Hardware & software Specifications

DCXS 750

Réf : DSMAT-1-008

PRELIMINARY JUNE 2007

1. Product overview

DC-XS 750 is a multiple sputter source DC power supply

Presentation: 19" unit, 2 U high.

All controls and parameters display are on the front panel; a remote connector can be used to adjust output power and to read working parameters.

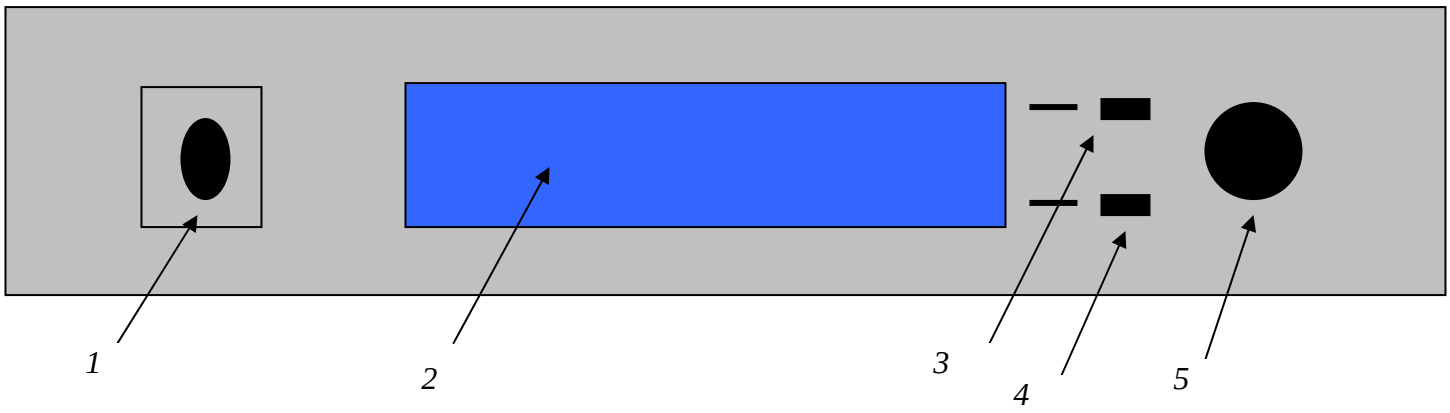
Mains power:	208 V - 240 V - 50/60 Hz - 1.5 KVA Max (to be confirmed)
Dimensions:	width 440 mm, height: 8.88 mm (2U), depth: may be increased until 465 mm.
Output power:	up to 750 W – Voltage: 160V to 1000V – Current: 30mA to 1000mA (See "Set point & regulation mode" for more information)
Regulation mode:	Selectable Voltage / Current / Power
Output:	3 or 5 SHV female connectors. Plug reference: R 317 072. Socket reference R 317 580
Control mode:	Local OR remote analog input: 0-5V / output: 0 –10V OR remote RS232

2. Terminology

DC-XS Multiple Sputter Source DC Power Supply consists of:

- Front panel with LCD screen push buttons and a wheel.
- High voltage power supply
- Switching board

a. The front panel



1 - Main switch

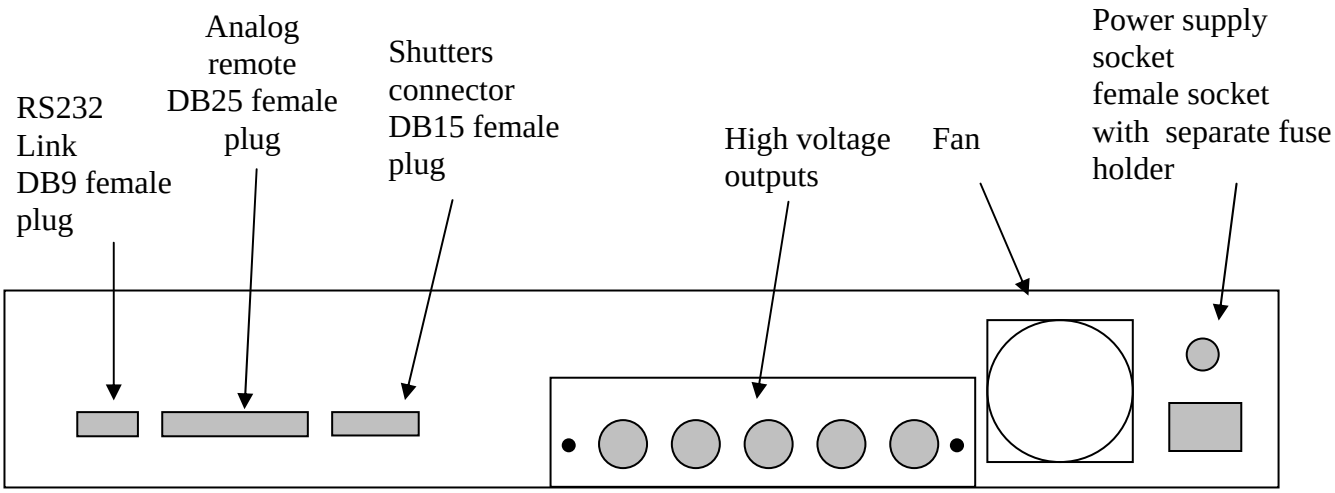
2 – LCD screen – 128 x 64 pixels liquid crystal display. It displays all the information's off the process.

3 – It is called the "A" button since it has different functions depending on what is displayed on the screen.

4 – It is called the "B" button since it has different functions depending on what is displayed on the screen.

5 – Knob & "C" button since it has different functions depending on what is displayed on the screen.

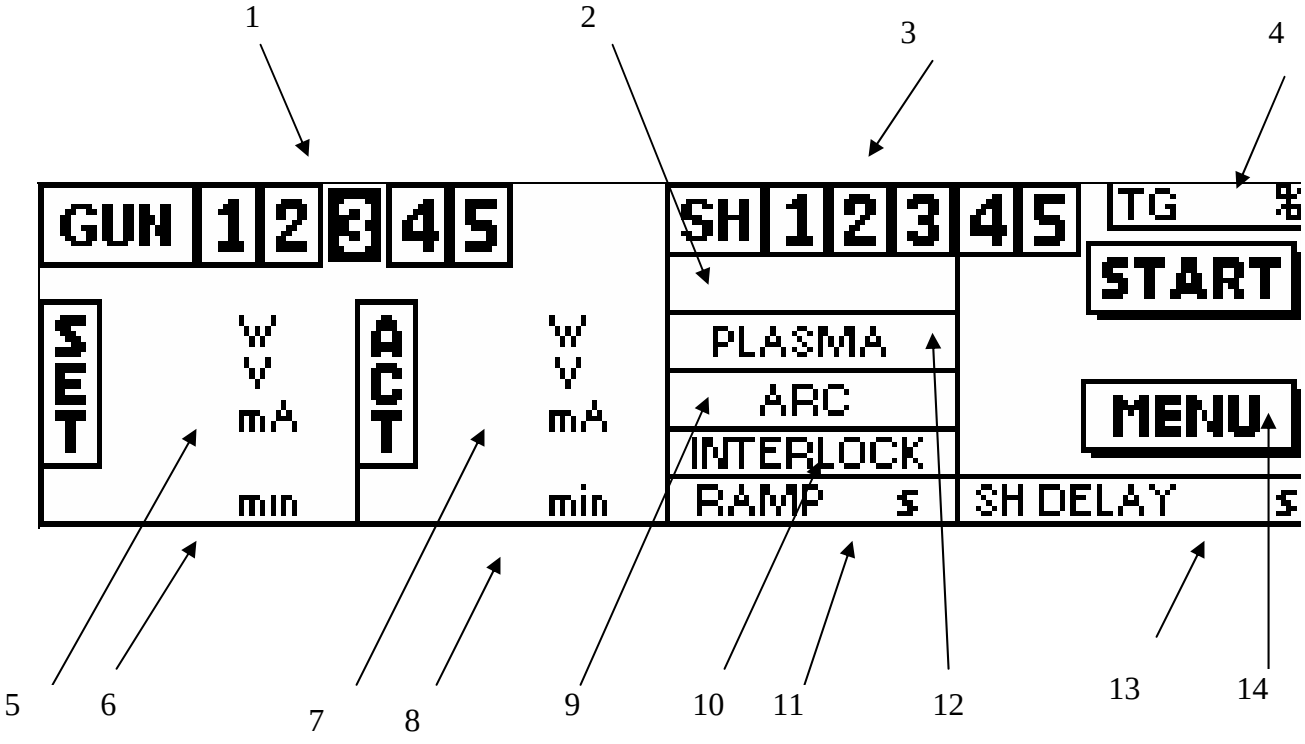
b. The rear panel



Unlike the DB9, DB15, DB25, and the "CE" plug, the BNC high voltage plugs are NOT supplied with the generator (reference R 317 072).

3. Screens description

a. Main screen description



1 – **Actual gun selection**

2 - **Material indication**

3 - **Shutter state indication**

4 – **TG indication**

5 – **Set point**

6 – **Deposition time**

7 – **Actual measurements**

8 – **Deposition remaining time**

9 **– Arc detection indicator**

10 – **Interlock indicator**

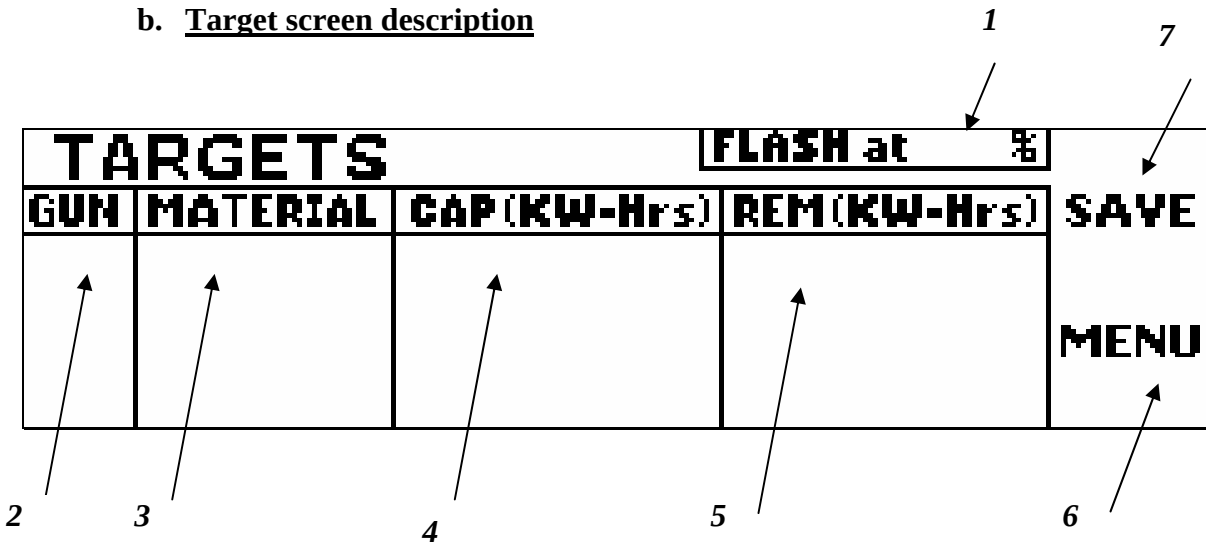
11 – **Ramp time**

12 – **Plasma indicator**

13 – **Shutter delay**

14 – **Menu**

b. <u>Target screen description</u>



1 – **Flash level**

2 – **Gun number**

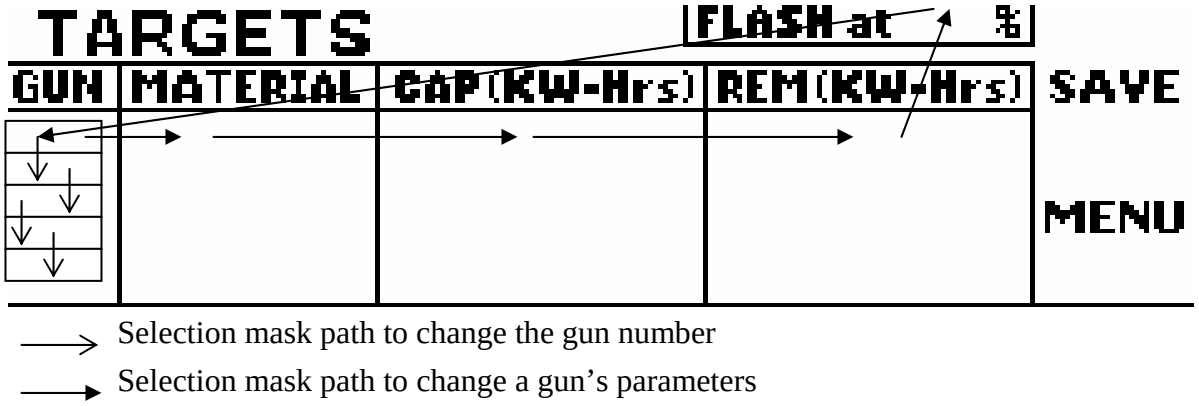
3 – **Material name**

4 – **Target Capacity**

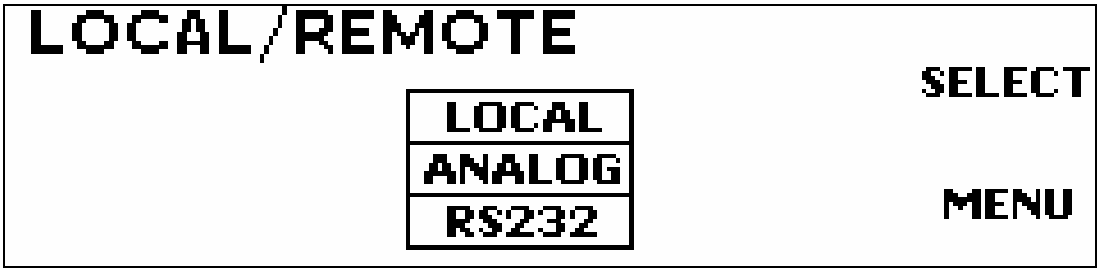
5 – **Remaining capacity**

6 – **"A" button function in this screen: "Menu"**

7 – **"B" button function in this screen: "Save"**



c. <u>Control mode selection screen</u>



From the "local/remote" menu, 3 control modes are available:

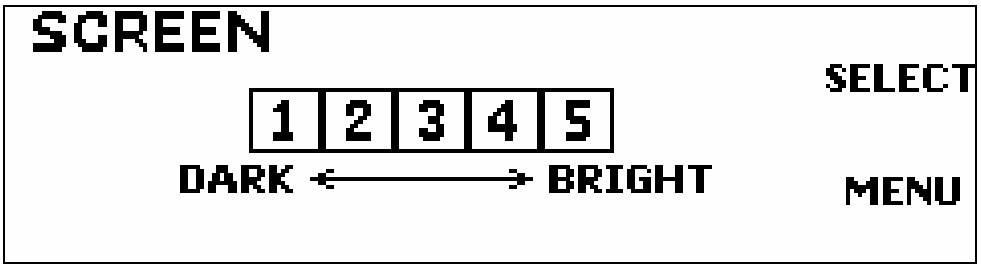
- **Local mode** – All is controlled from the front panel.

- **Analog mode** – Most of the parameter can be set from the DB25 plug. In analog mode, the process can't be start from the front panel (the "A button: DC ON" is not available anymore), however it is still possible to stop the process using the "B" button: DC OFF. Shutters cannot be driven by the DCXS in this mode. Ramp and shutter delay are set to "0" and can't be changed.

- **R**S232 – A set of ASCII commands give access to the gun and generator parameters and allow controlling the whole process.

Only one control mode can be selected at a time.

d. Screen menu



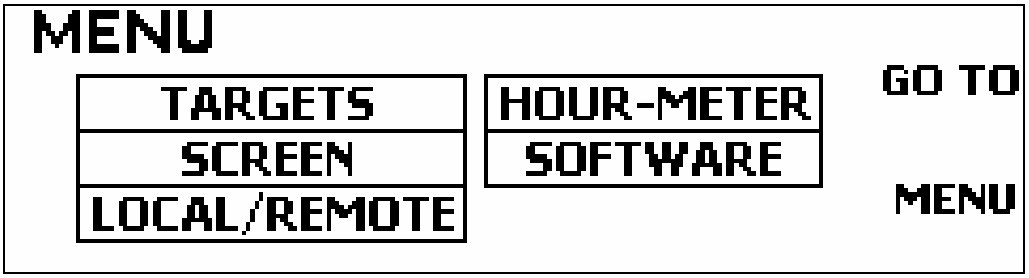
This screen is self explanatory. Once the contrast has been changed, it is saved and restore at each start of the DCXS.

The wheel allows going to a new contrast value. “C” button changes the contrast to the new value.
“B” is used to go back to the menu.

e. Software version screen

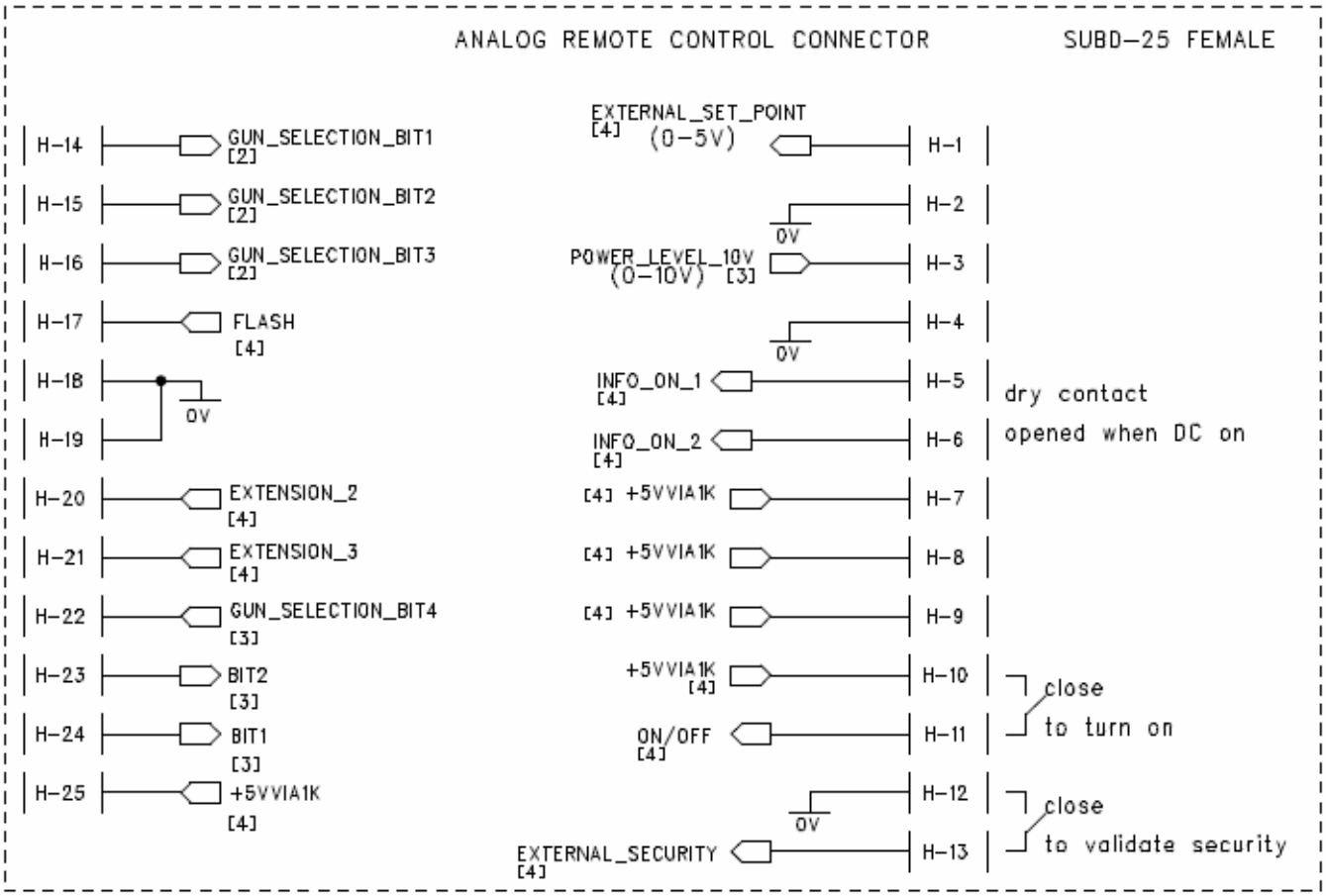
This screen displays the software version loaded in the programmable logic controller.
“A” button can be pushed to go straight to the main screen. “B” is used to go back to the menu.

f. Menu screen



4. Connectors pinout

a. Analog remote control connector



Gun selection	GUN_SELECTION_BIT1	GUN_SELECTION_BIT2	GUN_SELECTION_BIT3	GUN_SELECTION_BIT4
GUN 1	24V	not connected	not connected	not connected
GUN 2	not connected	24V	not connected	not connected
GUN 3	not connected	not connected	24V	not connected
GUN 4	not connected	not connected	not connected	24V
GUN 5	not connected	not connected	not connected	not connected

Regulation mode

	BIT 1	BIT 2
Watts	5V	not connected
Amps	not connected	5V
Volts	5V	5V

5V = connected to pin 25 using a dry contact for example

External set point: This input allows adjusting the set point of the regulation mode. 0V = Minimum power level, 5V=Maximum power level.

Bit 1 and Bit 2: These two signals are use to select the regulation mode. It cannot be changed during the process. The regulation mode remains the same during the process: the one just before DC ON has been pushed.

Power level: This output indicates the power level. (0V = NO POWER, 10V = MAX POWER).

Info on: This dry contact is closed when the process starts and remains closed until the end of the process. If the process if interrupted by a fault, this contact opens.

On/OFF: This input controls the process. Pulling it to +5V (pin 10 for example) starts the process. When it is no longer pulled to +5V the process stopped.

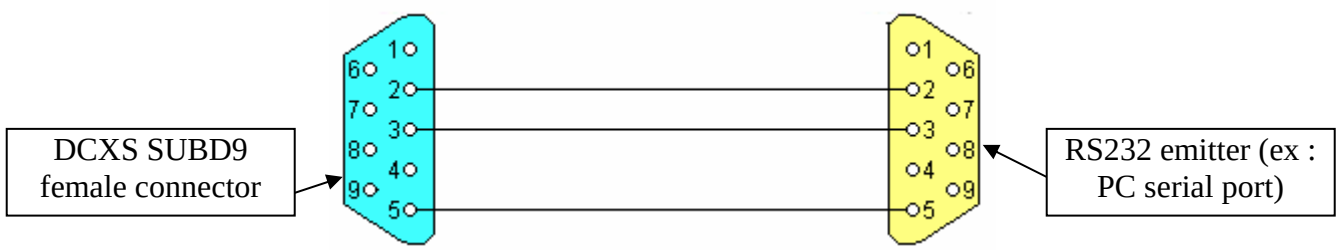
When a fault happens during the process, the ON/OFF signal must be put to 0V prior to put it ON again. This prevents the generator from restarting immedialty after a fault detection.

External security : This contact must be closed to start the process. If this contact is open, the process stops immediately and “INTERLOCK” is displayed on the screen.

Gun_selection_[0..2]: These three logic level signals allow selecting the gun to run. There value is only read just before DC ON is pushed. They can be changed during the process but won’t have any effect before the next start.

Flash: this pin toggle when the TG threshold has been reached.

b. RS232 Connector



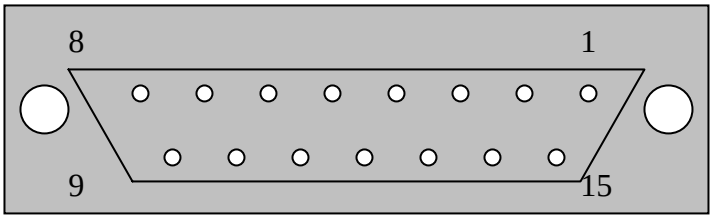
2: TXD Transmit
3: RXD Receive
5: Ground

Shielded cable should be used with shield connected to the ground.

c. Shutter control connector

Shutter can be controlled directly from the DCXS. Five 24V DC outputs are available. Shutter power supply requirements must not exceed 1W.

According to the discussion we had at the "MRS" of spring 2004, unlike the prototype, the shutter control connector will be a DB15 female connector.



1: Shutter n°1 power supply
3: Shutter n°2 power supply
5: Shutter n°3 power supply
7: Shutter n°4 power supply
9: Shutter n°5 power supply

2 – 4 – 6 – 8 – 10 – 12 – 14 - 15: Ground

In analog remote mode, the shutters are not controlled by the DCXS.

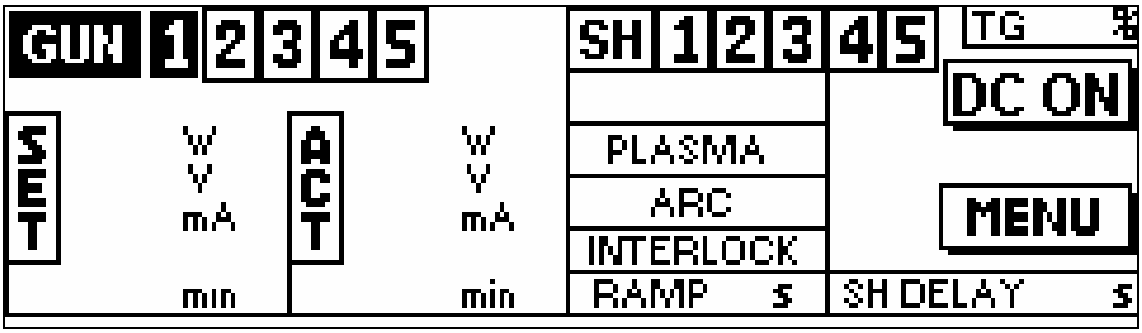
5. GUI (Graphical User Interface) description

a. Starting the DCXS

When the DCXS is turned on using the main switch, the AJA logo appears for 2 seconds.

b. Gun parameter setting

Then, the main screen appears.



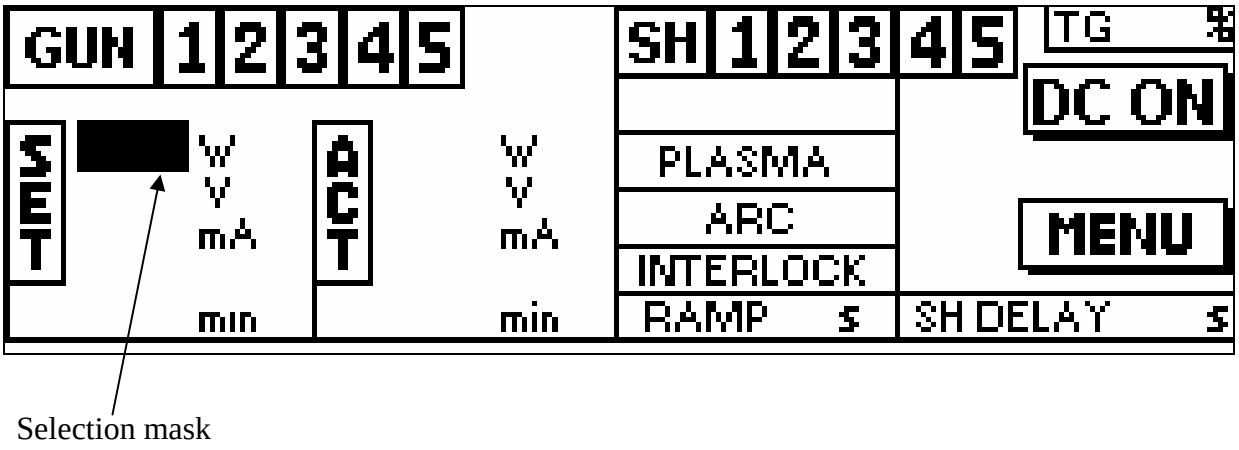
"GUN" is now "backlighted" and the box representing gun number "1" is blinking. The following Gun 1 settings are displayed on the screen:

- Power set point (W, V or mA)
- Deposition time
- Ramp time
- Shutter delay
- Target remaining percentage
- Material

While "1" is blinking, it is possible to change the current gun using the wheel. If you turn the wheel clockwise for example, you choose cyclically gun 1,2,3,4,5, 1,2,3,4,5, 1....

The "C" button is used to enter the gun parameter edit mode. Now, the gun number doesn't blink anymore, it appears "backlighted".

The selection mask is now blinking on the power set point.

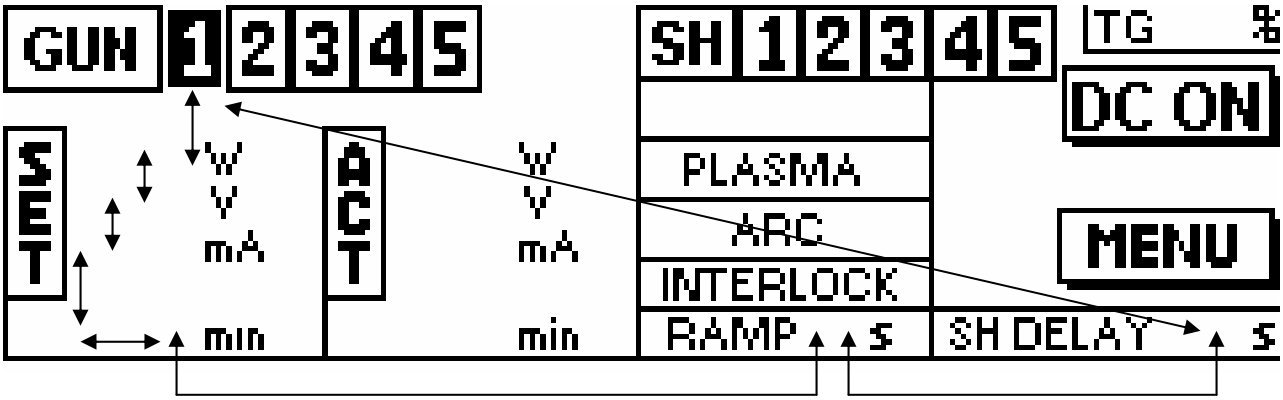


Wheel can change the selection mask position. Once the selection mask is located on the parameter that needs to be changed, the “C” button must be pushed to allow value adjustment.

The wheel is now used to increase or decrease the parameter value. Once the correct value has been set, the “C” button validates and the selection mask blinks. It is now possible to change the selection mask position.

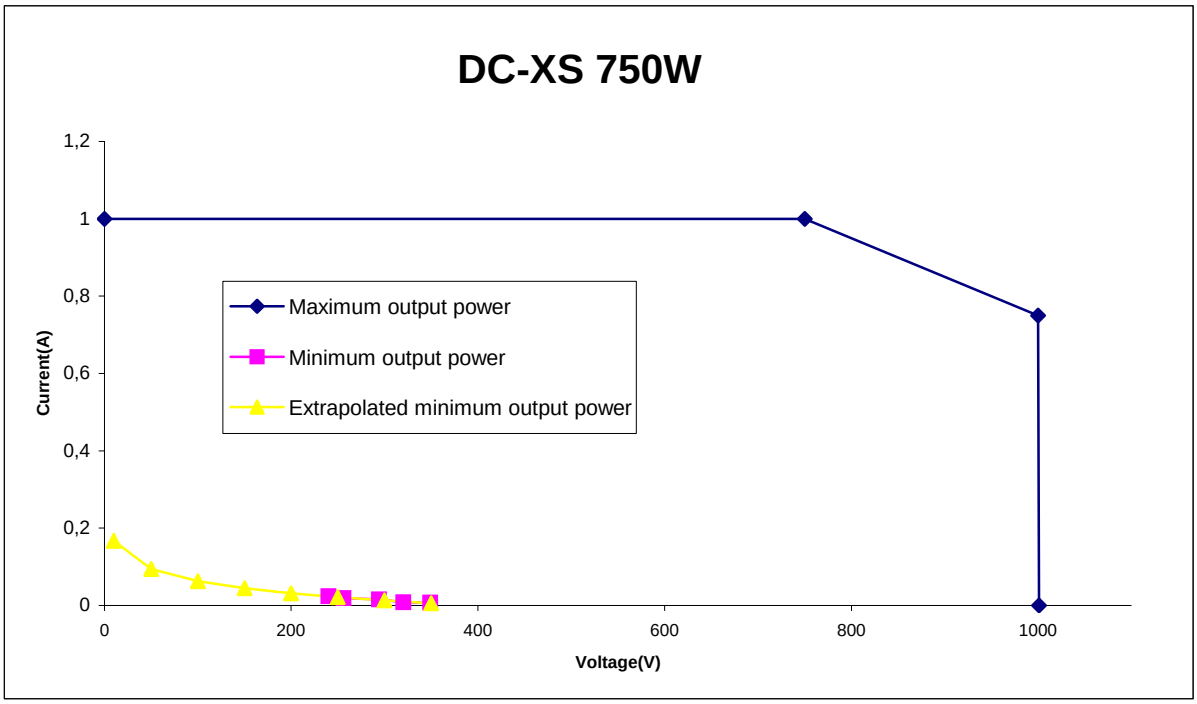
To leave the parameter edit mode, push “C” when the selection mask is on a gun number. It will start to blink. You now must leave the parameter edit mode.

Below is described the selection mask path:



c. <u>Set point & regulation mode</u>

Changing the power set point (W, V or A) also implies the choice of a regulation mode. For example, if you set 500 in the W set point then the regulation mode is now power (W). The voltage and current set point are no longer available.



- Operating area -

d. Deposition time setting

Time deposition setting is done in two actions: first, set the minutes: 0 to 999, then the seconds: 0 to 99

e. Ramp time

Ramp time can be adjusted from 0 to 99 second with 1 second stepping.

f. Shutter delay

Ramp time can be adjusted from 0 to 99 second with 1 second stepping.

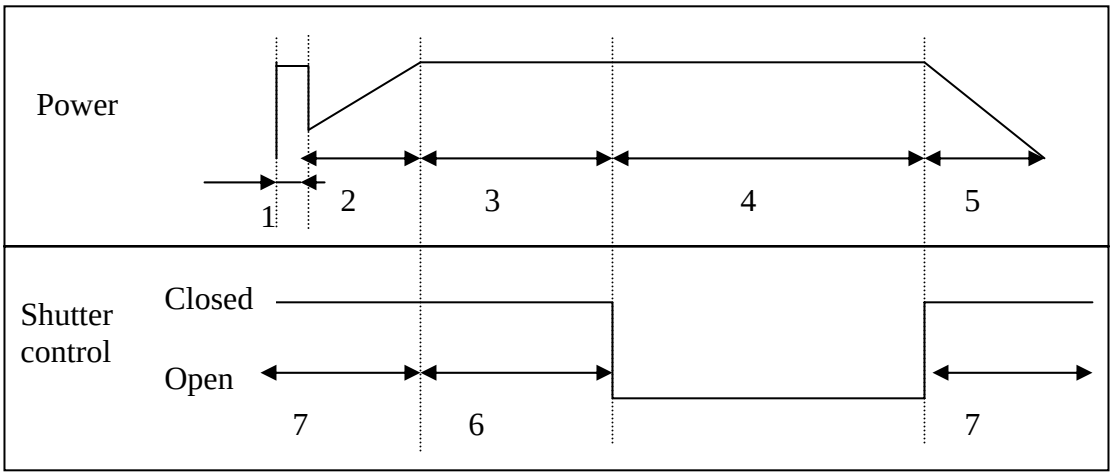
6. The “DC ON cycle”

Once the selection mask is on a gun number and the gun is blinking, that means you are not in parameter edit mode.

a. Automatic mode

Assuming the set point has been set and is not null, and a time deposition has been set and not null too, the automatic mode is selected. The process begins.
During the cycle, the user can stop the power supply at any time by pushing the “B” button.

Note that while in automatic mode, the wheel can’t be used to change the set point.



1. Spike voltages are generated to start the plasma. It is stopped as soon as plasma is detected (I >30mA)
   If the output current rises above 30mA, then the plasma indication turns on.
   The power ramp goes from the minimum level to the set point (ex: 30 mA to 800mA).
2. The power is regulated to the set point.
3. The power is regulated and the deposition time is counted down. The target remaining capacity is also counted down.
   If the target remaining capacity goes below the flash threshold, then the remaining capacity value started to blink. => Also a pin is set at high level (+5V) on the analog remote control to inform target capacity felt below the flash threshold.
4. It ramps down to reach the minimum level.
5. Shutter delay
6. Shutter is closed

b. Manual mode

If DC ON button is pushed and

- Deposition time has been set to 0
- Ramp time has been set to 0
- Shutter delay has been set to 0

Then the *manual mode* is entered.

Note that in manual mode, neither ramp nor shutter delay is used. Shutter can be controlled by pushing the C button to toggle between opened / closed.

When running in manual mode, the deposition time, ramp time, and shutter delay are all “0” and are not displayed.

The wheel can be used at any time to adjust the power level. The power supply stays “on” as long as the user doesn’t stop the process.

c. RS232 remote mode

The RS232 can be selected in the remote menu.
RS232 is displayed in a small box at the left of "SH" in the main screen

Below are listed the RS232 command available.
The settings for the RS232 link are the following:

Speed: 38400 bps
Parity: none
Stop bit: 1

In RS232 mode it is not possible to edit gun parameter using the front panel. The only available menu is the remote menu.

d. Requests

Requests are used to read a value from the DCXS (measurement, state of the system...).

	Ascii code to send to DCXS	*Number of byte returned by DCXS*	*Minimum value returned*	*Maximum value returned*
DC state (ON/OFF)	a	1	0 = OFF	1 = ON
Set point	b	4	0000	1000
Regulation mode	c	1	0=Power, 1=Voltage, 2=Current	
Actual output power	d	4	0000	1000
Actual output voltage	e	4	0000	1000
Actual output current	f	4	0000	1000
Ramp time	g	2	00	99
Shutter delay	h	2	00	99
Deposition time (Min)	i	3	000	999
Deposition time (Sec)	j	2	00	59
Remaining deposition time (Min)	k	3	000	999
Remaining deposition time (Sec)	l	2	00	59
Remaining target capacity	m	3	000	100
Material name	n	?	-	-
Fault	o	1	All bit "0"	All bit at "1"
Shutter state	p	1	All bits "0" = all closed	5 lower bits at "1" = all open
Editing gun number	y	1	1	5
Software revision	z	4	1.00	X.XX
Generator reference	?	9	DCXS750-3	DCXS750-5

g. Commands

Commands are used to control the generator (set value, start the DCXS ect...)

	Ascii code to send to DCXS	*Number of byte following the command*	*Minimum value*	*Maximum value*	*Action*	*Condition*
DC ON	A	0	-	-	Turn DC On	Must be ready to start DC
DC OFF	B	0	-	-	Turn DC off	-
SET POINT VALUE	C	4	0000	1000	Adjust the set point	-
REGULATION MODE	D	1	0=Power , 1=Voltage, 2=Current		Choose the regulation mode	
RAMP TIME	E	2	00	99	Set the ramp time	DC OFF
SHUTTER DELAY	F	2	00	99	Set the shutter delay	DC OFF
DEPOSITION TIME (Minutes)	G	3	000	999	Set the minutes of the deposition time	DC OFF
DEPOSITION TIME (Seconds)	H	2	00	59	Set the seconds of the deposition time	DC OFF
MATERIAL NAME	I	8	XXXXXXXX	XXXXXXXX	Changes the material name	DC OFF
GUN NUMBER TO EDIT	Z		1	5	Set the gun number to edit	DC OFF

7. Fault cases

In case of fault during the process:

- Arc fault: The power supply is stopped to suppress the arc, and then plasma is struck again. Arc detection is based on voltage. Arc is detected if voltage goes below 160V.

- Power supply fault: the process is stopped and the power supply fault indication turns on. Plasma is struck again and process goes on.

- Interlock fault: the process stopped and the Interlock fault indication turns on until interlock is not re-validated.

- Fan fault: process is stopped to prevent the DCXS from overheating.