A @ 125degF 2.0A @ 75degF 2.6A @ 25degF 10A peak	IRL IPS521G part. Max continuous current is dictated by Junction Temperatures. These improve with lower ambient temps. and better heat sinking on chip or lan. The NDAQ board was not designed with any special heat sinking capabilities.
Power Choke on Input and Aux	20A	L6, Stewart Ferrite (240-2186-1-nd)
Pin on +12 Distrib to dc-dc submodule.	3A	Sullens .1" breakaway (s1011-35-nd)
Shunts on PowerPin	3A	Sullens .1" (s9000-nd)

PCB / Layout:


CON4
Gnd +V
CON2
CON6.1
-Vout
+Vout
JP2.3
JP2.2
JP4
JP7.2
R3
R2
MAIN
AUX2
D4
5KP
F1
C10
JP8
R1
L6
FET
+V
+Vaux
JP2.5
JP5
+5
TP1
OUT-0: COM1 PL9-11
OUT-2: USB PL9-15
OUT-6: Eth1 PL9-19
-Vaux
Ctrl
CON6.2
AUX1
JP2.4
To Breaker

Schematic:


Viper PL9 GPIO pins 11-20
map here to pins 1-10
for FET Pwr Ctrl
Title
NDAQ Power Distribution Panel
Size
Number
Rev
1.0
Date
Mon Aug 01, 2005
Drawn by
JWMilitzer
Filename
PowerDistPanel.sch
Sheet
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of
1

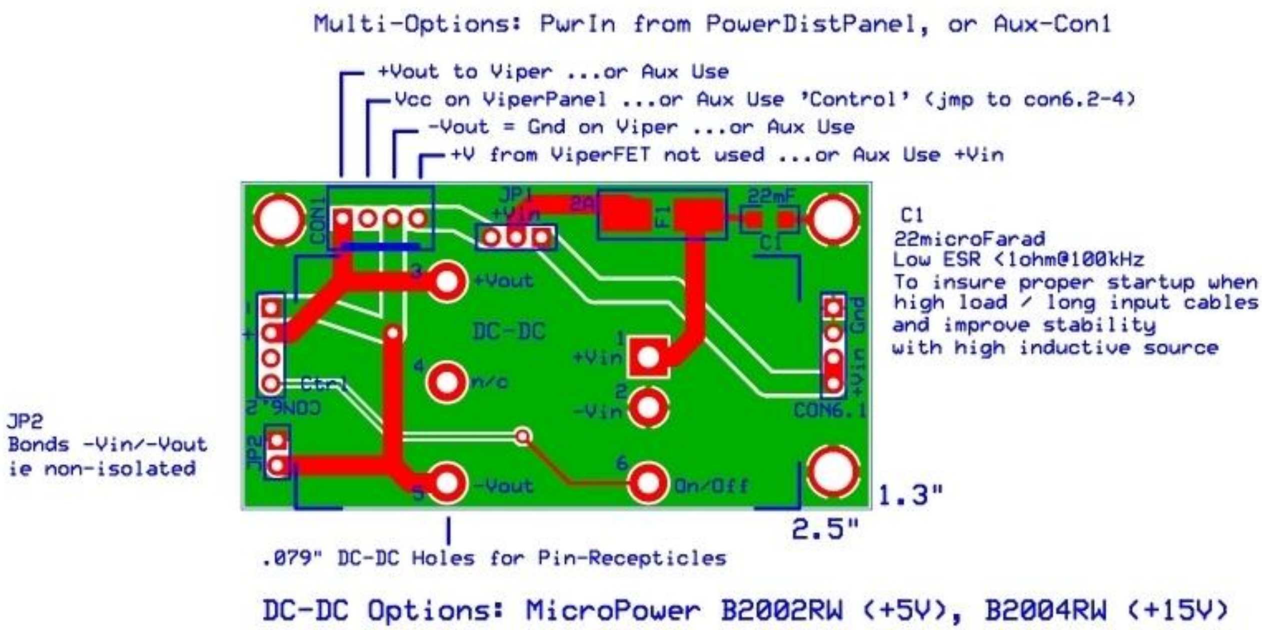
DC-DC Power Option:

A sub-module can be stacked on top of the power distribution board to provide a regulated voltage supply. Its output is routed to both its 'CON5' connector and to CON6.2 on this board and 'AUX2' via JP2.5. The initial purpose is to operate the wireless Ethernet antennas at optimum power setting. The commercial converter used is a 20W unit with wide input range from MicroPowerDirect (www.micropowerdirect.com), model B2004. It has a reasonable efficiency as shown in the diagram below.

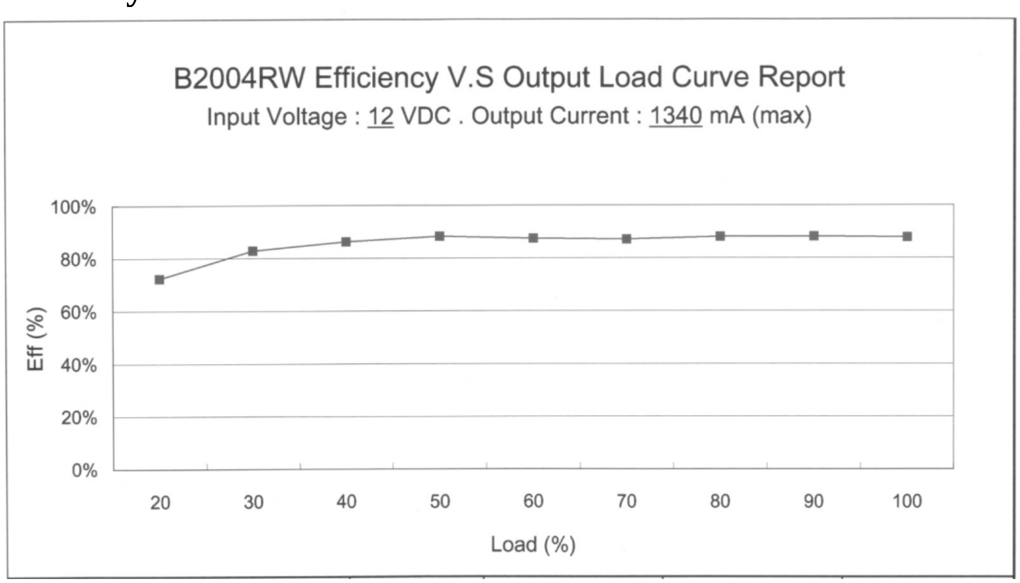
The DC sub-module obtains power from either:

- CON6 on this board via FET control. Insert JP2, JP7 and JP4 jumpers located adjacent to the 'Main' input. Control is provided via Viper OUT-6 signal.
- CON4 on this board, the 2-pin power connector would plug into pins 1,2 on CON1 of the DC-DC sub-module.
- CON1 on the submodule via the 'CON5' connectors on the Viper CPU panel Ethernet1 or COM5

DC-DC Sub-Module:



Efficiency:



PhotoDiode 'Night-Light' Switch:

For the TREX project a photo-diode based switch was built to turn on a tower beacon at night and turn it off in the daytime using either the Aux1 or Aux2 external power ports. The PerkinElmer diode VTP3310 available from www.newarkinone.com was used through a LM111 comparitor to drive the standard FET switch to control the output power. Shown below is a modified version of the NDAQ power distribution panel for clarification.