

SCPR Electronics inside Sphere: CF2 Main PC Board

External Connectors

Comm Port (monitor & test only)

LinkQuest Modem

Battery Packs

- #1 SCPR 14V
- #2 LinkQuest 24V
- #3 DL5 7V

Burnwire #1
Burnwire #2

Emergency Transponder
+9V to auto-lock Mass

RS232

SCPR Main Control Board

- Persistor CF2 Board
- Maxim DS3234 RTC w/ backup battery
- BB/TI 8 Ch 16 Bit SE ADC #1
- SPI Control for Interface Board
- 4 RS232 Comm Ports
- RPM
- Tilt XY & T (AGI)
- LM35 Temperature
- Aux Digital I/O
- Aux Analog Inputs
- Battery Sense 14V
- Battery Sense 24V

CF2 COMM

COM2
COM3
COM1

DL5 #1
DL5 #2

Paros Model 31/410K Transducer
Paros Model 31/410K Transducer

- CF2 Main** DWT RPM - 1 digital input
AGI X-Y Clinometer w/ T - 3 analog inputs
LM35 Temperature - 1 analog input
- Valves** Hanby Acuator #1 - 2 DO control & 2 DI status lines
Hanby Acuator #2 - 2 DO control & 2 DI status lines
- Gimble** Level Motors Assembly - L298P #1 motor control
Level Position Pots - 2 analog inputs
- Sensors** PRT - 1 analog input
Barometer - 1 analog input
- DWT** LVDT #1 & #2 - 2 analog inputs
Mass Lock Motor - 1 digital output, Vreg switch 8V
Mass Lock Motor Limit Switches - 2 digital input
Spin Motor, PWM for low to high speed - L298P #2 motor control
Tension Motor, forward & reverse - L298P #2 motor control
Tension Limit Switches, 2 digital inputs

SPI Bus Header (all boards)

H1 SPI Bus	
DCOM 1	2 SCK
DCOM 3	4 MOSI
DCOM 5	6 MISO
DCOM 7	8 SPI-4
3.3VSW 9	10 SPI-5
3.3VSW 11	12 SPI-6
SW3 13	13 SPI-7
2x7 Shrouded Header	

SCPR Interface Board

DWT Control

- Mass Lock Motor
- Valve Acuator #1
- Valve Acuator #2
- X & Y Level Motors (L298P #1)
- Belt Tension Motor (L298P #2)
- Spin up Motor (L298P #2)

DWT Monitor

- BB/TI 8 Ch 16 Bit SE ADC #2
- LVDT #1 LVDT #2
- PRT
- Barometer, Vaisala PTB110
- X Level FB Pot
- Y Level FB Pot
- Limit Switch #1 & 2, Mass Lock
- Limit Switch #3 & 4, Belt Tension

Burnwire #1
Burnwire #2

Pin #	Main Battery J1 J2 Batt 14V	Vsense 24V Batt J3 Batt 24V	Tilt, Serial J4 COM2	Paros J5 COM3	LinkQuest Modem J6 COM1	CF2 Main Comm J7 Comm	Digital J8 Aux I/O	Tilt, Analog J9 Tilt	Temperature J10 LM35	Analog J11 Aux Ain
1	common	common	common	common	common	common	common	common	common	common
2	common	+24V	Rx (in)	Rx (in)	Rx (in)	Tx (out)	SW3 (TPU2)	nc	Temp In	VAux1
3	+14V		Tx (out)	Tx (out)	Tx (out)	Rx (in)	RPM (TPU4)	Tilt T	JT5	VAux2
4	+14V	<u>1x2 Microfit 3mm</u>	Tilt 11V	Paros 9V	nc	nc	TPU6	Tilt Y		JT6
5	<u>1x4 Microfit 3mm</u>		<u>1x4 c-grid</u>	<u>1x4 c-grid</u>	<u>1x4 c-grid</u>	nc	TPU8	Tilt X	<u>1x3 c-grid</u>	
6						<u>1x5 c-grid</u>	TPU9	Tilt 11V		<u>1x4 c-grid</u>
7							<u>1x6 c-grid</u>	<u>1x6 c-grid</u>		
8										

CF2 Main Connectors

See the CF2 Getting Started Guide p. 26

- On actual Persistor CF2 Board
- C49 LinkQuest Tx (RS232 level)
- C50 LinkQuest Tx (logic level)
- C41 IRQ2 breaks into data logging

Jumper Select Blocks

- JT1 3.3VSW JT2 11VSW Tilt JT3 9VSW Paros
- 3-4 CF2 control
- 2-4 Always On
- 4-6 Always Off
- JT4 1-2 VBBK to CF2 (leave open, future use)
- JT5 LM35 JT6 Aux Analog
- 1-2 Tilt 11VSW
- 2-3 Paros 9VSW

DB9F to PC

- 2 Rx (data in from Tx)
- 3 Tx (data out to Rx)
- 5 common

Title SCPR Function Blocks

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Number Revision

Drawn by Mike Kirk 3/1/2011 Tel: 858-534-6729

File: F:\MarkZumberge\2010\SCPR\Schematics\SCPR_Block\SCPR_Block_SchDoc

Size **B**

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SCPR Interface Board

DWT Control

Mass Lock Motor
Valve Actuator #1
Valve Actuator #2
X & Y Level Motors (L298P #1)
Belt Tension Motor (L298P #2)
Spin up Motor (L298P #2)

DWT Monitor

BB/TI 8 Ch 16 Bit SE ADC #2
LVDT #1 LVDT #2
PRT
Barometer, Vaisala PTB110
X Level FB Pot
Y Level FB Pot
Limit Switch #1 & 2, Mass Lock
Limit Switch #3 & 4, Belt Tension

Burnwire #1 Burnwire #2

Interface Jumper Select Blocks

JT1 3.3VSW1	JT2 3.3VSW	JT3 Mot1_Pwr
JT4 Burnwire Pwr	JT5 MassLock Pwr	JT6 Mot2_Pwr
JT7 MassUnlock Pwr	JT8 Baro Pwr	JT9 3.3VA
JT10 LVDT Pwr	JT11 PRT Pwr	

----- No Jumper Always Off
----- 2-3 Always On
----- 1-2 Control

SCPR Interface Board

Valves Hanby Acuator #1 - 2 DO control & 2 DI status lines
Hanby Acuator #2 - 2 DO control & 2 DI status lines

Gimble Level Motors Assembly - L298P #1 motor control
Level Position Pots - 2 analog inputs

Sensors PRT - 1 analog input
Barometer - 1 analog input

DWT LVDT #1 & #2 - 2 analog inputs
Mass Lock Motor - 1 digital output, Vreg switch 8V
Mass Lock Motor Limit Switches - 2 digital input
L298 #2 : Spin Motor, PWM?
Tension Motor, forward & reverse
Tension Limit Switches, 2 digital inputs

CF2 Main H1 SPI Bus
J1 Battery
J8 AuxIO

SPI Bus Header (all boards)

H1 SPI Bus		
DCOM 1	2	SCK
DCOM 3	4	MOSI
DCOM 5	6	MISO
DCOM 7	8	SPI-4
3.3VSW 9	10	SPI-5
3.3VSW 11	12	SPI-6
SW3 13	13	SPI-7

2x7 Shrouded Header

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LinkQuest Modem

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Burnwire #1
Burnwire #2

Emergency Transponder
+9V to auto-lock Mass

Pin #	Main Battery	Valve 1	Valve 2	Aux Digital	DWT RPM	Tension Motor	Spin Motor	Burnwire Battery	Burnwires	X Level	ML Motor	Y Level	Emerg Xpond
	J1 J2 Batt 14V	J3 VALVE1	J4 VALVE2	J5 AuxDig	J6 RPM	J7 TenMot	J8 SpinMot	J9 Burn 12V	J10 Burn	J11 X Level	J12 ML_Mot	J13 Y Level	J14 EmXp
1	common	DCOM	DCOM	DCOM	R_BlK	Slack_Com	Mot-	BurnBatt -	sea ground	ACOM	Mot-	ACOM	EmX_COM
2	common	V1C1	V2C1	SW3 (TPU2)	R_Red	Tension_Com	Mot+	BurnBatt +	Burnwire	XFBPOT	LMot+	YFBPOT	EmX_9V
3	+14V	V1C2	V2C2	RPM (TPU4)	R_Yel	Slack_NO	<u>1x2 c-grid</u>	<u>1x2 Microfit 3mm</u>	<u>1x2 Microfit 3mm</u>	VREF	LSense	VREF	<u>1x2 c-grid</u>
4	+14V	V1S1	V2S1	TPU6	<u>1x3 c-grid</u>	Tension_NO	<u>1x2 c-grid</u>			nc	ULMot+	nc	
5	<u>1x4 Microfit 3mm</u>	V1S2	V2S2	TPU8		Mot-		<u>Independent Burnwire Battery</u>		Mot-	ULSense	Mot-	
6		VBAT_SW1	VBAT_SW1	TPU9		Mot+		3 Li Cells, AA or larger 12-14 VDC		Mot+	nc	Mot+	
		<u>1x6 c-grid</u>	<u>1x6 c-grid</u>	<u>1x6 c-grid</u>		<u>1x6 c-grid</u>				<u>1x6 c-grid</u>	<u>1x6 c-grid</u>	<u>1x6 c-grid</u>	

SCPR Interface Connectors

Pin #	Barometer	Aux Analog	LVDT1	DC-DC Onboard	DC-DC Offboard	PRT	LVDT2
	J15 Baro	J16 Baro	J17 LVDT1	J18 DC-DC Out	J19 DC-DC In	J20 PRT	J21 LVDT2
1	common	common	L1_BRN	DCOM	DCOM	PRT1	L2_BRN
2	nc	ADC6	L1_YEL	VBAT_IN	VBAT_OUT	PRT2	L2_YEL
3	BarSig	ADC7	L1_RED	nc	nc	PRT3	L2_RED
4	VBAT_Baro	VBAT_Baro	L1_BLU	-15V_OUT	VA-_IN	PRT4	L2_BLU
5	<u>1x4 c-grid</u>	<u>1x4 c-grid</u>	L1_GRN	ACOM	ACOM	<u>1x4 c-grid</u>	L2_GRN
6			L1_BLK	+15V_OUT	VA+_IN		L2_BLK
			<u>1x6 c-grid</u>	<u>1x6 Microfit 3mm</u>	<u>1x6 Microfit 3mm</u>		<u>1x6 c-grid</u>

Title **SCPR Interface Function Blocks**

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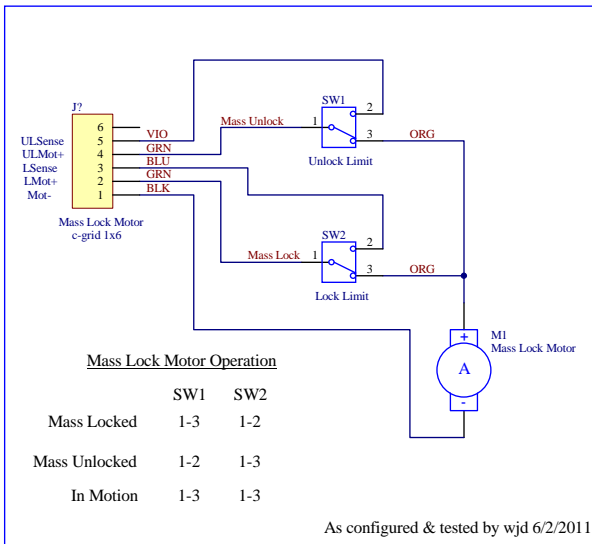
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6/1/2011 SCPR Mass Lock Motor Operation

The SCPR uses a Dead Weight Tester (DWT) which must be locked down during land/sea transportation, down to the sea floor on deployment and up from the sea floor during the recovery. The motor drives a cam plate to a lock position sensed by a limit switch. The same motor going in the same direction also drives it to the unlocked position sensed by a second limit switch. When not at either limit, both limit switches are engaged so NO is closed and NC is open.

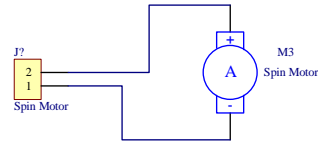
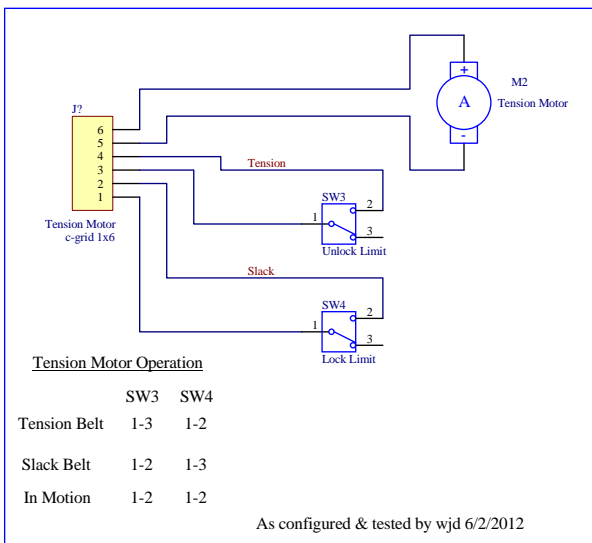
Lock or unlock operation
 A firmware controlled voltage regulator via a diode provides the motor power to limit switch common terminal.
 The limit switch NO terminal connects to the Motor +.
 The Motor - returns to common.

If the limit switch is not open (i.e., not at the limit), enabling the voltage regulator will drive the motor until the limit switch opens.
 Enabling the other voltage regulator, the second limit switch allows power until the other limit switch opens.

The NC terminals of the limit switches are used to provide open/close status back to the controller. Connect the NC terminal to a voltage divider for 3.3V logic and a buffer for protection.
 Logic 0 Not at the limit
 Logic 1 At the limit

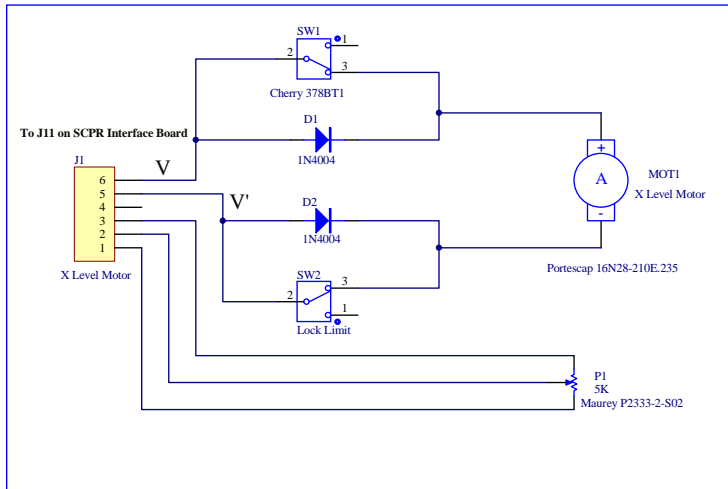
The limit switches are rated 2+ amps and can easily handle the 300 mA motor current.

Emergency Transponder Activation
 An independent Benthos Tranponder provides a backup release method.
 Prior to releasing, the Benthos unit provides +9V via a diode to the lock circuit.
 If already locked, nothing happens. Otherwise the motor will drive to the lock position even with main battery dead.

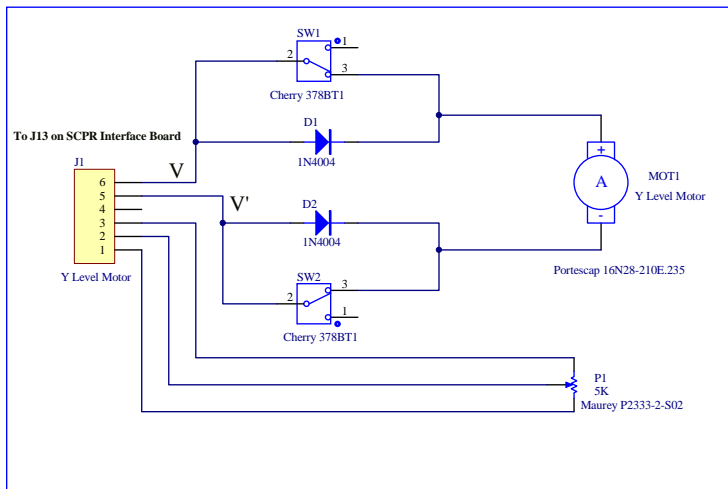


Title Mass Lock, Tension, Spin Motors & Limit Switches	
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VERIFY FROM SCPR SETUP !!!!



ROVDOG 2 Motor Interface
04/18/2000
Rev 1.1 by Glenn Sasawaga

Notes:

1. Point to point wiring from motor interface board to SW1, SW2, and MOT1 on actuator assembly.
2. Orientation of D1 & D2: diode stripe faces outboard on pc board.
3. Wire pigtail to solder pads 1 - 6.
4. We are using the standard unmodified ROVDOG motor packs for SCPR 2011 BUT notice the connector wiring is different!!!

ROVDOG 2 Motor Interface
GS 4/18/2000

As built, the motor with the gear reduction couples to a lead screw.
The 2 diodes with the 2 limit switches provide an auto-reverse at the end of travel.
The feedback pot provides position for accurate control.

Two of the above assembly provides X-Y leveling control to the gimbal mounted ROVDOG and now the SCPR in 2011.

From Glenn (see schematic):
The auto-reverse operation is clearer if you look at the actuator, but say the actuator is mid-range.
forward polarity (pin 6 positive relative to pin 5), both switches closed.
At end of forward travel, SW2 opens, motor stops.
Now Back up, reverse polarity (pin 5 > pin 6),
Diode is forward biased so SW2 doesn't matter, etc.....

From Mark (see figure)
The diodes circumvent an opened limit switch when the polarity is set to move the carriage away from that limit switch.
When $V > V'$,
the motor turns in a direction such that limit switch S2 (normally closed) is approached by the moving object.
When it hits the switch, the circuit opens and the motor stops.
The diode in parallel with S2 is reverse biased at that moment.

To enable motion in the other direction when the limit has been reached, the controller makes $V < V'$.
The diode in parallel with S2 becomes forward biased and the motor turns on in the other direction,
and the moving object approaches S1.
The same reversible limit action takes place on the other end.

A disadvantage to this method is that the motor briefly sees an extra diode drop in the input voltage when reversing direction. As long as it is not close to torque limited that's OK (in the ROVDOGS, you can hear this slight decrease after the limit switches have been engaged).

In practice, it's too hard to take into account all of the sign changes (from gears, etc.) so you wire it up and try it (engaging the limit switches with a popsicle stick before the thing actually arrives at that end) and swap the leads to the motor (or reverse both diode directions) if it's backwards.

***** BIG NOTE *****

ROVDOG uses the Portescap 16N28-210E motors (7.5V) at 12VDC with 2 diode drops
Not good but OK for ROVDOG mainly since it works.

Portescap 16N28 -210E	-207E
Voltage	7.5V 12V
No load, mA	13.3 7.7
Max load, mA	420 240
Resistance, ohms	14.6 40.5

ROVDOG
As built with the gear reduction & lead screw,
monitoring the current,

Tested at 7, 8, 9 & 10V
No load current 60-75 mA
Load current 90-150 mA
Using 2 fingers attempting to stall the moving bar. it would slow it resulting in the current rise but would take much more effort to stall.

The expected failure will likely be heat melting the motor windings insulation so very much over 3 W.
10V & 500 mA, should be worried.
As built, no where close.
ROVDOG is fine.

Gravity Lab has many of these motors.
Future designs should use the rated 7.5V and leave out the extra diodes.

Title X-Y Level Motors with FB Pots & Limit Switches	
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