MDSnCxx

Operating Manual

Laboratory Version

RoHS Compliant

**MDSnCxx
OEM Version
Laboratory Version**

OEM Version

Multi Digital Synthesizer
for AO modulators/shifters/AOTFnC

Web access

For further information, please contact
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Technical Customers' Service
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IMPORTANT

To have the exact specifications of your device, please refer to the test sheet provided with each unit. Please login to AA Website to get this manual as an electronic version; you will find ID and password in your test sheet.

Following the precautions included in this instruction manual, will guaranty the best performances of your devices, and will optimize their lifetime.

Your MDS driver is based on Direct Digital Synthesizers (DDS). It produces one or multiple fixed stable and accurate RF frequency signals for modulators, shifters or polychromatic modulators such as AOTFnC. Its design with "on the edge" technology offers unique performances in term of accuracy, speed and stability (single/multi-line), thanks to their internal temperature correction and high linearity design.

The built in amplifier delivers the necessary RF power to drive the acousto-optic device, with reduced power consumption below 20W.

In the case of multiple channels (4C or 8C), the RF output power per channel can be individually modulated (MOD IN signals) or simultaneously modulated (BLANKING signal). In the case of a single channel (1C), the RF output power is controlled through the MOD IN signal (Blanking not available).

The set up of the driver (Frequency & Power) can be done with a remote control, USB or through RS232 communication to allow user flexibility.
The standard way of operation of this driver is to operate through external control signals.

MDS DRIVER SET UP AND OPERATION

MDS driver can be provided with 1, 4 or 8 channels. For a 1 channel version, only channel 1 will be connected (No Blanking). For a 4 channels version, channels 1 to 4 will be connected together with the blanking input. For a 8 channels version, channels 1 to 8 will be connected together with the blanking input.

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PIN CONNECTIONS

Controls

Pin 14, 15, 16	: GND
Pin 23, 24, 25	: POWER SUPPLY (+24VDC)
	[NOT CONNECTED FOR LABORATORY VERSIONS]
Pin 12	: Channel 1
Pin 11	: Channel 2
Pin 10	: Channel 3
Pin 9	: Channel 4
Pin 8	: Channel 5
Pin 7	: Channel 6
Pin 6	: Channel 7
Pin 5	: Channel 8
Pin 13	: Blanking (BLK)
Pin 17	: RESET
Pin 1,2,3,4,18,19, 20,21,22	: Not Used

Modulation inputs & Power Supply

RS-232

Pin 2	: TX
Pin 3	: RX
Pin 5	: GND
Pin 6	: RESET (option)
Pin 1,4,7,8,9	: Not Used

RS232

USB/RC
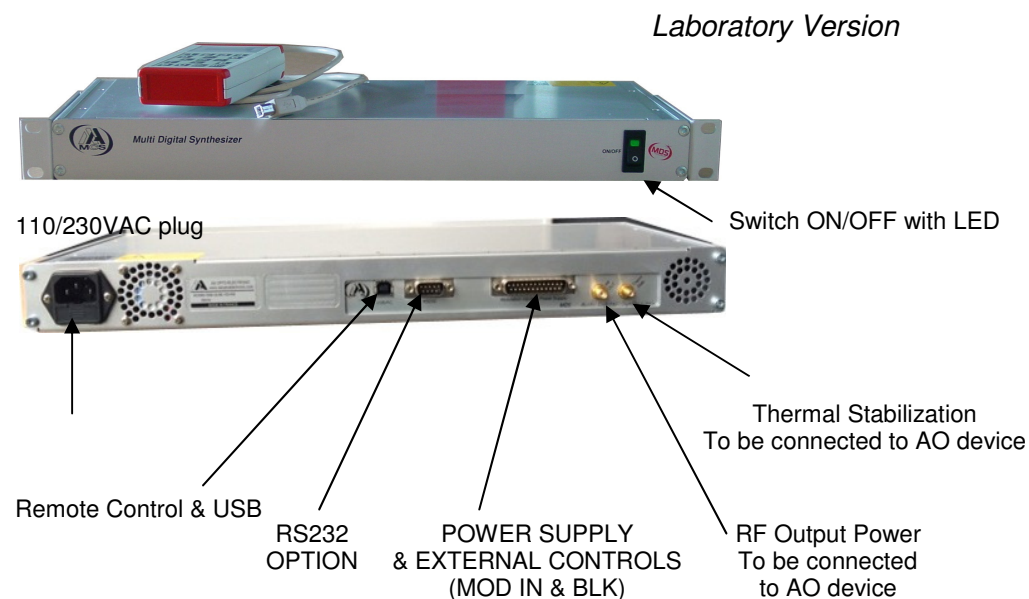
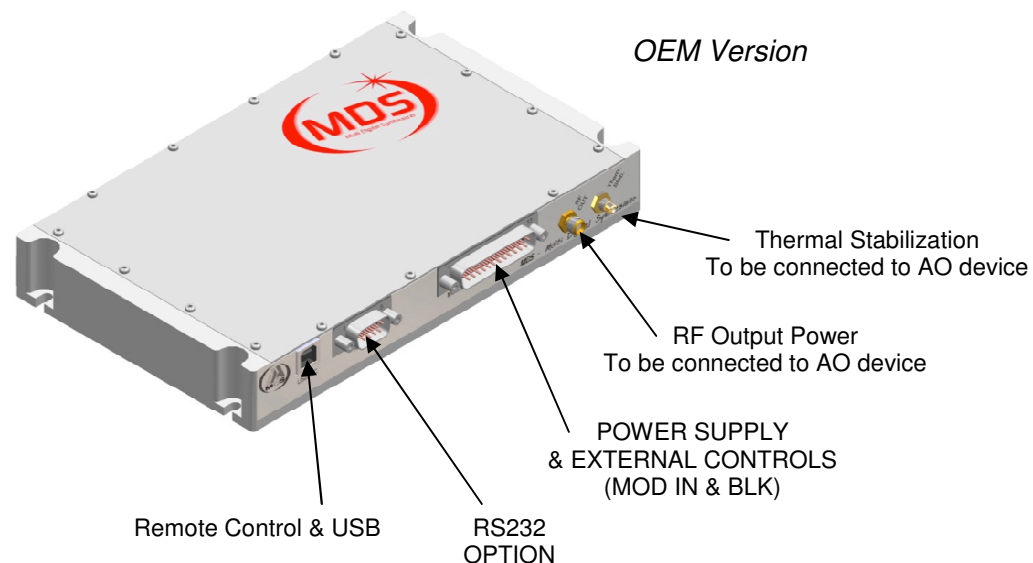Plug in an USB type B cable to use MDS with Remote control,
or USB PC interface.

USB/RC

RF OUT

Connect RF OUT to AO device.

RF OUT

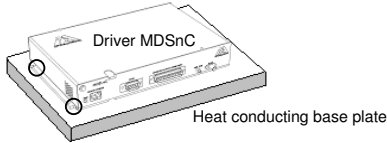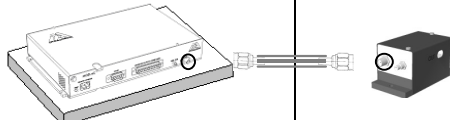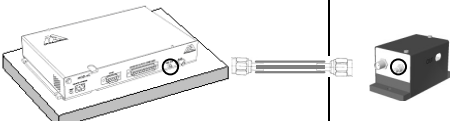### STAB T/TN (connect only if available on AO device)

Connect Therm Stab. to the Thermal stabilization of your device.

Therm Stab.

OEM Version

Thermal Stabilization
To be connected to AO device

RF Output Power
To be connected to AO device

POWER SUPPLY
& EXTERNAL CONTROLS
(MOD IN & BLK)

Remote Control & USB   RS232
OPTION

Laboratory Version

Switch ON/OFF with LED

110/230VAC plug

Remote Control & USB

RS232
OPTION

POWER SUPPLY
& EXTERNAL CONTROLS
(MOD IN & BLK)

Thermal Stabilization
To be connected to AO device

RF Output Power
To be connected
to AO device

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HOW TO INSTALL YOUR DRIVER?

1	**Install the OEM driver and screw it** using the fixation holes (⑦) on a heat conducting base plate. Driver MDSnC Heat conducting base plate	*Use conducting grease if necessary. Temperature of the case must not exceed 50 °C.* ***Laboratory driver is a standalone driver and does not need to be fixed or cooled.***
2	**Connect the "RF OUT" (①)** of the driver to the "SMA" (③) of the AO device with the provided RF cable.	
3	If your device has a thermal stabilization, **connect the "Therm Stab" (②)** of the driver to the "SMC" (④) of the AO device with the provided cable.	
4	**Connect the DB25 connector** with your Modulation inputs signals, blanking signals and 24 VDC power supply. "Modulation Inputs & Power Supply" (③)	NOTE: 24 VDC power supply must be connected trough DB25 pins only for OEM versions. **For Laboratory drivers, do not connect 24 VDC power supply through DB25 connector.**
5	**Switch your power supply on** at first. Your source must deliver the indicated level with a maximum variation of +/- 1 %. Blanking and MOD IN sources must be off! **For Laboratory versions switch on the front panel button.**	*Ensure yourself that the power supply can provide enough current for your driver (refer to the test sheet for the nominal current needed).*

	All control signals must be OFF (MOD IN & BLK).	
6	If your AO device has a thermal stabilization, **let it warm up for 15 minutes** before using it, for maximum stability.	
7	Your system is ready to operate.	

PRECAUTIONS

1. **Never use the driver output in open circuit, otherwise serious damages could occur.**

2. **Do not exceed 50 °C for case temperature.**

5. **Check on your test sheet your modulation input version (analog, TTL...).**
The MOD IN and BLANKING of your driver have a high impedance (1kOhms/10 Kohms) and they can operate with most voltage sources whatever are the impedance.

8. **You can operate your system in internal mode (RC03/USB/RS232) or with external control signals.**

Please note that your MDS driver is designed to operate with the best performances of speed, extinction ratio and noise when it is operated with external control signals.

MDS OPERATION

1- Sequence of operation of your MDS

SET UP: this is a static operation which goal is to adjust each individual channel with a specific frequency and maximum RF power, in order to match the AO device. At the end of this operation, all parameters will be stored in an EEPROM and automatically reloaded after each start.

This operation will be easily realized with a remote control RC03, or through USB/RS232 (software 2.03).

DYNAMIC OPERATION: once the set up is finalized, the dynamic operation can start for the real application. The get the best performances of this MDS driver in terms of speed, extinction ratio, dynamic and noise the user will have to control the driver with external signals through the DB25 connector (MOD IN + BLANKING).

An operation with the remote control or with USB/RS232 software is also possible with degraded performances (Low speed, 30 dB dynamic…).
User can also develop it own software to control the MDS driver.
The USB/RS232 protocole is open and free.

SET UP
RC03, USB, RS232

DYNAMIC OPERATION
EXTENAL SIGNALS FOR FULL PERFORMANCES

DYNAMIC OPERATION
RC03, USB, RS232 WITH DEGRADED PERFORMANCES

2- Reset of the RF Driver

AA provides an external reset of the driver, which can be controlled by a 5VDC pulse signal applied on the pin 17 of the "Modulation Inputs & Power Supply" driver input or on the pin 6 of RS232 connector. Weld and make the following circuit.

Microcontroler

RESET

"Modulation Inputs & Power Supply" (DB 25)

17

USER

100 Ω

+ 5 V
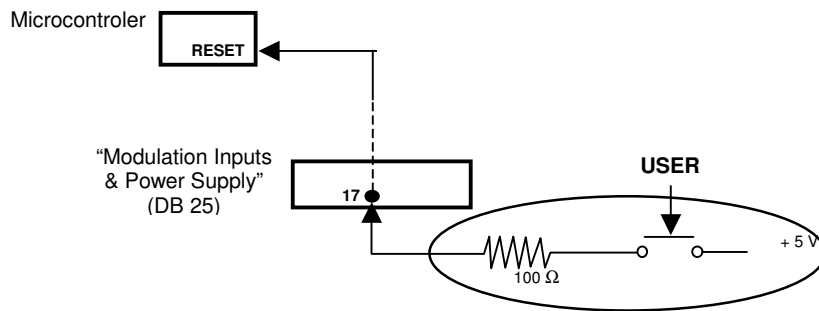
Circuit of the driver reset
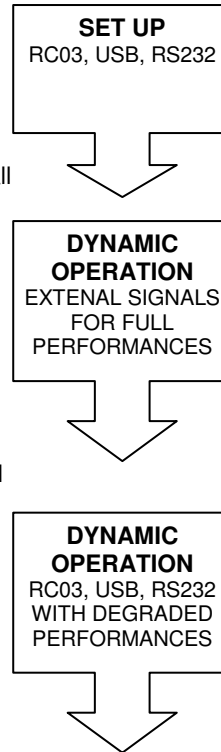
3- External Modulation Inputs / Blanking

Modulation inputs of your driver (1 per channel) controls linearly output RF signal amplitude from 0 to maximum level for each channel. This mode allows user to create any control signal (shape, duration, slope…). When applying V_{max} on Modulation inputs, RF output power rises up to P max. (Standard Vmax=10 Volts)
These inputs are used to control independently the amplitude/intensity of each channel.

Blanking input: this unique input controls simultaneously the amplitude of the n channels. It controls linearly output RF signal amplitude from 0 to maximum level (simultaneously for all channels) for an analog input (standard 10V).
Modulation inputs can operate only if the Blanking input is activated (High level).
Blanking input is used in complement to modulation inputs in order to increase the extinction ratio of the driver.
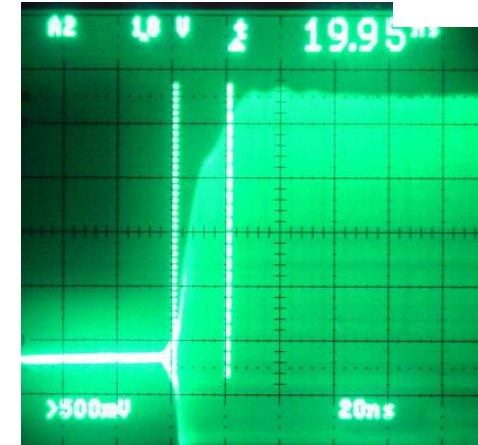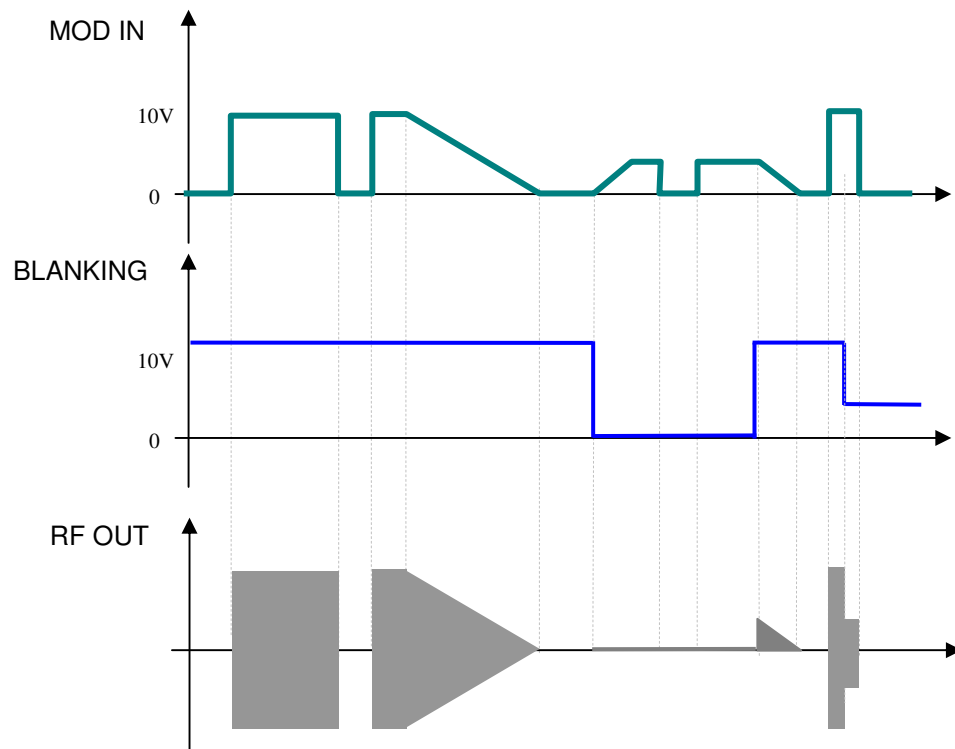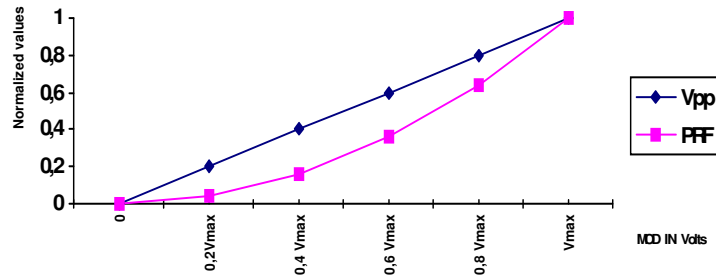
The output RF power P_{RF} through a 50 Ω load is related to the peak to peak signal amplitude Vpp by the relation:

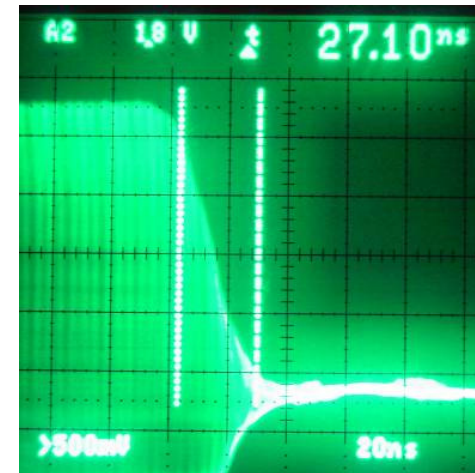$$P_{RF} = \frac{V_{pp}^2}{8R} = \frac{V_{pp}^2}{400}$$
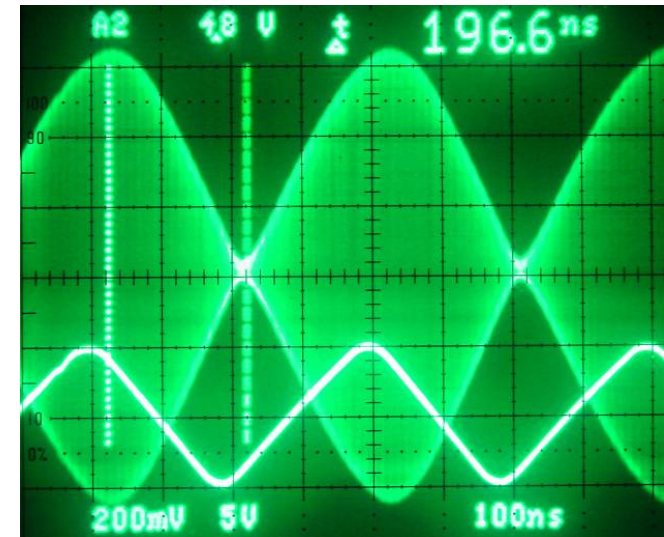
3- Rise Time / Fall Time

The rise time Tr and fall time Tf of your driver specified in your test sheet corresponds to the necessary time for the output RF signal to rise from 10 % to 90 % of the maximum amplitude value, after a leading edge front. This time is linked to carrier frequency and RF technology. This is < 50ns for the MDS.

Rise time

Fall time

MOD IN

BLANKING

RF OUT

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4- Extinction ratio

The extinction ratio of your driver specified in the test sheet is the ratio between the maximum output RF level (MOD IN = max value) with the minimum output level (MOD IN = MIN value). Depending on the model, it can reach > 80dB.

A bad modulation input signal can be responsible for the extinction ratio deterioration.

$$Extinction \ \ ratio = 10 \log(\frac{P_{max}}{P_{min}}) = 20 \log(\frac{V_{pp \ max}}{V_{pp \ min}}) \ \ (dB)$$

The maximum extinction ratio is obtained when both the modulation input and blanking are set to 0V. In that case, the extinction ratios are cumulative and can reach depending on the model > 120 dB (electrical). (Please refer to your test sheet for exact value).

Please note that the blanking input has an automatic "0" level which is activated when the blanking voltage is lower or equal 50 mV.

REMOTE CONTROL

1- Presentation

The remote control (RC) has been developed to allow the user to adjust the MDS.nC driver with its associated AO device. After adjustment, the RC can be unplugged until new adjustments are necessary. The RC has several functionalities like:
- Frequency adjustment for each channel (=line)
- Maximum RF Power adjustment for each channel (=line),
- Switch ON/OFF for each channel for test
- Parameters storage in EEPROM
- Switch from internal to external mode (or external to internal mode)

2- Remote Control Initialisation

Plug the remote control to the driver. The remote control will display the Firmware version.

3- Parameters Adjustments (for each channel)

Press any « Arrow » Key to access the channel adjustment mode.

Select a line number, with the digital keys (1 to 8 for a MDS8C, for example).

Set the maximum RF power level with the keys "^" and "v". Display is in dBm. Please note that this is an indication but not a measurement.

Sweep the frequency around the value memorized in the driver at factory (or stored at the previous adjustment), with the keys "<" and ">". A continuous pressure allows to sweep it smoothly over 2 MHz. Be careful, beyond this value, the sweep goes faster.

When the frequency is close to the value, which gives the maximum diffraction efficiency, operate a precise adjustment by sweeping it step by step.

Optimize the power adjustment djustment, when the frequency is adjusted, by varying the RF power "^" and "v".

4- Data Storage (To store data in the driver)

Press the "STR" (STORE) key to store all the adjustment values in an EEPROM.
Load these values in resetting your driver.

5- Mode Select (To switch between Internal / External modes)

Internal mode: Press a key from numerical keyboard. This mode allows to select one channel per one channel. In this mode, driver will respond to internal instructions given by RC03, USB or RS232. In internal mode, external controls are disables.

External mode: Press "ESC" once or twice depending on menu. Remote control (RC03) can be plugged or unplugged. External user control signals are operational. Note: the external controls (from DB25) are disabled in internal mode. User have to be in external mode to enable external controls.

6- Lines Select (To switch the output ON and OFF)

Select Internal mode by pressing the corresponding channel number to select a channel. Press again to switch off the line. When the channel number is displayed on screen, it means it is "ON", when the channel number disappears, it means it is "OFF".
Select all the channels you want to switch on.

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USE USB or RS232 with Hyperterminal, of user software

Use either a terminal or a hyper-terminal software (PC).
A special routine can be developed by the user using the RS232 or USB open protocole.

1- RS232 Communication (Option)

RS232 is an option of the driver. Please make sure that this option is available on your driver.

Configure the RS232 communication as follows:
   19200 bauds (bits/second),
   8 bits (data),
   no parity (N=0),
   1 stop bit,
   None (flux control).

Connect the RS232 cable between the port, which you have configured at the previously step, with the "RS232" input of your driver.
The connexion cable is a STRAIGH DB9 cable (with pin 2 on 2 , pin 3 on 3 and pin 5 on 5).

Warning: pin 6 could be use to make Hard Reset…

2- USB Communication

Read « installing the USB interface driver » before starting.

3- Programming of the RF Driver with the RS232/USB

Find below the RS232/USB protocole to communicate with your MDS driver:

Goal	Instruction written by the user // Message delivered by the driver	Comments
Selection of the channel	**X (or x)** Channel number > n ? (Waiting for the selected channel) n + <Enter>	$1 \leq n \leq N$ with n the number of the channel and N the number of channels
Frequency adjustment	**F (or f)** Frequency > ? (Waiting for the applied frequency) f + <Enter>	$fmin \leq f \leq fmax$ with f the frequency for the selected channel (n) (format xxx.xxx)

Power adjustment "Compatible MODnC"	**P (or p)**
	Power >
	? (Waiting for the applied power)
	p + <Enter>
		$0 \leq p \leq 63$ (step format integer)
		with p the power for the selected channel (n)
		
		Example :
		  $0 \rightarrow$ min RF power
		  $63 \rightarrow$ max RF power

Fine Power adjustment "NOT compatible with MODnC"	**LxPpppp** (ex : L3P0852) Or **LxDdd.dd** (ex : L2D19.00)	X = line number $0 \leq pppp \leq 1023$ or X = line number $00.00 \leq dd.dd \leq 22.00$ (dBm)
Lines Status displays (channel status)	**S (or s)** ? Example of status display : L1 F=121.321 P=19.2 ON L2 F=115.321 P=18.5 OFF … Ln F=87.965 P=17.6 ON	For all Lines in this mode the following information are indicated: Channel Number / Frequency / Power /ON/OFF
Driver mode adjustment	**I (or i)** Mode > ? (mode adjusted for the driver) i + <Enter>	i = 0 : internal mode i = 1 : external mode
PLL switch ON/OFF	**O (or o)** PLL n ON/OFF (1/0) > ? (selected channel is ON or OFF) o + <Enter>	o = 0 : PLL switched OFF o = 1 : PLL switched ON
Variable data storage	**E (or e)** STR... ? (data stored)	To store parameters in the EEPROM

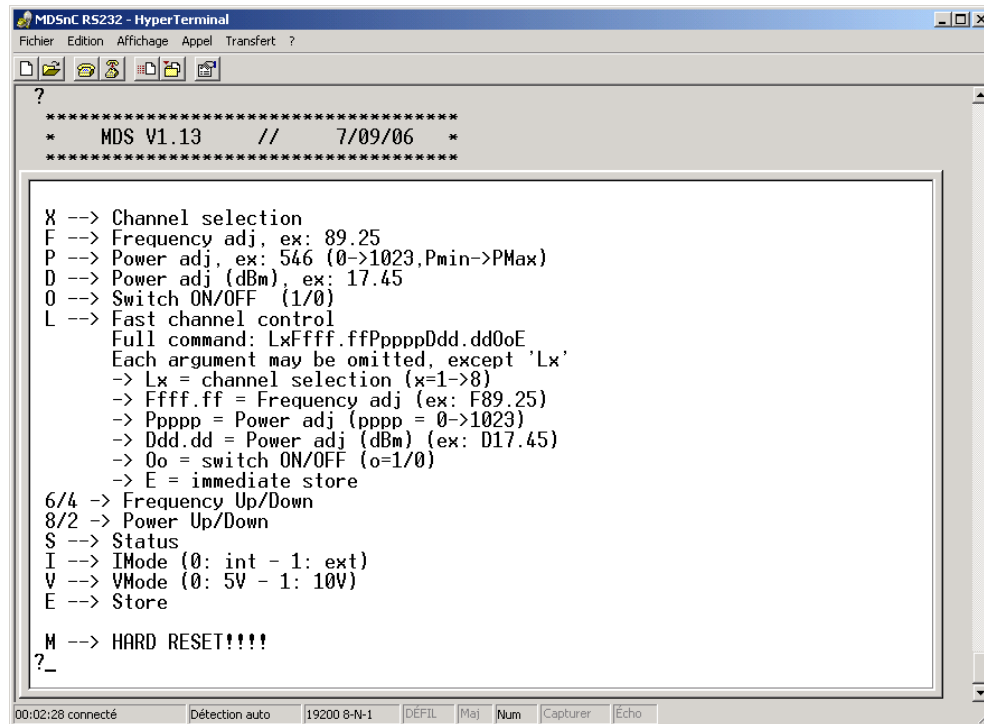## 3- Use Hyperterminal to control your driver

Command: Letter, which is associated at one command, written by the user through the software.
Response: Message delivered by the driver, which is displayed on the screen of the software.
<Enter>: Carriage return or Enter key pressed. (0x0D)
Variable: Number, which is associated at a variable data, written by the user through the software.

For any key sent to the driver, which is not in the Command list, the driver will send the following Command List Menu:

```
MDSnC RS232 - HyperTerminal                                    _|□|×|
Fichier  Edition  Affichage  Appel  Transfert  ?

 □ ☞  ⊜ ⅋  □  ☜ ☝

?
 *************************************
 *    MDS V1.13    //    7/09/06   *
 *************************************

 X --> Channel selection
 F --> Frequency adj, ex: 89.25
 P --> Power adj, ex: 546 (0->1023,Pmin->PMax)
 D --> Power adj (dBm), ex: 17.45
 O --> Switch ON/OFF (1/0)
 L --> Fast channel control
       Full command: LxFfff.ffPppppDdd.ddOoE
       Each argument may be omitted, except 'Lx'
       -> Lx = channel selection (x=1->8)
       -> Ffff.ff = Frequency adj (ex: F89.25)
       -> Ppppp = Power adj (pppp = 0->1023)
       -> Ddd.dd = Power adj (dBm) (ex: D17.45)
       -> Oo = switch ON/OFF (o=1/0)
       -> E = immediate store
 6/4 -> Frequency Up/Down
 8/2 -> Power Up/Down
 S --> Status
 I --> IMode (0: int - 1: ext)
 V --> VMode (0: 5V - 1: 10V)
 E --> Store

 M --> HARD RESET!!!!
?_

00:02:28 connecté   Détection auto   19200 8-N-1   DÉFIL   Maj   Num   Capturer   Écho
```

Example to switch on the channel 4 at top level (22dBm) and at 140 MHz:
Command X and push the key 4 then <Enter> ⇒ Channel 4 selected
Command P and push the keys 6 then 3 then <Enter> ⇒ Power 22dBm selected
Command F then the keys 1, 4 and 0 then <Enter> ⇒ Frequency 140MHz selected
Command I then 0 then <Enter> ⇒ Driver switched in internal mode
Command O then 1 then <Enter> ⇒ Channel 4 is ON
If you search the data (frequency or power), adjust the values using the direction keys (Numlock):
- <8> and <2>: respectively to increase and decrease the RF power (in dBm),
- <6> and <4>: respectively to increase and decrease the RF frequency (in MHz).
After any modification the driver delivers the following message: "Format XX ?", with XX corresponding to the frequency value or the power value depending which value is modified.

To select a channel in internal mode, respect imperatively all the following steps:
1 - Select the channel at first,
2 - Select the Frequency and/or Power command (if and adjust them if necessary),
3 - Adjust the driver mode in "Internal Mode",
4 - Adjust the PLL switch on "ON" .

FAST DIRECT USB/RS232 OPEN PROTOCOLE

The above protocole is useful and easy to handle with a terminal or a console. However, user may need a fast protocole to be directly integrated in the user program.
With only one command, one comple line can be adjusted (Line n°, ON/Off control, Frequency, power). This allows user speed and smooth control with rapid interactions with the driver.

FULL Command: **LxFfff.ffPppppDdd.ddOoE**

Note: Each argument may be omitted except 'Lx'

> → Lx   channel selection (x= 1 to 8)
> → Ffff.ff   frequency adjustment (fff.ff = frequency value ex-142.26 – MHz)
> → Ppppp   power adjustment (pppp = 0 to 1023)
> → Ddd.dd   power adjustment (dBm, ex dd.dd=17.45)
> → Oo   switch ON/OFF (o= 1 / 0)
> → E   immediate store

Example Set Line 3, Power 19.3 dBm
> → Command L3D19.30

Set Line 8, Frequency 103.32 MHz, Power 900, switch on and store
> → Command   L8F103.32P0900O1E

Reset of the RF Driver: Press M.

After a reset of the driver, the character "?" is displayed: the driver is ready in external mode. The driver is initialized with stored parameters. The driver is automatically set in external mode ("EXT" is displayed).

Storage of the Data: Press E.

This operation is necessary, in the case where the data must be loaded. At each storage the previously data are erased.

RS232/USB with Remote Control
In order to ease the operation of the driver, the RS232 version can be controlled simultaneously by a Remote Control and the RS232. Each command passing through the serial link is automatically displayed on the remote control when it is activated. To activate the remote control, plug it in.

USB Sofware 2.03 – Laboratory tool

IMPORTANT NOTES - READ THIS FIRST

Install the software on the computer before connecting the MDS device to an USB port.
When using the USB communication interface, the hardware must be connected to the computer prior to run the software. If not, a communication error may occur.
You must have the administrator rights to install the software.
See other important notes at the end of this section.

1- Installing the software

Software works on Win2000, Win'XP and VISTA platforms. Drivers are available for Windows 7 32/64 bits.
You must have the administrator rights to install the software.
Software is packed in the archive "MDS_V203.zip".
All the files needed for this application are included in the archive. (Including Config/driver)
Place this archive in a specific installation directory on the computer (eg. "C:\MDS\").
Unpack the archive in that directory.
All the USB drivers needed by Windows will be installed in the directory.

2- Installing the USB interface driver

Connect the device to a free USB port of the computer.

RS232

USB
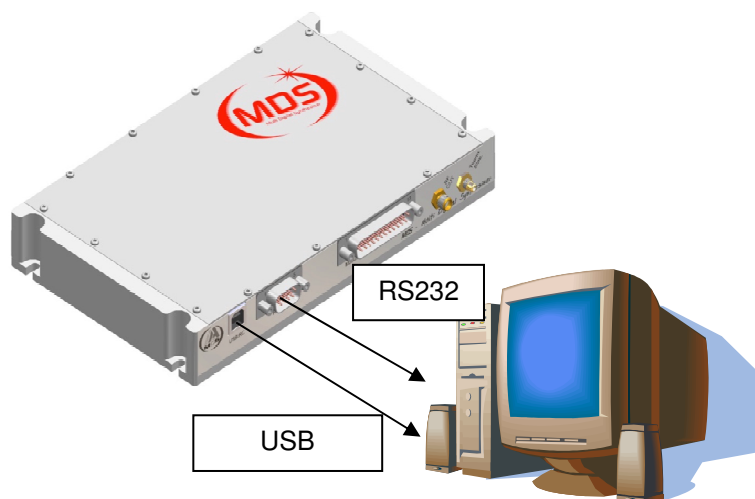
Power up the device (Please refer to MDS operating manual).

Upon the first connection on this port, Windows will detect the new hardware and ask for the driver.
Do not let Windows look automatically for updates for the new hardware.
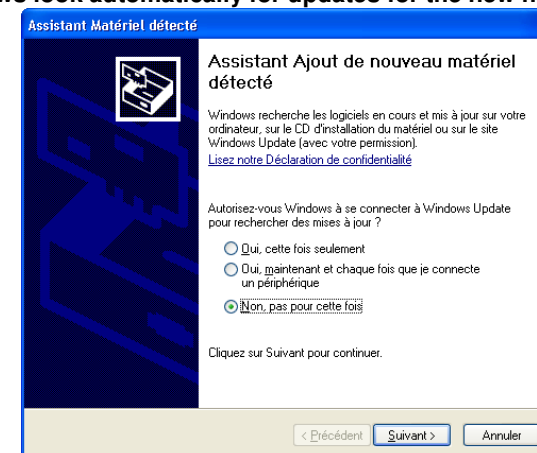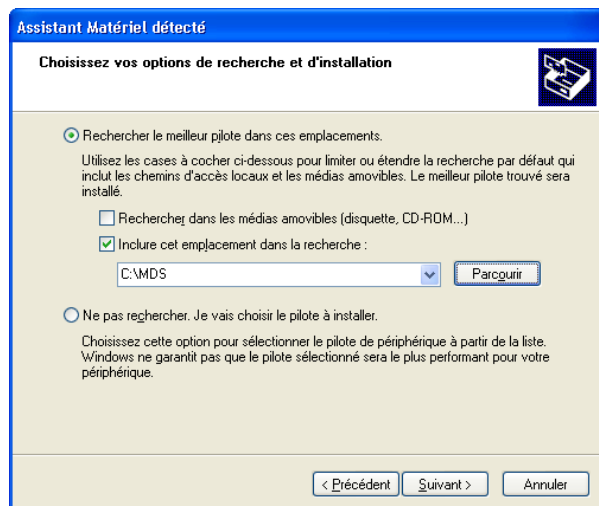

Click on the Next button.
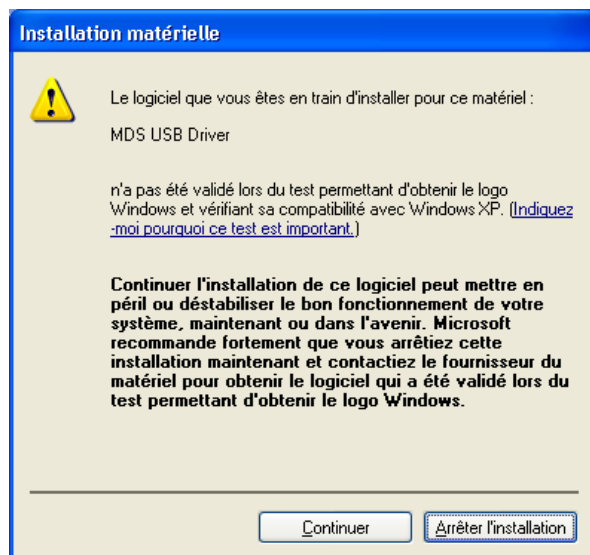In the next window, don't let Windows automatically install the software driver.
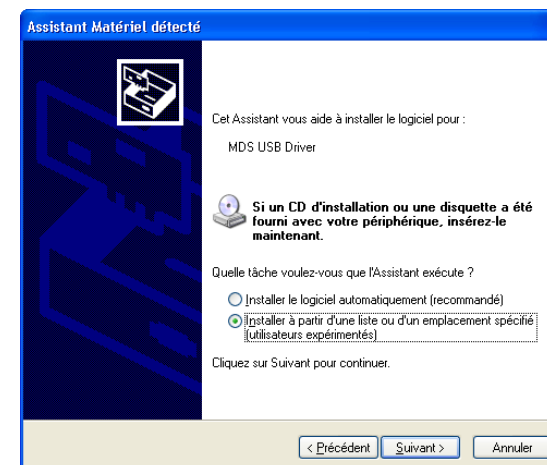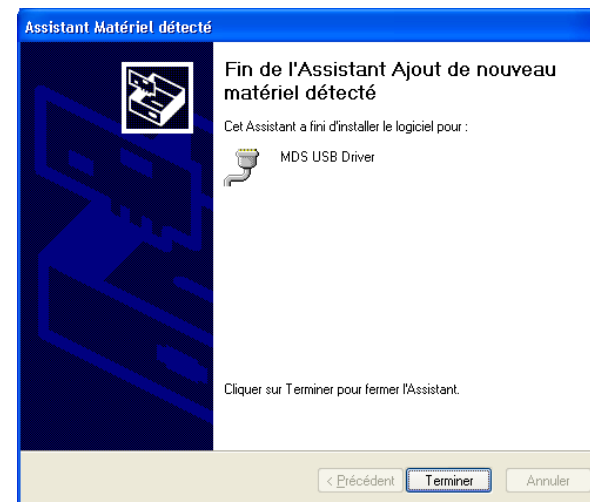

Click on the Next button.
In the next window, select the driver "AACDC.INF" located in the installation directory (eg. "C:\MDS\").

Click on the Next button.
In some cases, certificate verification window may appear.

Click on the Continue button.

Click on the End or Finish button.
USB Driver installation is completed for that USB hardware port.
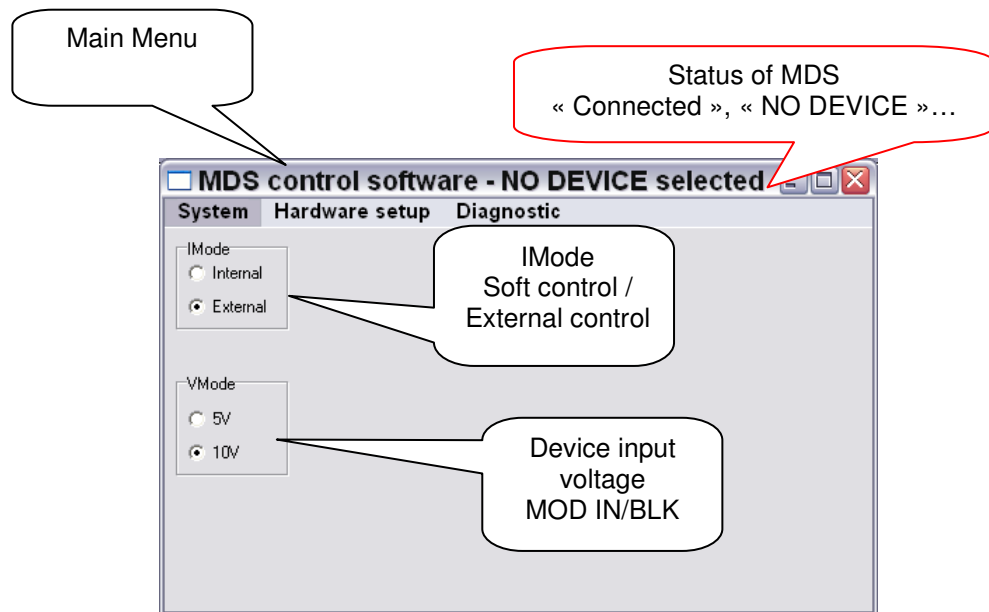
IMPORTANT

You will have to install the driver for each USB port you will use with that hardware.
The USB port on which the hardware is actually connected will be recognized as a COM port (eg. COM10).

3- Running the application

Run the software "MDS.EXE" located in the installation directory.
This soft automatically recognize a RS232 or USB Protocole.
The Main window and View window appear on screen.

Main Window

The main window of the software gives the status of the MDS:
VMode: Voltage range for Modulation Inputs and Blanking
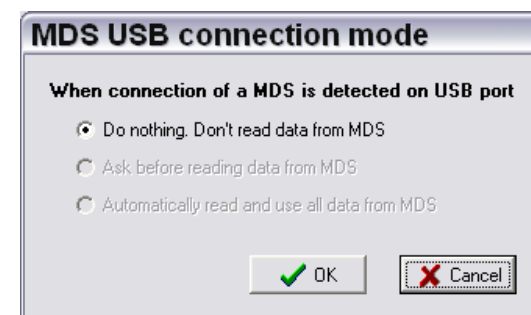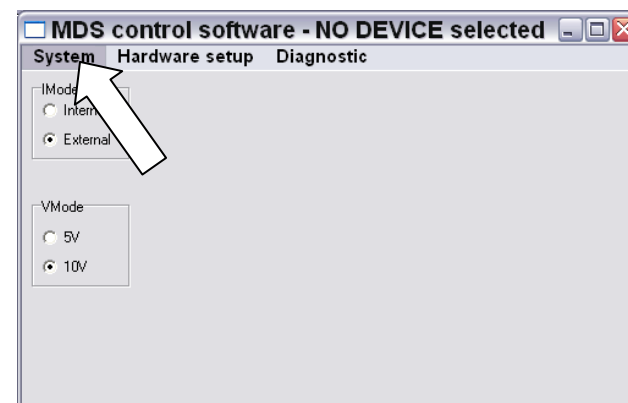IMode: Internal Mode (soft control) – external Mode (DB25 external signals control)

Main Menu

Status of MDS
« Connected », « NO DEVICE »…

IMode
Soft control /
External control

Device input
voltage
MOD IN/BLK

Main Menu: top of the window – Allow navigation.

IMode: Upon power up, the device is in External mode.
In External mode, channel power level is directly controlled by the voltage applied on the channel MOD IN & Blanking inputs (external user signals). The maximum value of the power level is controlled by the software interface with the value in the power edit box.
In Internal mode, channel power level is totally controlled by the software interface with the value in the power edit box and the On/Off box in the "Device line control" area.
In both modes, frequency and maximum power level can be adjusted with the software interface.

VMode: Select the level of the driving voltage applied on the inputs (line IN and analog blanking) of the device in this area.
Attention: if you apply 10 V on your external modulation inputs or Blanking, and then switch VMode to +5V, then irremediable damage may happen to the input buffers of your driver.
To validate change, a password is requested: pass="ACCEPT".

System menu

Click on SYSTEM to:
Exit Program
Get Software version (About)
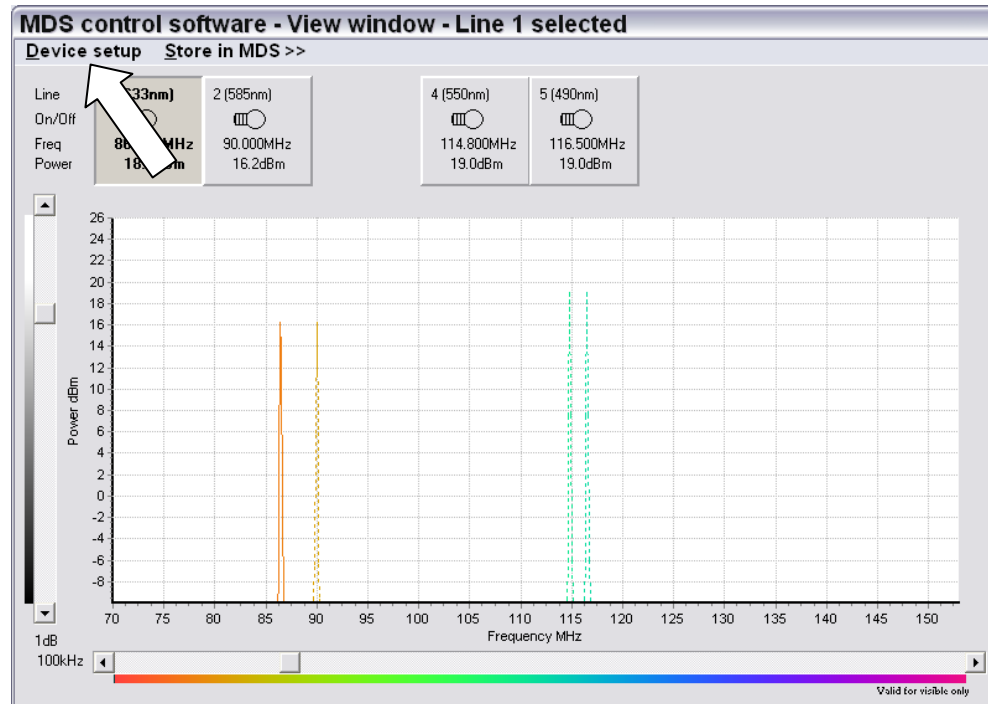Select MDS USB Connection Mode

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Device setup Menu

Click on "Device setup" to:
Load a stored configuration
Store and give a name to a configuration
Set manually frequency/Power for each channel

MDS control software - View window - Line 1 selected

Device setup - File DEVICE.MCF

Change RF power

Change Frequency

Change name

Click to display the line on the view graph

Adjust Scale of the view Frequency

Adjust Scale of the view Power

Store running adjustments in MDS

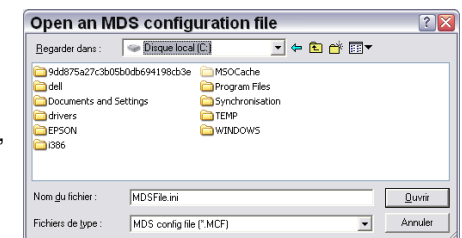Load data stored in MDS

Load a stored configuration
Click on "Open" Menu (top of window).

Select directory and name of the file to be loaded, then click "open".
The configuration will be loaded and displayed.

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Click on button "Store in MDS" in order to load this Data in the MDS. Lines will automatically be adjusted to the new data and stored inside MDS.

You can manually exchange each value, before saving or sending to MDS.

Save and give a name to a configuration

Click on "Save as" Menu (top of window).
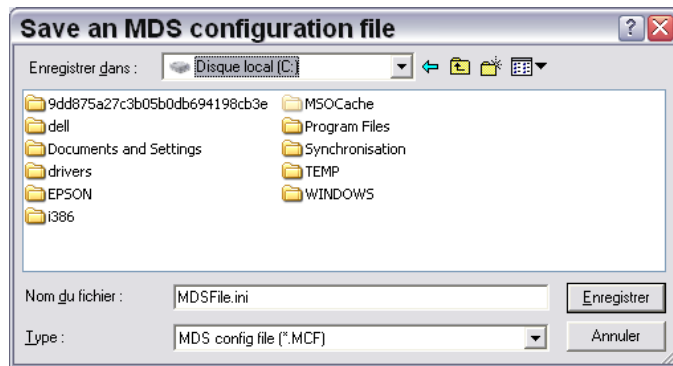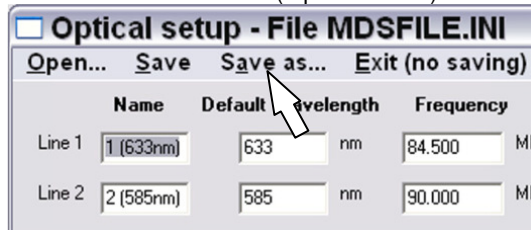
Select directory where you want to store the file, and give a name to the file , then click "Store".
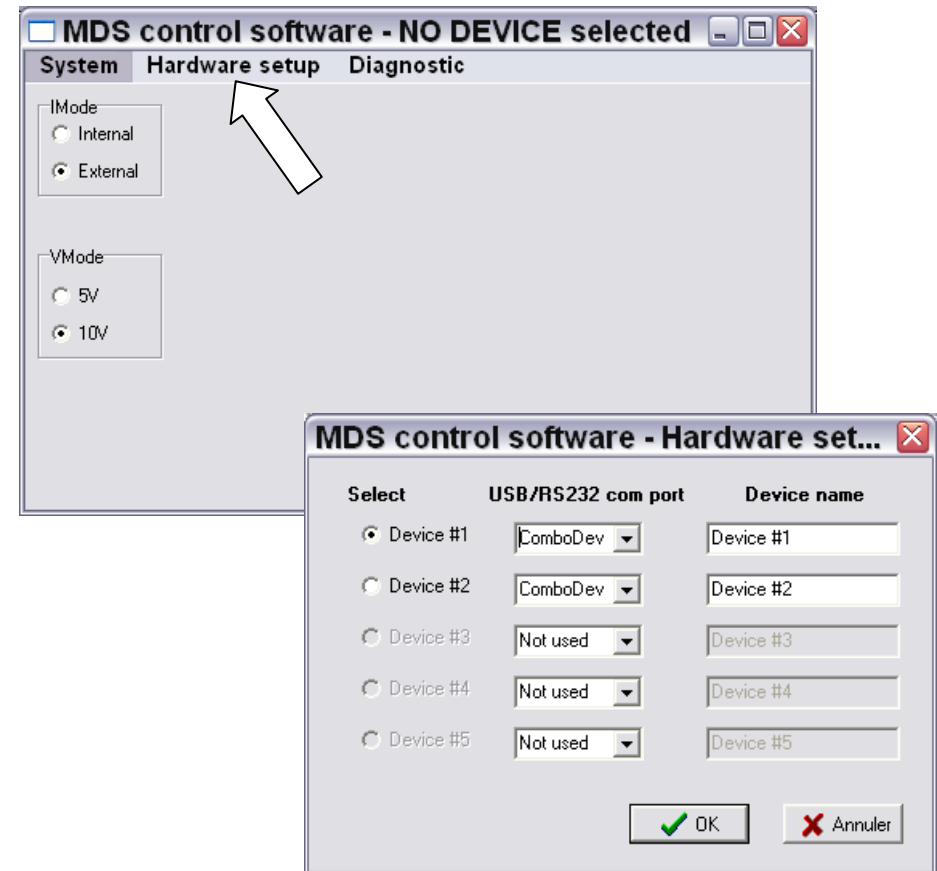
Save a configuration with same name

Click on "Save" menu (top of window)

Hardware setup menu

Click on "Hardware setup" menu to:
- Select number of MDS running simultaneously (Max 5)
- Configure/select port name for each MDS
- Give a name to each MDS (will be displayed on top window)
- Select the active MDS (controlled by soft)

Then click OK.

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VIEW WINDOW

Allows to
- Adjust easily all Lines
- Switch ON / OFF all Lines
- Visualize full adjustment

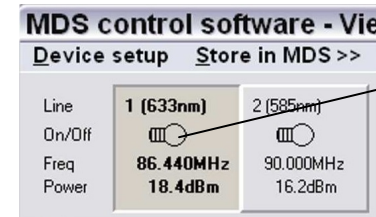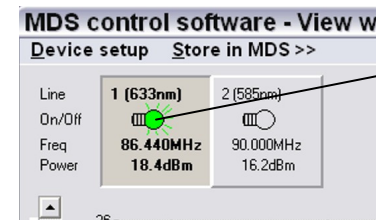MDS control software - View window - Line 1 selected
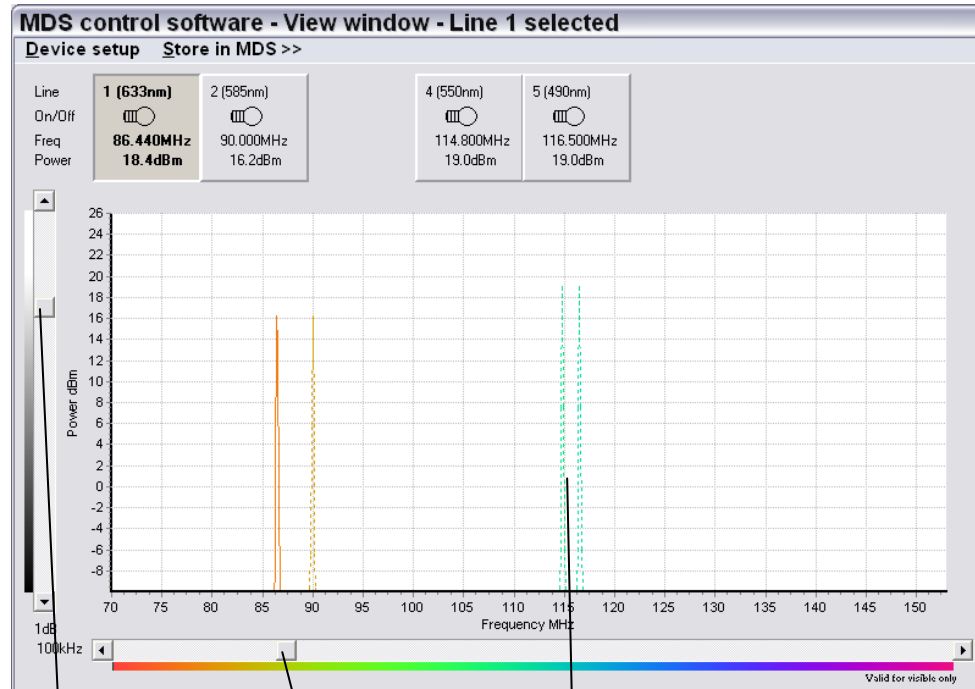
Frequency cursor

Power cursor

Visualization of the adjusted Lines / channels
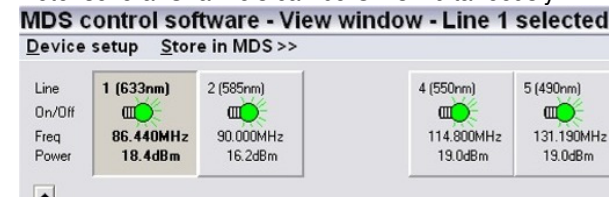
Switch ON/OFF the lines

Click on the Light
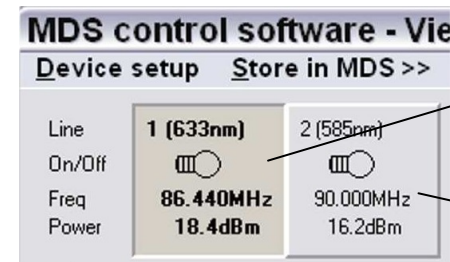Light OFF = Channel OFF

Light ON = Channel ON

Note: several Channels can be ON simultaneously:

Select Active Channel

The active channel corresponds to the channel on which adjustments (frequency/Power) will be active. Select the active channel by pushing the channel button.

Press channel button to make it active. It becomes darker. Press again to make it inactive

Non active channel

Active channels appears in solid line

Inactive channels are drawn in dash lines

Diagnostic Menu

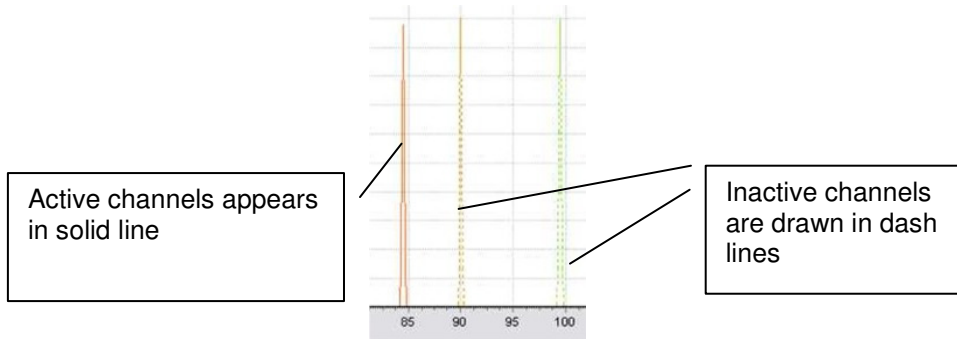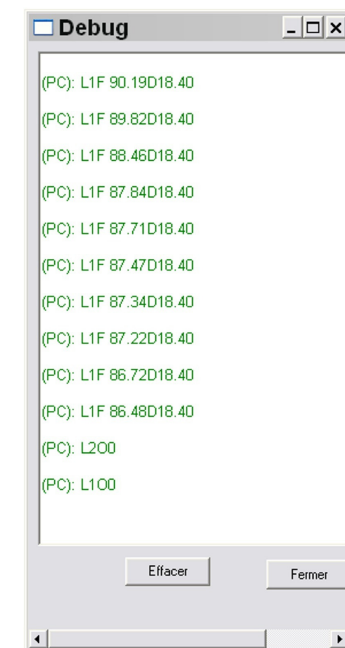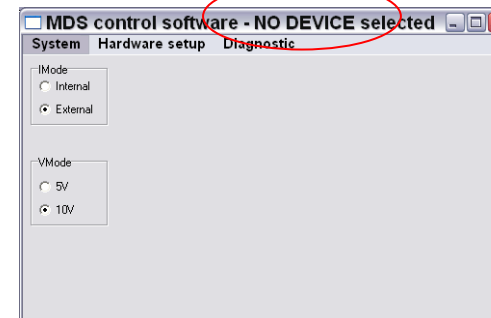Not used at the moment.

DEBUG WINDOW

Type "CTRL-D" on your keyboard.
The debug window appears. It will allow to verify the communication between computer and MDS.

- PC dialog is in green color
- MDS dialog (response) is in purple color

If there is no response from MDS (see example), then it means that MDS is not connected correctly.
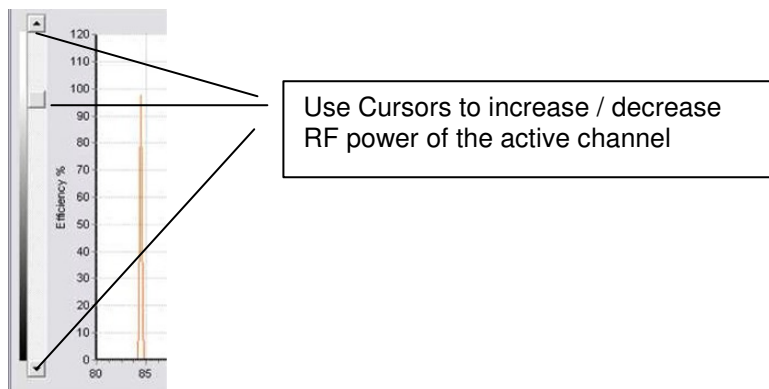"NO DEVICE selected" – check installation until MDS is "CONNECTED"

Frequency adjustment of the Active channel

Use Cursors to increase / decrease RF frequency of the active channel

Power adjustment of the Active channel

Use Cursors to increase / decrease RF power of the active channel

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SUMMARY

SET UP	Adjust frequency / max RF power per channel then store for automatic reload after each start. Use RC03. Can be achieved through USB/RS232.
Frequency adjustment	Use RC03, or USB/RS232. Speed limited by USB/RS232 communication.
Max RF power adjustment	Use RC03, or USB/RS232. Speed limited by USB/RS232 communication.
Switch ON/OFF channels	Use RC03, USB/RS232, or external controls (MOD IN + BLANKING). For maximum speed, use external controls only.
AM Control	Use RC03, or USB/RS232 and change power per channel. This method allows 30 dB dynamic. Use external control signals (MOD IN + BLANKING) to get best performance of speed and dynamic. Use MOD IN for individual AM control of each channel. Use Blanking for simultaneous AM control of all channels.
PC Control	External control signals can be driven through a PC board with convenient I/O levels. The PC board and convenient software is not provided by AA. USB/RS232 - You can use the "Hyperterminal" functionality of windows to access the driver's menu and control the driver. - You can use the simple software provided by AA (2.03) in order to control the MDS driver. - You can develop your own software and control interface by using the open protocole provided in this manual. - You can control your driver using standard softwares such as Labview or Matlab. In that case you have to develop special routines using the open protocole given in this manual. AA does not provide routines.