Precision AOM driver
DIM-3000

Front

Rear

Time-Base
Made in Germany

General description

DIM-3000 is a high-precision driver for acousto-optic modulators with the maximum output power of 2.5 W (optionally up to 4W) and the operation frequency range of 10 – 400 MHz.

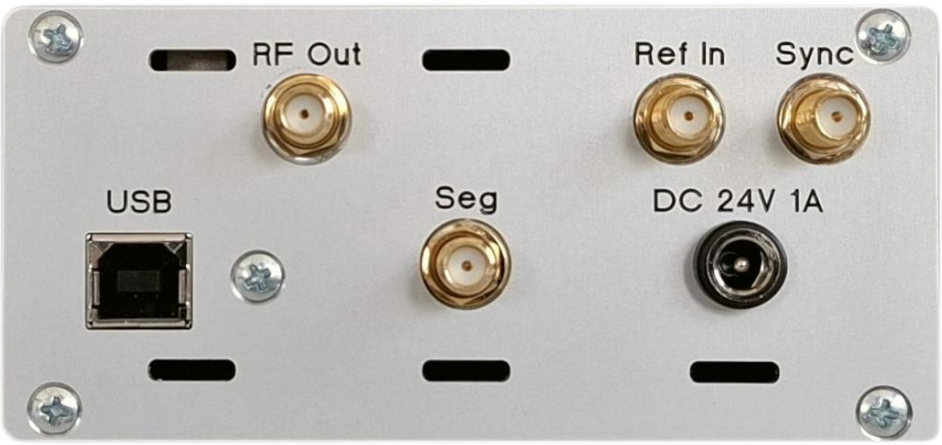
The main features are:

- **Broadband operation 10 – 400 MHz**
- **Output RF power up to 2.5 W**
- **High frequency stability**
- **Narrow linewidth**
- **Fast analog and TTL amplitude modulation**
- **FM modulation**
- **Frequency SWEEP function**
- **Computer control**
- **Stable on all loads**
- **Compact design**

Please carefully read this manual before operating the driver!

Front panel

Rear panel



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Specifications

Frequency range	10 to 400 MHz
Frequency resolution	1 Hz
Frequency stability	50 ppm (internal reference)
External reference	10 MHz, > $1V_{p-p}$
RF output power (50 Ohm load)	+34 dBm, 2.5 W (max)
RF power regulation range	+ 14 dBm to + 34 dBm in 0.1 dB steps
AM input: Bandwidth Depth Signal range Input impedance	 DC to 400 MHz > 40 dB ±1V 1 kΩ
TTL modulation: Response time Depth Input impedance	 < 6 ns > 40 dB 1 kΩ
Pulsed operation: Operation frequency Duty cycle	 20 to 1000 Hz 10 to 90%
FM input: Bandwidth Signal range Input impedance Deviation (min/max) at 1 V input signal	 DC to 100 KHz ±10V 1 kΩ ±3200 Hz / ±104 MHz
Sweep: min/max step time	 4 ns/262 µs
Connector type: In / Outs PC control interface DC Power	 SMA USB DC Jack 5.5/2.1 mm
Dimensions	160 x 100 x 90 mm
Power Supply	24 V DC, 1 A max.
Weight	1.7 kg

Operating instructions

WARNING!
Do not connect or disconnect the load (AOM) without switching off the output.

WARNING!
Due to large heat dissipation, DIM-3000 driver must be operated on open surfaces with free air circulation.
The surrounding temperature should not exceed +30°C.

WARNING!
DIM-3000 driver delivers up to 2.5 W of the RF power. Check whether the AOM you are intended to connect can stay this power level.

Switching on and off

Connect a load (AOM) to the "RF output" SMA connector using a 50 Ohm coaxial cable.

1. Plug in the 24 VDC power cord into the socket on the rear panel. The front-panel display will light up; the AOM driver is ready to work.

2. RF power is switched on or off using the "RF on/off" button on the front panel.

Setting the frequency

Press the "Freq/Power" button on the front panel to set the frequency value. To enter the frequency value, use the rotation knob on the front panel. The digit of the frequency step can be selected by pushing the rotation knob:
To **reduce** the frequency step by one order of magnitude: **short push on the knob**;
To **increase** the frequency step: **longer push on the knob**.

Setting the output power

The power of the output RF signal is set in dBm. Press the "Freq/Power" button on the front panel to set the output power value. To enter the desired output power, use the rotation knob on the front panel. The power step is preset to 0.5 dBm.

Attention!
The values on the display correspond to the true output power only in the case when the **AM offset** (see below) is set to **0**. *The „0" offset is the default value of the driver.*
The AM offset can be adjusted by pushing the button "Adv".

Attention!
The output power of the driver is altered by the AM offset even with the absence of the signal on the AM input.

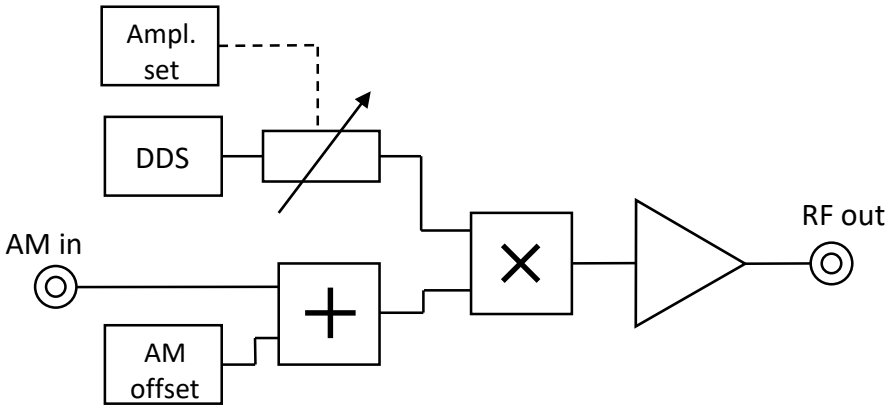
TTL amplitude modulation

The output RF signal of the AOM driver can be TTL modulated by applying a TTL modulation signal to the TTL input on the front panel. For a logical zero (0 – 0.4 V) at the TTL input the output power is at the set value. For a logical 1 (2.6 - 5V) the output power is switched off (suppressed to more than 40 dB).

Analog amplitude modulation (AM)

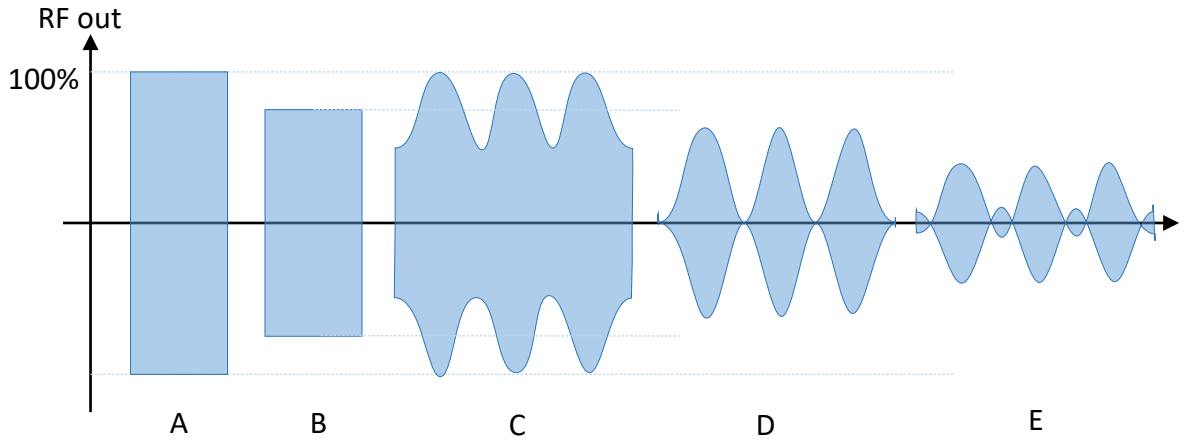
The amplitude of the carrier frequency can be varied by applying a modulation signal (bandwidth DC-400 MHz, ± 1 V_p max.) to the AM input on the front panel. In this case, 0 V corresponds to the set amplitude of the AOM driver, -1 V sets the output amplitude to minimum. Positive values of the modulation signal will increase the output amplitude.
The output power of the RF driver cannot exceed the specified maximum value (+ 34 dBm).

Simplified schematic of amplitude modulation



Attention!
For the proper operation in the AM regime the ”AM offset” should not be set to a maximum value. To optimize the AM settings, we recommend testing the output signal of the driver on an oscilloscope using a 50 Ω terminating resistor.

Illustration of the influence of the AM offset on the modulated signal



A AM ofset=0; AMin=0
B AM ofset=-50; AMin=0
C AM ofset=-50; Amin=0.5 Vpp; AM depth<100%
D AM ofset=-100; Amin=0.5 Vpp; AM depth=100%
E AM ofset=-150; Amin=0.5 Vpp; AM depth>100%

Analog frequency modulation (FM)

Frequency modulation of the carrier is done by applying a modulation signal to the FM input on the front panel. The depth of the modulation depends on the amplitude of the applied signal (max as well as on the user settings).

Enabling of the FM mode is done by pushing the "Adv" button.

1. Push the "Adv" button and rotate the knob to set the necessary modulation depth. With each rotation the values are changed by a factor of 2 starting from 3200 Hz up to the maximum frequency deviation of about 104 MHz (16 default values – 3200, 6400, etc.).
2. **Push** the rotation knob to activate the FM input. The sign FM appears on the monitor.

Attention!
Modulation depth, displayed on the monitor, corresponds to the nominal (2 Vp-p) input signal at the FM input.
If the input amplitude exceeds the nominal value, the LED "Overload" is lighting.

Attention!
In the "FM" mode the accuracy of the output frequency is not guaranteed since the carrier frequency is not locked to a local oscillator (internal or external reference).
The operation frequency of the driver should be at least 1.5 higher than the FM deviation (for example for the deviation 26 MHz the center frequency should be > 39 MHz)

Pulsed operation

Pulsed operation of the DIM-3000 driver can be activated via computer control using the command "**RFp_on** " (see "**Computer commands list**").

Frequency sweep

The Frequency sweep function can be activated using computer control. The command "**SWPm:**xxx" sets the mode of sweeping, xxx – parameters:

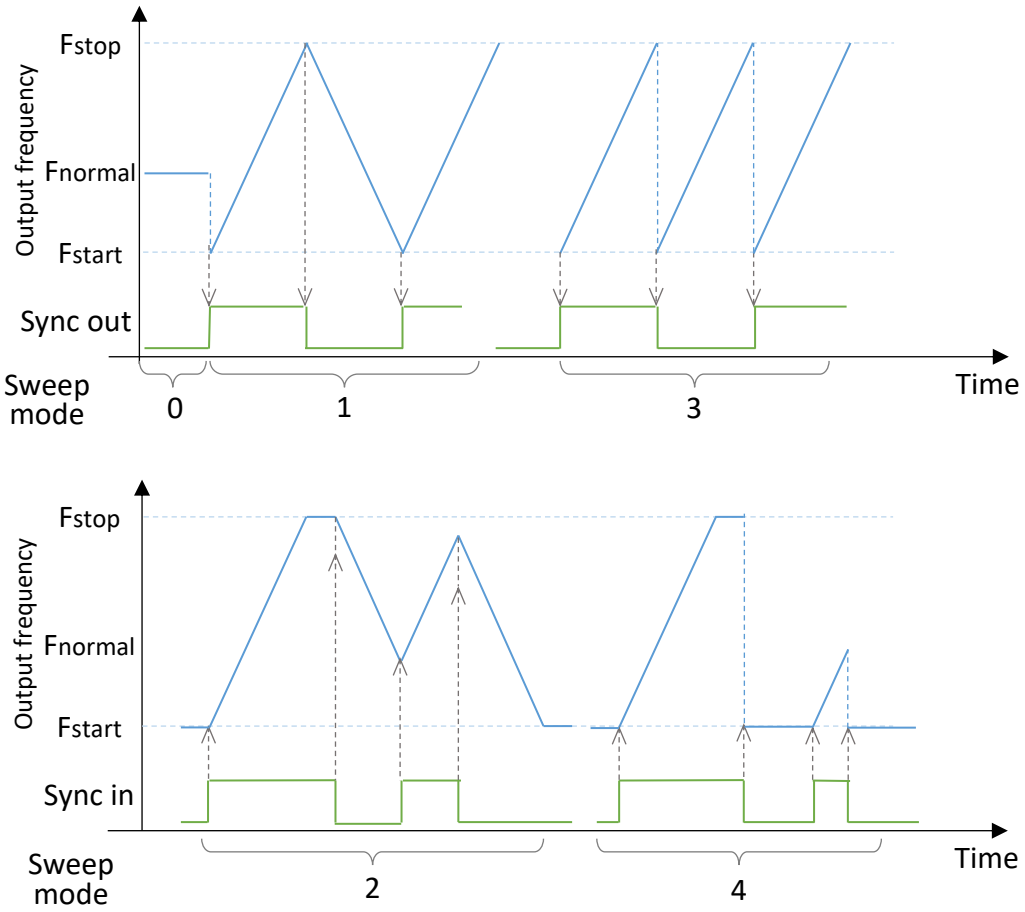
0 – sweep off, normal operation
1 – sweep on, continuous triangle with internal trigger
2 – sweep on, triangle with external trigger
3 – sweep on, continuous saw-tooth with internal trigger
4 – sweep on, saw-tooth with external trigger

In the modes 1 and 3 the trigger signal can be read out from the "Sync I/O" SMA connector (approx. 1Vpp).
In the modes 2 and 4 the "Sync I/O" SMA connector serves as trigger input (max. 5V pulse).
Commands "**SWPs:**xxx" and "**SWPp:**xxx" set the start and stop frequency correspondingly (xxx – frequency in Hz).
Command "**SWPf:**xxx" sets the step frequency – increment/decrement value
Command "**SWPt:**xxx" sets the time (ns) for one step. The time will be rounded down to whole 4 nanoseconds, i.e. 13 to 12, 251 to 248 and so on. The total sweep time *T* can be calculated as:

$$T = \frac{Fstop - Fstart}{Fstep} * Tstep$$

All sweep parameters are restored on power "on" (except "SWP mode": it is always 0 (off) on power "on").

sync In/Out and output frequency relationship



Frequency "segments play"

Valid for firmware FW_v10-b247
This option allows to generate a sequence of arbitrary frequency sweeps, each of which is consequently launched by applying a trigger signal to the "Seg" SMA connector on the rear panel of the driver.
"Segment" – a set of parameters for the frequency ramp
"play segment" – apply parameters and start the frequency ramp

Any combination of Fstart and Fstop is allowed, that is "positive" or "negative" ramp.
SMA connector "Seg" has a function only in "segment play mode" (see command Mseg).
Activation and setup of "segment play mode" is only possible through direct computer control (USB or TCP), not on devices local display or WEB interface.

Computer Commands:
All commands must be terminated in case of USB connection with symbol <LF> (0A hex); in case of a TCP connection with symbols <CR><LF> (0D0A hex)

Wseg:
Write segment values into memory using:
Wseg:N;A;B;C;D;E;F
Parameters
N – segment number which to write. min 1, max 20
A - segment attribute;
0 – segment inactive, will not be played
1 – segment active
8 – last segment, will not be played, by next pulse segment 1 will be played
B - start frequency, Hz. 10 000 000 to 400 000 000 Hz

C - stop frequency, Hz. 10 000 000 to 400 000 000 Hz
D - step freq, Hz. 0 to 400 000 000 Hz
if D=0 out, frequency will stay by Start freq.
E - step time, arb. units. 1 to 65535
1 unit is 3.90625 ns. Also possible time 3.90625 ns to 255,996 ns
F - Amplitude, dBm x10
0 – use current Amplitude, setted on display
>0 - currently not implemented

example:

```
Wseg:3;1;39000111;59000222;300;4750;0<LF>
```

answer: no

Rseg:

read segment values.

using

Rseg:N

Parameters

N – number of segment which to read. 1 to 20

example:

```
Rseg:3<LF>
```

Answer example:

```
Rseg:3;1;39000111;59000222;300;4750;0<LF>
```

Mseg:

on/off "segment play mode".

using

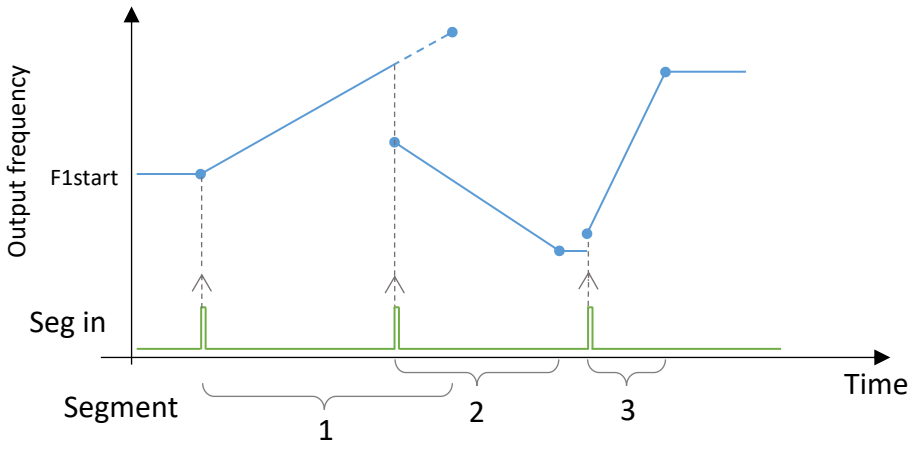
Mseg:N

Parameters

N=0 - off;
Connector "Sync" inactive, single frequency operation.
0<N<20 - on .
Connector "Seg" accept TTL pulse 3.3 to 5 V minimum pulse width 2 us
Segments will play from N upward on each rising edge of TTL pulse.
Repeat Mseg:N command reset segment counter to N
Delay between rising edge of TTL pulse and start next segment approx. 3 ms
If next pulse comes before segment play is done, the next segment will start.

Example:

```
Mseg:1<LF>
```



Computer control

Most of the parameters of the DIM-3000 AOM driver can be set and read out by a computer using a dedicated program (Labview, etc.). For computer control the DIM-3000 is connected to a USB port of the computer.

Connect DIM-3000 to a PC via USB cable. Make sure that a new serial port (it can be any - COM6, COM2, etc.) appears in the system (check in "Windows Device Manager"). Remember this number.
If it does not appear you should install the USB-serial chip driver (VCP driver). The driver can be downloaded e.g. from one of the following addresses:

- https://www.silabs.com/developer-tools/usb-to-uart-bridge-vcp-drivers?tab=downloads
- https://ftdichip.com/drivers/vcp-drivers/

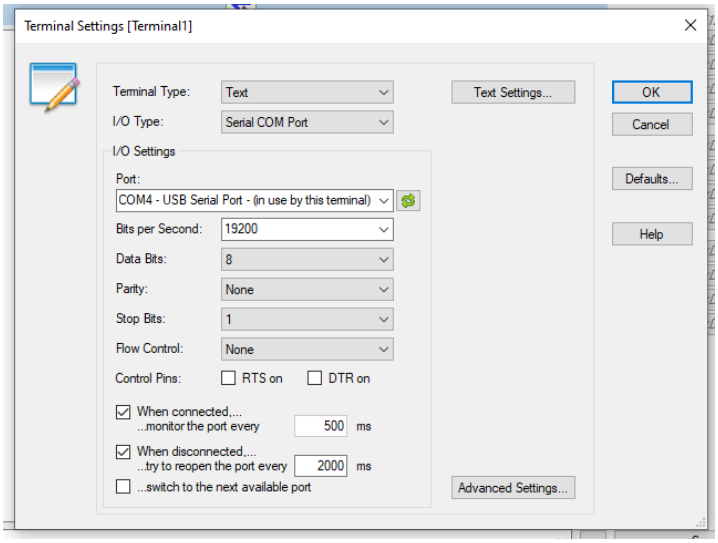
Configuration of the virtual COM-Port:

Baud Rate - 19200, Parity - none, Data Bits - 8, Stop Bits – 1

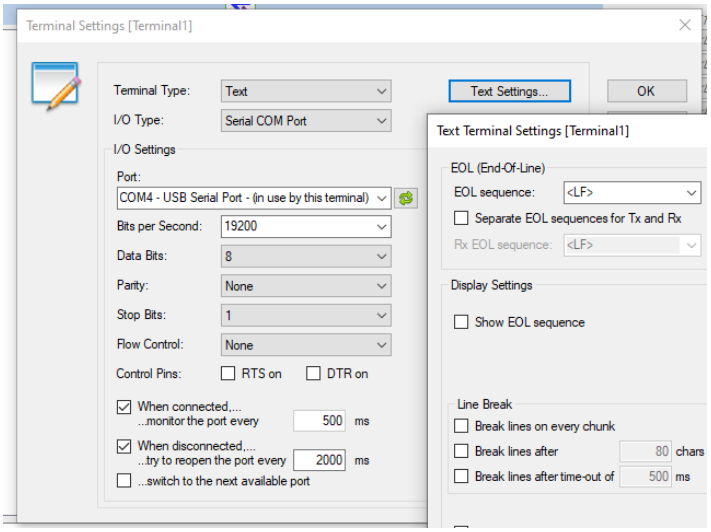
All commands must be terminated with "LineFeed" (LF) character (0A hexadecimal)
Maximum Execute speed is about 10 commands/sec.
Commands are case sensitive, xxx – numbers.

For computer control of the DIM-3000 AOM driver, it is convenient to use one of the typical terminal programs, for example freeware "Yet Another Terminal" (YAT) https://sourceforge.net/projects/y-a-terminal/
Install and open the YAT program.

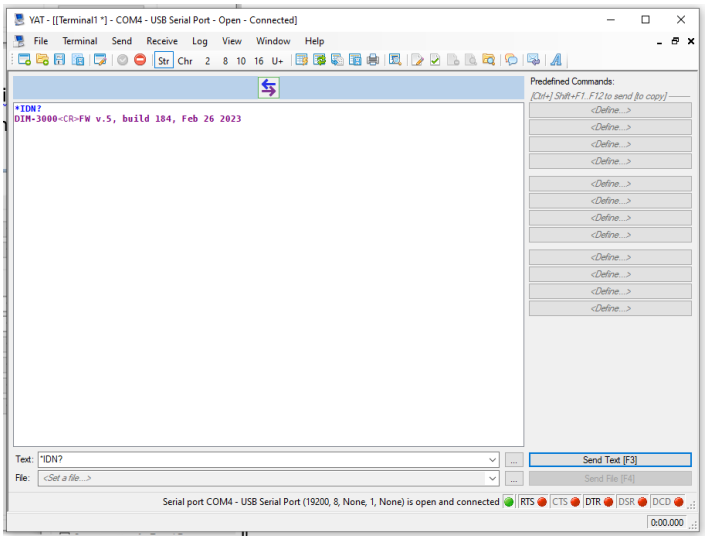
Configuration of the virtual COM-Port:
Baud Rate (bits per second) - 19200, Parity - none, Data Bits - 8, Stop Bits – 1



All commands must be terminated with "LineFeed" (LF) character. To realize this, in "Text Settings" choose EOL sequence <LF>.



Check the communication with the driver. Type e.g. *IDN? (see the DIM-3000 command list). If communication works, you will receive a reply from the current driver.



Example – programming using Python

It is assumed that the "Anaconda" program is installed on the computer
https://www.anaconda.com/download
In Anaconda Navigator find the app "Anaconda_prompt" > start app (console appears).
In console type "pip install pyserial".

In Anaconda Navigator find the app "Spyder" -> Launch
Open demo program "Python_serialport.py" (supplied by Time-Base unpon request), follow the instructions in the comments.

DIM-3000 computer commands list (FW v.10-247 May 2025)

command	description	action	output/input (units), range
***IDN?**	Identification request		device ID
FRQ?	output Frequency request		frequency, Hz
FRQs?	Frequency step request		frequency step, Hz
AMP?	output Amplitude request		dBm*10
AMO?	AM offset request		arb. units
FFRQ?	FSK Frequency request		Hz
FAMP?	FSK Amplitude request		dBm*10
sn?	serial number request		serial number
rst1	restart device		
OUT_on	RF output enabled		
OUT_off	RF output disabled		
FRQ:xxx	Setting of the output frequency		Hz, 10 – 400 MHz
FRQs:xxx	Increment/decrement step (influences regulation knob)	sets increment/decrement step	Hz, 1Hz - 10MHz
AMP:xxx	Setting of the output amplitude		dBm*10, +14 – +34 dBm
FFRQ:xxx	Setting of the FSK frequency		Hz, 10 – 400 MHz
FAMP:xxx	Setting of the FSK amplitude		dBm*10, +14 – +34 dBm
SWPm:xxx	Sweep mode	Setting sweep mode	numbers 0 – 4, 0 – sweep off 1 – triangle int. trigger 2 – triangle ext. trigger 3 – saw int. trigger 4 – saw ext. trigger
SWPs:xxx		Setting sweep Start freq.	Hz, 10 - 400 MHz
SWPp:xxx		Setting sweep stoP freq.	Hz, 10 - 400 MHz
SWPf:xxx		Setting sweep step Freq.	Hz, 10 - 400 MHz
SWPt:xxx		Setting sweep step Time	ns, 4 – 262000 ns
FM_on	FM input enabled	FM "on"	
FM_off	FM input disabled	FM "off"	
FMdev:xxx	FM deviation	Setting of the FM deviation	numbers 0 – 15, 0 - 3200Hz 1 - 6400Hz – so on
RFp_on	Pulse mode on		
RFp_off	Pulse mode off		
RFpfr:xxx	Pulse frequency		Hz, 20 - 1000
RFpdt:xxx	Pulse duty cycle		%, 1 - 99

Wseg: xxx	write segment values into memory	see Frequency segments play	
Rseg: xxx	read segment values.	see Frequency segments play	
Mseg: xxx	on/off "segment play mode".	see Frequency segments play	
following commands are adapted for computer communication			
Gdev	get device info	see explanation below	
Ginit	get initial data		
Gpar	get parameters		

Some of the following parameters can be written.
For writing, use the prefix „**S**" istead of „**R**"

For example „**Sampl:254**" – set output amplitude to 25.4dBm

Gdev
answer example:
`Rdev:ADRV4|Rhv:4|Rfv:5|Rfb:168|Rsn:111111`

parameter	description	value	read/write
Rdev	internal device name		r
Rhv	hardware version		r
Rfv	firmware version		r
Rfb	firmware build		r
Rsn	serial number		r

Ginit
answer example:
`Ramoffsmin:-225|Ramoffsmax:25|Ramoffsnom:0|Rbtstat:1|Rinit:1<LF>`

parameter	description	value	read/write
Ramoffsmin	AM offset min. value	-225	r
Ramoffsmax	AM offset max. value	25	r
Ramoffsnom	AM offset nominal value	0	r
Rbtstat	Bluetooth status (disable/ensable)	0/1	rw
Rinit		1	r

Gpar
answer example:
`Rfreq:39195001|Rampl:236|Rout:1|Rpmon:0|Rpmfr:34|Rpmd:200|Rpmphc:0|Rswpm:0|Rswps:20000000|Rswpp:71000222|Rswpf:700|Rswpt:45000|Rfmon:0|Rfmdev:11|Rplson:0|Rplsfr:66|Rplsdt:50|Rffreq:32000000|Rfampl:156|Ramoffs:0|Rpcbtemp:6175|Rrefstat:0|Rreflev:-85|Rvcclev:2418<LF>`

parameter	description	value	read/write
Rfreq	output frequency	Hz	rw
Rampl	output amplitude	dBm*10	rw
Rout	RF out off/on	0/1	rw
Rpmon	*test, please don't use*		rw
Rpmfr	*test, please don't use*		rw

Rpmd	*test, please don't use*		rw
Rpmphc	*test, please don't use*		rw
Rswpm	sweep mode	0/1/2/3/4	rw
Rswps	sweep start freq.	Hz	rw
Rswpp	sweep stop freq.	Hz	rw
Rswpf	sweep step freq.	Hz	rw
Rswpt	sweep step time	ns	rw
Rfmon	FM off/on	0/1	rw
Rfmdev	FM deviation	0-15	rw
Rplson	pulse mode off/on	0/1	rw
Rplsfr	pulse freq.	20-1000	rw
Rplsdt	pulse duty cycle	1-99	rw
Rffreq	FSK freq.	Hz	rw
Rfampl	FSK amplitude	dBm*10	rw
Ramoffs	AM offset	-225 – 25	rw
Rpcbtemp	internal temperature	°C*100	r
Rrefstat	ext. reference status	0/1	r
Rreflev	ext. reference level	arb. units	r
Rvcclev	DC voltage level	V*100	r

Appendix 1. Compatibility of the DIM-3000 functions

Most functions are independent from each other and can be used simultaneously.

	AM	**TTL**	**SWP**	**FM**
AM		**+**	**+**	**+**
TTL	**+**		**+**	**+**
SWP	**+**	**+**		**-**
FM	**+**	**+**	**-**	

Warranty

Time-Base provides the warranty for the DIM-3000 AOM driver for a period of one year starting from the date of shipment. For the warranty, the unit should be sent back to Time-Base. The customer will carry the shipping costs to Time-Base; Time Base will carry the shipment costs back to the customer.
The warranty does not cover errors and defects being the result of improper treatment, modifications, misuse or operation outside the defined ambient conditions stated in this manual.