AOTFnC & MDSnC

Operating Manual

Polychromatic Tunable Filter
&
Multi Digital Synthesizer

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IMPORTANT

To have the exact specifications of your devices, please refer to the test sheets provided with each unit.

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)**, produce multiple fixed stable and accurate RF frequency signals for polychromatic modulators. Its brand new design with "on the edge" technology offers unique performance in term of **accuracy, speed and stability (single/multi-line), thanks to their internal temperature correction and high linearity design.**

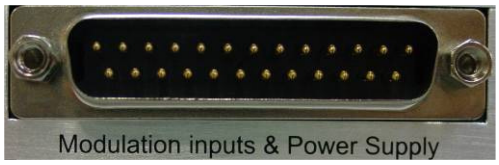
The built in amplifier delivers the necessary RF power to drive the acousto-optic device, with reduced power consumption below **20W.**

The RF output power per channel can be individually modulated (MOD IN signals) or simultaneously modulated (BLANKING signal). AA focussed on a ultra low crosstalk version with faster rise and fall time.
The adjustments of the driver (Frequency & Power) can be done with a remote control, USB or through RS 232 communication to allow user flexibility in power control or frequency scanning.

MDS DRIVER SET UP AND OPERATION

PIN CONNECTIONS

Controls



Pin 14, 15, 16	: GND
Pin 23, 24, 25	: POWER SUPPLY (+24VDC standard)
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

RS-232

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

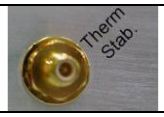
USB/RC

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

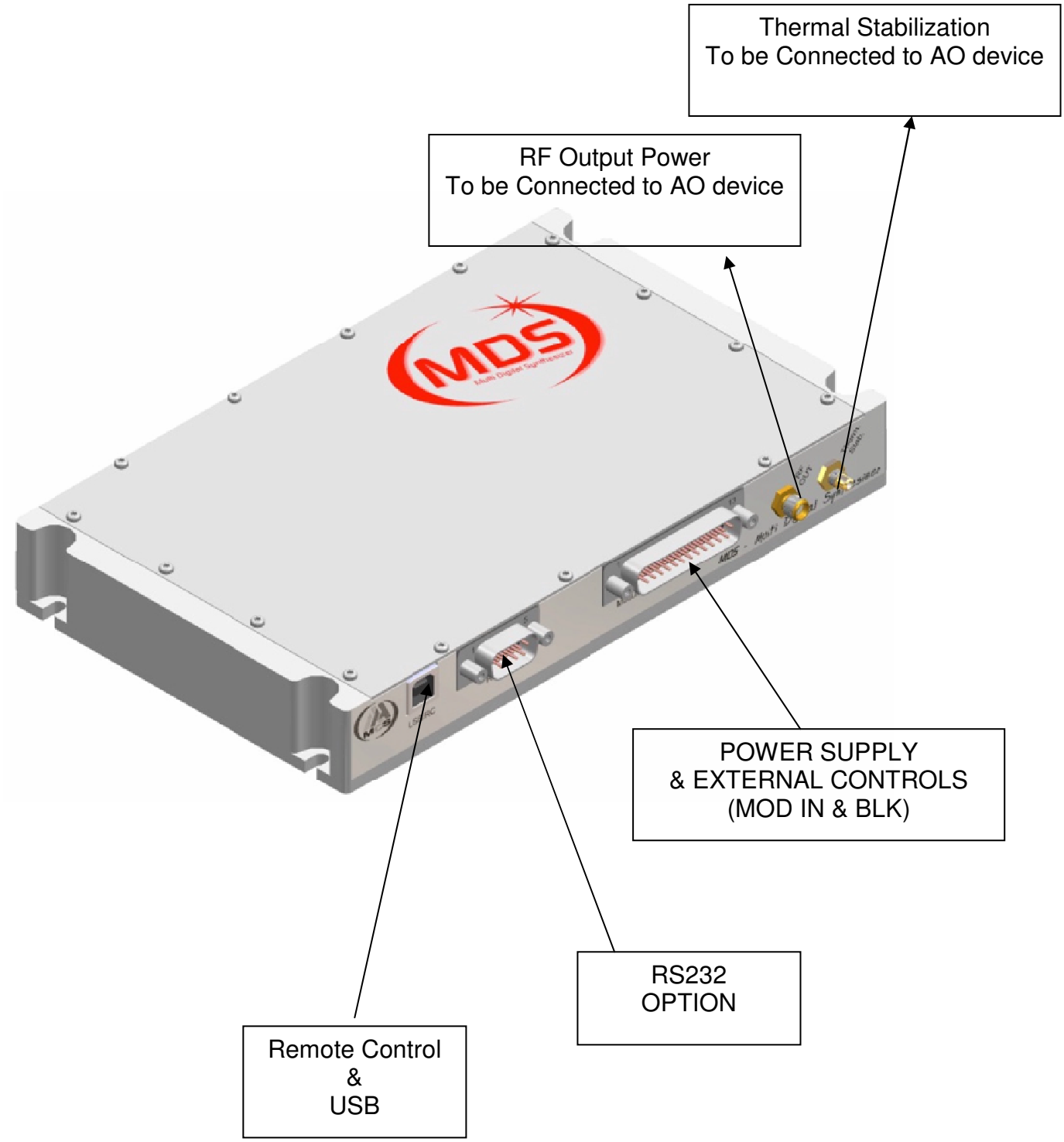
RF OUT

Connect RF OUT to AOTFnC.

STAB T/TN



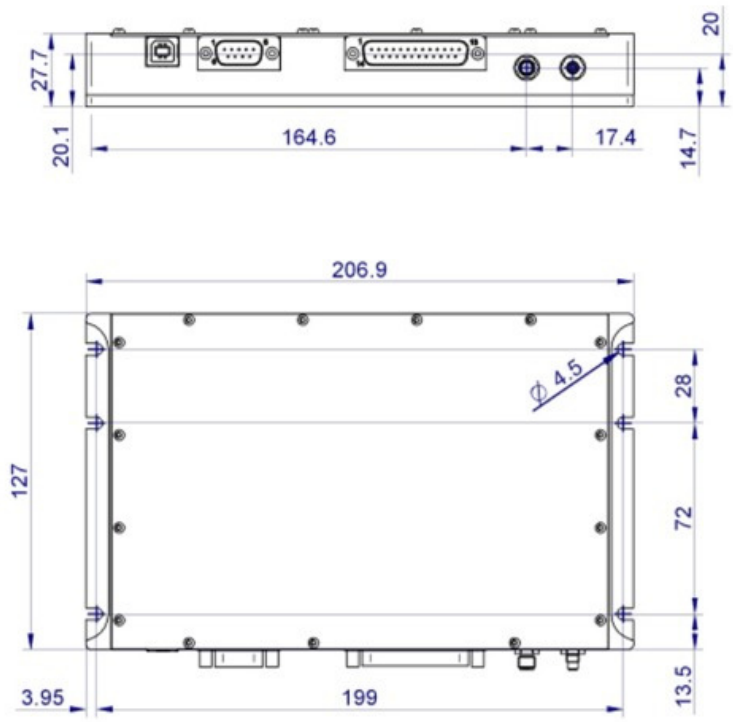
Connect
Therm Stab. to AOTFnC, if you have T or TN option.

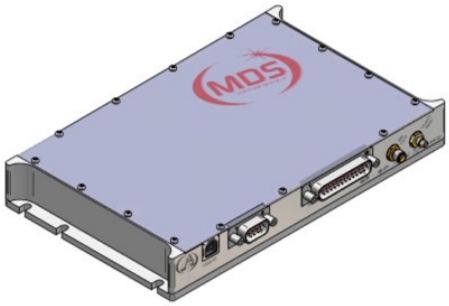

Thermal Stabilization
To be Connected to AO device
RF Output Power
To be Connected to AO device
POWER SUPPLY
& EXTERNAL CONTROLS
(MOD IN & BLK)
RS232
OPTION
Remote Control
&
USB

MECHANICAL DRAWING

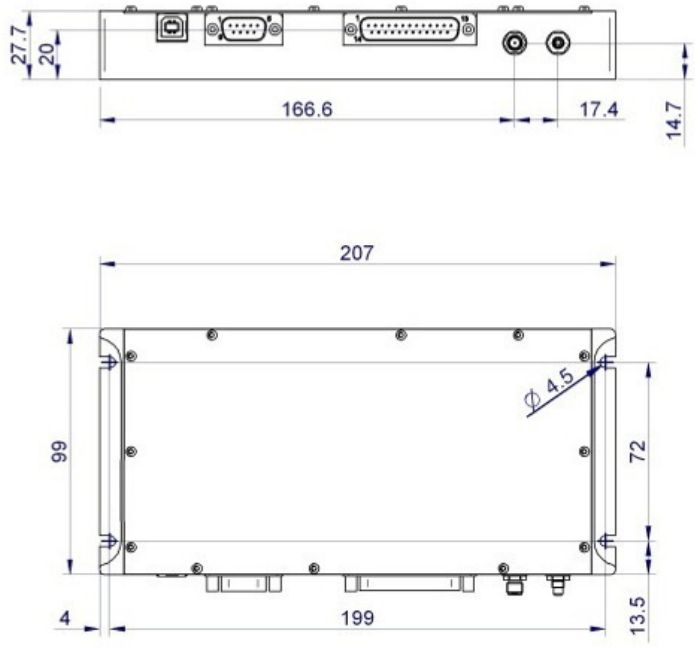
NOTE : AA proposes 2 types of housings depending on the number of channels.

8 chanels version





≤ 4 chanels version



PRECAUTIONS

1. **Before first use**, read "**MDS** Software version 1.03 description" page 5 to 12.

2. Connect the "RF OUTPUT" to the AO device (or 50 Ω power termination).
Never use the driver output in open circuit, otherwise serious damages could happen.

3. Connect the convenient power supply (24 VDC) through the DB25 connector. Check that your power supply can deliver enough current (as per specified, typ 1.2A with AOTF thermal stabilization). The power supply must be off.

4. Do not exceed 50°C for case temperature. Must be screwed on heat sink, or use ventilation kit (sell in option). Use conducting grease if necessary.

5. Connect external modulation inputs ("Line IN"/"Blanking) (IF AVAILABLE) to the amplitude control source (Laboratory power supply, signal generator, PC interface board...).
Check on your test sheet your modulation input version (analog, TTL...).
Take care to match the output impedance of the controller with the input impedance of the modulation input (1KΩ). (You can also use compatible output impedance. In case of doubt, contact A.A. Sa.)
In case of impedance mismatch, your driver will not operate in a proper way.

6. Switch on the power supply (+ 24 VDC). Maximum ripples +/- 1%.

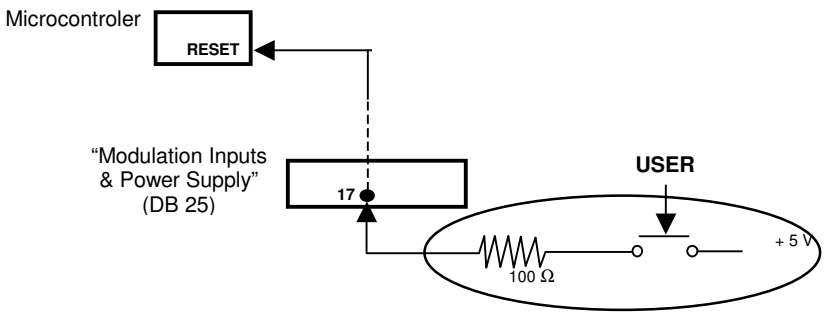
7. **Only few minutes warm up is necessary, due to internal compensated temperature.**

8. THEN you can switch on Line IN command(s) and/or Blanking input to control MDS(external mod)
or you can use remote control (see section…) or USB/RS232 with "**MDS** software MDS.exe (available on line or on CD-R 1PRG006003) or with (eg.) Hyperterminal

MDS TECHNICAL INFORMATION

1- Reset of the RF Driver

A&A provides an external reset of the driver, which can be piloted 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.



Circuit of the driver reset

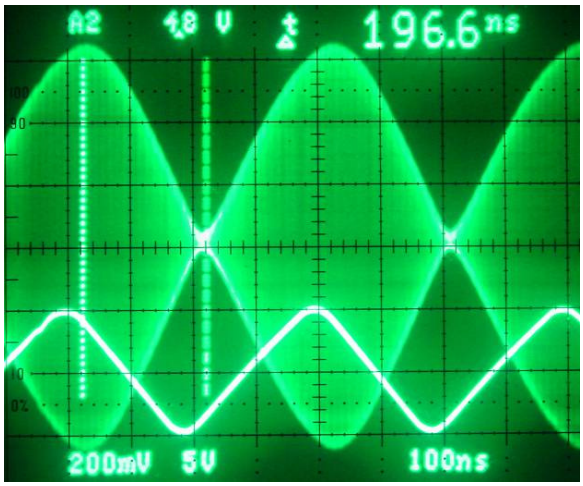
2- External Modulation Inputs / Blanking

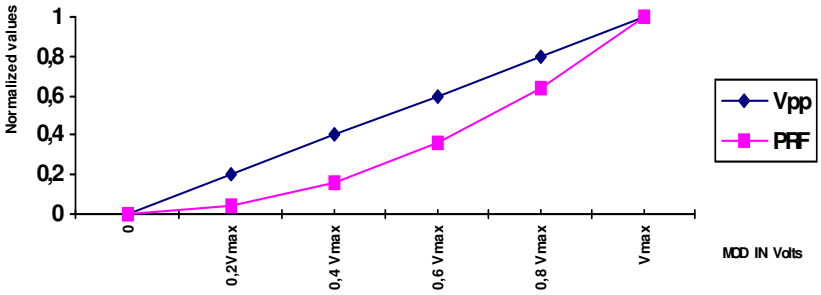
Modulation inputs of your driver (1 per channel) controls linearly output RF signal amplitude from 0 to maximum level for each channel. This mode allows user to create any control signal (shape, duration, slope…). When applying V_{max} on Modulation inputs, RF output power rise up to P max.
These inputs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

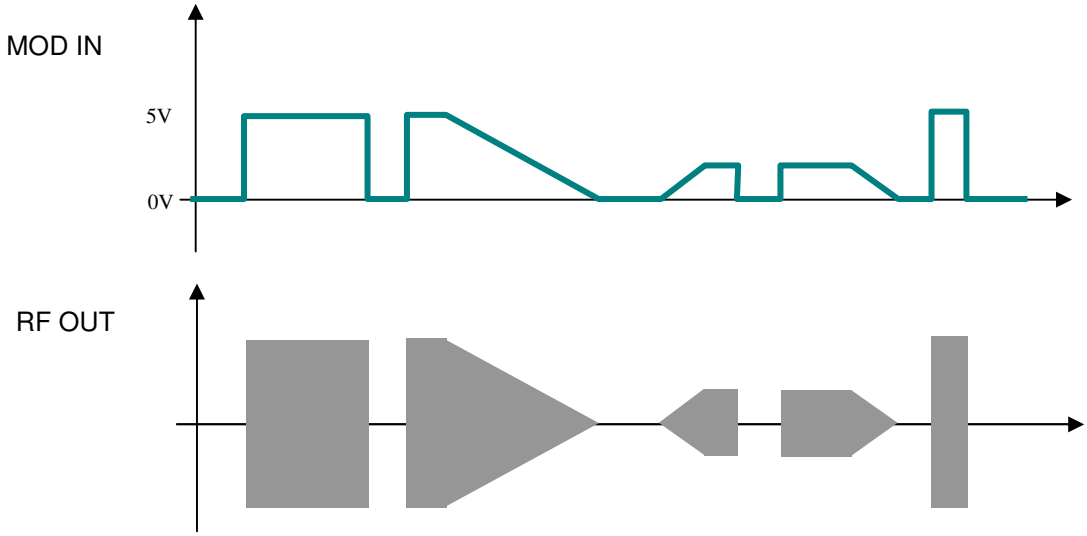
Blanking Input : This unique input controls simultaneously the amplitude of the n channels. It controls linearly output RF signal amplitude from 0 to maximum level (simultaneously for all channels) for an analog input. On request this input can be TTL (ON/OFF).
Modulation inputs can operate only if the 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 :

$$P_{RF} = \frac{V_{pp}^2}{8R} = \frac{V_{pp}^2}{400}$$

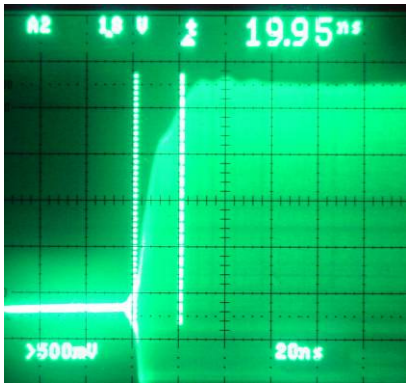




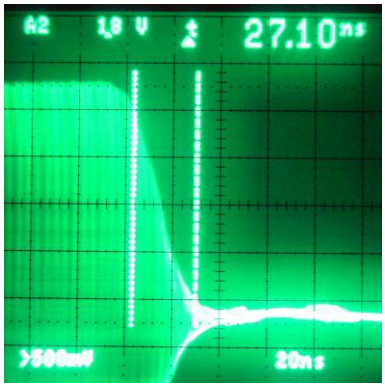


3- Rise Time / Fall Time

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.



rise time



fall time

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

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

MDS SOFTWARE VERSION 1.03 (WINDOWS)

IMPORTANT NOTES - READ THIS FIRST

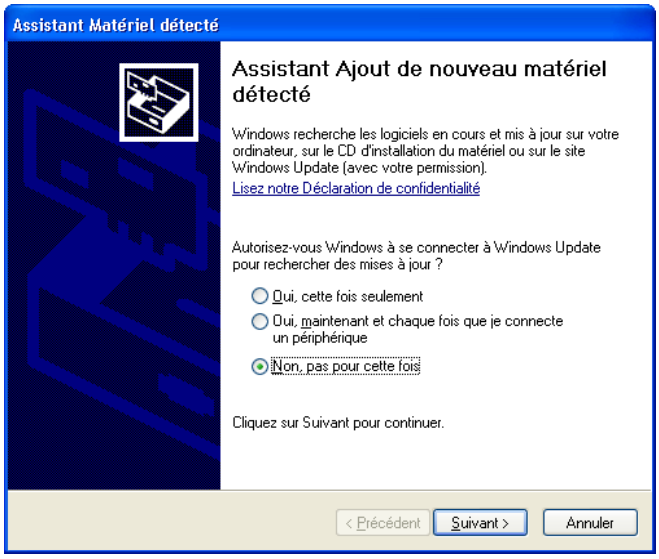
Install the software on the computer before connecting the MDS device to an USB port.
When using the USB communication interface, the hardware must be connected to the computer prior to run the software. If not, a communication error may occur.
You must have the administrator rights to install the software.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

1- Installing the software

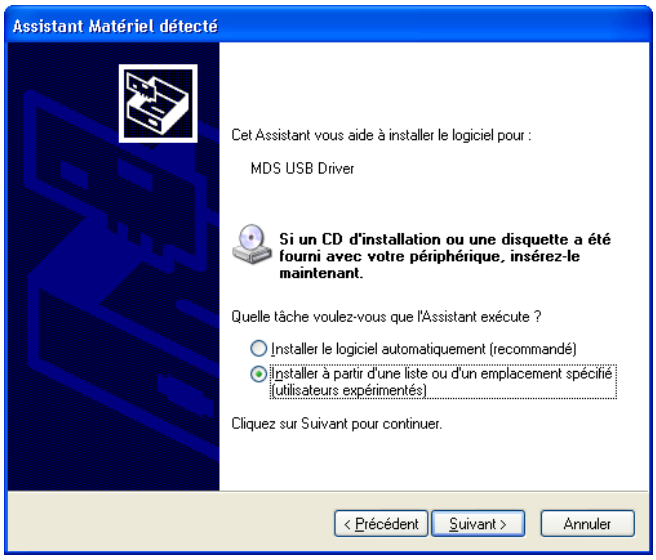
Software works on Win2000 and Win'XP platforms.
You must have the administrator rights to install the software.
Software is packed in the archive "MDS103.zip".
All the files needed for this application are included in the archive.
Place this archive in a specific installation directory on the computer (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

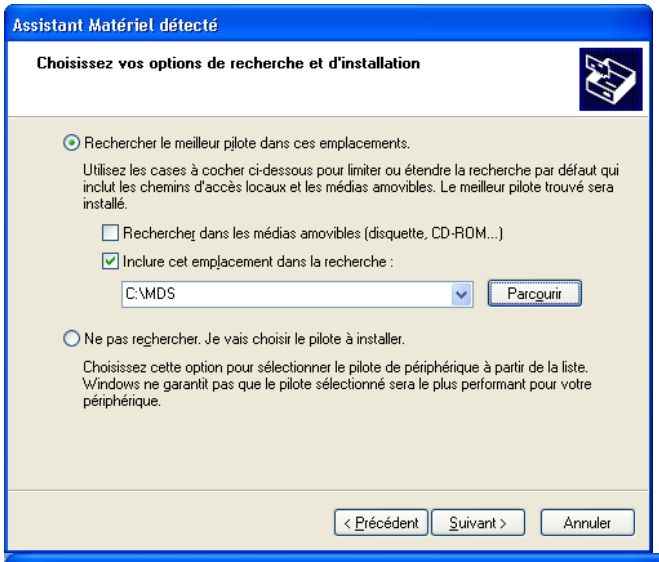
Connect the device to a free USB port of the computer.
Power up the device.
Upon the first connection on this port, Windows will detect the new hardware and ask for the driver.
Do not let Windows look automatically for updates for the new hardware.



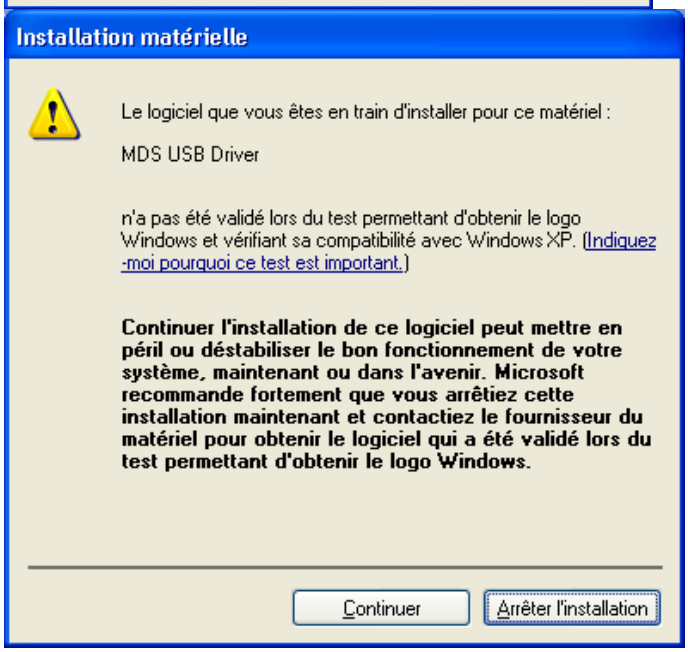
Click on the Next button.
In the next window, don't let Windows automatically install the software driver.



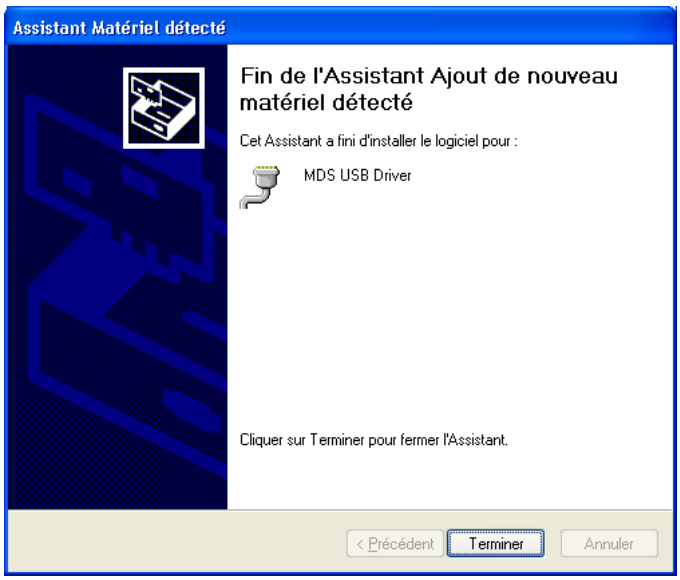
Click on the Next button.
In the next window, select the driver "AACDC.INF" located in the installation directory (eg. "C:\MDS\").



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.

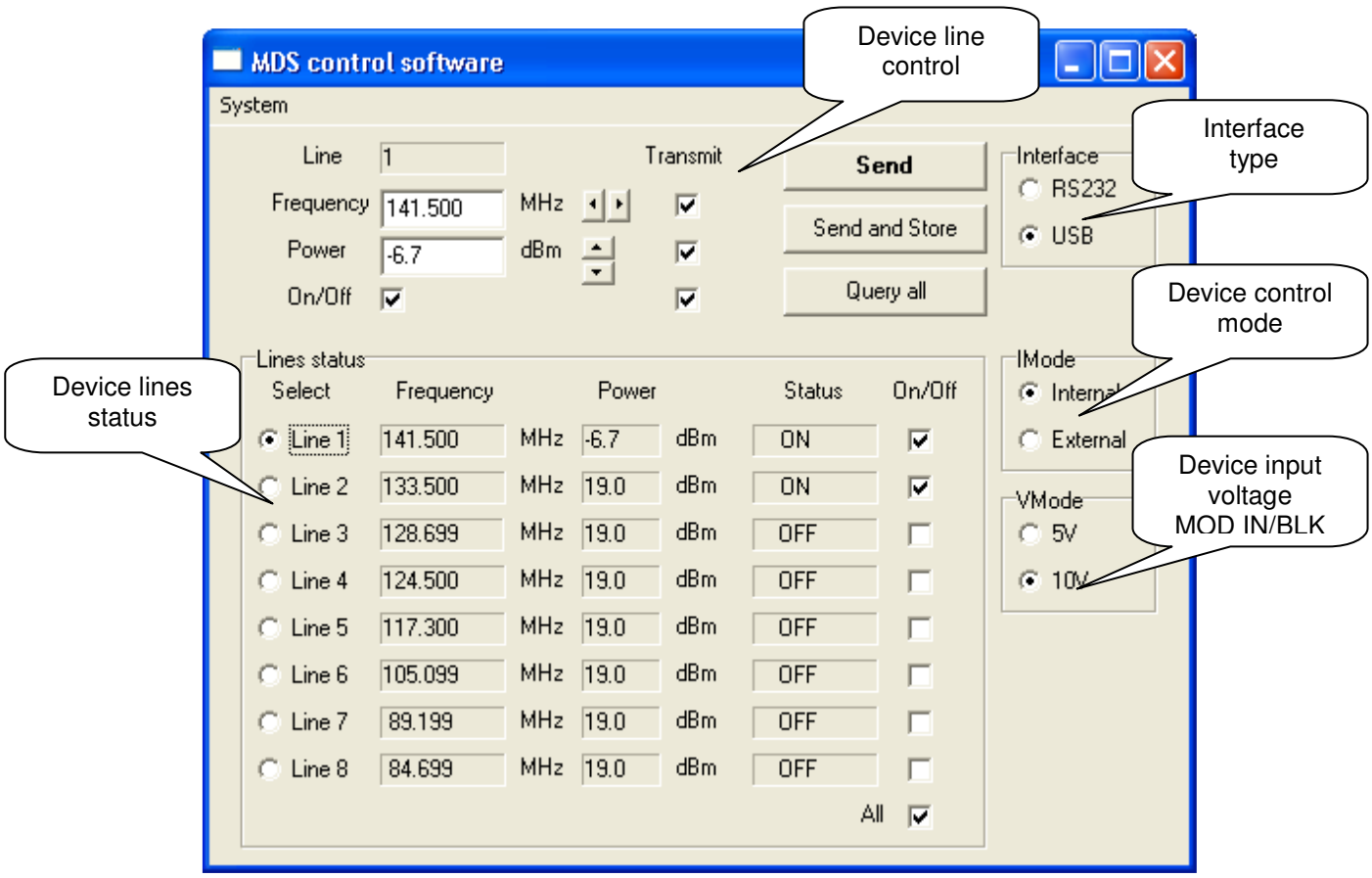
IMPORTANT NOTE ABOUT USB INTERFACE

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.
The main window of the software appears.

Main window



The main window of the software is separated in 5 areas:

Device line control

This area is used to control one RF line of the device.
Click on the “Query all” button to display the entire state of the device in the software’s window.
Select the line number to be controlled in the “Select” column of the “Device lines status” area.
Once selected, all the parameters of the line are placed in the corresponding edit box in the “Device line control” area.
If needed, fill in the frequency edit box in MHz.
Check the “Transmit” box located on the Frequency row if you want to include the frequency value in the next command sent to the device.
If needed, fill in the power edit box with a dBm value.
Check the “Transmit” box located on the Power row if you want to include the power value in the next command sent to the device.
Check the “On/Off” box to set the line On or Off.

Check the “Transmit” box located on the On/Off row if you want to include the On/Off state in the next command sent to the device.
Click on the “Send” button to send the command to the device.
Click on the “Send and Store” button to send the command and to store the new parameters in the device.

Use the left and right arrow buttons located on the Frequency row to decrease or increase the frequency of the line.
Use the up and down arrow buttons located on the Power row to increase or decrease the power of the line.
Once adjusted, click on the “Send and Store” button to store the frequency and/or the power of the line in the device.

Device lines status

This area is used to know the status of all the lines of the device.
All the data viewed in this area are sent by the device to the software when the “Query all” button in the “Device line control” area is clicked on.
Select the line number to be controlled in the “Select” column of this area to control this line with the software.
When the device is in Internal mode, check the “On/Off” box on a row to switch on or off the corresponding line.
Check the “On/Off” box in the bottom of the area to switch on or off all the lines together.

Interface type

Select the type of interface used to control the device (USB or RS232).

Device control mode

Upon power up, the device is in External mode.
In External mode, line power level is directly controlled by the voltage applied on the line IN & Blanking inputs.
The maximum value of the power level is controlled by the software interface with the value in the power edit box.
In Internal mode, line 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.
Select the Device control mode in this area.

Device input voltage

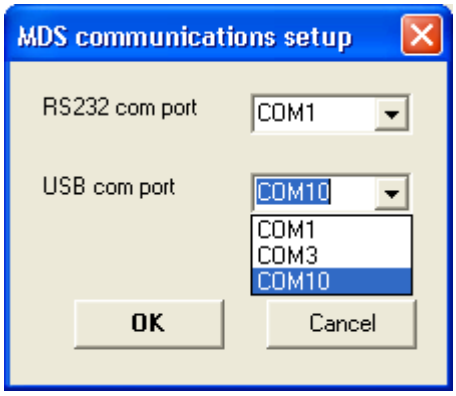
Select the level of the driving voltage applied on the inputs (line IN and analog blanking) of the device in this area.

System menu

The system menu has 3 items:

- Options to setup the communication ports of the software
- About to view some information about the software
- Exit to quit to Windows

Setting up the communication ports

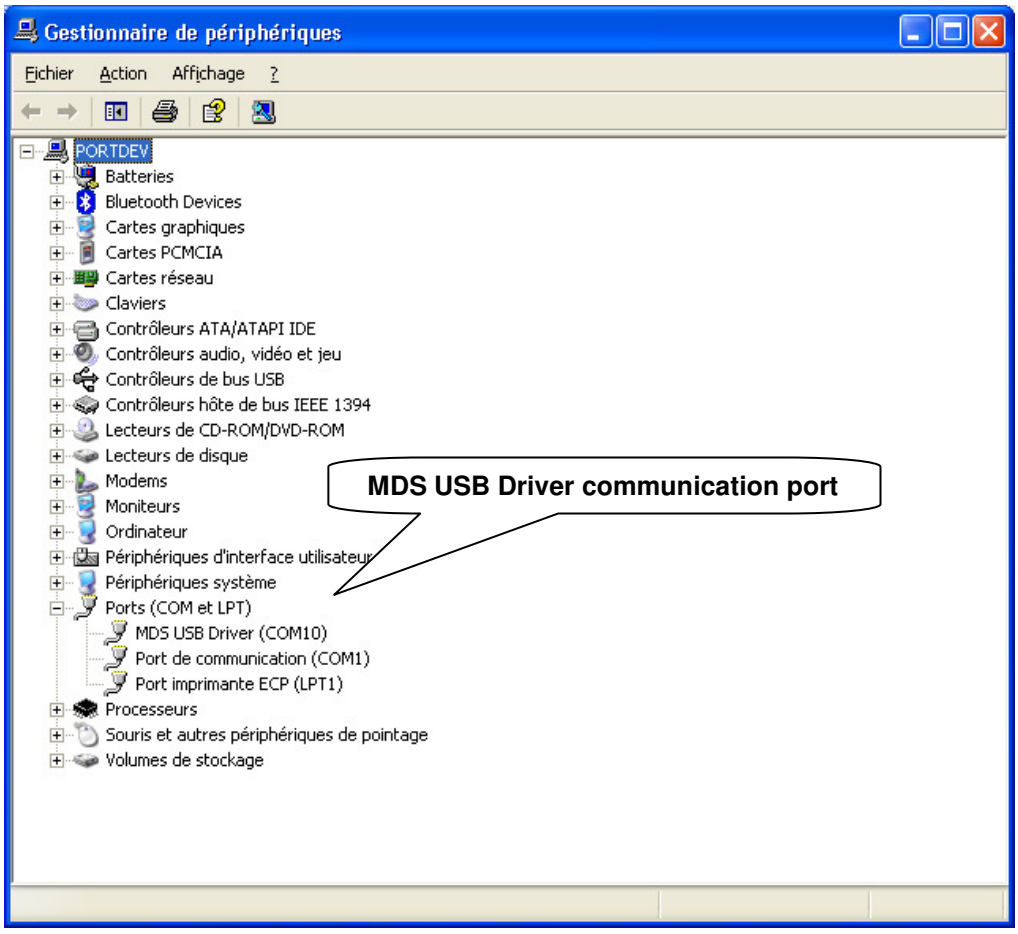


RS232 communication port

- Select the RS232 communication port on which the device is connected.

USB communication port

- In order to select the USB communication port, the device must be connected to the USB port and powered.
- Find the mapped communication port in the Windows System Parameter window (see example below).
- Select the USB communication port on which the MDS USB Driver has been mapped.
-



IMPORTANT NOTES

Software considerations

USB protocol implies that any hardware connected to a USB port must be detected, addressed, activated, and then used. This protocol takes an amount of time depending on the computer speed and other parameters. So before being able to communicate with the controller via the software, the user must wait that the computer terminates this identification.

REMOTE CONTROL

PROGRAMMING OF THE RF DRIVER WITH THE REMOTE CONTROL

1- Presentation

The remote control (RC) has been developed to allow the user to adjust the MOD.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),
- Max RF Power adjustment for each channel (=line),
- ON/OFF for each channel for test,
- Parameters storage.

2- Remote Control Initialisation

Plug the remote control to the driver.

The remote control will display the Firmware version

3- Parameters Adjustment (To adjust the parameters of each channel)

Press an Arrow Key

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

Set the maximum RF power level with the keys “^” and “v”.

Sweep the frequency around the theorical value, memorized in the driver at factory (or stored at the previously 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 adjustment, when the frequency is adjusted, by varying the RF power “^” and “v”.

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

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

6- Mode Select (To switch in Internal or External mode)

Internal mode: Press a key from numerical keyboard. This mode permits to select one channel per one channel.

External mode: Press “ESC” once or twice depending on menu. The driver can operate with or without the remote control. *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.*

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

Go in *Internal mode*

Press the corresponding channel number to select a channel.

Press again to switch off the line

Select all the channel you want to switch on.

USE USB or RS232 with Hyperterminal

Use either a terminal or a hyper-terminal software (PC). A special routine can be developed too by the user. *The RF driver programming has been designed to operate with one of them.*

1- Using the RS232 link (Option)

Configuring the RS 232 communication with the following data:

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 ([4]). *The connexion cable is a STRAIGH DB 9 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- Using the USB link

Read "installing the USB interface driver before starting.

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

Programming your driver in using the following popular command list from the software, other commands are explain in the "Help menu".

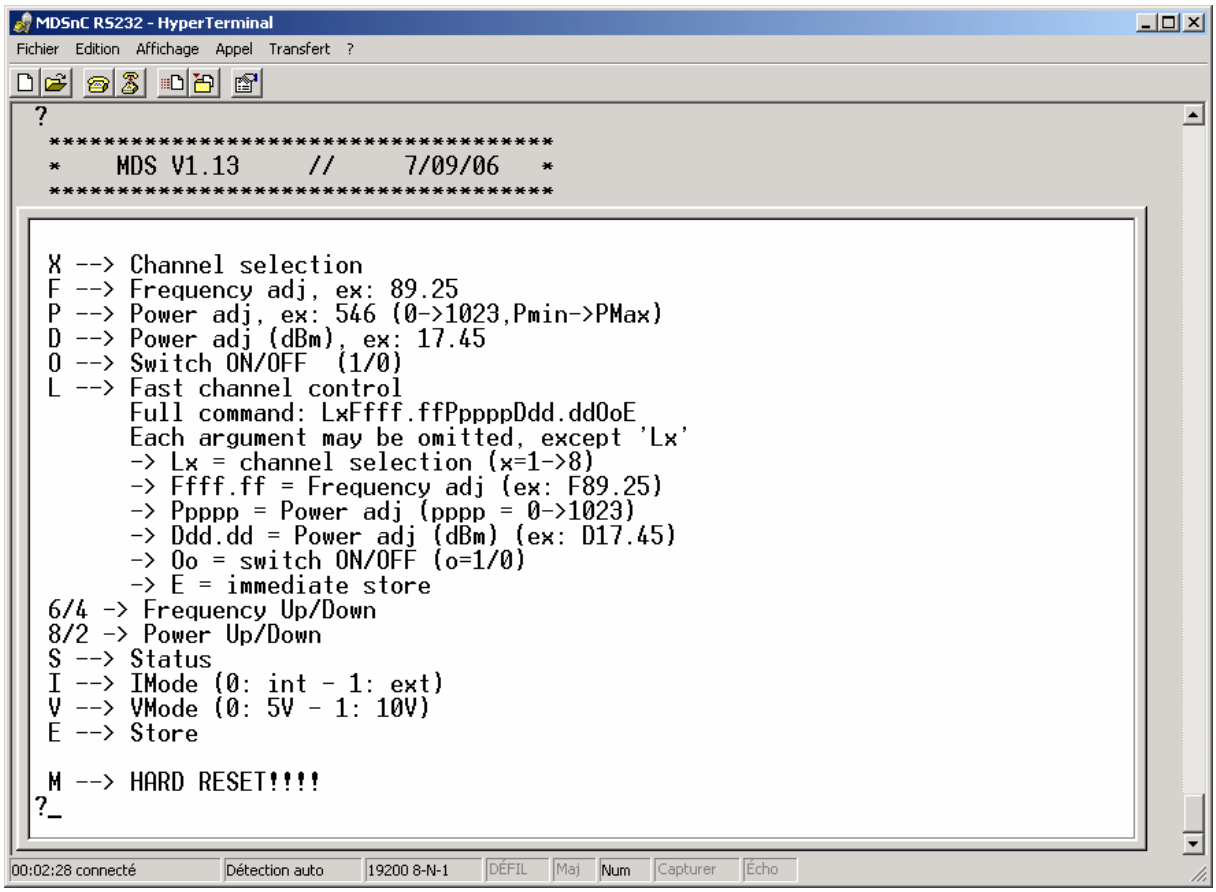
Goal	Instruction written by the user // Message delivered by the driver	Comments
Selection of the channel	**X** (or **x**) Channel number > n ? (*Waiting for the selected channel*) ***n*** + <Enter>	$1 \leq n \leq N$ with ***n*** the number of the channel and N the number of channels
Frequency adjustment	**F** (or **f**) Frequency > ? (*Waiting for the applied frequency*) ***f*** + <Enter>	$f_{min} \leq f \leq f_{max}$ 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 → min RF power 63 → max RF power
Fine Power adjustment "NOT compatible with MODnC"	**L**x**P**pppp (ex : L3P0852) Or **L**x**D**dd.dd (ex : L2D19.00)	X = line number 0 ≤ pppp ≤ 1023 or X = line number 00.00 ≤ dd.dd ≤ 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

Notation of the previously syntax:

Command: Letter, which is associated at one command, written by the user trough 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 trough 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:



- 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 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 in it.

AOTF SET UP AND OPERATION

ELEMENTARY PRECAUTIONS

Mechanical Precautions

- ✓ Note that any strong mechanical shock can lead to irreversible damage on the devices.

Electrical Precautions

- ✓ Never operate the RF driver without proper cooling (heat sink, fan, cooling plate...).
- ✓ Never operate the driver into an open or short circuit load, otherwise serious damages could happen. Always connect the driver "RF OUT" to the AOTF device (or to a 50Ω power load).
- ✓ Connect the convenient power supply (24VDC...) through the power supply filter (+V and ground). Check that your power supply can deliver enough current (as specified). The power supply must be off.
- ✓ Do not force on the connector!
- ✓ Never disconnect the connectors while the power supply is ON.

Optical Precautions

Windows Cleaning

- ✓ Dust on optical windows can be responsible for irreversible damage on the coating (especially if you use high power). Make the device work in a clean environment whenever is possible.
- ✓ To clean up the optical surfaces: use a soft Q-tip. Clean it with pure ethanol first, then with acetone. Most of AO devices use soft materials and need careful cleaning.
- ✓ "Oily stains" should be removed immediately to avoid irreversible marks.

Laser Power Density

- ✓ Check the maximum value specified for the given AO device, otherwise irreversible damage could occur.

Laser Polarization

- ✓ Make sure that the specified optical polarization is correct to have an optimum AO efficiency (Please refer to the test sheet of your AO device to get this specification).

Optical Aperture

- ✓ Holes in the housing of the modulator are larger than the specified optical aperture. The AO device will need to be adjusted, using slight translations perpendicular to the laser beam, in order to get the beam travelling through the correct area of the crystal and to maximize the efficiency.
- ✓ Do not focus the laser beam on the AO cover.

Incidence Angle

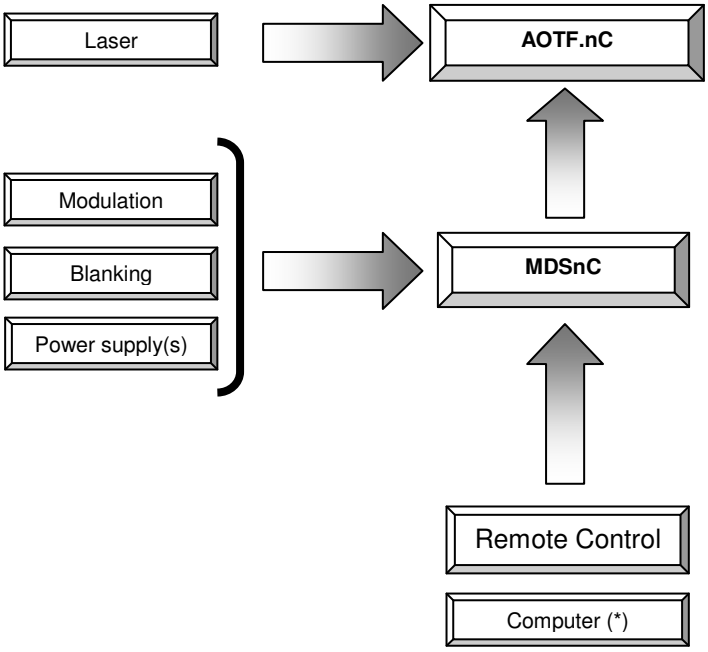
- ✓ For a birefringent interaction (anisotropic), adjust the position of the AO device in function of the specified value for the incidence angle of your AOTF to optimize the efficiency.

Warning: Any disassembling of your AO or RF devices makes the guarantee null and void!

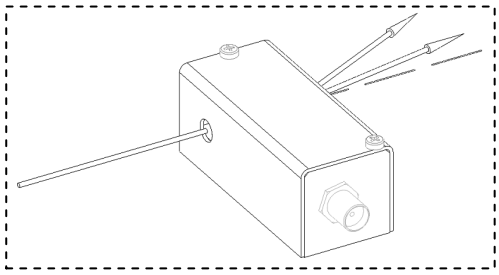
INSTALLATION AND ADJUSTMENTS

The AOTFnC is an acousto-optic tunable filter, which allows the selection and amplitude modulation of a single, or several wavelengths, in a large spectral range (Visible or UV depending on your AOTF device). It can be used with lasers like Ar+, Kr+, " Dye", « White light », HeNe,... The AOTFnC can be used for various applications such as laser entertainment or laser spectroscopy (scientific or medical).

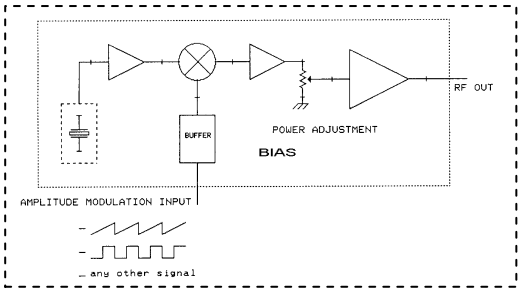
Synoptic of the Polychromatic Modulation System



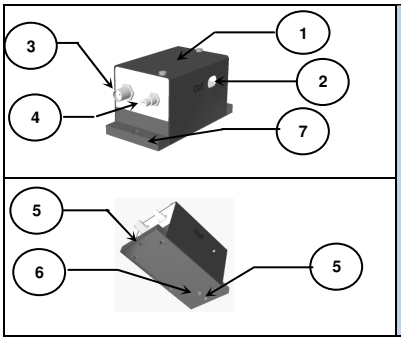
(*): USB or Option RS232
(**): Angular sketch depending on the AOTF device



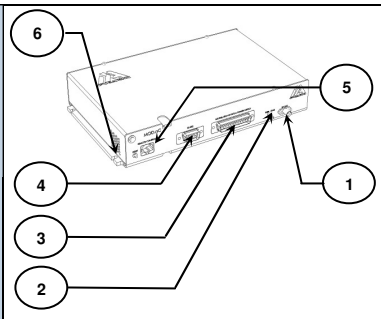
SMA connected to the driver (Drive RF power: Voltage control)



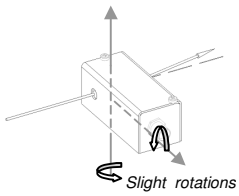
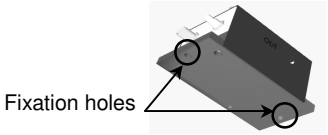
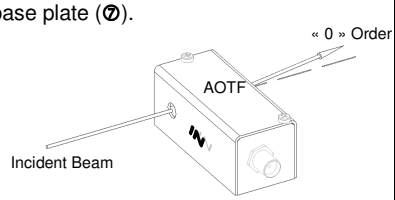
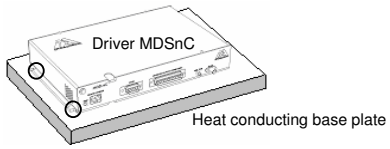
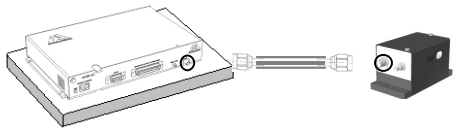
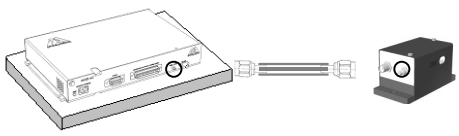
Synoptic of the MDSnC

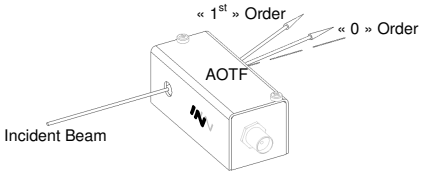


1 – Cover
2 – Optical aperture
3 – SMA connector
4 – SMC connector
(*if thermal stabilization*)
5 – Fixation hole
6 – Bragg hole
7 – Base Plate



1 – RF Out
2 – Thermal Stab
3 – Modulation Inputs & Power Supply
4 – RS 232
5 – Remote control/USB
6 – Fixation hole

OPERATION	WHAT DO YOU DO?	COMMENTS
1	**Install the AO device**, so that the laser beam enters by the IN face and through the optical aperture (❷) at its centre under the incidence angle (indicated on the test sheet of your AO device).  	*Make sure the laser beam diameter is lower than the given active aperture of the AO device, and its power lower than the maximum power tolerated by the AO device.* *The crystal is installed in the mechanics so that if the laser beam is perpendicular to the housing, the laser comes in the crystal under the appropriated incidence angle. Adjust the position of the AO device to place the crystal face quite perpendicular to the laser beam (visible by reflected light), avoiding any reflection in the laser cavity!* *Adjustments can be done by hand or thanks to rotation-translation stages. You can also use the bottom Bragg hole (❻) with a pin for higher accuracy.*
2	**Screw the AO device** using the fixation holes (❺).  	*Please note that a fixation of your AO device will avoid problems.*
3	**Check that the input laser polarization** is correct referring to the base plate (❼).  	*A wrong input polarization will decrease the performances of the AO devices, and will lead to unexpected effects. (Please refer to the test sheet of your device.)*
4	**Install the driver and screw it** using the fixation holes (❼) on a heat conducting base plate.  	*Use conducting grease if necessary. Temperature of the case must not exceed 50 °C.*
5	**Connect the "RF OUT"** (❶) of the driver to the "SMA" (❸) of the AO device with the provided RF cable. 	
6	If your device has a thermal stabilization, **connect the "Therm Stab"** (❷) of the driver to the "SMC" (❹) of the AO device with the provided cable. 	

7	**Connect the DB25 pins female connector** of your modulator, blanking and power supply(s) to the DB25pts male connector “Modulation Inputs & Power Supply” (❸) of the driver.	
8	**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!	*Ensure yourself that the power supply can provide enough current for your driver (refer to the test sheet for the nominal current needed).*
9	**All control signals must be OFF (MOD IN & BLK).**	
10	If your AO device has a thermal stabilization, **let it warm up for 15 minutes** before using it, for maximum stability.	
11	To start, **use the laser with the 488.0nm** or 514.5nm wavelength for example.	
12	**Apply the drive RF Frequency and the drive RF power** associated to the used laser wavelength.  	*The correspondence table between the Wavelength and the RF Frequency, and between the Wavelength and the RF power is given in the test sheet of your AO device.* *For set up, we advise to use internal controls of the driver to vary RF power and frequency. It can be done with RC03 (remote control), USB control, or RS232 control.*
13	**Repeat the operations of step 12.** for each wavelength corresponding to a different driver’s channel.	Once, all channels are correctly adjusted, do not forget to STORE the data, by using the convenient key (RC03) or command (USB or RS232).
14	**After your system is adjusted, you are ready to operate in external mode for fast operation. In this case, use external controls through DB25.**	To come back to external mode, reset the driver.

AO EFFICIENCY ADJUSTMENT VS RF FREQUENCY & RF POWER

- ✓ Install a photo-detector on the "1st" diffraction order of the laser beam. *It is the spot, which appears when you apply a RF drive power. This manipulation can permit to measure the output optical signal.*
- ✓ Connect the photo-detector to an oscilloscope to get a more detailed response of the photo-detector.
- ✓ For a precise adjustment of the AO efficiency in function of the RF Frequency ($\eta_{max} \Leftrightarrow F_{optim}$), look for the frequency to obtain the maximum intensity in the 1st diffraction order. When you have found a maximum, please verify that you are not on a side lobe in modifying the frequency to make sure that you are at the maximum efficiency η_{max}. Otherwise it will lead to a low efficiency and a wrong collinearity in the 1st order. (**Fig.1**)
- ✓ Adjust the RF drive power to reach the best efficiency in function of your application ($\eta_{max} \Leftrightarrow P_{optim}$). Do not exceed the optimum value P_{optim} indicated on your test sheet. (**Fig.2**)

Fig. 1: **η=f(F)**

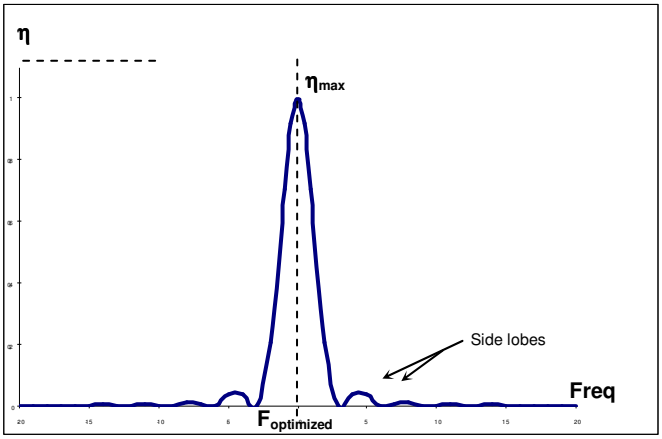
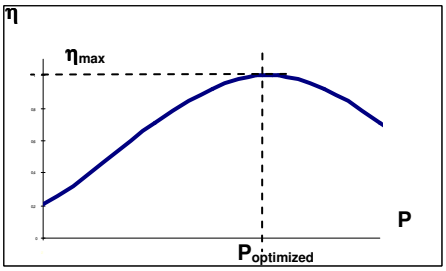


Fig. 2: **η=f(P)**



NOTE : In external Mode, both Blanking and MOD IN must be active to get a signal in first order.

Few Acousto-Optic Definitions / General Purpose

PARAMETER	DIMENSION	DEFINITION
λ	*m*	Optical Wavelength (air)
f	*Hz*	Light Frequency
n_i, n_d		Incident and Diffracted Crystal Indexes
k_i, k_d	m^{-1}	Optical Incident and Diffracted Wave Vector
Λ	*m*	Acoustic Wavelength
K	m^{-1}	Acoustic Wave Vector
F	*Hz*	Acoustic / Drive Frequency
v	*m/s*	Acoustic Velocity
P	*W*	Acoustic Power
P_{rf}	*W*	RF Drive Power
V_{rf}	*V*	RF Drive Voltage (defined following by /rms or /pp)
V_{con}	*V*	External Control Voltage of the RF Driver ($\propto V_{rf}$)
I_{00}	*A*	Incident Optical Intensity
I_0	*A*	Output Optical Intensity at the 0 Order
I_1	*A*	Diffracted Optical Intensity at the 1st Order
D	*m*	Optical aperture
T_a	*s*	Acess Time
T_R	*s*	AO Rise Time
F_m	*Hz*	Modulation Frequency
ϑ_d	°	Separation angle
T		Optical Transmission
η		AO Efficiency

TERM	DEFINITION / COMMENTS / FORMULA
ACOUSTO-OPTIC INTERACTION	An acoustic wave propagates in the Bragg cell. It generates a refraction index perturbation in the cell. At the matching phase, the light diffracts on the acoustical "grating", with a grating step corresponds to acoustic wavelength: $\Lambda = \frac{v}{F}$ *where* **v**: *the acoustic velocity and* ***F****: the acoustic frequency.* The momentum and energy conservations between the incident light (k_i, f), the diffracted light (k_d, f_d) and the acoustic signal (K, F), lead to the following expressions: $k_d = k_i \pm K$, *with* $\|k_i\| = 2\pi n_i/\lambda$, $\|k_d\| = 2\pi n_d/\lambda$ *and* $\|K\| = 2\pi F/v$ $f_d = f \pm F$
"0" AND "1" ORDERS	Respectively direct beam through the cell and beam deviated by acoustic diffraction grating.
OUTPUT POLARIZATION	In the anisotropic interaction a flip of the incident polarization is produced depending on the difference of the material refraction index (n_i and n_d). For the AOTF.nC it is equal to 90°.
OPTICAL TRANSMISSION (T)	Ratio of output optical intensity (I_0) without RF power and incident optical intensity (I_{00}): $T = \frac{I_0}{I_{00}}$
DRIVE FREQUENCY (F)	The AO interaction leads to a "one to one" correspondence between the laser lines and the drive frequencies. A given line will be controlled by a single discrete drive frequency.
DRIVE POWER (P_{RF})	As the drive frequency, for each laser lines correspond a drive power, which is given by the formula: $P_{rf} = V^2_{rf/rms}/Z = V^2_{rf/pp}/2Z$, *with* ***Z****: the impedance of the piezoelectric transducer*
ACOUSTO-OPTIC EFFICIENCY (η)	Ratio of intensity in the diffracted order (I_1) and intensity in the 0th order (I_0) without applied RF power @ F_0: $\eta = \frac{I_1}{I_0} = \sin^2\left(c\sqrt{P_{RF}}\right)$ *with* ***c****: a constant*
ACCESS TIME (T_A)	Time for the acoustic wave to cross the optical aperture (D) of the cell: $T_a = \frac{D}{v}$
ACOUSTIC POWER (P)	The acoustic power is proportional to the RF drive power: $P = a \times P_{rf}$, *with* (***a*** *< 1) the transformation factor*
AO RISE TIME (T_R)	Time to increase the AO efficiency from 10% up to 90% of its maximum value (considering a pulse drive signal and a gaussian laser beam): $T_R = \frac{0.66D}{v}$ *with* ***D****: the beam diameter @ 1/e²*
MODULATION FREQUENCY (F_M)	Naturally linked to rise time: $F_m = \frac{0.48}{T_R}$
AO EXTINCTION RATIO	Ratio of the max light intensity in the 1st order and the min light intensity in the same direction.
SEPARATION ANGLE (ϑ_D)	Angle between the "0" / "± 1" beams: $\vartheta_d = \frac{\lambda F_0}{v}$

FAQ

PROBLEM	POSSIBLE CAUSE AND CORRECTION
No light at the AO device output	⇒ Laser Power Supply or RF Driver is not operating. ⇒ Laser Beam doesn't pass through the AO device.
Laser beam output diameter varies	⇒ Laser Power is too high. Please refer to the test sheet, to get the maximum value supported by the AO device. (Blooming effect)
Efficiency Loss of the AO device output (compared to the value specified in the test sheet)	⇒ Laser Beam doesn't enter by the IN face of the AO. ⇒ Laser Beam is not centred to the optical aperture. Centre the laser (or the AO device) along the horizontal and the vertical axis. ⇒ The laser polarization is not appropriated to the AO device. Please refer to the test sheet, to know the polarization to use with the AO device. ⇒ Laser Beam Diameter is too high. The laser beam output is truncated. Please refer to the test sheet, to get the maximum value for the AO device. ⇒ "Oily stains" stay on the optical face and the Output Laser Beam is scattered. Clean the optical surfaces up using a soft Q-tip with pure ethanol first, then with acetone. ⇒ The frequency or RF power of the tested line is not equal to the one indicated on the test sheet. To adjust these parameters, refer to the 2-5 paragraph of this user's manual. ⇒ The blanking supply tension, and/or the tested line is inferior to the value stated on the MDSnC's test sheet. ⇒ The output impedance of the power sources (power supply and function generator) are not adapted to the blanking's input impedance, and/or to the tested line. (impedances are specified on the MDSnC test sheet.)
Efficiency Loss of the AO device output (compared to the value specified in the test sheet) ***Case of an AOTF with thermal stabilization (model: /T or /TN).***	⇒ A modification of the RF frequency permits to obtain the optimal efficiency again. Either the connector of thermal stabilization is not plugged in or the first operation (to search optimal frequency) has been made before the 15 warming up minutes. ⇒ The cable between the "Therm Stab" (②) of the driver and the "SMC" (④) of the AO device is not switched on.
No output colinearity ***Case of an AOTF-UV***	⇒ The laser polarization is not appropriated to the AO device. Please refer to the test sheet, to know the polarization to use with the AO device.
Very scattered Laser Beam Output	⇒ "Oily stains" stay on the optical face. Clean the optical surfaces up using a soft Q-tip with pure ethanol first, then with acetone.
Nothing happens when the driver is being piloted	⇒ Power supply is off. ⇒ One (or more) cable is not connected: RS232, SubD25, In between the MDSnC and the AOTF.nC, MDSn power supply ⇒ The MDSC power source tension is inferior than 24V. The indicated consumption of the MDSnC is inferior to the one indicated on the test sheet. ⇒ The maximum MDSnC power supply current is limited to an inferior value than the one stated on its test sheet. The display of the MDSnC consumption is inferior than the one indicated on its test sheet. ⇒ The MDSnC consumption display is superior to the one stated on its test sheet: ✓ Switch the MOD.nC power supply off right away. ✓ The + and – pin connectors of the SubD25 are reversed. ✓ The +24 power supply is in short circuit with an other pin. ✓ The 5 to 12 pins of the SubD25 are not welded properly. ✓ The blanking is not connected or supplied. ✓ The MOD.nC is in INT mode. Push on the MDSnC Reset to be in EXT mode. ✓ There is a short circuit between different pins of the RS232. ⇒ Nothing is displayed on the remote even though it is on. ✓ Unplug the RS232. Push the MOD.nC. Reset button. ✓ Look for the short circuit on the RS232.