OPTO-ELECTRONIC

User's Guide
MPDSnCxx Ed 2018-1

Multi Purposes Digital Synthesizers
Multi channels DDS Drivers
OEM and Laboratory versions
MPDSnCxx

OEM

RACK Version

CONTENTS

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User's Guide

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Introduction

The MPDS driver is based on Direct Digital Synthesizers (DDS). It produces multiple fixed stable and accurate RF frequency signals (up to 8) for polychromatic modulators, Tunable filters, Frequency Shifters or Deflectors. Its design with "on the edge" technology offers unique performance in term of compactness, accuracy, speed and stability (single/multi-line), thanks to its internal temperature correction and high linearity design.
The built in amplifier delivers the necessary RF power to drive the acousto-optic devices, with reduced power consumption (AA "COLD DESIGN"). In case of Powers higher than 4 Watts, an external power amplifier will be added.

The RF power per output can be individually modulated or simultaneously modulated (BLANKING signal). AA focussed on an ultra low crosstalk version with superior fast and fall times.
The adjustments of the driver (Frequency & Power) can be done in different ways in order to allow user flexibility in power control or frequency scanning, and match most of the applications. A mix between internal mode and external mode is now possible. Indeed, user will be able to use external AM modulation inputs together with a blanking control through RS232 for instance.

Important:
For compatibility reasons with previous generations of drivers (MDSnC, MODnC), it may happen that redundant commands are available. To check compatibility please contact AA.
To have exact version (number of channels, Frequency range, max Power…) of your driver please refer to your test sheet.

Compatibility and Compliance

The MPDS driver is compatible and compliant with the following standards and directives:
Electronic Industries Association RS232 communication standard (EIA232).
Universal Serial Bus standard (USB).
"CE" European Directive N°EN 61326-1:2006
"RoHS" European Directive N°2011/65/EU

Related documents

- MPDSnC –TheMPDS Application for Android
- MPDSnC –USB/RS232 Software

→ Downloadable at www.aaoptoelectronic.com

Assistance

In case you have any question, you can contact AA OPTO-ELECTRONIC by email: sales@a-a.fr or by phone at +33 1 76 91 50 12.

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General Precautions

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

2. Do not exceed 50°C for case temperature (OEM versions).

3. Check on your test sheet your modulation input version (analog, TTL...), characteristics and options before operation.

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

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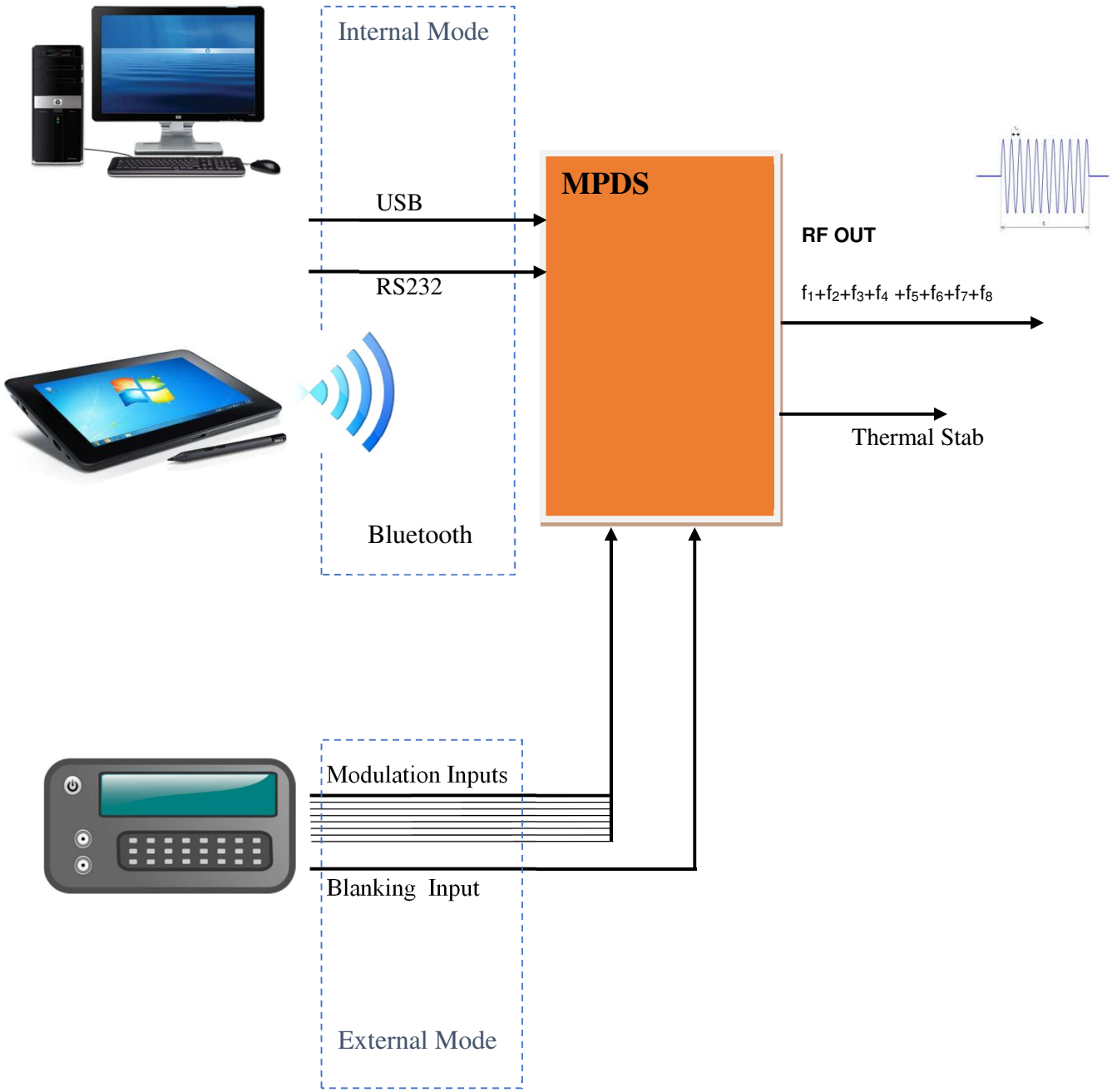
Synoptic



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Connections

Pin connexions DB25	Modulation inputs & Power supply
1	**TX (RS232)**
2	**RX (RS232)**
3	**RAMP OUT 0-3.3V (Sweep FCT)**
4	**Enable (1)/Latch(0) Pin Profile FCT**
5	**Line 8**
6	**Line 7**
7	**Line 6**
8	**Line 5**
9	**Line 4**
10	**Line 3**
11	**Line 2**
12	**Line 1**
13	**Blanking**
14,15,16	**Ground**
17	**Reset**
18	**Bit 0 (LSB) Pin Profile FCT**
19	**Bit 1 Pin Profile FCT**
20	**Bit 2 (MSB) Pin Profile FCT**
21	**OPT FCT1 (NC)**
22	**OPT FCT2 (NC)**
23, 24, 25	**24 VDC**

Note:
MPDS driver can be provided with 1, 4 or 8 channels. For a 1 channel version, only channel 1 will be connected. For a 4 channels version, channels 1 to 4 will be connected. For a 8 channels version, channels 1 to 8 will be connected.

OEM Version
Rear pannel for Laboratory version

RF Output Power
To be connected to AO device

USB

POWER SUPPLY
& EXTERNAL CONTROLS
(MOD IN & BLK) + RS232 option

Thermal Stabilization
To be connected to AO device if available

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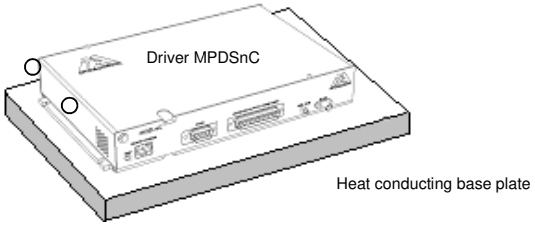
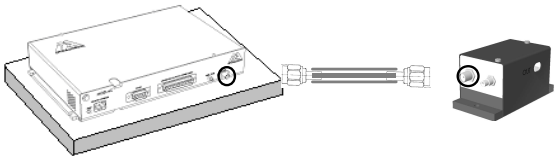
How to install your driver?

OEM driver:

1	**Install the OEM driver and screw it** using the fixation holes on a heat conducting base plate.  	*Use conducting grease if necessary. Temperature of the case must not exceed 50 °C.*
2	**Connect the "RF OUT"** of the driver to the "SMA" input of the AO device with the provided RF cable. **Connect the "STAB OUT"** of the driver to the "SMC" input of the AO device with the provided RF cable. 	*NOTE: The thermal stabilization (STAB OUT) may be not available for some devices. In that case do not connect.*
3	**Connect the DB25 connector** with 24 VDC power supply. "Modulation Inputs & Power Supply"	***NOTE: 24 VDC power supply must be connected through DB25 pins (23,24,25/14,15,16) only for OEM versions.***
4	**Select your way to control your driver:** - Remote Control RC04 - USB/RS232 - External controls **Then make necessary connections:** - Remote Control RC04: bluetooth - USB/RS232: communication cable USB / connections through DB25 for RS232 option (see connections) - External controls: MOD IN and BLANKING connections through DB25	
4	**All control signals must be OFF (MOD IN & BLK).**	
5	**Switch your power supply ON**. Your source must deliver the indicated level of voltage and current with a maximum variation of +/- 1 %.	*Ensure yourself that the power supply can provide enough current for your driver (refer to the test sheet for the nominal current needed).*
7	Your system is ready to operate.	

Laboratory driver: Supply your driver with 110/230VAC using the provided power supply cable. Then follow above steps 2 to 7. Do not connect the 24VDC Pins of the MPDS.

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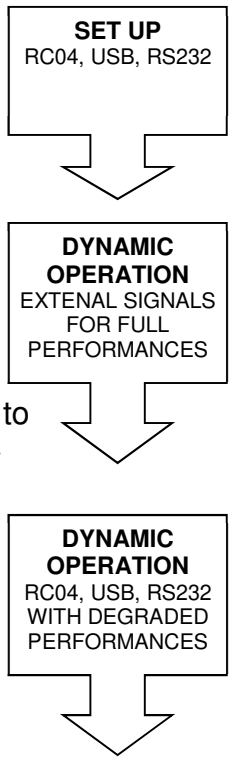
MPDS Operation

Sequence of operation of your MPDS



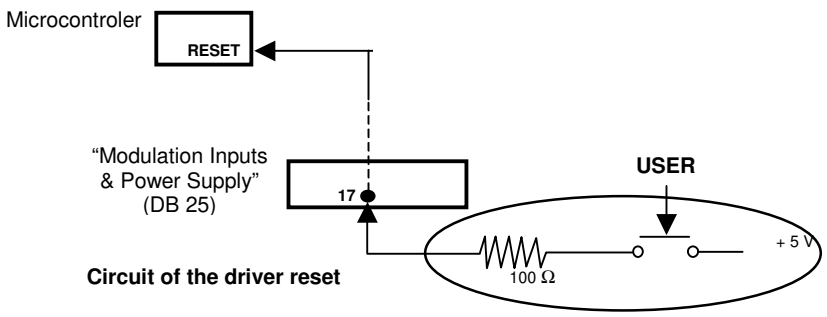
SET UP: this is a static operation which goal is to adjust each individual channel with a specific frequency and maximum RF power, in order to match the AO device. At the end of this operation, all parameters will be stored in an EEPROM and automatically reloaded after each start.
This operation will be easily realized with a remote control RC04, or through USB/RS232.

DYNAMIC OPERATION: once the set up is finalized, the dynamic operation can start for the real application. To get the best performances of this MPDS 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 (Lower speed and dynamic…).
User can also develop its own software (GUI) to control the MPDS driver. The USB/RS232 protocole is open and free. Please refer to MPDSnC SDK – Software Development Kit manual.

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.



Circuit of the driver reset

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External Modulation Inputs / Blanking

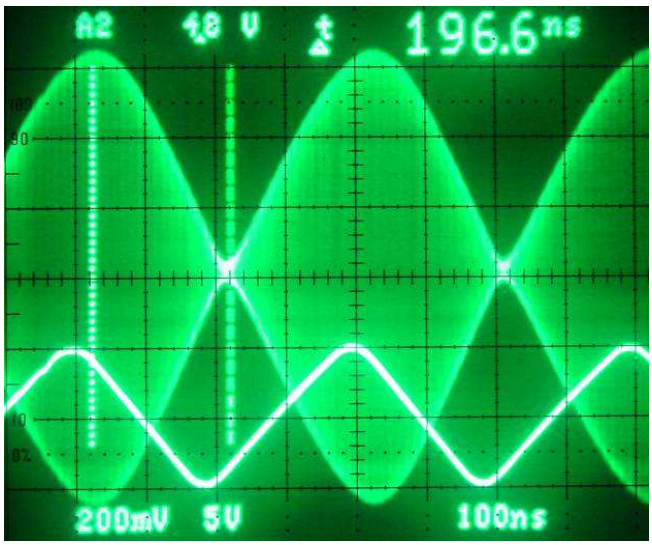
Modulation inputs of your driver (1 per channel) control linearly output RF signal amplitude from 0 to maximum level for each channel. This mode allows user to create any control signal (shape, duration, slope…). When applying V_{max} on Modulation inputs, RF output power rises up to maximum RF power Pmax. (standard Vmax=10 Volts). (Note: Maximum RF power level is set by user through "D" or "P" command, or through RC04/PC software)
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).

The output power of your driver is the result of the combination (multiplication) between Blanking level and MOD IN level. In case Blanking level is equal to Zero, then no power can come out of the driver whatever is the MOD IN 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:

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



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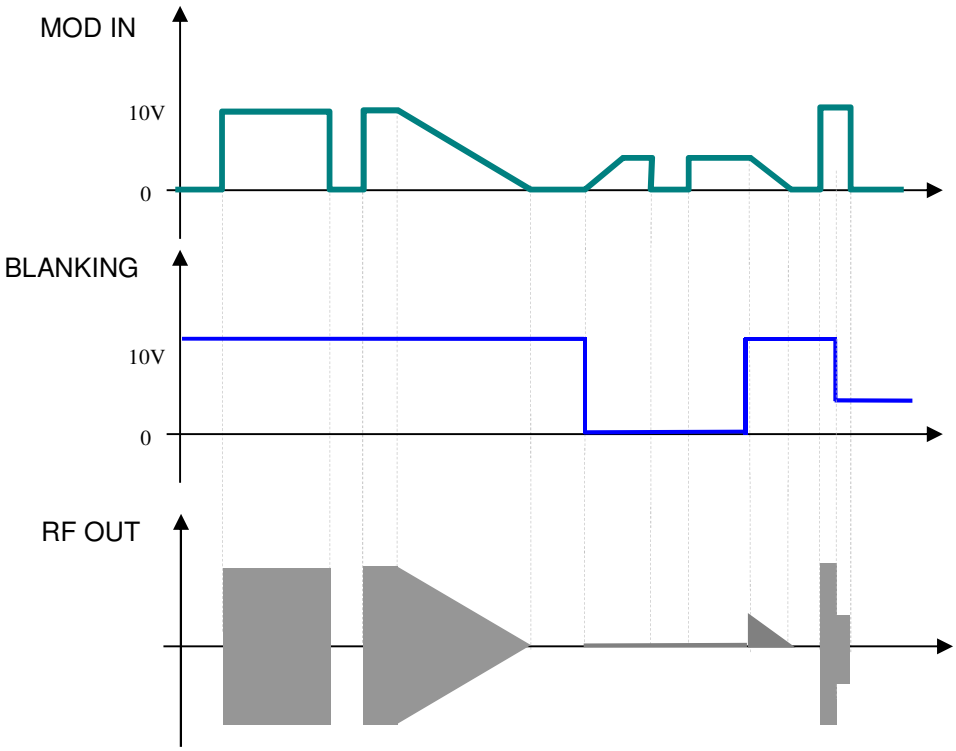
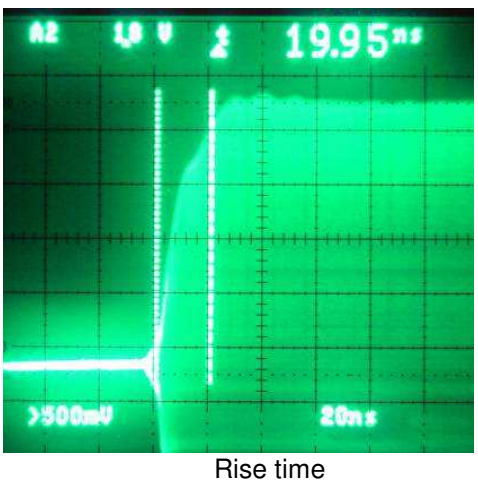
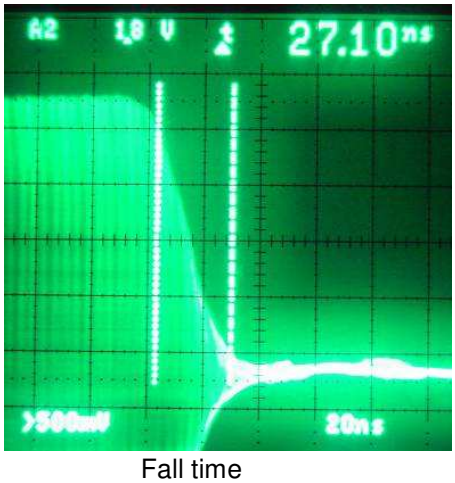


Rise Time / Fall Time

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

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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.

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

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.

Internal/External Mode Control

The MPDS driver allows user to mix external and internal controls. In that case Modulation input control of each channel and Blanking can be individually set/controlled in different ways (RC04/USB/RS232/External).
For instance, user can decide to control channels 1 to 4 by using USB control, and channels 5 to 8 by using External controls.
Another possibility can be to control all modulation inputs externally, while the blanking will be controlled through USB.

ON/OFF control of the channels

This option is available only in Internal Mode. In internal mode, user can decide to switch ON or OFF each channel. Same for blanking functionality.
For example, if user decides to disable the Blanking input, then he can set the Blanking to both Internal mode and ON. As a consequence, he will not need to control the blanking input.

External Voltage control change

The MPDS external controls (MOD IN + BLANKING) are analog 0-10 Volts by default. It can be switched to 0-5 Volts by user, through RC04, USB or RS232. (VMODE)

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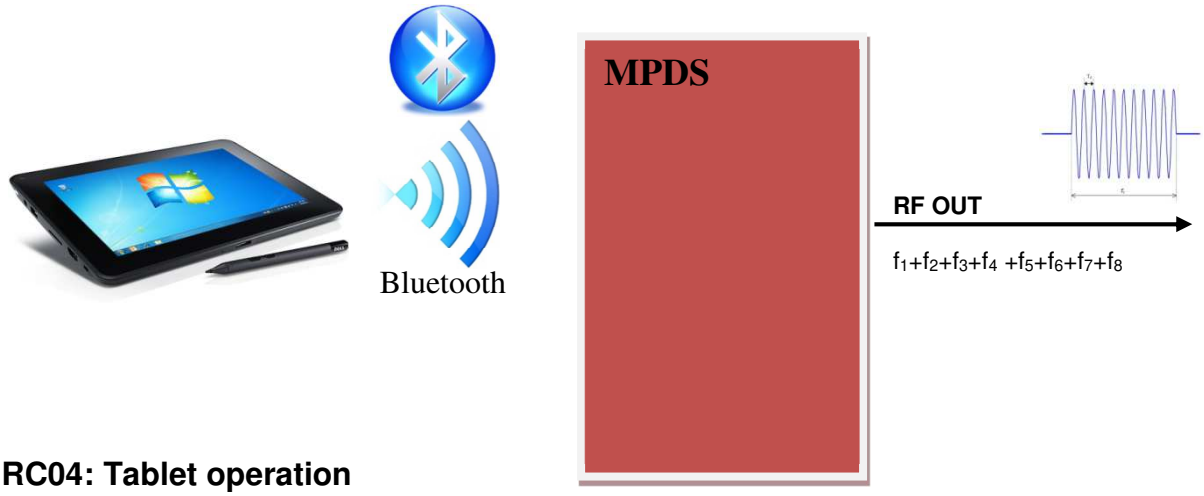
Introduction to RC04 Remote control

The MPDS driver can be controlled in different ways for both static and dynamic operation. Remote control (RC04) is an easy way to set all parameters of the MPDS. It is also a simple way to operate the system in a laboratory for instance, without the need of using external devices such as signal generators or a computer.

RC04 remote control is based on an Android tablet which uses the specific Android MPDS Application ("TheMPDS").
The MPDS App can be supplied on request on can be downloaded on AA Website and will operate with any system using Android 4.0 and more with a Bluetooth connection.



RC04: Tablet operation

Please refer to the tablet user manual supplied in the parcel from the tablet manufacturer.

RC04: Launch the App

Make sure that the MPDS driver is correctly installed, supplied, connected to AO and cooled.
Switch ON the MPDS driver.
Switch on the RC04 tablet. The tablet is equipped with a touch screen.
Launch "TheMPDS" application from the icon displayed on the main screen. (Application already installed in the tablet)
The main menu will be displayed (SETTINGS).

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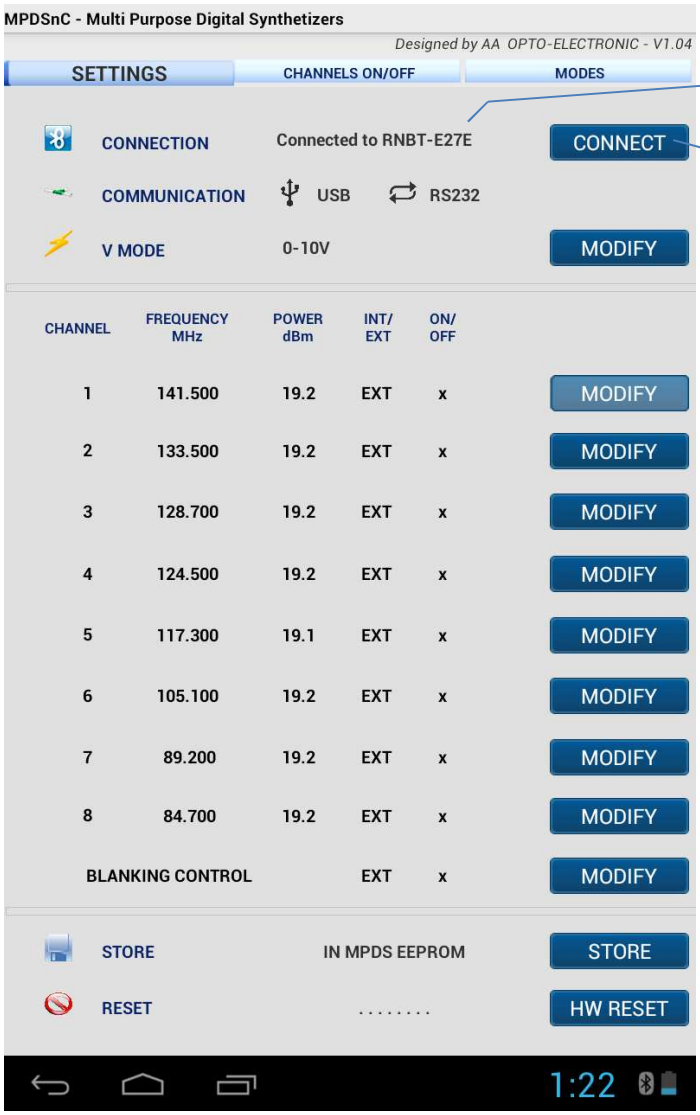
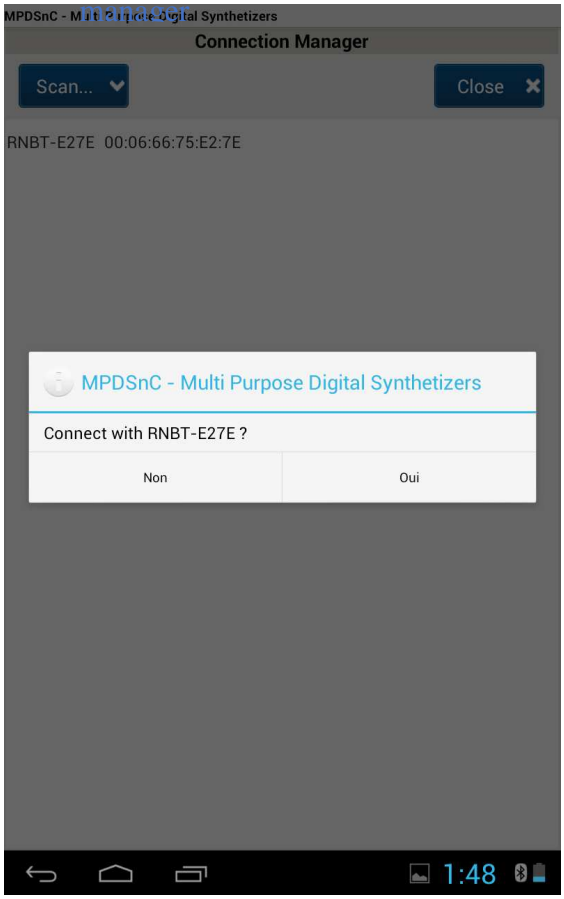
RC04: SETTINGS Menu



Status of connection

Bluetooth menu/Connection



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Bluetooth CONNECTION:

Press the "CONNECT" Bluetooth button in order to access Bluetooth menu.
Press "SCAN" to display the list of Bluetooth devices.
ID of your MPDS is displayed on the label.
Select MPDS ID you want to connect to.
Confirm connection by pressing YES/NO (OUI/NON).
Close window by pressing "CLOSE" button.
Status of the connection with ID is displayed.

COMMUNICATION:

USB logo or RS232 logo is displayed when USB communication or RS232 communication is detected.

V MODE – external controls voltage:

External modulation inputs (MOD IN) and blanking input (BLK) are analog 0-10 Volts by default.
0 V → No power, 10 V → maximum power.
State of the driver is indicated 0-10 V.

Press "MODIFY" button in order to switch voltage from 0-10 V to 0-5 V or 0-5 V to 0-10 V.
Select Voltage.
Press "CLOSE" button to escape.

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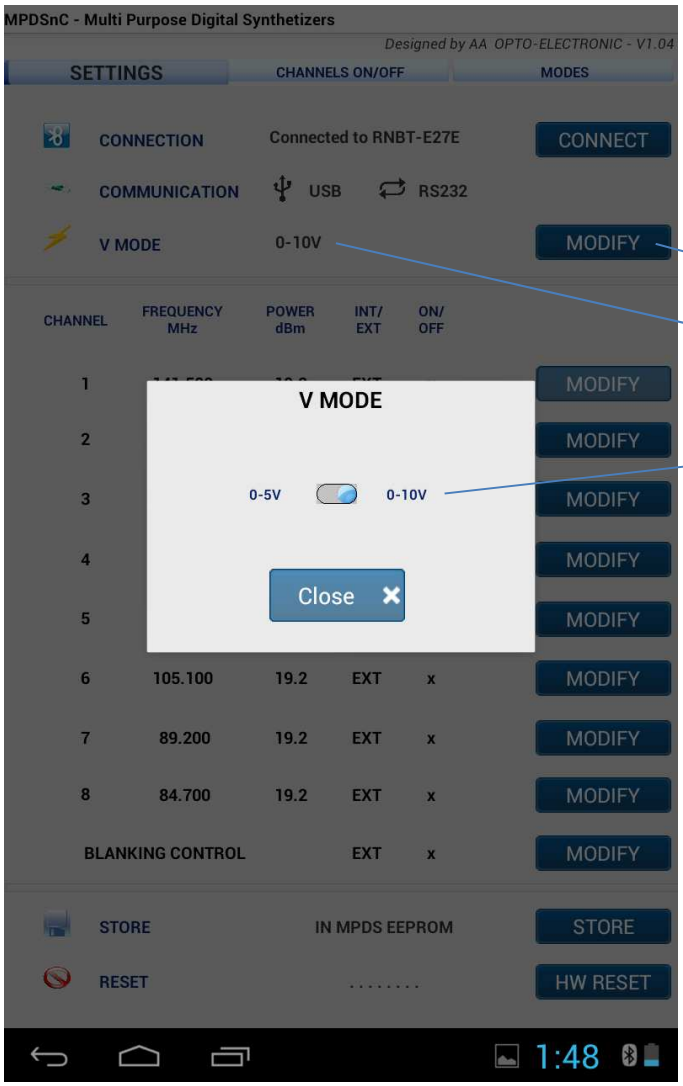

Modify Voltage

Display actual Voltage state

Select Voltage
Attention: applying 10V while option 5V is selected may damage your input.

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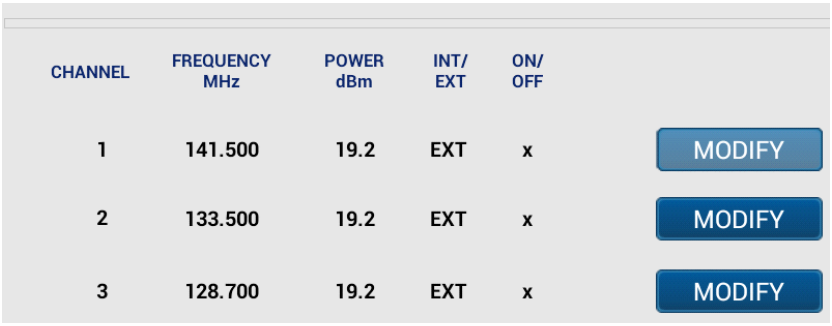
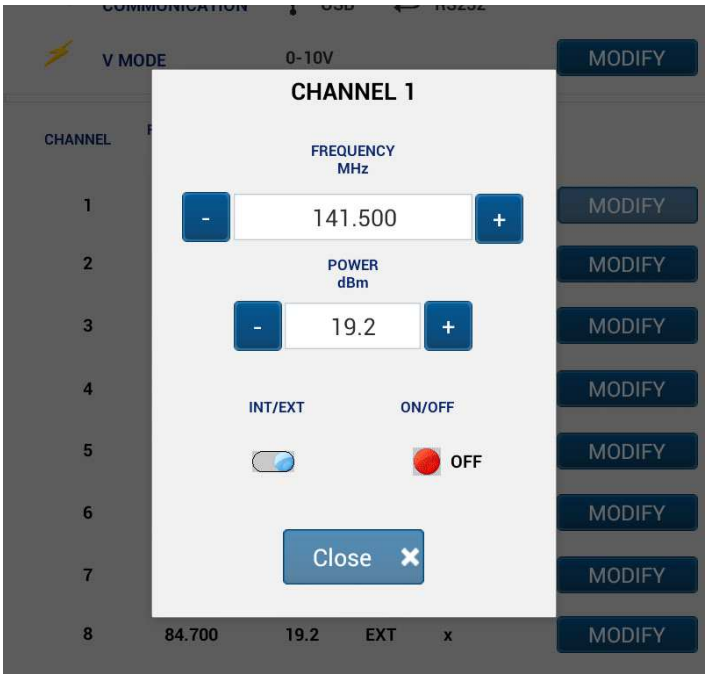
PARAMETERS SETTINGS

After connection with MPDS, parameters stored in MPDS for all channels (max 8) are displayed on screen as follows.
Please note that the number of channels depends on your version of MPDS.
By default the displayed profile is n°1.



Press the "MODIFY" Button in front of the channel number you want to adjust.

A channel menu will be displayed.



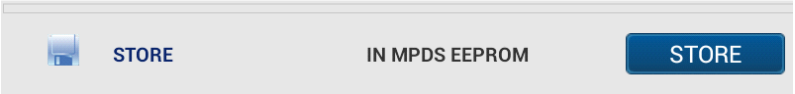
Type Frequency value you need or sweep Frequency by pressing keys +/-.
Type Power value you need or sweep Power by pressing keys +/-.

Set Channel to Internal mode or External mode by pushing button INT/EXT.
Note: External Mode means that channel is controllable only by user through external analog modulation inputs/blanking. Internal Mode means standalone through RC04/USB/RS232).

Set channel to ON or OFF level (available only for Internal mode). When set to ON, then power level of this channel is always maximum until state is modified by user. This is a way for example to disable blanking (Set to ON).

Press close to exit window. Repeat operation for other channels if necessary.

Press "STORE" button to store parameters in MPDS EEPROM.



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HARD RESET

Press the "HW RESET" Button in order to make a hardware reset of the MPDS and reload store parameters.

RC04: CHANNELS ON/OFF Menu

This menu is a control dashboard of your MPDS in order to operate the driver with the adjusted parameters.

For each channel you can:
Change the operating mode internal/external by pressing the selector INT/EXT – valid also for Blanking.
Switch ON/OFF the channel by clicking on the red/green status indicator –valid also for blanking.
Change power by typing value or sweeping power by pressing +/- buttons.

For all channels simultaneously, you can:
Change the operating mode internal/external by pressing the selector INT or EXT.
Switch ON/OFF the channels by clicking on the red/green status indicator.

Attention: to visualize effect on AOTF, Blanking must be ON in internal mode, or activated by user in external mode.

Press "STORE" button to store modified parameters in MPDS EEPROM if suitable.

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RC04: MODES menu

Sweeping Mode (option):

Switch ON/OFF the sweeping mode by pressing the RED/GREEN button OFF/ON.
Sweeping mode is available for **channel 1 only**.

Type Minimum Frequency Fmin, Maximum Frequency Fmax and sweep time.

Sweeping of channel 1 will start automatically.

Store Values in MPDS by pressing "STORE" button.

Fmin-Fmax: the sweeping frequency range cannot exceed the Fmin-Fmax values given in the Product Characteristics at the bottom part of the page.

Sweep time: between 1 and 5000µs by steps of 1µs.

RAMP OUT: bit 3, is an output trig signal for user from 0 to 3.3 Volts which follows the sweeping.

Product Characteristics

Product specifications (characteristics) of your MPDS are displayed on the bottom part of the menu.
These are the parameters set at factory: Fmin, Fmax, Power min, Power Max, ID of the driver.
They cannot be modified by user.

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RC04: How to Install the Application in an Android tablet or Telephone?

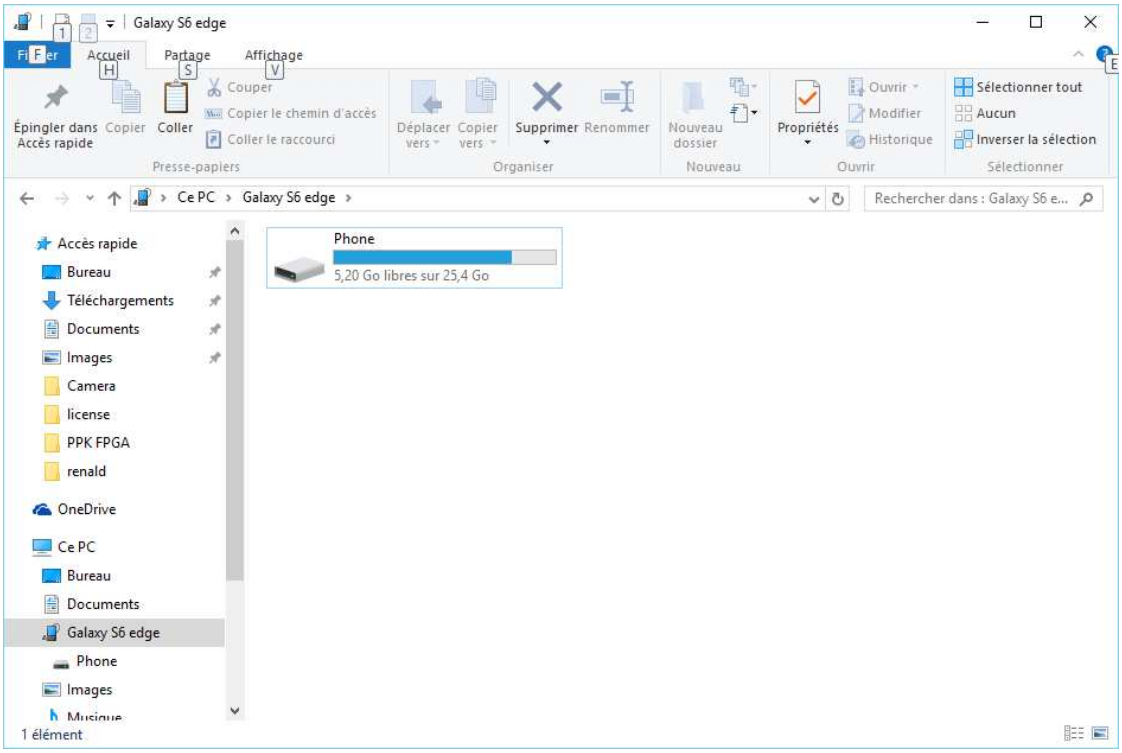
This section explains how to install the Application on an Android Tablet or Telephone equipped with a Bluetooth connection in order to be used as a remote control for MPDS. (Android 4.0 min).

File Copy:

Download Application on AA Website: http://www.aaoptoelectronic.com/8.aspx (ID= purchase2013, password=xvd2013).

Connect your Android device with your computer through USB.

Open Windows explorer and select your device.



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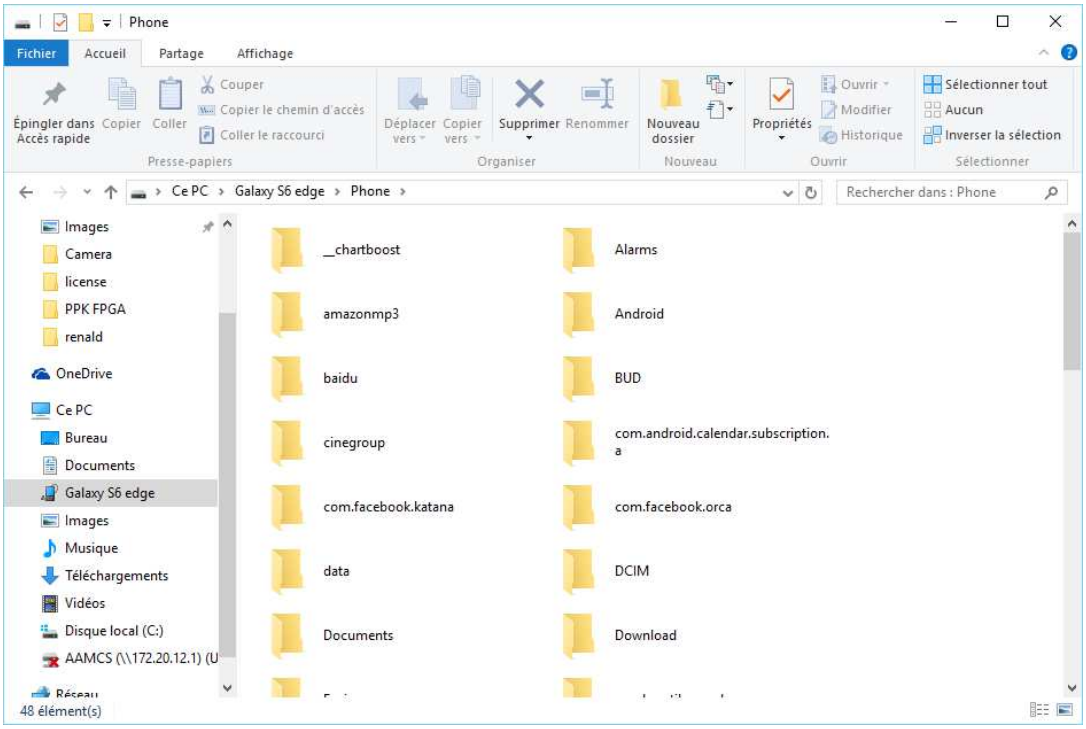
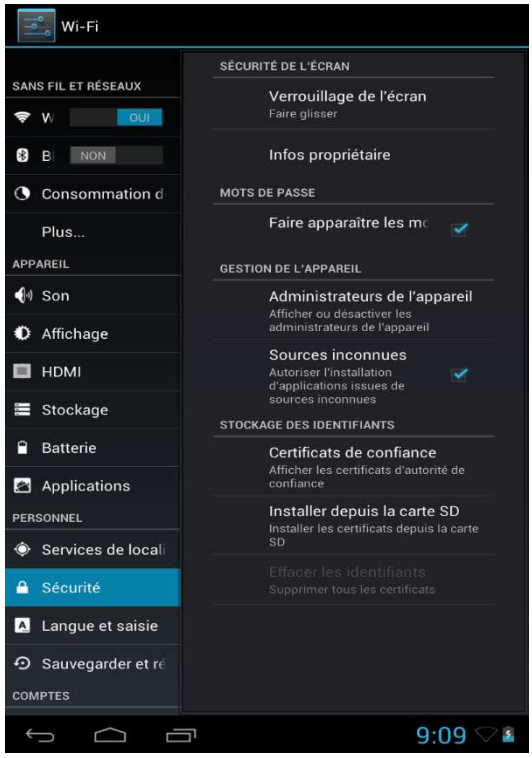
Open the Download folder and copy the aplication file (TheMDS.apk and ThePPK.apk).



Device configuration:

On your Android device go to the parameters.

On the Security menu validate the "unknown sources". (Authorize unknown sources to install a program…)



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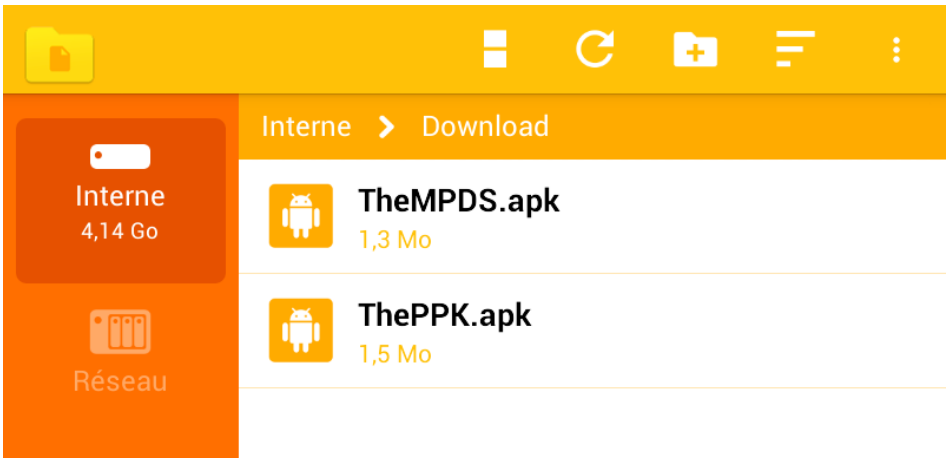
Apk installation:

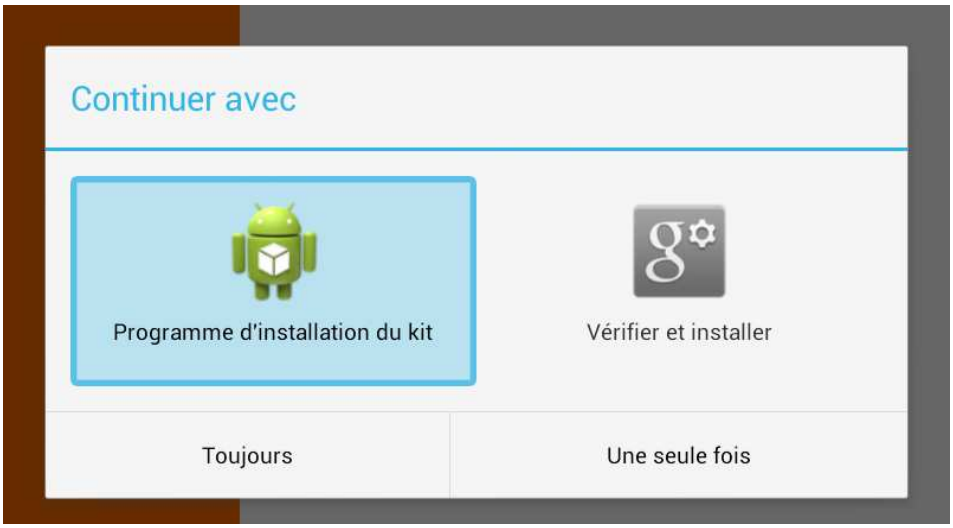
On your Android device open the file explorer.

Then open the download folder.

Click on the desired application to install.



A message box should be prompt choose "only once".



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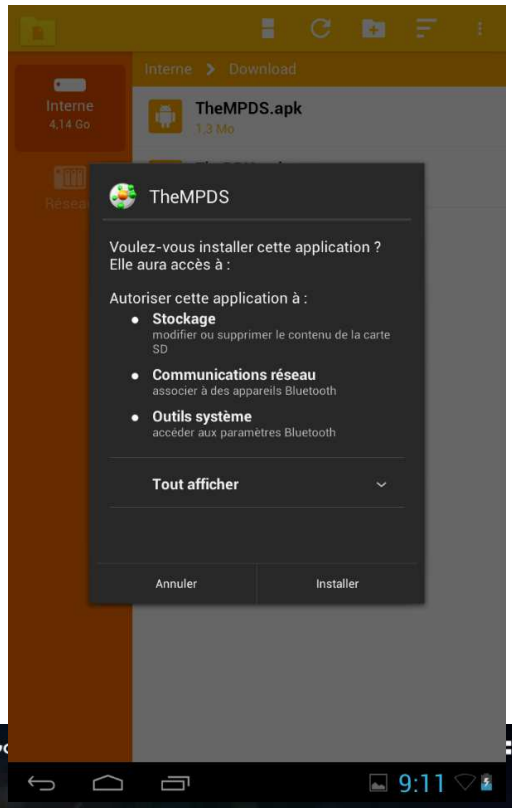
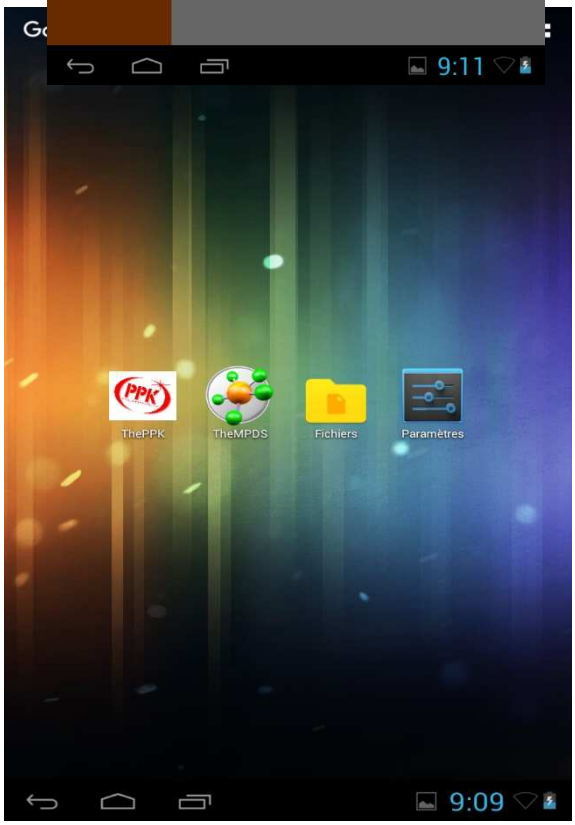
On the following screen choose install.



The application is now ready to be used on your Android device.



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SDK – Software Development Kit (V 2.2)

User Guide to create a TPI (third party interface) or a GUI (Graphical User Interface)

SDK: Introduction

This document is intended to help user to integrate the MPDSnC driver (Multi Purpose Digital Synthesizer) inside its own system and be able to create and customize its own third party interface (TPI) or Graphical User Interface (GUI). To do so, user will have to properly communicate with the MPDS and send different commands to the controller in order to change frequency and power for instance. This document is related to RS232 and USB communication. It is to be noticed that the MPDS controller includes an embedded microcontroller firmware which facilitates the communication by providing an intermediary level of simple commands.

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What parameters can be controlled?

Parameter	Definition	Mode set up
I Mode [Internal/External]	**This parameter can be set for each individual AM control and blanking. (Settling time 100ms typ)** **Internal mode:** applies only for AM control: when RS232, USB or Bluetooth is enabled to bring any modification to driver in operation **External mode:** when only external analog control signal can control the output amplitude.	USB, RS232, Bluetooth
Frequency [F]	Frequency of each channel can be set **independently** with an **accuracy of 1 KHz** within the driver's frequency range.	USB, RS232, Bluetooth
Power [P]	Output power of each channel can be set independently **from 0 to maximum level.** This can be used to vary the intensity of the channel. This value also sets the maximum RF power level for the external controls.	USB, RS232, Bluetooth
ON/OFF	Each channel can be switched **ON and OFF**. This function sets the RF power to minimum value.	USB, RS232, Bluetooth
V Mode [0-5V/0-10V]	This parameter allows user to set the **voltage for external controls.** Selection between analog 0-5V and 0-10V. Both Modulation inputs and Blanking will have the same control voltage. **The acceptance code is "ACCEPT".**	USB, RS232, Bluetooth
Query [Product ID]	Use the query function in order **to get the ID** of the connected MPDS. This can be useful in case of multiple MPDS in a system.	USB, RS232, Bluetooth
Hard Reset	Hard reset generated by soft.	USB, RS232
Sweeping Mode	Option for channel 1 with **automatic self sweeping** from Fmin to Fmax set by user, with a sweeping time in **1µs up to 5000µs** set by user in steps of 1µs.	USB, RS232, Bluetooth
Profile Mode	User can select **any profile from 8.** For a 8 channels driver, a profile is composed by 8 couples frequency/power stored in memory of the microcontroller. This allow user to access up to 64 different pre-defined wavelengths. Profiles are stored in memory through USB/RS232. **Profiles are selected through 3 external bits.**	3 bits external
Store	Mode of operation and parameters are stored in memory. They are **automatically reloaded** after each power up of the driver.	USB, RS232, Bluetooth

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Summary of the performances

In case you have any question, you can contact AA OPTO-ELECTRONIC by email: sales@a-a.fr or by phone at +33 1 76 91 50 12.

Parameter	Mode	Specifications
Frequency [F]	USB, RS232	Nom 1 ms
Power [P]	USB, RS232	Nom 1 ms / dynamic 50 dB
ON/OFF	USB, RS232	Nom 1 ms / Extinction ratio > 100 dB
Sweeping Mode	USB, RS232	1 to 5000 µs from Fmin to Fmax
Profile Mode	3 bits external	Nom 1.2 ms setlling time (8 channels)
AM Control (MOD IN)	External	Rise/fall time nom 25 ns, Extinction ratio > 70dB
Blanking Control	External	Rise/fall time nom 25ns, Extinction ratio > 70 dB

First step: RS232/USB Settings

57600 bauds
8 bits
No parity
1 stop bit
No flux control.
(RS232 connections: Pins 1&2)

Driver installation

When connecting the MPDS product to your PC via USB link for the first time, the operating system will automatically search the web for the driver compatible with your computer and Operating system (OS).

In case your computer is not connected to Internet or in case the automatic installation does not work, then you can download your FTDI driver at http://www.ftdichip.com/Drivers/VCP.htm

For more information on how to download and install your FTDI driver, please follow the link http://www.ftdichip.com/Support/Documents/InstallGuides.htm

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Operation using Hyperterminal (USB, RS232)

Any of the red commands below can be typed by user on the keyboard of the computer using an hyperterminal program.

```
*********************************************
*       MPDS V8.14    //   23/07/2015       *
*********************************************
```

X --> Channel selection
F --> Frequency adj, ex: 89.253
P --> Power adj, ex: 46 (0->63, Pmin->PMax)
D --> Power adj (dBm), ex: 17.45
O --> Switch ON/OFF (1/0)
L --> Fast channel control
Full command: LxFfff.fffPppppDdd.ddOoIiE
Each argument may be omitted, except 'Lx'
-> Lx = channel selection (x=1->8:lines, x=0:blanking)
-> Ffff.fff = Frequency adj (ex: F89.253) - N/A for blanking
-> Ppppp = Power adj (pppp = 0->1023) - N/A for blanking
-> Ddd.dd = Power adj (dBm) (ex: D17.45) - N/A for blanking
-> Oo = switch ON/OFF (o=1/0)
-> Ii = internal mode ON/OFF (i=1/0)
-> E = immediate store
6/4 -> Frequency Up/Down
8/2 -> Power Up/Down
3/1 -> Profile number Up/Down
S --> Status
I --> Global IMode (0: int - 1: ext) [Settling time 100ms typ]
V --> Global VMode (0: 5V - 1: 10V)
E --> Store all channels data for selected profile + sweeping + blanking
q --> Query Product ID
M --> HARD RESET!!!!
G --> Sweeping control (Applies on channel 1 only)
Full command: GgAfff.fffOfff.fffUuuuuE
Each argument may be omitted, except 'Gg'
-> Gg = Sweeping ON/OFF (g = 1/0)
-> Afff.fff = Start Frequency in MHz (ex: A89.253)
-> Offf.fff = Stop Frequency in MHz (ex: O110.651)
-> Uuuuu = Sweeping Ramp Up time in us (uuuu = 1->5000)
-> E = immediate store

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ASCII Codes table

Dec	Hex	Name	Char	Ctrl-char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	0	Null	NUL	CTRL-@	32	20	Space	64	40	@	96	60	`
1	1	Start of heading	SOH	CTRL-A	33	21	!	65	41	A	97	61	a
2	2	Start of text	STX	CTRL-B	34	22	"	66	42	B	98	62	b
3	3	End of text	ETX	CTRL-C	35	23	#	67	43	C	99	63	c
4	4	End of xmit	EOT	CTRL-D	36	24	$	68	44	D	100	64	d
5	5	Enquiry	ENQ	CTRL-E	37	25	%	69	45	E	101	65	e
6	6	Acknowledge	ACK	CTRL-F	38	26	&	70	46	F	102	66	f
7	7	Bell	BEL	CTRL-G	39	27	'	71	47	G	103	67	g
8	8	Backspace	BS	CTRL-H	40	28	(	72	48	H	104	68	h
9	9	Horizontal tab	HT	CTRL-I	41	29	)	73	49	I	105	69	i
10	0A	Line feed	LF	CTRL-J	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	VT	CTRL-K	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	FF	CTRL-L	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage feed	CR	CTRL-M	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	SO	CTRL-N	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	SI	CTRL-O	47	2F	/	79	4F	O	111	6F	o
16	10	Data line escape	DLE	CTRL-P	48	30	0	80	50	P	112	70	p
17	11	Device control 1	DC1	CTRL-Q	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	DC2	CTRL-R	50	32	2	82	52	R	114	72	r
19	13	Device control 3	DC3	CTRL-S	51	33	3	83	53	S	115	73	s
20	14	Device control 4	DC4	CTRL-T	52	34	4	84	54	T	116	74	t
21	15	Neg acknowledge	NAK	CTRL-U	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	SYN	CTRL-V	54	36	6	86	56	V	118	76	v
23	17	End of xmit block	ETB	CTRL-W	55	37	7	87	57	W	119	77	w
24	18	Cancel	CAN	CTRL-X	56	38	8	88	58	X	120	78	x
25	19	End of medium	EM	CTRL-Y	57	39	9	89	59	Y	121	79	y
26	1A	Substitute	SUB	CTRL-Z	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	ESC	CTRL-[	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	FS	CTRL-\	60	3C	<	92	5C	\	124	7C	|
29	1D	Group separator	GS	CTRL-]	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	RS	CTRL-^	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	US	CTRL-_	63	3F	?	95	5F	_	127	7F	DEL

The commands in red must be followed by a carriage return (CR, ASCII code 13).

For some commands, Microcontroller will send a question mark (?, ASCII Code 3F) in order to indicate that it is expecting user to enter some values, followed by a Carriage Return.

Some short cuts and sweeping keys have been added for user:
6/4 -> Frequency Up/Down sweeping
8/2 -> Power Up/Down increasing/decreasing
3/1 -> Profile number Up/Down sweeping

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Values to be entered by user:

Goal	Instruction written by the user // Message delivered by the driver	Comments
Selection of the channel	**X (or x)**	1 ≤ n ≤ N with n the number of the channel and N the number of channels
Frequency adjustment	**F (or f)**	fmin ≤ f ≤ fmax with f the frequency for the selected channel (n), (format xxx.xxx)
Power adjustment "Compatible MODnC"	**P (or p)**	0 ≤ p ≤ 63 (step format integer) with p the power for the selected channel (n)
Fine Power adjustment "NOT compatible with MODnC"	**LxPpppp** (ex : L3P0852) **LxDdd.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)**	For all Lines in this mode the following information are indicated: Channel Number / Frequency / Power /ON/OFF
Driver mode adjustment	**I (or i)**	i = 0 : internal mode, i = 1 : external mode [100ms]
Channel switch ON/OFF	**O (or o)**	o = 0 : Channel switched OFF o = 1 : PLL switched ON
Variable data storage	**E (or e)**	To store parameters in the EEPROM

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 - Set the driver mode in "Internal Mode",
4 - Set the Channel switch on "ON".

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GUI/TPI programming

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 (labview, C++…). With only one command, one complete line or profile can be adjusted. This allows user speed and smooth control with rapid interactions with the driver.

General operation

FULL Command: LxFfff.ffPppppDdd.ddOoIiE

Note: Each argument may be omitted except 'Lx'

→ Lx	Channel selection (x= 1 to 8 for channels, 0 for BLK selection[Oo, Ii, only])
→ 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)
→ Ii	Internal mode ON/OFF (i=1/0)
→ E	Immediate store

Examples

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

Set Blanking in internal mode, always switched ON (do not need external control)
→ Command L0I1O1

Reset of the RF Driver:
→ Command M

Storage of data in microcontroller:
→ Command E

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Sweeping operation (channel 1)- option

FULL Command: GgAfff.fffOfff.fffUuuuuE (applies on channel 1 only)

Note: Each argument may be omitted except 'Gg'

→ Gg Sweeping mode – OFF/ON - g=0/1
→ Afff.fff Start frequency (fff.ff = frequency value ex-75.206 – MHz)
→ Offf.fff Stop frequency (fff.ff = frequency value ex-84.260 – MHz)
→ Uuuuu Sweeping time in microseconds by steps of 1µs from 1 to 5000
→ E Immediate store

FULL Command: L1PppppOo

Note: Each argument may be omitted except 'Lx'

→ Ppppp Power setting from min to max (ppp = 0…1023)
→ Oo Switch ON/OFF (1/0)

RAMP OUT: bit 3, is an output trig signal for user from 0 to 3.3 Volts which follows the sweeping.

Examples:

Initialization of the sweeping mode from 80 to 100MHz swept in 100µs with immediate store:
→ Command G1A80O100U100E

Modify higher frequency value to 105,36 MHz:
→ Command G1O105.36

Stop sweeping:
→ Command G0 (sweep mode off) or L1O1 (Switch off channel 1)

Set RF power to 750:
→ Command L1P750

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Profile operation

By default the profile in operation is number 1 (000). All stored valued will be valid for profile 1. To access any other profile, user should use the 3 external bits to select a given profile. All parameters will then be automatically loaded in MPDS.
When the store function is used, parameters will store in the running selected profile.

Number of Profiles for a 8 channels MPDS: 8
Number of preset wavelengths: 64

Profile Selection			Profile	BLK		CH1				CH2				.....	CH8			
Bit 2 (MSB)	*Bit 1*	*Bit 0 (LSB)*	*N°*															
0	0	0	1	F1	P1	I	O	I	O	F2	P2	I	O		F8	P8	I	O
0	0	1	2	F1	P1	I	O	I	O	F2	P2	I	O		F8	P8	I	O
0	1	0	3	F1	P1	I	O	I	O	F2	P2	I	O		F8	P8	I	O
0	1	1	4	F1	P1	I	O	I	O	F2	P2	I	O		F8	P8	I	O
1	0	0	5	F1	P1	I	O	I	O	F2	P2	I	O		F8	P8	I	O
1	0	1	6	F1	P1	I	O	I	O	F2	P2	I	O		F8	P8	I	O
1	1	0	7	F1	P1	I	O	I	O	F2	P2	I	O		F8	P8	I	O
1	1	1	8	F1	P1	I	O	I	O	F2	P2	I	O		F8	P8	I	O

Profile selection Enable/Disable: Bit 4 – High level → Enable, Low level → Disable

After a profile have been selected, all commands of the general operation can be used.

FULL Command: LxFfff.ffPppppDdd.ddOoIiE

Note: Each argument may be omitted except 'Lx'

- → Lx — Channel selection (x= 1 to 8 for channels, 0 for BLK selection [Oo, Ii, only])
- → 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)
- → Ii — Internal mode ON/OFF (i=1/0)
- → E — Immediate store

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Profiles loading:

First, user must select the profile number by using bits 18,19,20.
Profile selection bit 4 must be enabled: NC or high level (pull up input).
Then user can access to any of the channels for the selected profile number.
Do not forget to store values.

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Operation using AA Software (USB, RS232)

This document describes how to use the Human Machine Interface to configure an MPDS driver via RS232 or USB connection. The software is compatible with Windows 7, Windows 8 and Windows 10. It is available in both 32 bits or 64 bits version.

When connecting the MPDS product to your PC via USB link for the first time, the operating system will automatically search the web for the driver compatible with your computer and Operating system (OS).
In case your computer is not connected to Internet or in case the automatic installation does not work, then you can download your FTDI driver at http://www.ftdichip.com/Drivers/VCP.htm

For more information on how to download and install your FTDI driver, please follow the link http://www.ftdichip.com/Support/Documents/InstallGuides.htm

USB or RS232 settings must be
57600 bauds
8 bits
No parity
1 stop bit
No flux control.
(RS232 connections: Pins 1&2)

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Presentation

The Human Machine Interface (HMI) has 1 main window with 3 tabs to configure the product.

Main Window - Setting Tab

Status Information: Status must be "CONNECTED" in order to control MDS

Connection Information: Displayed logo indicates the recognized communication mode

External Control Voltage: Status is unknown when MDS is powered up. Voltage (MOD IN/BLANKING) can be modified by user at any time

Channels Status and Configuration: User can set or modify individually each channel (frequency, power).

Profile selection: User can choose one of the 8 profiles configuration

Store configuration: All values of the current profile will be stored in EEPROM. They will be automatically reloaded after power up.

Hardware Reset: Reboot the product and reload stored parameters.

Load profile from file: Load profile parameters from *.INI file

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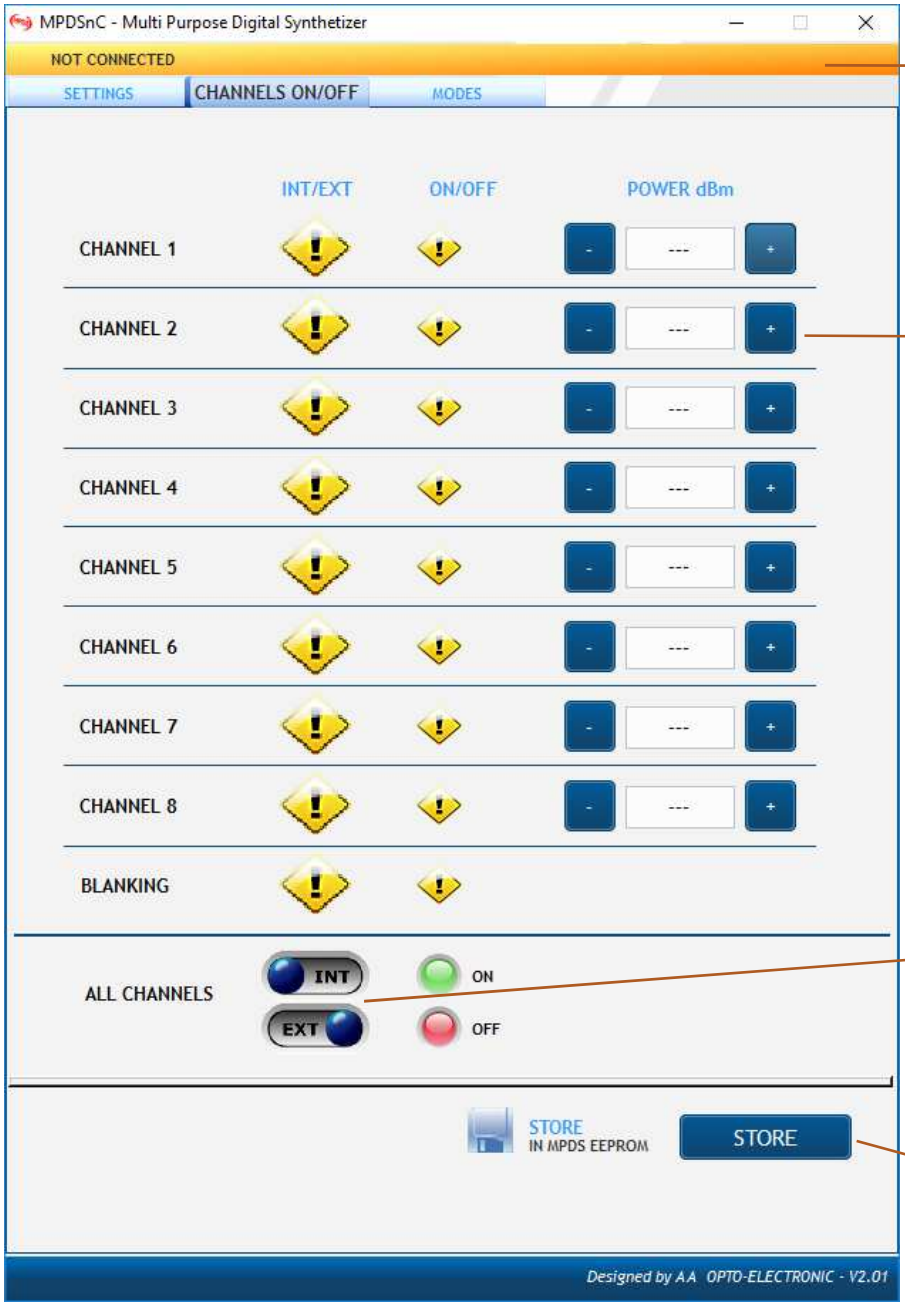
Main Window – Channels ON/OFF Tab



Status Information

Channels Configuration: Allows user to switch individually ON and OFF the channels, to choose if the channel is driven Internally or Externally and modify RF power.

logo means status unknown.

External / Internal control switch:
External mode: user will control channels with external voltages through Modulation Inputs and Blanking
Internal Mode: user will control channels through Remote control, USB or RS232 communication

Store current profile parameters

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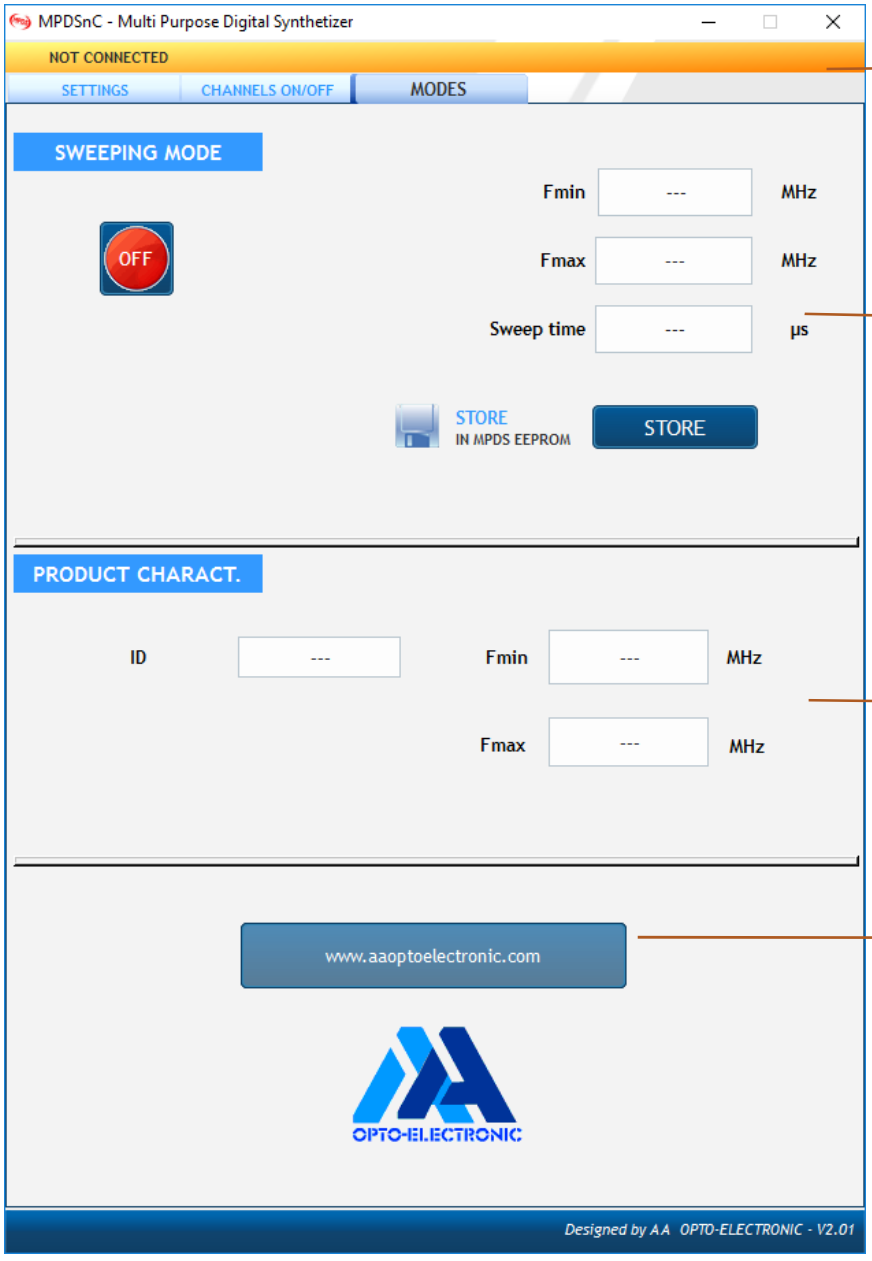
Main Window - Modes Tab



Status Information

Frequency Sweep parameters and control
Only channel 1 performs the sweep

Product characteristics:
ID number and frequency range

Contact AA or access Website

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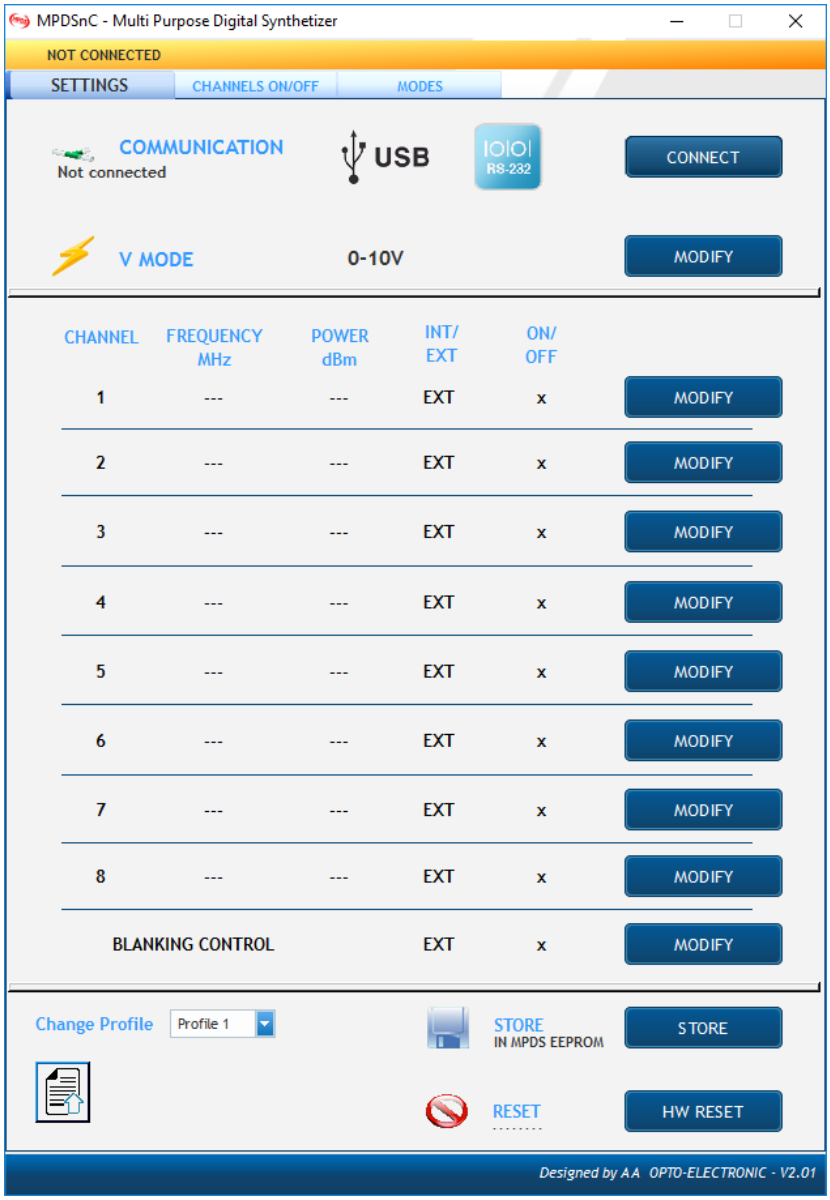
Configuration process

Step 1: Connection

When launching the HMI, the main window is displayed as follows:



The orange Status Information bar displays the information "Not Connected" as no connection has been established at the beginning.

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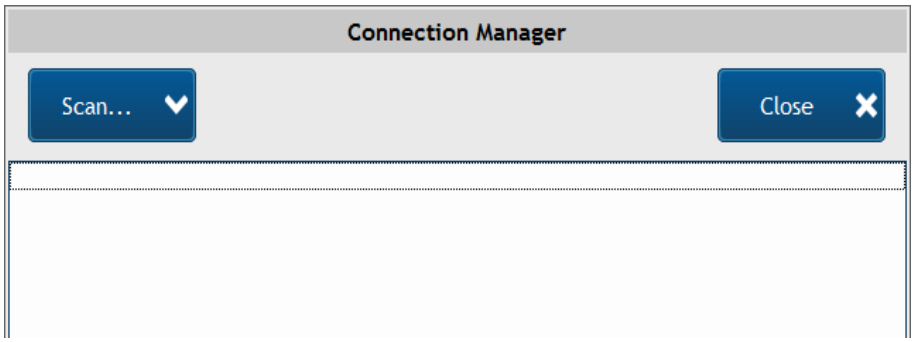
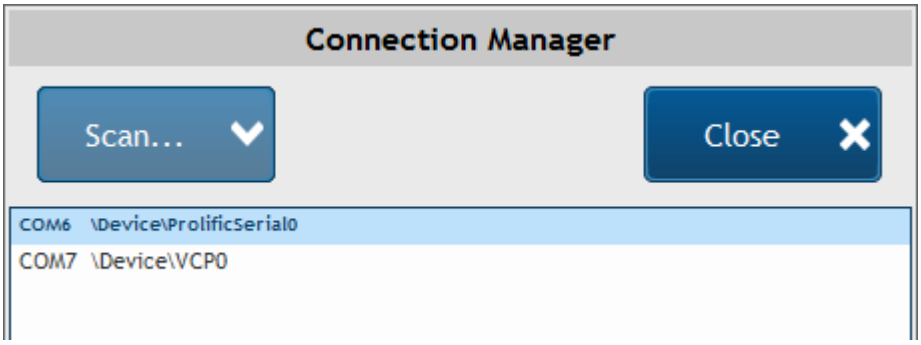
To establish a connection through RS232 (option) or USB link, click on the "Connect" button.
A new window called "Connection Manager" will be displayed.



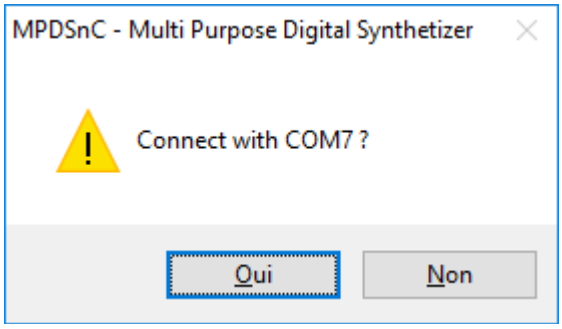
On this window you can scan your computer to list the COM Port by clicking the "Scan" button.

The COM Port list is then displayed on the white zone.



Click on the COM Port where the MDS is connected to establish a connection.

NOTE: When using USB link MDS COM Port are generally described as \Device\VCPxxx.
You will be asked if you really want to connect with this COM Port.



Warning: Do not use both means of communication, RS232 and USB, at the same time. It would result in some communication conflicts.

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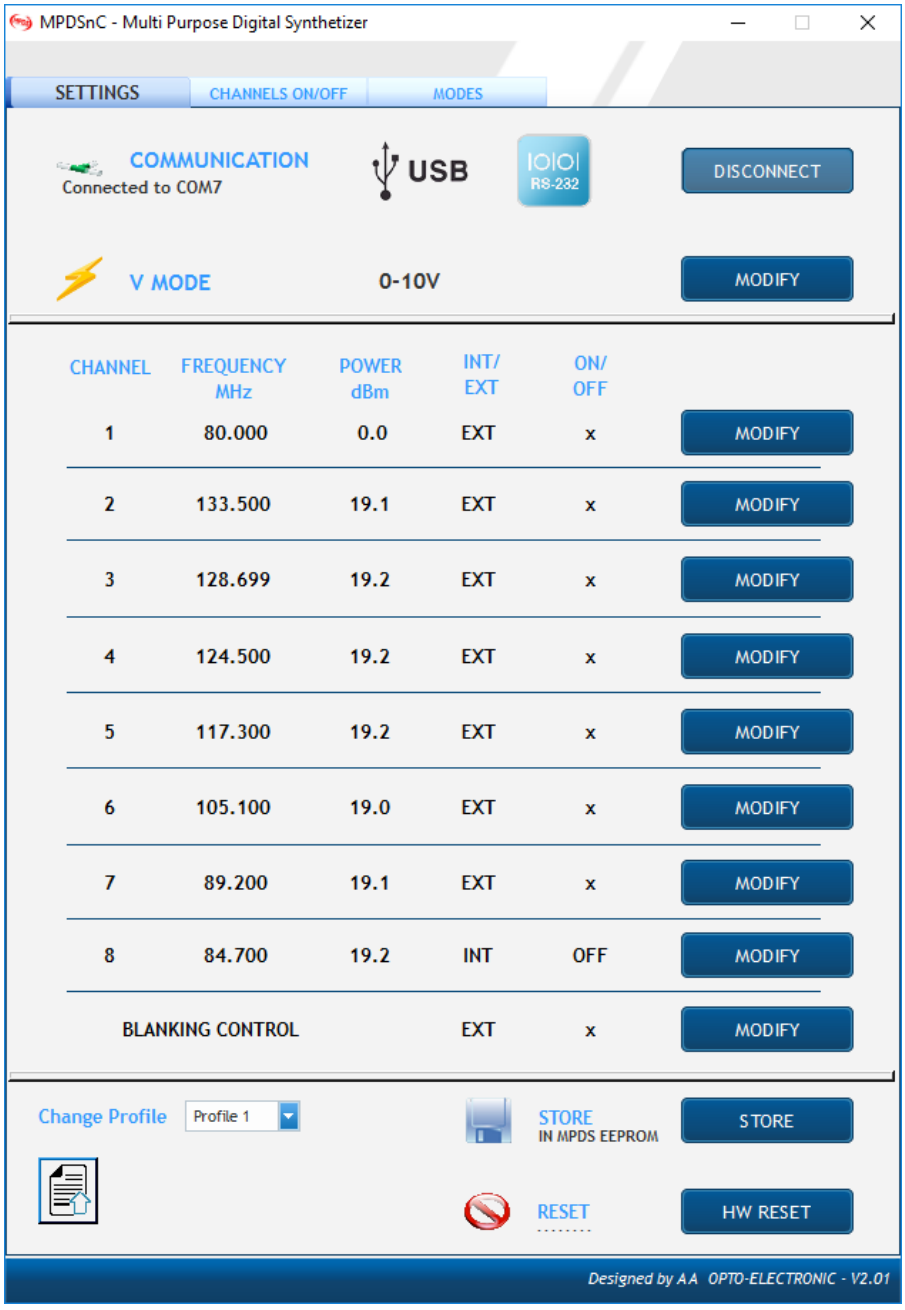

When all the parameters have been read and displayed, the Status zone becomes empty and grey.

NOTE: the software may take some time to read the parameters. During this time, you can go on the Channels ON/OFF tab and click on each  logo to acquire the status of the unknown channels.

Step 2: Voltage configuration

If you want to externally drive the channels, you can modify the external logic voltage by clicking on the MODIFY button.

It opens a new window that allow you to switch from 5V to 10 logic voltage.

Attention: if you switch to 5 Volts external control, and you input a 10 Volts signal (>5 Volts), then you may damage the inputs of your driver.

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Step 3: Channels Configuration

On the main page "Settings" tab, by clicking on the "MODIFY" button of each channel, you can access a window to configure the frequency, the output power, the Internal or External command and the status ON/OFF.

+ button will scroll up frequency or power
- button will scroll down frequency or power

ON/OFF button will switch channel from ON to OFF or from OFF to ON. (Always ON, always OFF)

When clicking on the text box, a keyboard will appear in order to directly enter Frequency or output power value.

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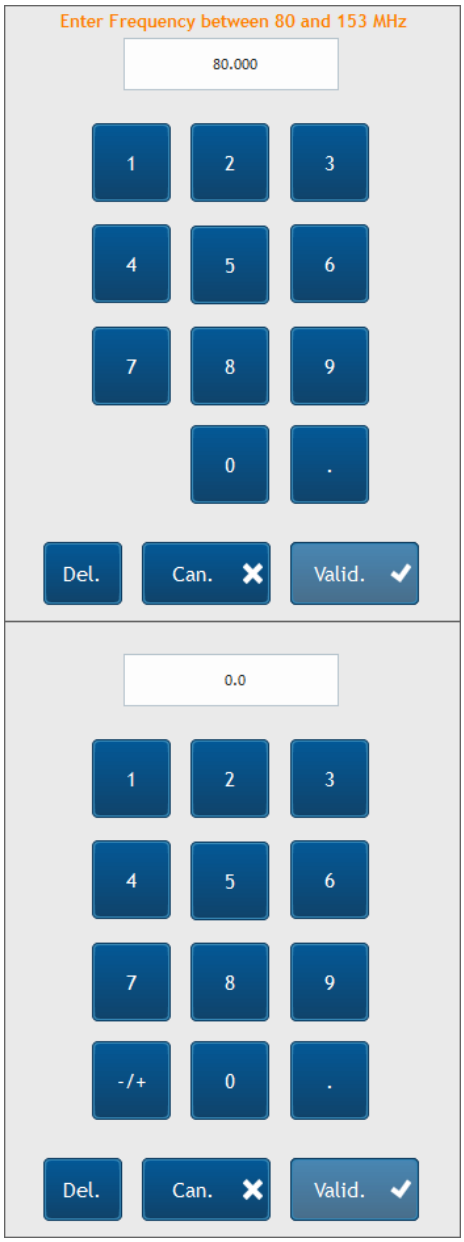

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Profile Selection: You can select the profile between 1 and 8. A profile is a full configuration of 8 channels (respectively 4 or 1 depending on the versions). The profiles set up can be adjusted one by one (then store), or in one step using the file download button. (See section Loading Profile from file). The Profile function allows user to access to 64 pre-stored selections.

The status operation of the channel is displayed in front of the channel number.

INT/EXT: operation in Internal Mode (RC04, RS232, USB) or External Mode (MOD IN+BLK).

ON/OFF: channel can be set to ON or OFF.

Blanking: For the new generation of MPDS, user can mix the operation of the different channels with Internal and External Mode.

For instance, it can be decided that channels 1 to 4 will be controlled externally through user voltage (MOD IN + Blanking) while channels 5 to 8 will be controlled through RS232 communication in Internal Mode.

Special Case: Blanking "disconnected"
For some reasons, user may want to not use the Blanking input.
In that case, the Blanking input must be set at "INT" (Internal Mode) and "ON", in order to be always "disabled".

Step 4: Quick Configuration

To operate or quickly set ON/OFF channels, or to scroll power of each channel use the main window "Channels ON/OFF" tab.

For each channel:
+ and – button scroll the output power up and down.
Clicking on "ON" or "OFF" button will switch on/off the channel
Clicking on INT or EXT button will switch the channel command between internal and external

You can also set all channel ON/OFF to internal or external and ON or OFF. External mode refers to a control by user through external Modulation Inputs (MOD IN) and Blanking, while internal mode refers to any control through Remote (Bluetooth), RS232 or USB.

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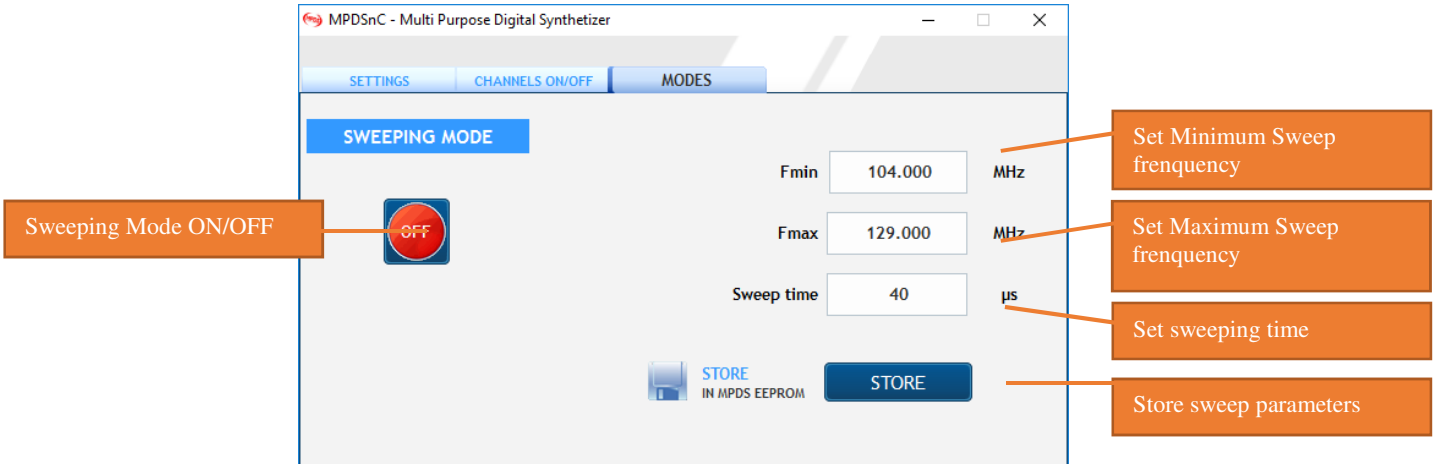
Step 5: Saving configuration

At the bottom of each tab you will find a "Store" button to store the parameters of every channel of the driver in EEPROM. These parameters will be automatically reloaded after each reset or start.

This way when the driver is Power OFF and ON it will retrieve its configuration.

Sweeping mode (Option)

By selecting the Modes tab you can configure the sweeping mode.
This mode allows user to create an automatic frequency sweep on channel one, with possibility to adjust the minimum and maximum frequency range, and the sweeping time.



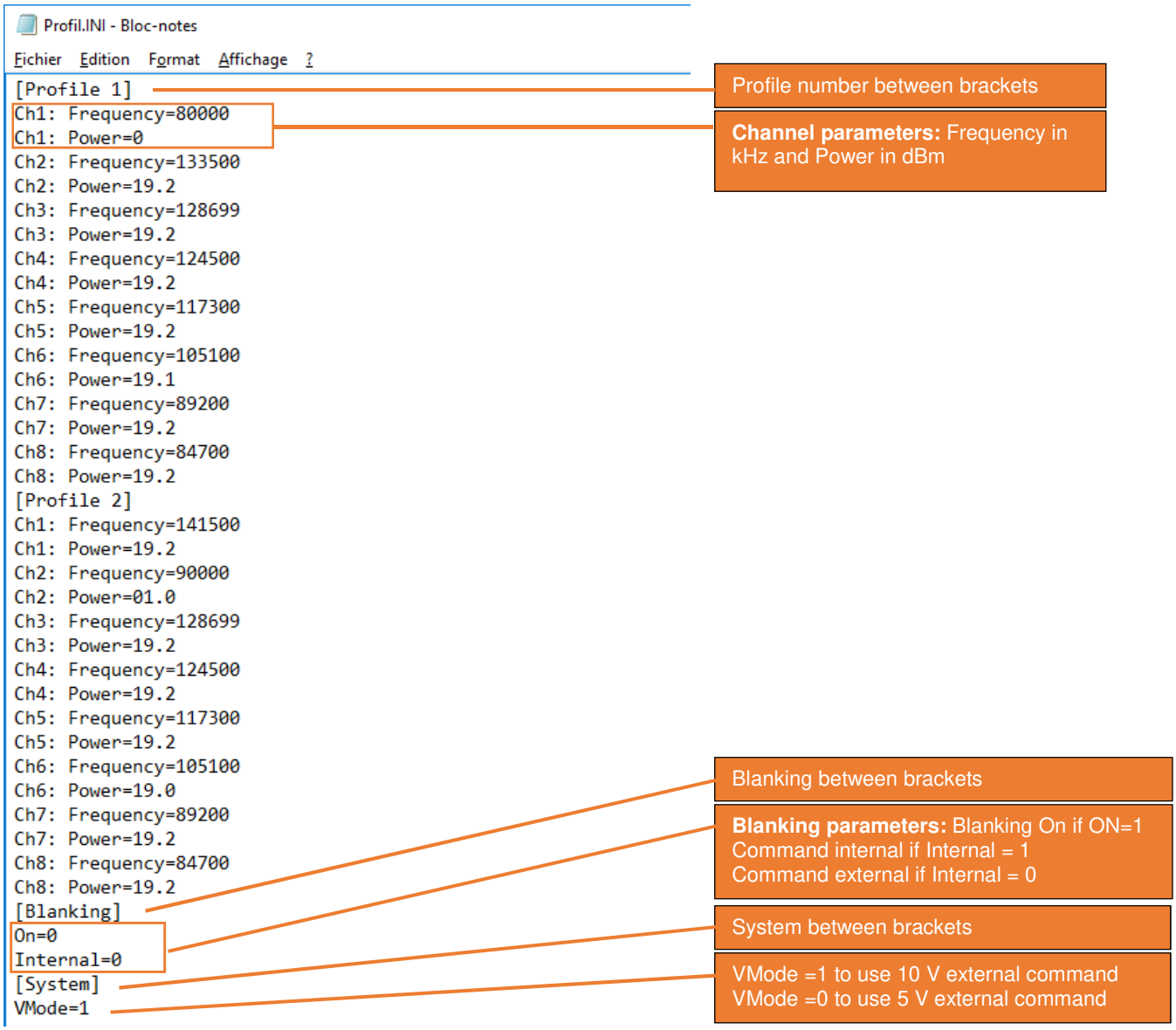
NOTE: Only channel 1 can be swept.

Loading Profile from file

First you need to edit a profile file for the upload.

Create a new *.txt file and rename it to have the extension *.INI

Open the file and file it with the parameters following the format described below.



NOTE: The MPDS can use up to 8 profiles, all blank value or non-existing value will be ignored during upload.

Save the file on your computer with a .INI extension

Warning:
Strictly respect the file format or value will be ignored.
Out of bound value will be set to the nearest minimum or maximum value allowed by the MPDS.

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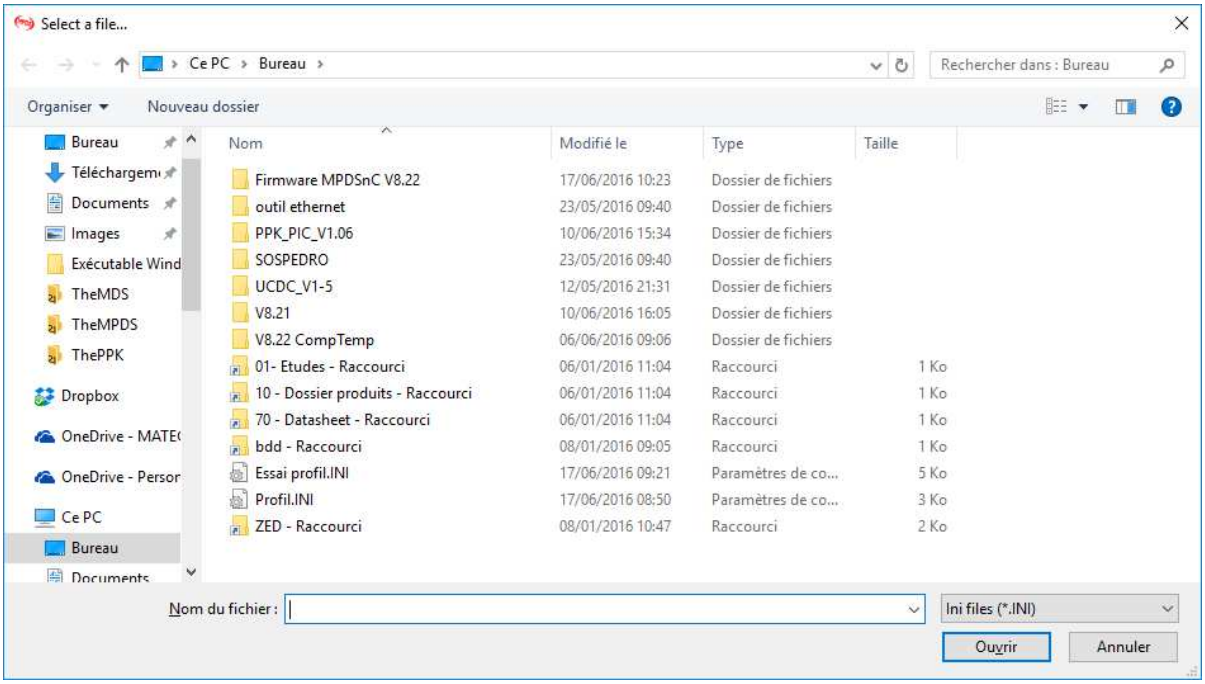
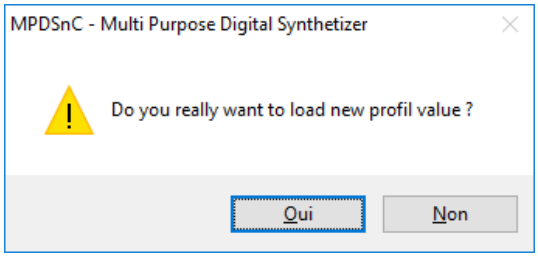
Now that the profile file is created it can be upload to the MPDS using the upload button at the bottom of the Settings tab

Clicking on the upload button open a browser that allow to choose the file to be upload



Choose the *.INI file you want to upload.
You will be asked if you really want to upload a new configuration.



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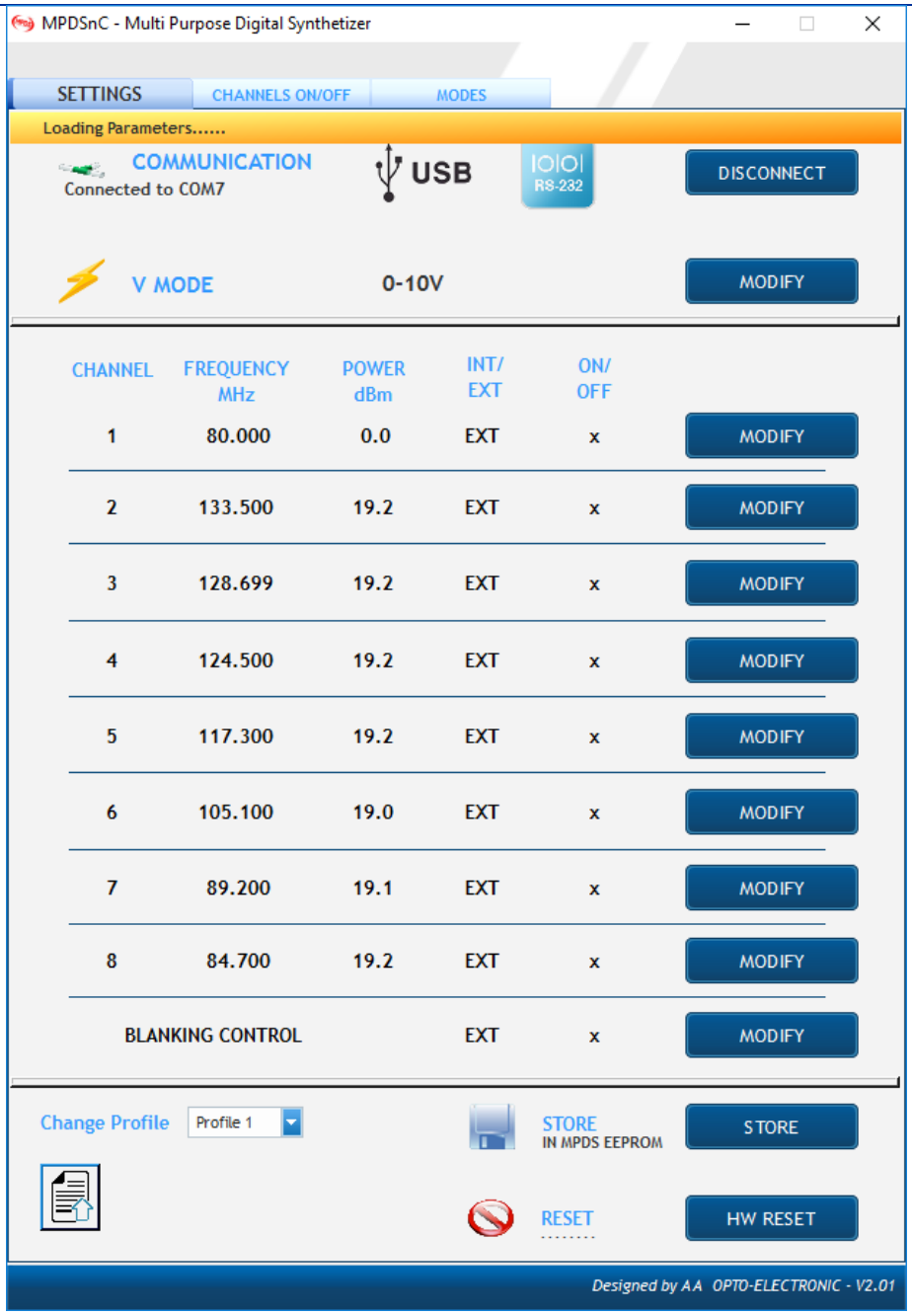

Loading the value can take few minutes, the user is informed by the blinking bar displaying the message Loading Parameters…. that the process is running.

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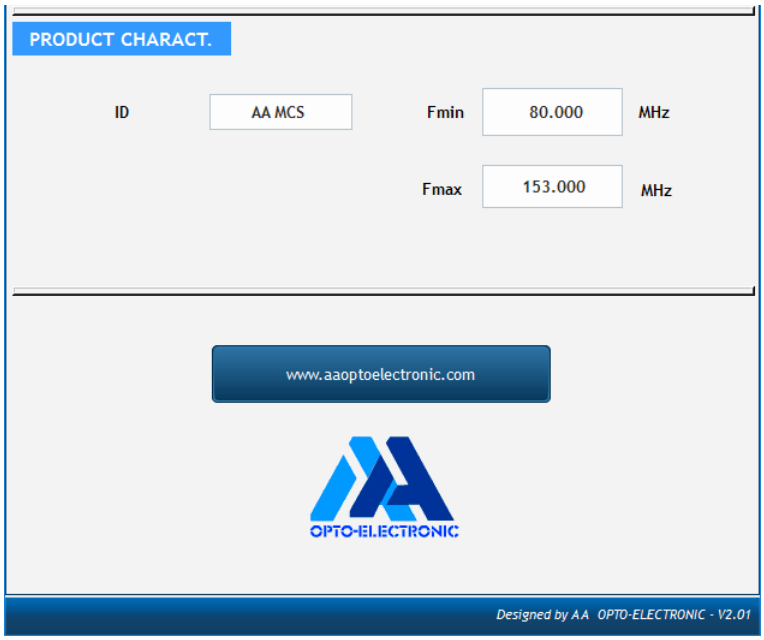
Other information

On the "Modes" tab you will find information on the MPDS driver like its ID, the minimum and maximum frequency it can generate.



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