

VOA Array Rack System

(net-ready, high precision, 70dB, high speed, SM/MM, broadband)

(US patent 8,666,218 and other patents pending)

The VOA Array Rack System is highly versatile that is cable of meeting performance requirements for all application scenarios. The system intergrades feedback minoring power taps to provide high-precision attenuation or output laser power control. Power control is lower in cost than attenuation control. Many types of VOAs can be selected. MEMS VOAs offer low cost and up to 70dB shut-off. Electro-optical NanoSpeed™ VOAs offer 800ns fast response and a high-speed laser power stabilization function that eliminates fluctuations and surges. Fiber-Fiber™ VOAs offer ultra-broadband covering from 200 to 2500nm with all types of fibers and ultra-low insertion loss.

The system is a modular pluggable design that accommodates any number of channels in a single system with various corresponding rack heights. Each standard plug-in contains up to 8 channels using compact LC connectors, and a 1U system can be configured to have 24 channels. Only the VOAs on the same plug-in module can be controlled simultaneously. There is a short time delay to control VOAs between modules. A special unit can be made in which all channels are controlled simultaneously. The same system can further integrate other modules, such as switches, power monitors, and dispersion compensators.... The standard control interface is ethernet. Other control methods may be available per request. A standard Web-based GUI is included.



Specifications

Features

- Very Low Loss
- Highly Repeatable
- Latching
- High Resolution
- Large Attenuation

Parameters	Min	Typical	Max	Unit
Operation Wavelength	300		2500	nm
Insertion Loss		0.3	0.5 [1]	dB
Polarization Dependent Loss		1	1.5 [2]	dB
Wavelength Dependence Loss		0.15	0.5	dB
Attenuation Range		0.1	0.2	dB
Attenuation Setting Repeatability	20	60	78 [3]	dB
Extinction Ratio (PM version only)			0.05	dB
Polarization Mode Dispersion (SM version only)	18	23	25	dB
Return Loss		0.01	0.05	ps
Response Time	45		100	ms
Optical Power handling (CW)		0.3	20 [4]	W
Operating Temperature	-20		75	°C
Storage Temperature	-40		85	°C
Electrical Power Input	100		230	VAC
Communication Interface (Ethernet)	SNMP	Telnet		

Notes:

- [1]. Use Ultra-broad band Precision MEMS VOA with build-in position sensor. The loss is without the connectors. Each connector adds 0.1 to 0.3dB (<https://agiltron.com/product/high-precision-optical-variable-attenuator/>)
- [2]. Conventional MEMS VOAs with tap monitor. It has a limited wavelength range due to coatings. The loss is without the connectors. Each connector adds 0.1 to 0.3dB depending on mating condition.
- [3]. 60dB and 78dB uses special MEMS VOAs and Precision MEMS VOAs
- [4]. 1W single mode and 3W multimode are only available with Precision MEMS VOAs (<https://agiltron.com/product/high-precision-optical-variable-attenuator/>)

Applications

- Power Control
- Power Regulation
- Channel Balance
- Instrumentation

Note: The specifications provided are for general applications with a cost-effective approach. If you need to narrow or expand the tolerance, coverage, limit, or qualifications, please [click this link](#):

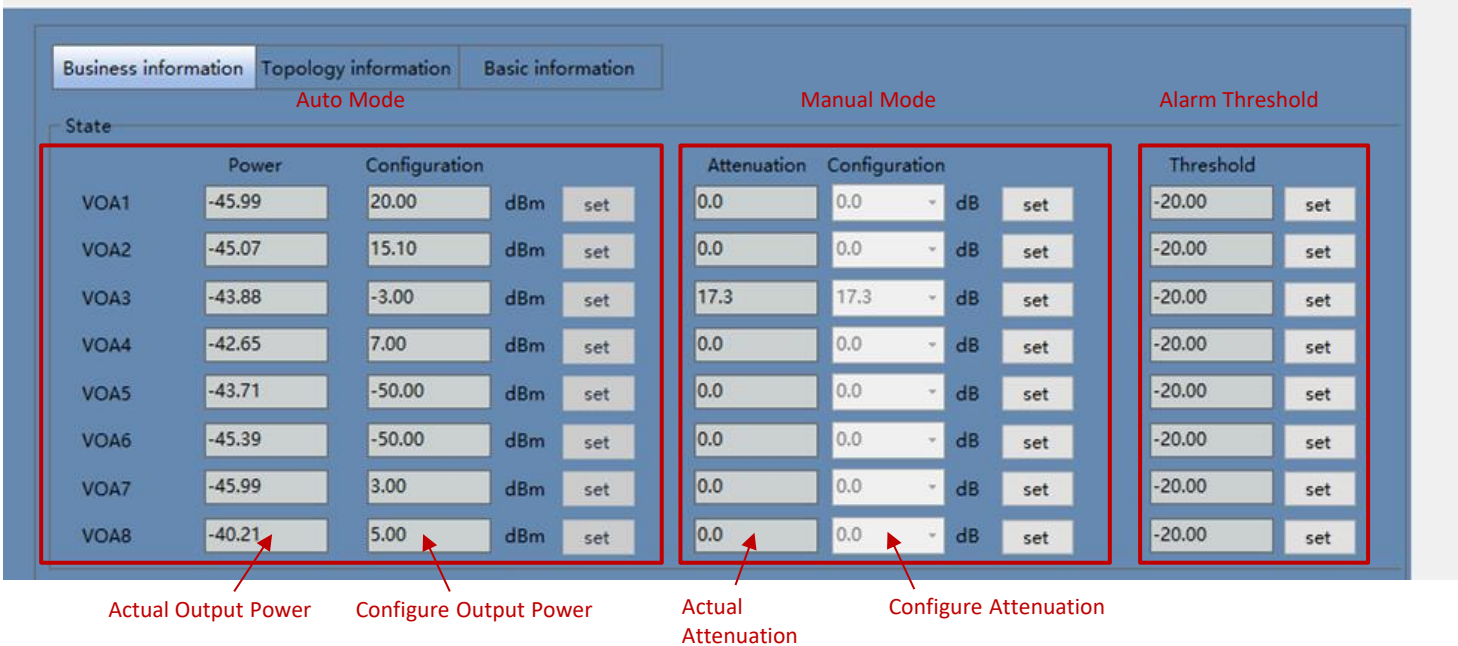
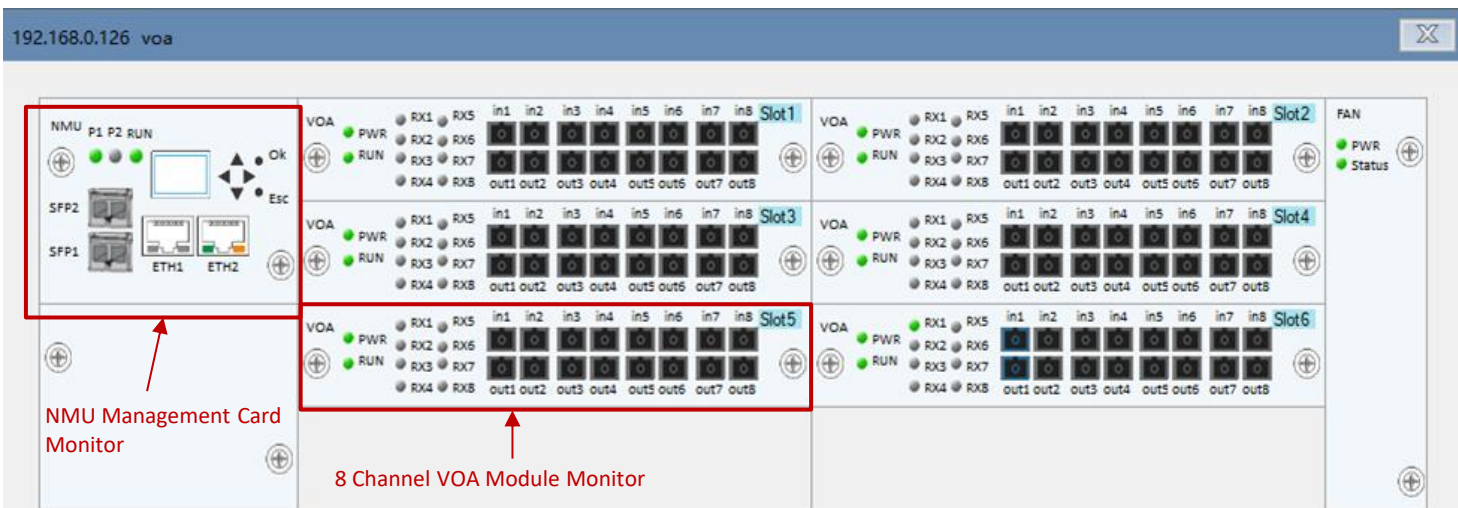
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GUI Software

- The system contains tap monitor on each channel output providing attenuation and power control function.



We provide a command list for customers to write their control code, such as Python



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Mechanical Footprint Dimensions (mm)

19" rack. The unit will select the minimum height to accommodate the channel count and connector type

For 1U chassis

- Choose LC connectors up to 32 Channels; 4 pluggable cards
- Choose FC, SC, or ST connectors for up to 16 Channels; 2 pluggable cards

*Product dimensions may change without notice. This is sometimes required for non-standard specifications.

Ordering Information

- The system includes a rack-mount box of from 1U up to 6U with multiple plug-in modules
- Pluggable module order information below, each module accommodate up to 8 channels power control with LC connectors

Prefix	Channel	Speed	Configuration ^[1]	Test Wavelength	Fiber type	Attenuation	Connector	Interface ^[2]	Output Power ^[3]
VOAS-	8 = A8 16 = 16 24 = 24 32 = 32 ... 96 = 96	MEMS 100ms = 1 NS 10µs/18dB = 2 NS 10µs/35dB = 3 NS 10µs/50dB = 5 NS 1µs/18dB = 6 NS 1µs/35dB = 7 NS 1µs/50dB = 8 Latching 100ms = L	Transparent Auto Output Control = 1 Transparent Auto Attenuation Control = 2 Opaque Auto Output Control = 7 Opaque Auto Attenuation Control = 5 5W NS Transparent/Auto Output Control = H Special = 0	1260-1620 = C 488 = 4 532 = 5 630 = 6 780 = 7 850 = 8 980 = 9 1060 = 1 1310 = 3 1550 = A 2000 = 2 Special = 0	Pick from the below table	35dB = 1 60 dB = 2 65 dB = 3 70 dB = 4	FC/PC = 2 FC/APC= 3 SC/PC = 4 SC/APC= 5 ST/PC = 6 LC/PC = 7 MTP = 9 LC/APC = A LC/UPC = U Special = 0	Ethernet = E RS232 = R 0-5V = A UART = U	N/A = NA 0.001W = A1 0.002W = A2 ... 0.01W = B1 0.02W = B2 ... 0.1W = C1 0.2W = C2 ... 1W = D1 2W = D2 ... 9W = D9 10W = 10 ... 20W = 20

[1]. **Transparent:** The device passes light without applying electrical voltage.

Opaque: The device blocks light without applying electrical voltage.

Auto Output Control: Using one output tap to feed-back control the output power.

Auto Attenuation Control: Using input and output taps to subtract feed-back control the attenuation

[2]. **A and U** are choice for NS type fast VOA only. Each channel has a dedicated connection on the front panel. UART is a digital control format that can also be converted into USB interface. A GUI is provided.

[3]. For the selection of auto output power control only. Since the VOA has a limited dynamic range, a maximum output power needs to be selected and the minimum controllable output power = max output setting – dynamic range-insertion loss.

Fiber Type Selection Table:

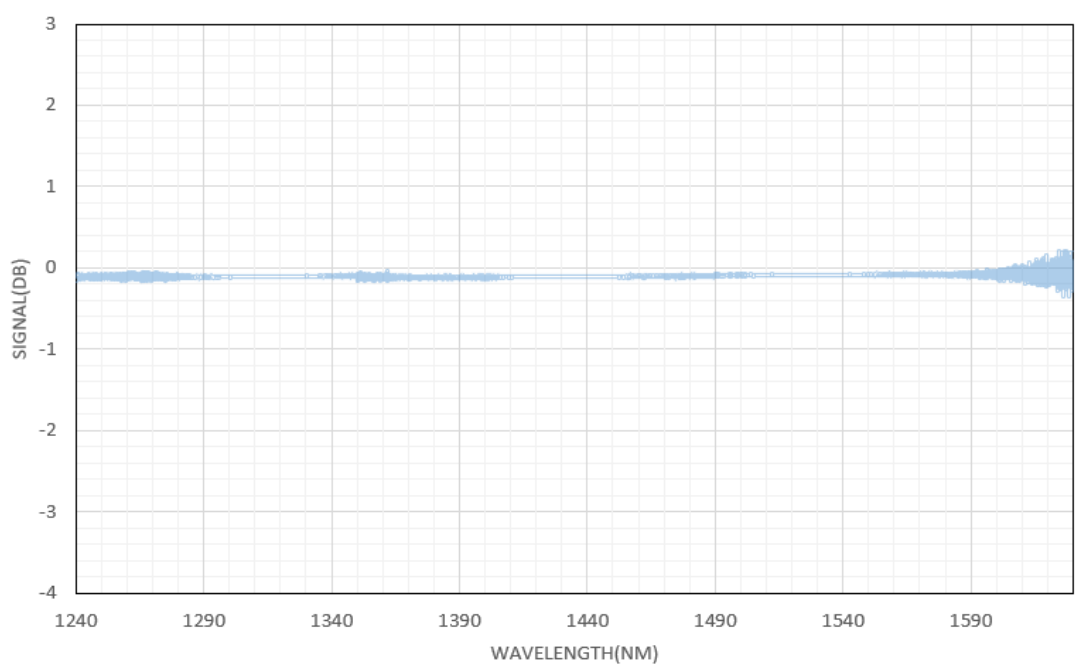
01	SMF-28	34	PM1550	67	OM1 (MMF 62.5/125µm)
02	SMF-28e	35	PM1950	68	OM2 (MMF 50/125µm)
03	Corning XB	36	PM1310	69	OM3 (MMF 50/125µm)
04	SM450	37	PM400	70	OM4 (MMF 50/125µm)
05	SM1950	38	PM480	71	GIF50 (GIF 50/125µm)
06	SM600	39	PM630	72	GIF625 (GIF 62.5/125µm)
07	Hi780	40	PM850	73	105/125um
08	SM800	41	PM980	74	FG105LCA
09	Hi980	42		75	FG50LGA
10	Hi1060	43	PM780	76	
11	Draka BBE	44		77	
12		45		78	

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Typical Insertion Loss vs Wavelength (1240-1630nm)



Application Notes

Fiber Core Alignment

Note that the minimum attenuation for these devices depends on excellent core-to-core alignment when the connectors are mated. This is crucial for shorter wavelengths with smaller fiber core diameters that can increase the loss of many decibels above the specification if they are not perfectly aligned. Different vendors' connectors may not mate well with each other, especially for angled APC.

Fiber Cleanliness

Fibers with smaller core diameters (<5 μm) must be kept extremely clean, contamination at fiber-fiber interfaces, combined with the high optical power density, can lead to significant optical damage. This type of damage usually requires re-polishing or replacement of the connector.

Maximum Optical Input Power

Due to their small fiber core diameters for short wavelength and high photon energies, the damage thresholds for device is substantially reduced than the common 1550nm fiber. To avoid damage to the exposed fiber end faces and internal components, the optical input power should never exceed 20 mW for wavelengths shorter 650nm. We produce a special version to increase the how handling by expanding the core side at the fiber ends.



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Operation Manual

1. Connect a control signal to the SMA connector on the PCB.
2. Attach the accompanied power supply (typically a wall-pluggable unit).
3. The device should then function properly.

Note: Do not alter device factory settings.

Questions and Answers

Q: If the device were to fail, would the switch continue to pass the fiber light through the switch as configured before failure? When power is restored, does the IN/OUT configuration before failure remain in place?

A: This depends, if one mirror fails, it only affects the light go through that mirror. Yes, when power back up it will go to the previous points

Q: When power is restored, does the IN/OUT configuration before failure remain in place?

A: Yes, when power back up it will go to the previous flightpath

Q: If power to the device were shutoff, would the device continue to pass the fiber light as configured before failure?

A: This function is call latching. We uniquely offer MEMS latching switch but cost more.

Q: With the Ethernet Control Option, does the switch support SNMPv3

A: Yes. This internet standard protocol allows user to write their own control code

Q: With the Ethernet Control Option, what type of encryption does the SNMPv3 use?

A: MD5/DES

Q: With the Ethernet Control Option, could this device be controlled by multiple users at different locations and all users will also see the configuration updates?

A: Yes

Q: With the Ethernet Control Option, could this switch be controlled by multiple users at different locations and all users will also see the configuration updates?

A: Yes

Q: With the Ethernet Control Option, does the user need to install any software on their computer other than a web browser?

A: No



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Command List (page 1)

```

Login:
1, Use the Windows Command Prompt,
2, telnet 192.168.1.200 or the current IP address
3, Username: root
4, Password: fs19681086

***** Command List *****
1, Request General information:
NMC B_?
Example:
[FAST@h \W]# NMC B_?
Show NMC Info:
===== NMC Chassis Info =====
Name Power1Status Power2Status FanSwitch FanStatus DateTime
OTNS4443 open close open close 2021-07-15 08:28:13

===== NMC Basic Info =====
Type Slot SoftVer HardVer MadeDate DevType SeqNum
NMC 00 1.08.15 1.02.01 2021-01-01 OTNS-M4 1234567890AB

===== NMC Payload Info =====
Name Payload(%) PayloadThr(%) Status
CPU 2 80 normal
Memory 9 80 normal

===== NMC Database Info =====
Name AutoBackup(day) AutoRecord(hor) Capacity(row)
DBM 1 1 200

===== NMC Network Info =====
Version Switch NetAddress Netmask Gateway MacAddress
IPv4 open 192.168.001.200 255.255.255.000 192.168.001.001 70-b3-d5-46-04-29
IPv6 close fe80:0:0:0:1034:56 ff:fe78:9126/64 fe80:0:0:0:0:0:1 70-b3-d5-46-04-29

===== NMC SNMP Info =====
Version ReadCom WriteCom AuthPassword PrivPassword TrapIP TrapIP2
IPv4 public private 123456789 123456789 127.000.000.001 127.000.000.001
IPv6 public private 123456789 123456789 0:0:0:0:0:0:1

===== NMC RemoteLog Info =====
Version Switch NetAddress
IPv4 open 127.000.000.001
IPv6 close 0:0:0:0:0:0:1

```

2, Fan Operation:

2.1 Turn on the Fan

NMC FNC_1

2.2 Turn off the Fan

```

NMC FNC_0
Return Success or Fail
Example:
[FAST@h \W]# NMC FNC_1
Send: FNC_1
Return: Operation Success
[FAST@h \W]#
[FAST@h \W]# NMC FNC_0
Send: FNC_0
Return: Operation Success
[FAST@h \W]#

```



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Command List (page 2)

3, Set System Time

```
NMC TIME_2021-07-05-14-02-02
Example:
[FAST@h \W]# NMC TIME_2021-07-05-14-02-02
Send: TIME_2021-07-05-14-02-02
Return: Operation Success
[FAST@h \W]#
```

4, Set the Payload

4.1 CPU payload

```
NMC CPULIM_xx
Note: xx is the payload of CPU, from 1~99
Example: Set the CPU payload to 80%
[FAST@h \W]# NMC CPULIM_80
Send: CPULIM_80
Return: Operation Success
[FAST@h \W]#
```

4.2 Memory Payload

```
NMC MEMLIM_xx
Note: xx is the payload of system memory, from 1~99
Example: Set the memory payload to 80%
[FAST@h \W]# NMC MEMLIM_80
Send: MEMLIM_80
Return: Operation Success
[FAST@h \W]#
```

5, Network Operations

5.1 IP address

```
NMC IP_192.168.1.200
Example:
[FAST@h \W]# NMC IP_192.168.1.200
Send: IP_192.168.1.200
Return: Operation Success
[FAST@h \W]#
```

5.2 Subnet Mask

```
NMC MSK_255.255.255.000
Example:
[FAST@h \W]# NMC MSK_255.255.255.000
Send: MSK_255.255.255.000
Return: Operation Success
[FAST@h \W]#
```

5.3 Gateway

```
NMC GW_192.168.1.1
Example:
[FAST@h \W]# NMC GW_192.168.1.1
Send: GW_192.168.1.1
Return: Operation Success
[FAST@h \W]#
```



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Command List (page 3)

6, Card information

CARD -c xx B_?
 xx is the card slot number, 2~16
 Example:
 [FAST@h \W]# CARD -c 16 B_?
 Show Card Info:

===== CARD Monitor Info =====

Chan	Mode	Wave(nm)	CurrPower(dBm)	ConfigPower(dBm)	CurrAtten(dB)	ConfigAtten(dB)	OutputThr(dBm)	OutputState
1	auto	1550	-50	-63.15	36	36	-69	normal
2	auto	1550	-50	-63.1	40	40	-19	alarm
3	auto	1550	-50	-63.1	40	40	-19	alarm
4	auto	1550	-50	-63.15	0	0	-19	alarm
5	auto	1550	-50	-63.1	0	0	-19	alarm
6	man	1550	-50	-63.13	9	9	-19	alarm
7	auto	1550	-50	-63.13	0	0	-18	alarm
8	man	1550	-50	-63.18	0	0	-70	normal

===== CARD Basic Info =====

Type	Slot	SoftVer	HardVer	MadeDate	DevType	SeqNum
VOA8	16	1.05.01	1.01.02	2021-03-16	VOA8-2table	123456789012

7, VOA Operations

7.1 Single Channel working mode setup

CARD -c xx My_z
 Note:
 xx is the slot number of the card, from 2~16
 y is the Channel number on the card, from 1~8
 z is the mode, 1 is auto mode, 0 is manual mode
 Example of setting the channel 1 on Card 16 to auto mode:
 [FAST@h \W]# CARD -c 16 M1_1
 Send: M1_1
 Return: Operation Success
 [FAST@h \W]#
 Example of setting the channel 1 on Card 16 to manual mode:
 [FAST@h \W]# CARD -c 16 M1_0
 Send: M1_0
 Return: Operation Success
 [FAST@h \W]#

7.2 All Channels working mode setup

CARD -c xx MTOT_z_z_z_z_z_z_z_z
 Note:
 xx is the slot number of the card, from 2~16
 z is the mode, 1 is auto mode, 0 is manual mode
 Example to set the channel 1 and 2 on card 16 to auto mode, the rest channels are set to manual mode:
 [FAST@h \W]# CARD -c 16 MTOT_1_1_0_0_0_0_0_0
 Send: MTOT_1_1_0_0_0_0_0_0
 Return: Operation Success
 [FAST@h \W]#



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Command List (page 4)

7.3 Single Channel wavelength setup

CARD -c xx Wy_z

Note:

xx is the slot number of the card, from 2~16

y is the Channel number on the card, from 1~8

z is the wavelength code, 1 is 1550nm, 0 is 1310nm

Example of setting the wavelength of channel 1 on card 16 to 1550nm:

[FAST@h \W]# CARD -c 16 W1_1

Send: W1_1

Return: Operation Success

[FAST@h \W]#

Example of setting the wavelength of channel 1 on card 16 to 1310nm:

[FAST@h \W]# CARD -c 16 W1_0

Send: W1_0

Return: Operation Success

[FAST@h \W]#

7.4 All Channels wavelength setup

CARD -c xx WTOT_z_z_z_z_z_z_z_z

Note:

xx is the slot number of the card, from 2~16

z is the wavelength code, 1 is 1550nm, 0 is 1310nm

Example of setting the channel 1 and 2 on card 16 to 1550nm, the rest channels are set to 1310nm:

[FAST@h \W]# CARD -c 16 WTOT_1_1_0_0_0_0_0_0

Send: WTOT_1_1_0_0_0_0_0_0

Return: Operation Success

[FAST@h \W]#

7.5 Single Channel Output Power setup

CARD -c xx Py_z

Note:

xx is the slot number of the card, from 2~16

y is the Channel number on the card, from 1~8

z is the power in dBm

Example of setting the output power of Channel 1 on card 16 to 2dBm:

[FAST@h \W]# CARD -c 16 P1_2

Send: P1_1

Return: Operation Success

Example of setting the output power of Channel 1 on card 16 to -1dBm:

[FAST@h \W]#

[FAST@h \W]# CARD -c 16 P1_-1

Send: P1_-1

Return: Operation Success

[FAST@h \W]#

7.6 All Channels Output Power setup

CARD -c xx PTOT_z_z_z_z_z_z_z_z

Note:

xx is the slot number of the card, from 2~16

z is the power in dBm

Example of setting the output power of Channel 1 and 2 on card 16 to 1dBm, the rest channels to 2dBm:

[FAST@h \W]# CARD -c 16 PTOT_1_1_2_2_2_2_2_2

Send: PTOT_1_1_2_2_2_2_2_2

Return: Operation Success

[FAST@h \W]#



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Command List (page 5)

7.7 Single Channel attenuation setup

CARD -c xx Ay_z

Note:

- xx is the slot number of the card, from 2~16
- y is the Channel number on the card, from 1~8
- z is the attenuation in dB

Example of setting the output power of Channel 1 on card 16 to 10dB:

[FAST@h \W]# CARD -c 16 A1_10

Send: A1_10

Return: Operation Success

[FAST@h \W]#

[FAST@h \W]# CARD -c 16 A1_20

Send: A1_20

Return: Operation Success

[FAST@h \W]#

7.8 All Channels attenuation setup

CARD -c xx ATOT_z_z_z_z_z_z_z_z

Note:

- xx is the slot number of the card, from 2~16
- z is the attenuation in dB

Example of setting the output power of Channel 1 and 2 on card 16 to 1dB, the rest channels to 2dB:

[FAST@h \W]# CARD -c 16 CARD -c 16 ATOT_1_1_2_2_2_2_2_2

Send: ATOT_1_1_2_2_2_2_2_2

Return: Operation Success

[FAST@h \W]#

7.9 Single Channel alarm level setup

CARD -c xx RXy_z

Note:

- xx is the slot number of the card, from 2~16
- y is the Channel number on the card, from 1~8
- z is the power level in dBm

Example of setting the alarm level of channel 1 on card 16 to -20dBm

[FAST@h \W]# CARD -c 16 RX1_-20

Send: RX1_-20

Return: Operation Success

[FAST@h \W]#

Example of setting the alarm level of channel 1 on card 16 to -21dBm

[FAST@h \W]# CARD -c 16 RX1_-21

Send: RX1_-21

Return: Operation Success

[FAST@h \W]#

7.10 All Channels alarm level setup

CARD -c xx RXTOT_z_z_z_z_z_z_z_z

Note:

- xx is the slot number of the card, from 2~16
- z is the power level in dBm

Example of setting the alarm level of Channel 1 and 2 on card 16 to -10dB, the rest channels to -20dB:

[FAST@h \W]# CARD -c 16 RXTOT_-10_-10_-20_-20_-20_-20_-20_-20

Send: RXTOT_-10_-10_-20_-20_-20_-20_-20_-20

Return: Operation Success

[FAST@h \W]#