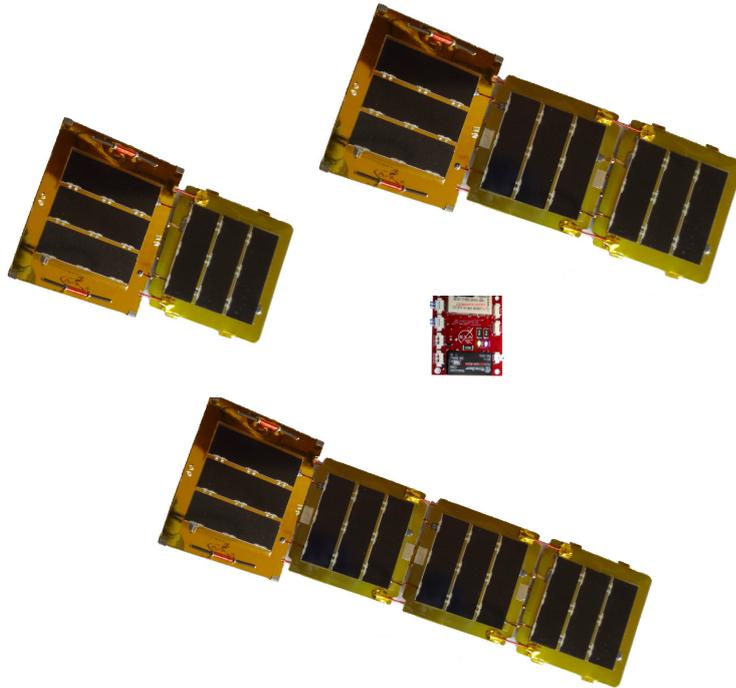


DSA Family Interface Control Document

DSA Board version 7.9

DSACTRL board version 6.3

Document Revision B



1. OVERVIEW:

This document describes how to connect and interface your DSA solar deployable solar arrays to the satellite's system bus; this is not a user manual.

2. DSA CONFIGURATIONS:

Side IU panel, deploys as 3 panels (2 on top side, 1 on bottom side)
Side IU panel, deploys as 5 panels (3 on top side, 2 on bottom side)
Side IU panel, deploys as 7 panels (4 on top side, 3 on bottom side)
Optional Integrated NEMEA Anti Radiation (EM, High Gamma, X-Ray, Alfa, Beta and low neutron) MLI shield
Optional GaAs Triple-junction solar cells AzurSpace 3G-3D (yielding up to 16.8W per array)
Optional: Low cost, space grade solar cells (yielding 6.25W per array)
Optional integrated MTOI Magnetorquer
Integrated thermal sensor LMS0C
Included DSACTRL RELEASE/DEPLOY control circuit

3. DESCRIPTION:

The DSA deployable solar array family are deployable solar panels that can be folded in as much as 6.5mm (for 3 panel arrays) and as low as 2 mm (for 1 panel arrays) they use a proprietary technology developed by the EXA called AMT (Artificial Muscle Technology actuators) which is vastly superior to other methods like thermal knife because offers no-



perturbation release and deploy operations and zero-effort repeatability, which is very desirable both in orbit and in the lab. The DSA family has been designed to overcome the typical 1U and 2U power limitations due the size and geometry of this form factors

4. INTERFACES:

Each DSA has the following interfaces:

POWER PATH:

- VCC and GND from top panel power (2 wires)
- VCC and GND from bottom panel power (2 wires)
- All wires integrated into a Molex Picoblade 4 wire connector with PTFE AWG#22
- VCC and GND (2 wires) PTFE AWG#22 for connection to the battery to provide actuator power

CONTROL PATH:

ACTUATORS (in to DSACTRL):

- VCC/GND for RELEASE (2 wires) **DSA-ACTU**
- VCC/GND for DEPLOY (2 wires) **DSA-ACTU**

All wires integrated into a Molex Picoblade 4 wire connector with PTFE AWG#22

CONTROL (in to DSACTRL)::

- VCC/GND for ACTIVATION signal (2 wires) **ACT-SGNL**

All wires integrated into a Molex Picoblade 2 wire connector with PTFE AWG#24

- VIN/VD for RELEASE SENSOR (2 wires) (**DSA-SNS-IN** from DSA to DSACTRL)

- VIN/VD for DEPLOY SENSOR (2 wires) (**DSA-SNS-IN** from DSA to DSACTRL)

All wires integrated into a Molex Picoblade 4 wire connector with PTFE AWG#24/26

- VCC/GND for RELEASE SENSOR (2 wires) (**DSA-SNS-OUT** from DSACTRL to user sensor matrix)

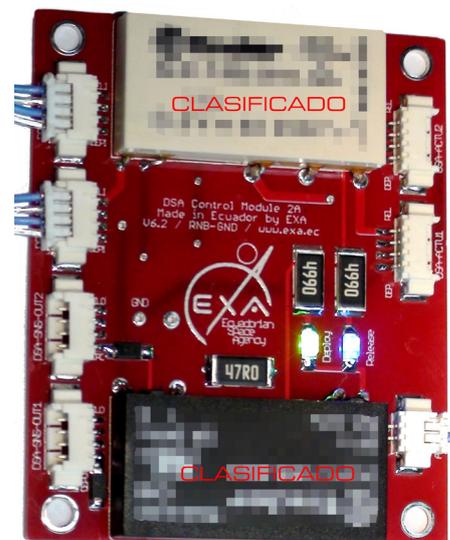
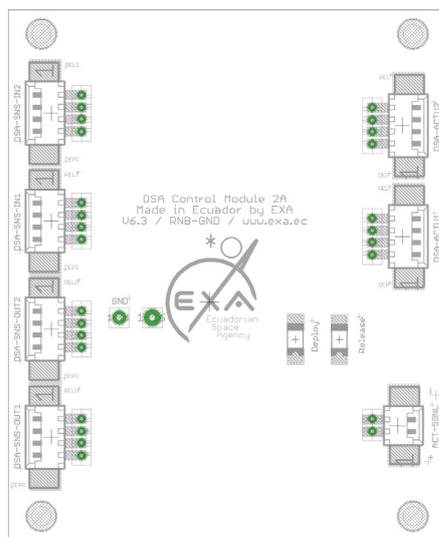
- VCC/GND for DEPLOY SENSOR (2 wires) (**DSA-SNS-OUT** from DSACTRL to user sensor matrix)

All wires integrated into a Molex Picoblade 4 wire connector with PTFE AWG#24/26

SENSORS PATH:

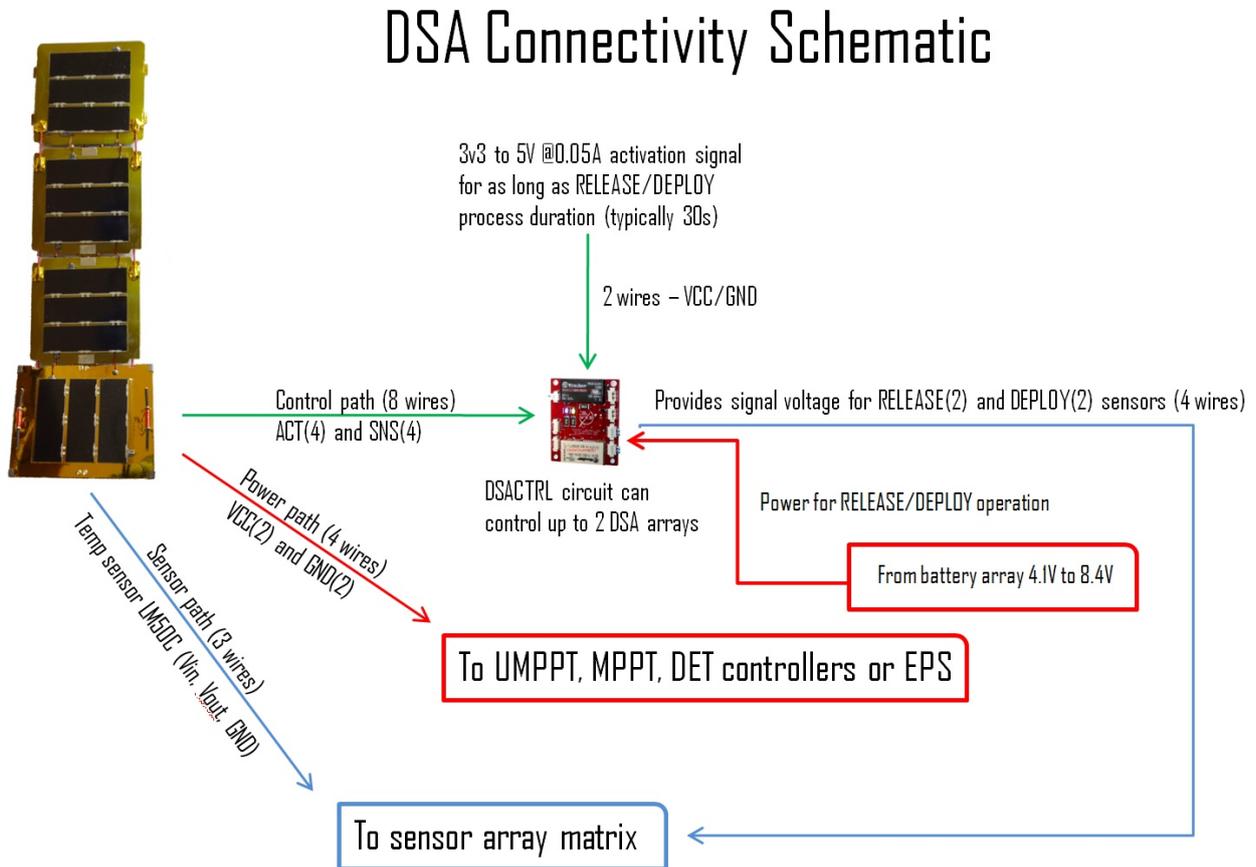
- VIN, VOUT and GND for TEMPSNS SENSOR (3 wires) (out from DSA to user sensor matrix)

All wires integrated into a Molex Picoblade 3 wire connector with PTFE AWG#24/26



5. CONNECTIVITY SCHEMATICS:

The DSA are normally folded during deploy, then are released and deployed in orbit via the use of the DSACTRL control board, which is a circuit that automatically performs the RELEASE and DEPLOY operation without requiring user intervention upon receiving the 3V3/5V ACTIVATION signal.



6. Power usage:

The DSACTRL control board displays the following power ratings and usage during the RELEASE/DEPLOY operation FOR 2 (TWO) DSAs simultaneously:

DSA class/Op.	Volts	Amps	Watts	Seconds	Joules
2 arrays, 1 panel ea./RELEASE	4.12	2.5	10.30	5	51.5
2 arrays, 1 panel ea./DEPLOY	4.18	2.5	10.45	2	20.9
2 arrays, 2 panel ea./RELEASE	4.12	2.5	10.30	10	103.0
2 arrays, 2 panel ea./DEPLOY	4.18	2.5	10.45	5	52.25
2 arrays, 3 panel ea./RELEASE	4.15	2.5	10.38	15	155.6
2 arrays, 3 panel ea./DEPLOY	4.19	2.5	10.48	5	52.4
*DSACTRL activation signal	5	0.1	0.5	20	10

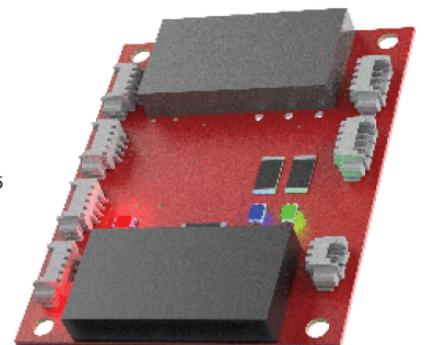
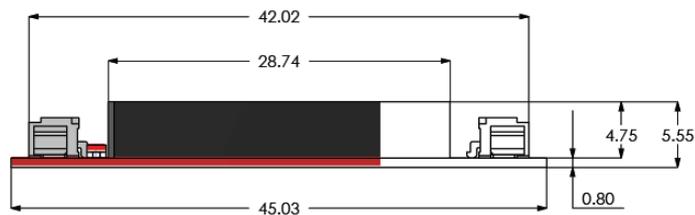
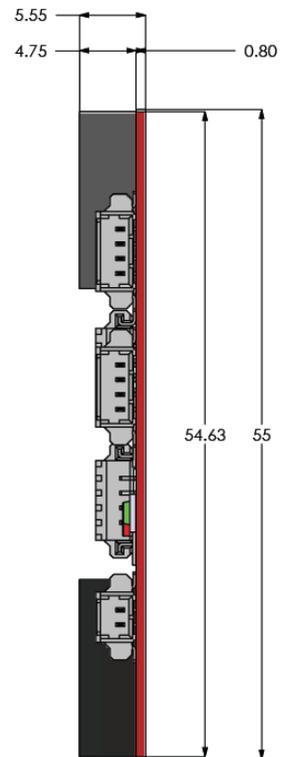
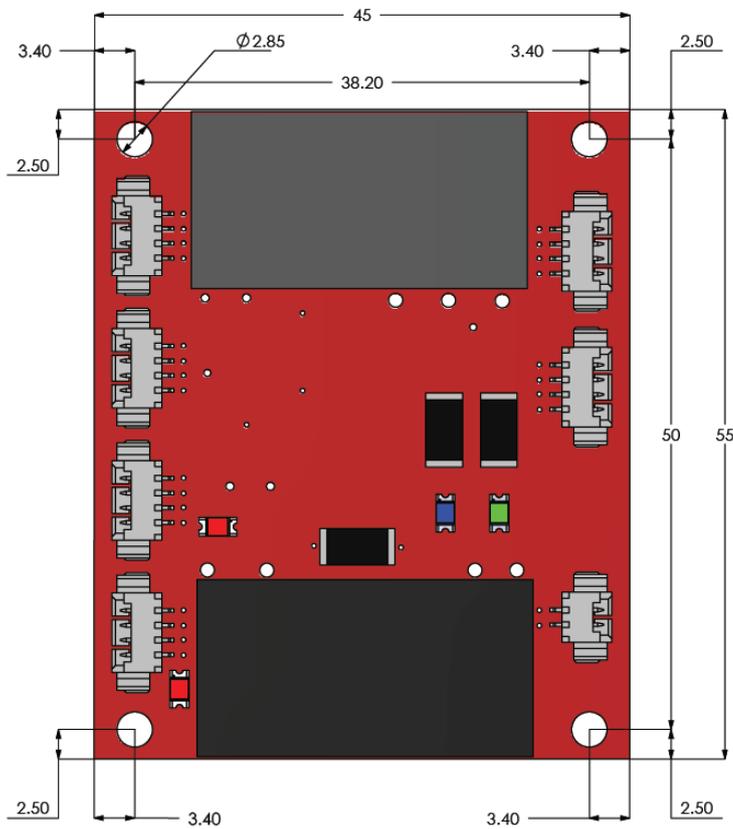
*Worst case scenario

DSACTRL can only need to operate once during the mission, however, once the solar arrays are released and deployed, the ACTIVATION signal can be re-send from ground as many times as required in case of the onboard sensors reporting NORELEASE or NODEPLOY or both, or in case that the user would like to 'move' the panels for some reason.



7. MECHANICAL LAYOUT AND DIMENSIONS:

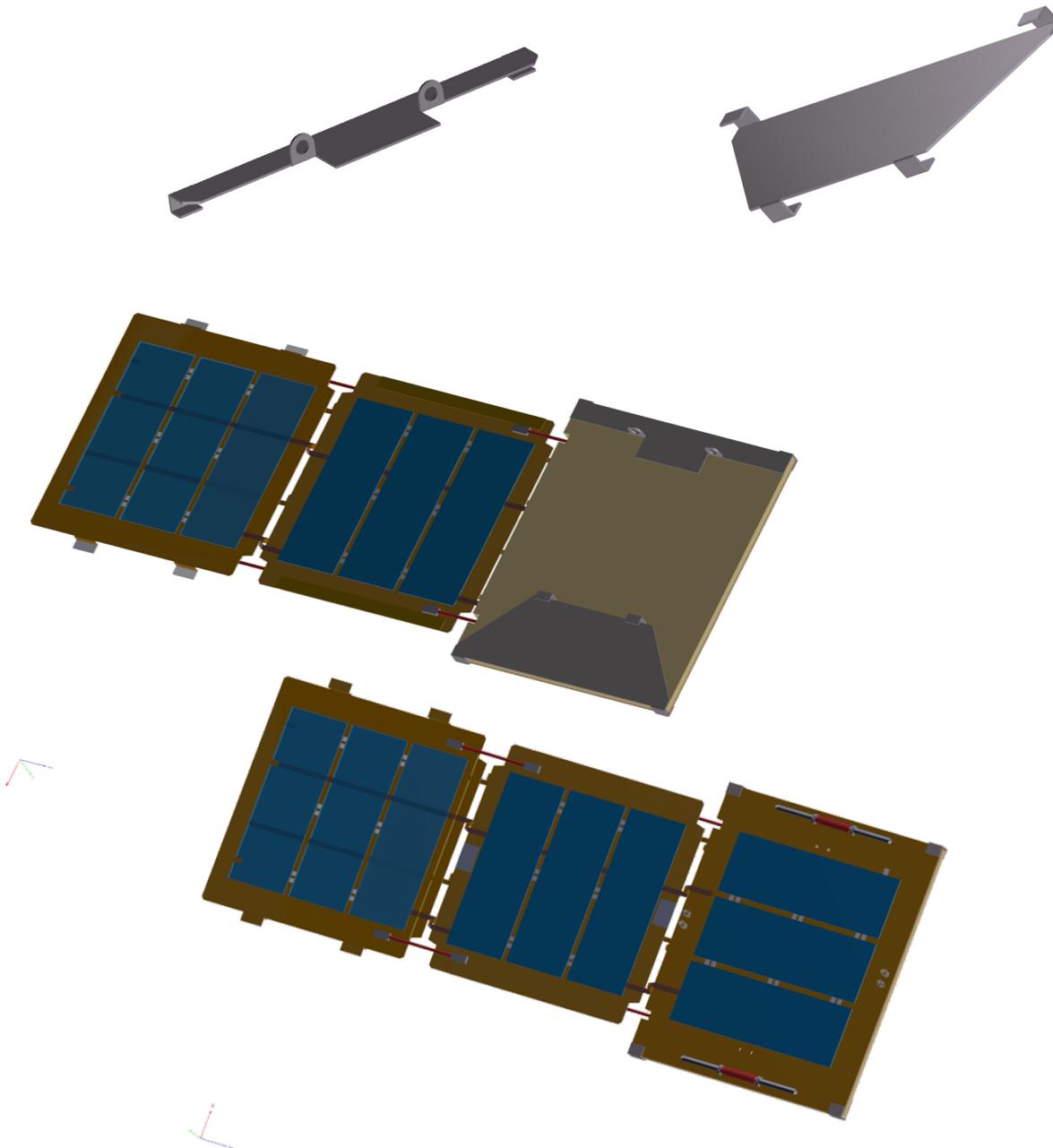
Following are the mechanical interface and dimensions for the DSACTRL card, the mechanical drawings for the DSA family can be found online at <https://www.cubesatshop.com/product/solar-panels/>



8. MECHANICAL INTERFACE:

The DSA mechanical interface with the cubesat structure varies in regard of the chosen mechanical architecture chosen by the user, in the case of NEE-D1 and NEE-D2, The mechanical interface was of the type of a Pumpkin class structure, in the case of IRVINE01 and IRVINE02, the DSAs were interfaced via 0.5 mm titanium clips designed specifically for this structures that were very similar to ESTcube. Other cases may include just simple holes following an standard pattern for the DSA to be attached to ISIS class structures. Each cases is different and normally EXA works with the customer to define the best interface for the user's structure.

Here are some examples of mechanical interface using titanium clips:





9. CONTINGENCIES:

In the unlikely and never registered case that the RELEASE and/or DEPLOY mechanism does not comply with their expect functions during mission, the sensors interface DSA-SNS-OUT will report a voltage different than the one sent by ACT-SGNL being this 3V3 or 5V as this sensors uses the ACT-SGNL to form the sensor voltage.

The DSCTRL module takes care of this contingencies and in this cases it detects the anomaly and implements the EMRG-REL command, which basically activates the DEPLOY muscles forcing the release of the panels, however this action can disturb the attitude of the spacecraft a little.

In any case, DSA release and deploy mechanisms are designed so that the in-orbit solar heat will eventually release and deploy de solar arrays, but in no case the DSAs will remain folded once in orbit.

10. SIGNAL MAP/INTERFACE:

Below is the signal map of the DSA and DSCTRL interface

MODULE	NAME	Vmin	Vmax	I-min	I-max	Type	Dir	Comment
DSA-CTRL	DSA-SNS-IN (RELI)	3.3	5	0.01	0.1	SGNL	IN	Deploy sensor on DSA #1
DSA-CTRL	DSA-SNS-IN (DEPI)	3.3	5	0.01	0.1	SGNL	IN	Release sensor on DSA #1
DSA-CTRL	DSA-SNS-OUT (RELO)	3.3	5	0.01	0.1	SGNL	OUT	Deploy sensor on DSA #2
DSA-CTRL	DSA-SNS-OUT (DEPO)	3.3	5	0.01	0.1	SGNL	OUT	Release sensor on DSA #2
DSA-CTRL	DSA-ACTU (REL)	4	8.4	2.5	6	PWR	OUT	Temperature sensor LM50C
DSA-CTRL	DSA-ACTU (DEP)	4	8.4	1.5	4	PWR	OUT	Temperature sensor LM50C
DSA-CTRL	AS_GND	-	-	-	-			Activation signal ground
DSA-CTRL	ACT_SGNL	3.3	5	0.05	0.1	SGNL	IN	Activation signal
DSA-CTRL	GND							Activation power ground
DSA-CTRL	VACT	4	8.4	2.5	6	PWR	IN	Activation power from battery array
DSA	DSAPWR A	1.8	9	0.01	2	PWR	OUT	Solar power from top DSA array
DSA	DSAPWR B	1.8	9	0.01	2	PWR	OUT	Solar power from bottom DSA array
DSA	TEMPSNS-Vs	5	7	0.01	0.1	SGNL	IN	Temperature sensor LM50C VCC supply
DSA	TEMPSNS-Vo	0.1	0.7	0.01	0.1	SGNL	OUT	Temperature sensor LM50C Vout signal

END DOCUMENT

