



COMMISSIONING GUIDE



MP-PS-A

MID POWER Advanced

Dual Band Digital Radio

UL2524

Supports Band 700/800/900/UHF/VHF

Supports Tetra/P25/DMR/PMR/LTE

Passive Cooling

HVIN: PS-R232UA



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- This is NOT a CONSUMER device. It is designed for installation by an installer approved by an ISSED licensee. You MUST have an ISSED LICENCE or the express consent of an ISSED licensee to operate this device.
- Il ne s'agit PAS d'un dispositif CONSOMMATEUR. Il est conçu pour être installé par un installateur agréé par un titulaire de licence ISSED. Vous devez avoir un LICENCE ISSED ou le consentement exprès d'un titulaire de licence de l'ISSED pour l'utilisation de cet appareil.
- To comply with FCC&IC RF exposure compliance requirements, each individual antenna used for this transmitter must be installed to provide a separation distance greater than 57cm or more from all persons during normal operation and must not be co-located with any other antenna for meeting RF exposure requirements.
- Pour se conformer aux exigences FCC&IC en matière d'exposition RF, chaque antenne utilisée pour cet émetteur doit être installée pour assurer une distance de séparation supérieure ou égale à 57 cm de toutes les personnes pendant le fonctionnement normal et ne doit pas être co-localisée avec une autre antenne pour satisfaire aux exigences d'exposition RF.
- Antenna gain should not exceed 0 dBi.
- Le gain d'antenne ne doit pas dépasser 0 dBi

Note: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including



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interference that may cause undesired operation.

NOTE: This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.



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System Overview

CrossFire MP-PS-A is a dual band digital DAS system supporting public safety coverage on fiber optic cable using the CPRI protocol. It adopts Feed-Forward and Class AB PA technology, allowing for deployment of legacy narrow band solutions while still benefiting from the digital transmission and filtering functionality. This platform is ideal for P25, DMR, PMR, LTE & Tetra technology either as standalone or complimentary with wide-band cellular deployments.

System Features

Up to 30dBm for VHF	Dual Band per Remote Unit
Up to 37dBm for UHF	UL-2524 Compliant
Up to 40dBm for 700/800/900MHz	Band/Carrier Selective Digital Filters
Radio Cascading and Loop	UL Squelch

System Connection

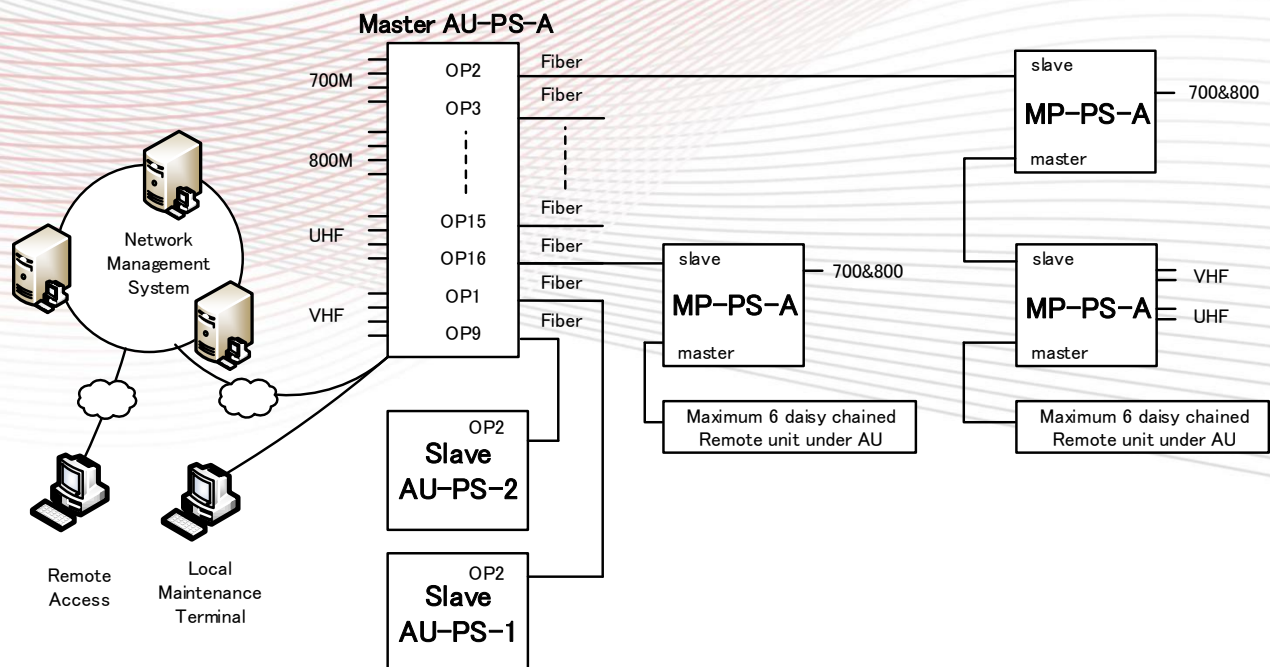


Figure 1. Typical System Connection

Pre-Commissioning

Before starting the commissioning process, verify the status of the equipment as follows:

Access Unit (AU-PS-A)

1. Verify that the correct band-specific Active Combiner modules are installed.
2. Ensure the RF cables between the BTS and modules on AU-PS-A are connected as designed.
3. Ensure the fibers are connected to the proper optical ports as designed.
4. Check LED of Status and Optical ports.

Remote Unit (MP-PS-A)

1. Verify that the correct band-specific PA modules are installed.
2. Ensure the RF cables from each RF port are connected tightly.
3. Ensure the optical transceivers are inserted and fibers are connected to the proper optical ports as designed.
4. Check LED of Status and Optical ports.

Interfaces and Indicators

AU-PS-A and MP-PS-A Interfaces and the Indicators are as below.

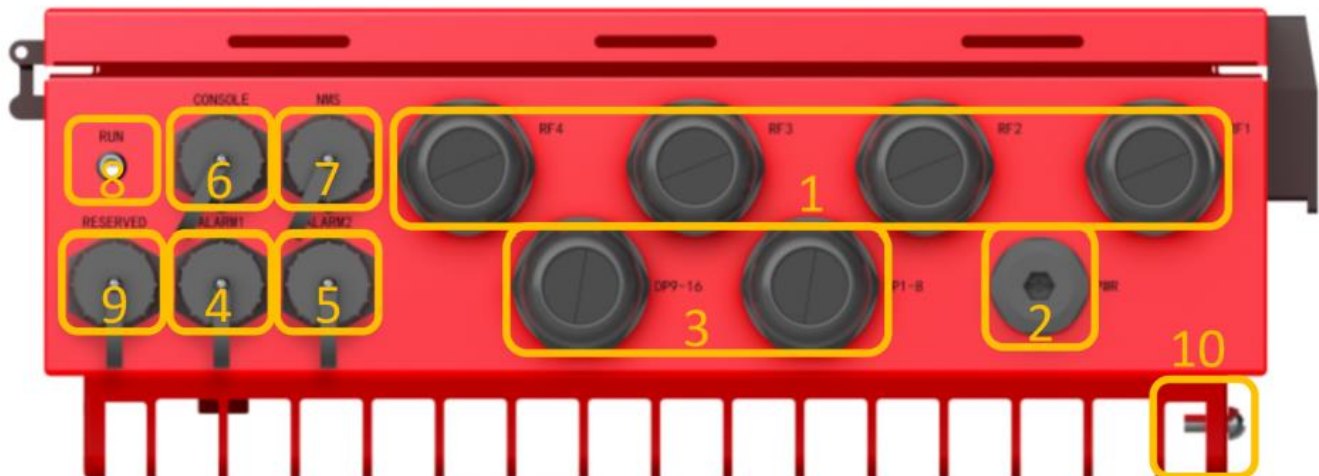


Figure 2. AU-PS-A Interface

1	4x Quad-Core RF Cable Glands	6	RJ-45 OMT Access Ethernet Port
2	Power	7	RJ-45 NMS Access Ethernet Port
3	2x Octa-Core Fiber Cable Glands	8	LED Status Indicator
4	RJ-45 External Alarm Interface 1	9	Reserved Annunciator Port
5	RJ-45 External Alarm Interface 2	10	GND

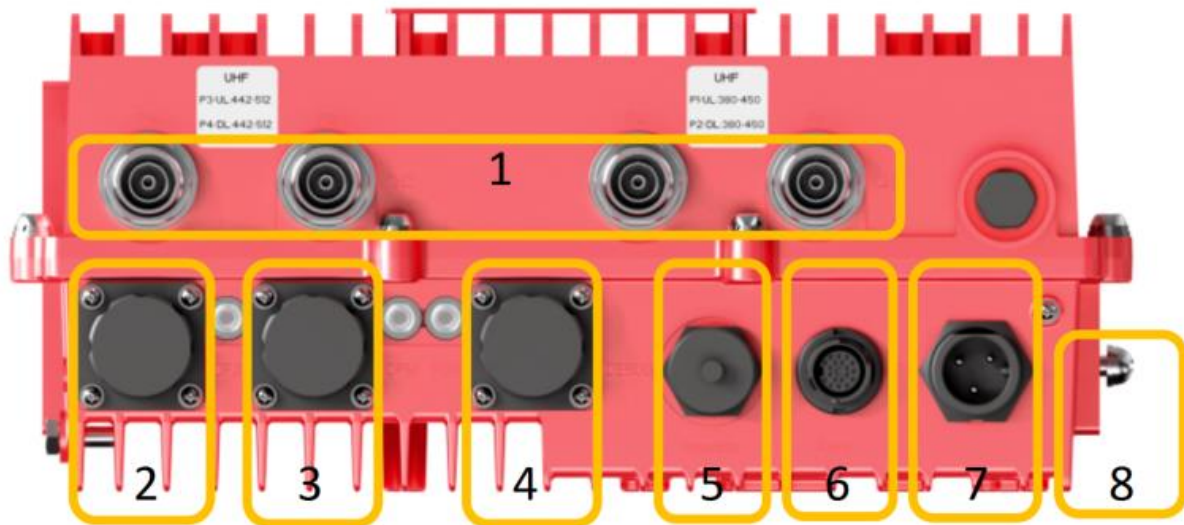


Figure 3. MP-PS-A Optical Port

1	1 ~ 4 RF Port (Number of ports depends on the band configuration)		
2	Slave OP Port	3	Master OP Port
4	RJ-45 Maintenance Interface	5	RJ-45 for Annunciator
6	Socket for External Alarms	7	Power
8	GND		

Optical Indicator	Description
Green	Normal
Red	The optical path is not synchronized, or optical module is not plugged in



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Status Indicator	Description
Flash Green	Element is working without an alarm
Solid Green	Software is crashed, but it will reboot automatically in 3 mins
Flash Red	Element is working but with alarm
Solid Red	Software is crashed (with alarm), but it will reboot automatically in 3 mins
Flash Orange	Software is upgrading
Solid Orange	Element is booting

Operation and Maintenance Terminal

The Operations and Maintenance Terminal (OMT) software runs on all devices in the CrossFire system. WebOMT is the interface for OMT. WebOMT is based on a web browser and is compatible with most common browsers such as IE and Google Chrome. WebOMT is customized for CrossFire to query, debug, and configure parameters on devices.

The Master AU-PS-A is generally set as the Host of the system. Meanwhile, technicians can access the whole system through the WebOMT of any device (Master or Slave AU and RU) connected in the system.

Access to the OMT on the Master AU-PS-A

In the CrossFire system, the Master AU-PS-A is defined as Host. The default IP address of the AU-PS-A is 10.7.3.200.

To set up wired access to the OMT:

1. Connect a PC to the Master AU with a network cable in the CONSOLE port on the front panel.
2. Change the TCP/IP properties (see Figure 3):
 - a. Click Network Connections
 - b. Click Local Area Connection Properties
 - c. Click TCP/IP Properties
 - d. Change parameters as indicated:

IP address: 10.7.3.1 (the last number is changeable except for 10.7.3.200)

Subnet mask: 255.0.0.0

Default Gateway: 10.7.3.200 (IP address of Master AU-PS-A)
3. Check the status of the Local Area Connection and confirm the connection.
4. Open a browser window and enter the default gateway in the navigation bar to access the WebOMT page. Figure 6 shows an example using <https://10.7.3.200> as the default gateway.

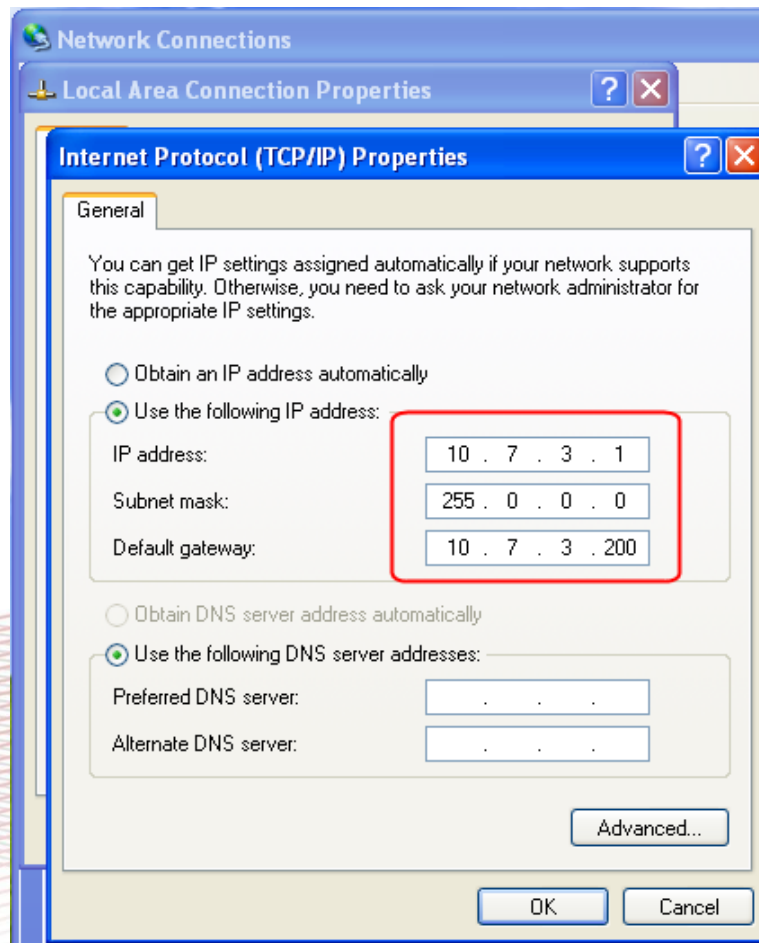


Figure 4. Wired Connection to the OMT on the Master AU-PS-A

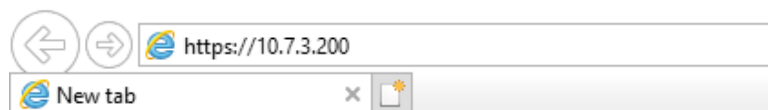


Figure 5. Web Browser OMT Connection for Wired Access

Access to the OMT on the Slave Devices

In the CrossFire system, MP-PS-A and AU-AIR, as well as the Slave AU-PS-A, are defined as Slaves. They have no fixed IP address. The IP addresses are assigned by the host automatically, based on the network topology.

To set up wired access to the OMT:

1. Connect a PC to the slave device with a network cable in the CONSOLE / DEBUG port on the front panel.
2. Change the TCP/IP properties (see Figure 6):
 - a. Enable Obtain an IP address automatically by clicking the check box.
 - b. Enable Obtain DNS server address automatically by clicking the check box.
3. Check the status of the Local Area Connection and confirm the connection.
4. Open a browser window and enter the default gateway in the navigation bar to access the WebOMT page. Figure 11 shows an example using <https://12.7.1.1> as the default gateway.

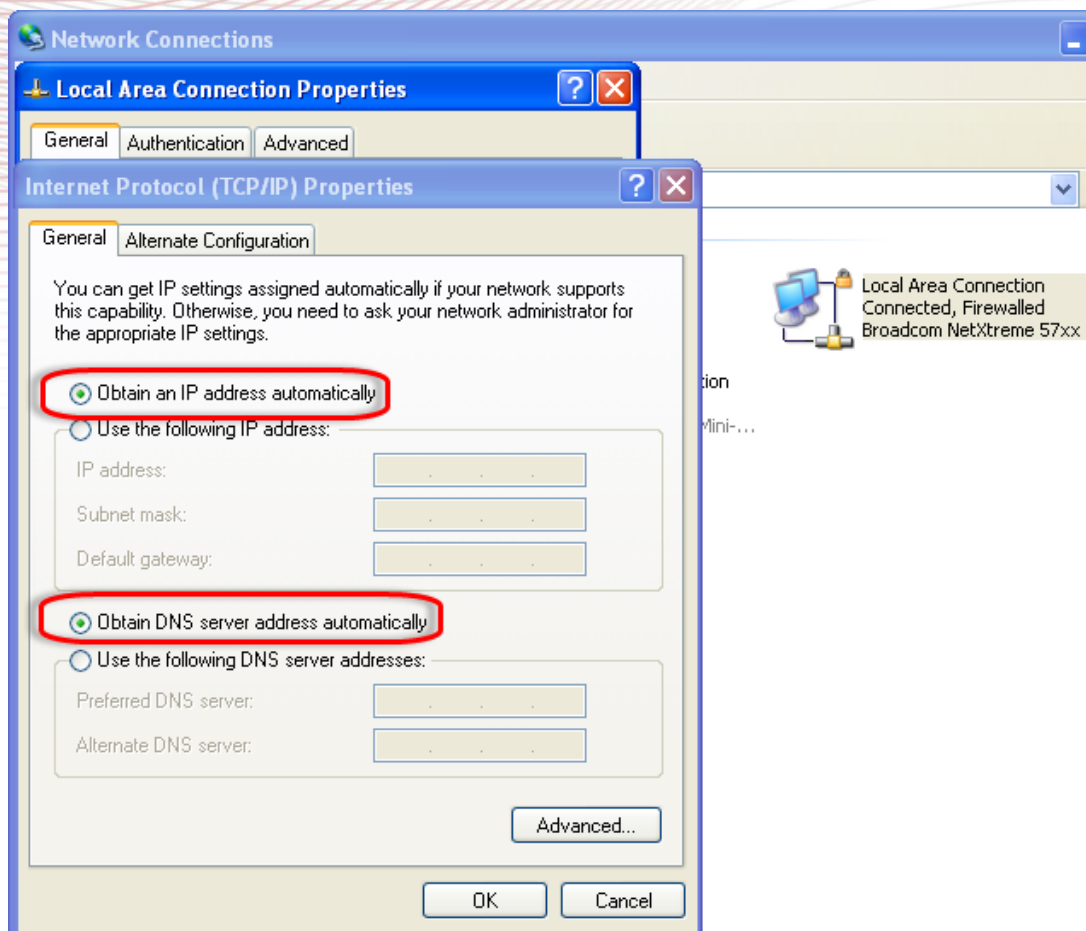


Figure 6. TCP/IP Properties Configuration – Slave devices

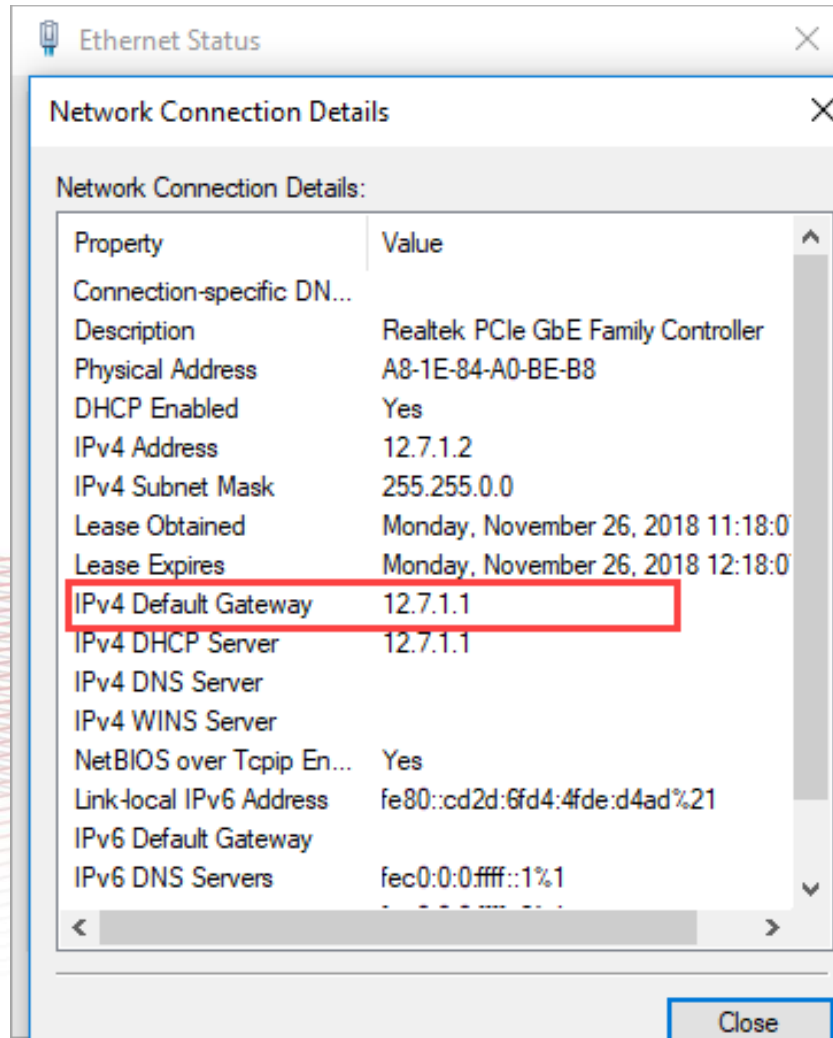


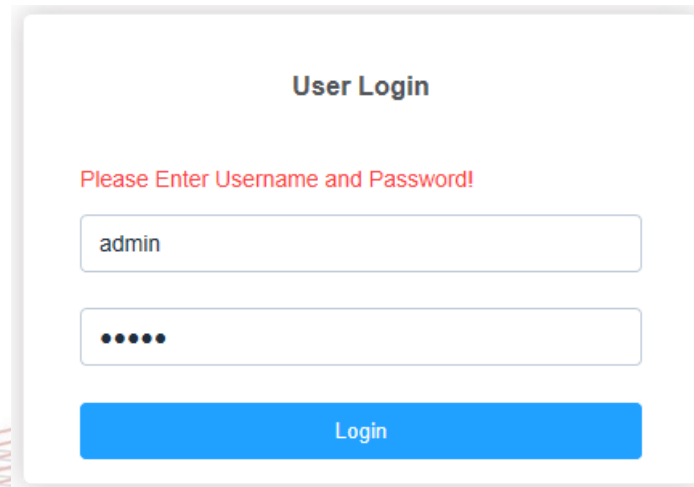
Figure 7. Wired Connection to the OMT on the Master AU-PS-A



Figure 8. Web Browser OMT Connection for Wired Access

User Login

1. Enter the IP address of the OMT you are trying to access.
2. Type the username and password in the field.



The image shows a 'User Login' dialog box. At the top, it says 'User Login'. Below that, a red message says 'Please Enter Username and Password!'. There are two input fields: the first contains the text 'admin', and the second contains six dots representing a password. Below the fields is a blue button labeled 'Login'.

Figure 9. Login Screen

Account	Password	Access Level
admin	admin (default)	Fully administration permissions. (User Management)
Others	(null)	Installer, configuration, monitoring

Note: Only the **admin** account has the permission of user management, including creating a user profile, changing password.

Homepage and Basic Functions

When first logged in OMT, it displays the main page, as shown in Figure 9.

The topology of the system displays in the center of the main page.

Device icons in the topology have 2 colors:

Green icon: indicates this element is connected.

Red icon: indicates this element was once connected but is currently disconnected.

 This symbol indicates the devices with alarms.

When a red icon shows up, check whether this device exists or not. If the device does not exist anymore, delete the device in the DAS Topo page.

Note: Deleting one device or all slave devices must be under **Factory Mode**. Access **Factory Mode** through **Maintenance -> Factory Command -> Factory Mode**. Enable the mode and click **Set** to validate it.



Figure 10. WebOMT Homepage

Tabs, buttons, and fields description (refer to corresponding numbers in Figure):

No.	Name	Description
1	Site Info	Includes "Device ID", "Device Sub ID", "Dev Type" and "Dev Name" information
2	Screenshot	Button used for saving the current parameter information and device operating status. (See more details in Section Screenshot)
3	Logs	Records the operating status of the devices. The logs can be downloaded and deleted on the Logs page.
4	Upgrade	Access to function that enables system and element upgrades. See more details in Section 5.5 Software Upgrade.
5	Register	This function is for BTI factory use only.
6	Configuration	Access to manage configuration files and restore configurations.
7	Log Out	Button used for logging out.
8	Operation Interface	Queries status and sets parameters.
9	Online User	Shows the users that are currently connected to the OMT and the IP address of each user's device.
10	Operation Bar	Tabs that access pages that display and allow setting of device parameters.
11	Parameters Backup	Buttons that show/hide the parameter ID number & checkbox and save configuration parameters. See more details in Section 5.4 Backup/Restore Configuration.
12	Users	Displays user list.

Operation Bar

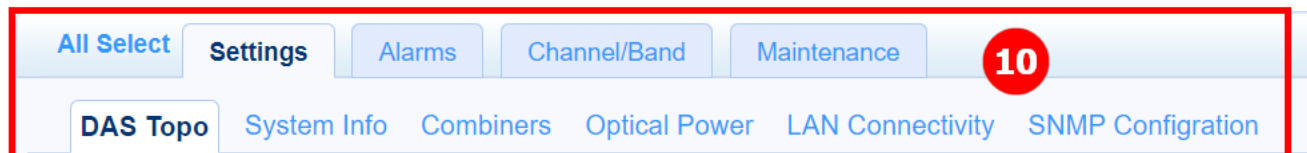


Figure 11. Operation Bar

Name	Description
Settings	
DAS Topo	All devices are automatically discovered and displayed in the topology.
System Info	Displays digital filter operating frequency, device temperature, etc.
Combiners	Displays Input power per port per module and adjusts the attenuation
Optical Power	TX / RX Power of SFP Modules.
LAN Connectivity	Displays general information includes software version, site information, serial number, etc.
SNMP Configuration	SNMP Configuration.
Alarms	
Device Alarms	Access to the real-time device general alarm list.
DL Input Power Alarms	Access to the real-time downlink input alarm list. Including Over input power alarm and under input power alarm.
Alarm Thresholds	Access to configure the alarm threshold as an over-temperature alarm threshold, input power alarm threshold, etc.
Channel/Band	
Radio Module 1/2/3/4	Operating channel/band frequency configuration;
Channel Power	Displays the channel power
Maintenance	
Digital Info	Displays digital baseband power and SFP parameters (TX/RX Power, voltage, wavelength, etc.)
Engineer	Access to maintenance function.
Software Package Info	Displays the current software package information and CRC code. Delete the saved software package by clicking the button Clear.
Factory Command	Used to obtain the permission to delete unwanted devices in the topology and initialize all alarms.

Network & Communicating Settings

The CONSOLE port of the Master AU-PS-A is pre-assigned from the factory with the default IP address – 10.7.3.200. To enable local/remote access to the system, you must assign a unique routable address within the domain of the local/wide-area-network.

Configure the IP address of the CONSOLE port as follows:

1. Log in the Master AU OMT, and go to the LAN Connectivity section.
2. Go to the IP Settings section and assign the following fields as appropriate:

Protocol - The CrossFire system supports SNMP (Get & Set, Trap, etc.) and BTI NMS(UDP) for remote monitoring.

NMS IP Addr - The BTI NMS IP Addr

NMS Port - The Port number assigned for communication with BTI NMS

Device IP Addr 1(NMS) - The address assigned to the AU for local and remote access

Subnet Mask1(NMS)

Default Gateway1(NMS)

Device IP Addr2(CONSOLE) - The address assigned to the AU only for local access

Device Port (UDP) - The Port number assigned for communication with BTI NMS

Heartbeat Interval - The interval in which the Master AU sends a heartbeat to the surveillance server.

3. Click Set to save the setting.

IP Settings			
☐	Protocol	UDP	✓
☐	NMS IP Addr	10.7.3.100	
☐	NMS Port	80	
☐	Device IP Addr1(NMS)	10.7.3.200	
☐	Subnet Mask1(NMS)	255.0.0.0	
☐	Default Gateway1(NMS)	10.7.0.1	
☐	Device IP Addr2(CONSOLE)	9.7.3.200	
☐	Subnet Mask2(CONSOLE)	255.0.0.0	
☐	Default Gateway2(CONSOLE)	9.7.0.1	
☐	Device Port(UDP)	100	
☐	Heartbeat Interval Time	300	s

Figure 12. IP Address Configure

NMS Configuration

BTI Network Management System (NMS) is a software system to achieve remote monitoring, alarm reporting, and remote configuration of all the devices.

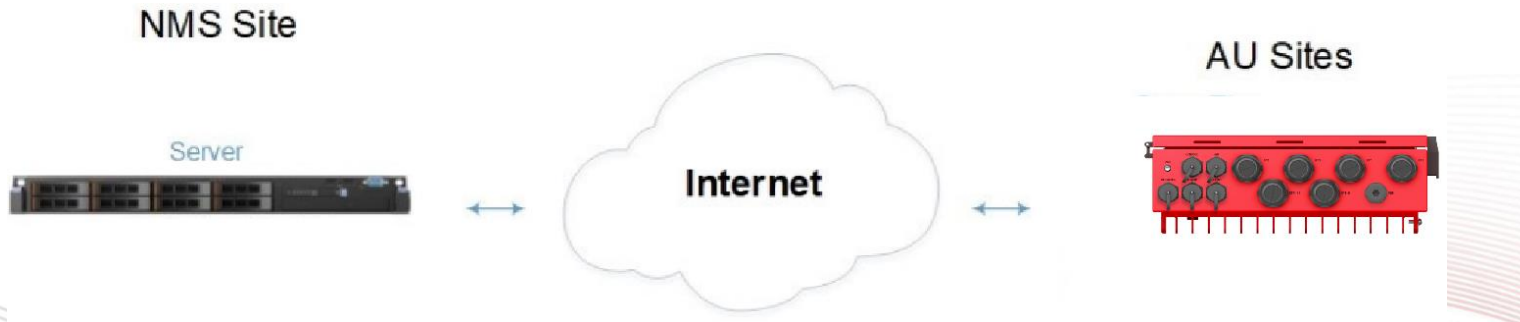


Figure 13. NMS System Architecture

Use the following steps to configure NMS IP settings.

1. Log in the Master AU OMT, and go to the LAN Connectivity section.
2. Go to the IP Settings section and select UDP protocol, as shown in Figure 13.
3. Locate the fields and set the appropriate values:
 - NMS IP Address - The target IP address of NMS Server.
 - NMS Port - The target port of NMS Server (default defined port of 80).
4. Click Set to save the setting.

IP Settings			
☒	Protocol	UDP	▼
☒	NMS IP Addr		
☒	NMS Port		

Figure 14. NMS Configuration

SNMP Configuration

The Master AU generates SNMP traps and delivers them through the CONSOLE Ethernet interface.

The CrossFire system supports SNMP V2 and V3 in this current version.

To configure SNMP settings:

1. Log in the Master AU OMT, and go to the LAN Connectivity section.
2. Go to the IP Settings section and select the SNMP protocol, as shown in Figure 14.
3. Click Set to save the setting.
4. Go to the SNMP Configuration section and select the appropriate SNMP Trap Protocol.

SNMP Trap Protocol - The trap protocol to send the SNMP trap.

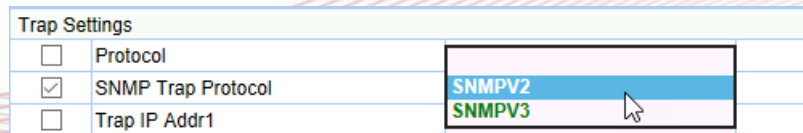


Figure 15. SNMP Trap Protocol

5. Locate the fields and set the appropriate values:

For **SNMP V2**

Trap IP Address (1~2): Up to 2 target IP address of SNMP trap receiver.

Trap Port: The target port of the SNMP trap (default defined port of 162).

For **SNMP V3** (See Figure 15 for details)

Reset USM - USM Reset

Security User Name - Security User Name

Authentication Protocol - Authentication Protocol

Authentication Password - Authentication Password

Privacy Protocol - Privacy Protocol

Privacy Password - Privacy Password

Edit User Confirm - Edit User Confirm

Trap IP Address (1~2) - Up to 2 target IP address of SNMP trap receiver.

Trap Port - The target port of SNMP trap (default defined port of 162).

Trap IP Addr Security EngineID - The Security EngineID of target Trap IP address.

SNMPV3 USM Reset			
☒	Reset USM	Reset	
SNMPV3 USM Edit			
☒	Security User Name		
☒	Authentication Protocol	▼	
☒	Authentication Password		at least 8 characters
☒	Privacy Protocol	▼	
☒	Privacy Password		at least 8 characters
☒	Edit User Confirm	Confirm	
Trap Settings			
☒	Protocol	SNMP	
☒	SNMP Trap Protocol	SNMPV3 ▼	
☒	Trap IP Addr1		
☒	Trap IP Addr2		
☒	Trap Port		
☒	Trap IP Addr1 Security EngineID		For SNMPv3
☒	Trap IP Addr2 Security EngineID		For SNMPv3

Figure 16. SNMP V3 Configuration

6. Go to the Trap Resend section at the bottom of the page.

Trap Resend Enabled: **On / Off** to enable / disable trap resend.

Trap Resend Interval: The interval time to resend the SNMP trap.

Community: Community Identifier.

Delete History Alarm: Click **Confirm** to delete history alarms.

7. Click Save to save the settings.

Trap Resend			
☒	Resend Enable	On	
☒	Resend Interval	▼	
☐	Community		20 characters
☐	Delete History Alarm	Confirm	

Figure 17. Trap Resend

Note that the Write/Read Community in SNMP server to communicate with CrossFire Public Safety Device is 'Community + Device Sub ID'. For example, the default community is 'public' and the Device Sub ID of Master AU-PS-A is '0'. SNMP Server must use 'public0' to communicate with Master AU-PS-A.

Additional Settings

Site Info

1. Log in the Master AU OMT, and go to the LAN Connectivity section.
2. Locate the *General* fields and set the appropriate values:

Device ID - Unique hexadecimal number used to identify the site, default 00000000.

Device Sub ID - Device number in a single system, auto-assigned by Master AU or manually set by the user.

Device Location - The detailed device installation location.

Site Name - The detailed device site name

Device Name -The detailed device name

3. Click Set to save the setting.

DAS Topo System Info Combiners Optical Power LAN Connectivity SNMP Configuration			
General			
☐	Vendor		
☐	Product Model	PSAU-111	
☐	Serial Number	PS-A2120	
☐	Software Version	1.0TT	
☐	Hardware Version	001	
☐	SNMP Version	1.0.0	
☐	FPGA Version	26	
☐	Device ID	00000000	hexadecimal
☐	Device Sub ID	0	decimalism
☐	Device Location	NA	20 characters
☐	Site Name	NA	100 characters
☐	Device Name	NA	40 characters

Figure 18. Site Info Configuration

Time Synchronization

The CrossFire system uses a local timeclock on Master AU to create timestamps for locally generated alarms.

1. Log in the Master AU OMT, and go to the LAN Connectivity section.
2. Locate the Date and Time section at the bottom of the page and click Query to check the current setting.
3. Click now to synchronize the system time with the local PC time.
4. Go to the Time Zone section at the bottom of page.
5. Select the appropriate time zone and click the button Set to validate the settings.

Date And Time	
☒ Date And Time	2018-11-19 15:50:07 now
Site Report	

Figure 19. Time Synchronization

Time Zone	
☒ Time Zone	UTC

Figure 20. Time Zone Setup

Note: If the NMS is connected to the NTP server, the CrossFire system time is updated automatically and periodically.

Local Access Control

To Enable / Disable the Local Debug Port of all slave devices in the system.

1. Log in the Master AU OMT, and go to the LAN Connectivity section.
2. Locate the Local Access Control section at the bottom of the page.
3. Select Enable / Disable and click the button Set to validate the settings..

WEBOMT Logout		
☐ WEBOMT Logout Time	30	Min
Local Access control		
☐ Slave Local Debug Port	Enable	

Figure 21. Local Access Control

System Configuration

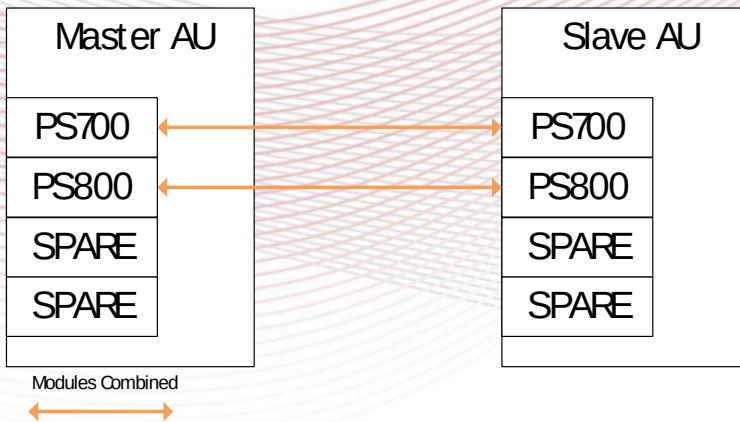
Frequency Channel/Band Configuration

According to the different base station operating frequency channels or bands for each operator, select the active combiner modules for the AU-PS-A and active PA modules for the MPRU with the corresponding frequency channel or band and set the frequency properties in the OMT of the Master AU-PS-A and Slave AU-PS-A.

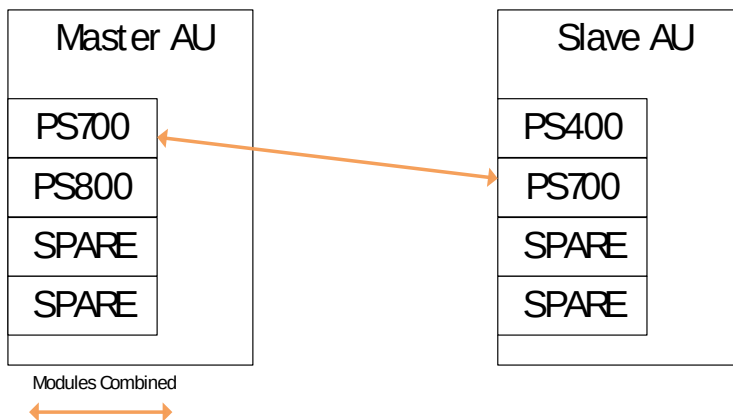
The AU-PS-A and MP-PS-A support 2 operating modes - wideband and channelized filters. The public safety solution also provides Master/Slave AU-PS-A modules combined function that 2 same band modules(separated in Master and Slave AU) combine all input power of different RF service mapping to one RU PA module.

For example, the system has 6 RF service in a same band, like PS700, mapping to one RU module. Because each module has only 4 port for RF service, we need 2 x PS700 modules for this case, one in Master AU; another one in Slave AU. Then the system will combine all 6 RF service from 2 modules and transmit combined signal to RU PA module.

Example1



Example2



To configure the channel or band frequency of active combiner modules in the AU-PS-A:

1. Log in the AU-PS-A OMT, and go to the **Channel/Band** section.

Radio Module 1	Radio Module 2	Radio Module 3	Radio Module 4	Channel Power
General settings				
☐ UL Freq Low	0			Only UHF/VHF band
☐ UL Freq High	0			Only UHF/VHF band
☐ DL Freq Low	0			Only UHF/VHF band
☐ DL Freq High	0			Only UHF/VHF band
☐ Set the operating band	Update operating band			
☐ Band Configuration Update	Update			
☐ Info Check	Invalid			
☐ Used Channelized Filters	0		0~12	
☐ Used Wideband Filters	0		0~4	
☐ Low Delay Mode	Off			

Figure 22. General Settings of Frequency/Band Configuration

UL/DL Operating frequency band limits - Read Only

Filter Count - Max.12 channelized filters and Max.4 Wideband Filters per band per system

Including Master AU-PS-A, Slave AU-PS-A.

Low Delay Mode - Enable or Disable the Low Delay Mode.

If enable Low Delay Mode for Channelized filter, Only uplink channel is turned on and downlink channel will be invalid.

If enable Low Delay Mode for Wideband filter, Only downlink channel is turned on and uplink channel will be invalid.

Note - Only Radio Module 4 can support VHF Band.

2. Verify the uplink and downlink operating frequency band limits for Module 1, 2, 3, and 4.
3. Set the appropriate values in Channelized Filter Configuration and Wideband Filter:

Signal UL Centre Freq - The uplink centre frequency of the channel or band.

Signal DL Centre Freq - The downlink centre frequency of the channel or band.

Bandwidth - The bandwidth of channelized and wideband filters.

Filter Delay - Channelized - Filter Selection

Filter Selection - Type A/B/C/D

Type A: 40us / 50dB @ 70KHz offset; Type B: 65us / 50dB @ 30KHz offset

Type C: 90us / 50dB @ 20KHz offset; Type D: 160us / 50dB @ 10KHz offset

Note: Each Carrier can have different Filter Delay Selection.

RF Signal Switch - Disable/Enable the RF channel or band.

Note: Each band can operate with channelized and wideband filters together at same time. However the channelized filter shall not exceed 12 and wideband filter shall not exceed 4.

The UL/DL Centre Freq and Bandwidth shall not over range of the band of AU-AC.

4. Click Set to save the settings and then click Update button to validate the settings.

5. Click Query all to verify the value of the Info Check is valid.

Note: If the Info Check is invalid after configuration, check if the Signal UL/DL Centre Freq are correct and retry Update.

Channelized Filter Configuration				
Channelized 1				
☐	0d7d	☒	Signal UL Centre Freq	0
☐	0d7e	☒	Signal DL Centre Freq	0
☐	0c3c	☒	Bandwidth	12.5k
☐	0630	☒	Filter Delay - Channelized	Type A - 40
☐	0c3d	☒	RF Signal Switch	Off
Channelized 2				
☐	0d7f	☒	Signal UL Centre Freq	0
☐	0d90	☒	Signal DL Centre Freq	0
☐	0c40	☒	Bandwidth	12.5k
☐	0631	☒	Filter Delay - Channelized	Type A - 40
☐	0c44	☒	RF Signal Switch	Off
Channelized 3				
☐	0d91	☒	Signal UL Centre Freq	0
☐	0d92	☒	Signal DL Centre Freq	0
☐	0c47	☒	Bandwidth	12.5k
☐	0632	☒	Filter Delay - Channelized	Type A - 40
☐	0c48	☒	RF Signal Switch	Off
Channelized 4				
☐	0d93	☒	Signal UL Centre Freq	0
☐	0d94	☒	Signal DL Centre Freq	0
☐	0c4b	☒	Bandwidth	12.5k
☐	0633	☒	Filter Delay - Channelized	Type A - 40
☐	0c4c	☒	RF Signal Switch	Off

Type A - 40 ✓

Type A - 40

Type B - 65

Type C - 90

Type D - 160

Wideband 1				
☐	Signal UL Centre Freq	0		MHz
☐	Signal DL Centre Freq	0		MHz
☐	Bandwidth	500K	✓	Hz
☐	Filter Delay - Wide Band	Type A - 15	✓	us
☐	RF Signal Switch	Off	✓	

Figure 23. Frequency Configuration

Module Gain Adjustment (Attenuation)

In CrossFire, the downlink input power of the AU is specified as -10dBm, and the maximum allowable input power is 10dBm. CrossFire has an automatic level control (ALC) function to balance the input power around -10 dBm at the input port. What's more, AU and RU digital board have attenuation configuration for Gain Adjustment.

Gain Adjustment on AU (Active Combiner)

Each active combiner module has four ports that support up to 4 inputs, and each input is reduced by its corresponding attenuator as shown in Figure 24.

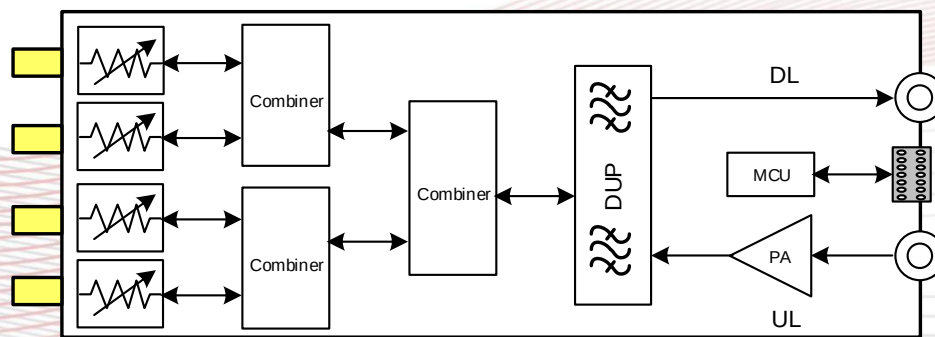


Figure 24. Active Combiner Block Diagram

To adjust the gain of the active combiner modules.

1. Log in the Master AU OMT, and go to the Combiners section.
2. Select the desired attenuation control mode and click Set to save the setting.

Combiner ATT Control Mode - The mechanism to maintain the input power no higher than -10 dBm.

Automatic Mode - The internal ALC function is working when the peak input power exceeds -10 dBm. The host can allocate the maximum output power of each operator in percentage(%).

Manual Mode - Reduce input power by setting the attenuation manually.

Adjust Interval - The interval time to automatically reduce the attenuation in 2dB step when the peak input power decrease.

Combiner Att Reset - Reset all the attenuation values.

3. Locate the field and set the appropriate values:

For Manual Mode: Set the appropriate value in the field of **Port Attenuation Value**.

For example: if Port 1 input power is -4.5 dBm / Port 2 input power is -1.0 dBm and the composite output power is divided by fifty-fifty, set 8.5 dB $(-4.5\text{dB} - (-10) + 3\text{dB})$ in Port 1 Attenuation Value and 12.5 dB $(-1.0 - (-10) + 3\text{dB})$ in Port 2 Attenuation Value. (Note: Extra 3dB attenuation is used for power distribution).

For Automatic Mode: Set the appropriate value in the field of **Port Power Offset** for power distribution.

For example: If the system has 2 operators in Port1/2 and each operator shares 50% output power at RU side. Then configure Port 1/2 Power Offset to 50%/50%.

If the system has 3 operators in Port1/2/3 and Operator 1 shares 50% and Operator 2/3 share 25%/25% output power at RU side. Then configure Port 1 Power Offset to 50% and Port 2/3 to 25%/25%.

4. Set the operator information in the field of Port 1 ~4 Operator.
5. Click Set to save the settings.

All Select
Settings
Alarms
Channel/Band
Maintenance

DAS Topo
System Info
Combiners
Optical Power
LAN Connectivity
SNMP Configuration

General									
☐	Combiner Att Control Mode	Manual							
☐	Adjust Interval	6Hour							
☐	Combiner Att Reset	Reset							
Radio Module 1									
☐	Power Switch	On							
☐	UL Freq Low	824							
☐	UL Freq High	849							
☐	DL Freq Low	869							
☐	DL Freq High	894							
☐	Port1 Input Power	-26.107							
☐	Port2 Input Power	-26.015							
☐	Port3 Input Power	-26.015							
☐	Port4 Input Power	-25.831							
☐	Port1 Attenuation	0					0-15		
☐	Port2 Attenuation	0					0-15		
☐	Port3 Attenuation	0					0-15		
☐	Port4 Attenuation	0					0-15		
☐	Port1 Power Offset(%)	0					%		
☐	Port2 Power Offset(%)	0					%		
☐	Port3 Power Offset(%)	0					%		
☐	Port4 Power Offset(%)	0					%		
☐	Port1 Operator						20 characters		
☐	Port2 Operator						20 characters		
☐	Port3 Operator						20 characters		
☐	Port4 Operator						20 characters		
☐	Serial Number	YCJ5200104							

Figure 25. Channel Gain Adjustment

Gain Adjustment on AU-PS-A (Digital Board)

To configure the downlink and uplink attenuation for each band as follows:

1. Log in the AU WebOMT, and go to the System Info section.

2. Locate the fields and set the appropriate values:

RF Signal Switch - Turn On / off the signal transmission.

UL Attenuation - UL attenuation to reduce the uplink input power, range 0 – 20 dB

DL Attenuation - DL attenuation to reduce the composite output power, range 0 – 20 dB

3. Click Set to save the settings.

Note: The downlink attenuation setting determines the maximum output power.

Note: It is recommended that no more than 10 dB attenuation be set.

Device ID: 00000000
Device Sub ID: 0
Dev Type: Master PSAU-A
Dev Name: DAS PSAU
Online User
1 10.7.5.96

DAS Topo
System Info
Combiners
Optical Power
LAN Connectivity
SNMP Configuration

Radio Module 1			
☐ RF Signal Switch	On		
☐ UL Attenuation	0	dB	
☐ DL Attenuation	0	dB	
☐ UL Centre Freq	0	MHz	
☐ DL Centre Freq	0	MHz	
☐ Radio Module Type	NORMAL BAND	VHF band not supported	
Radio Module 2			
☐ RF Signal Switch	On		
☐ UL Attenuation	0	dB	
☐ DL Attenuation	0	dB	
☐ UL Centre Freq	0	MHz	
☐ DL Centre Freq	0	MHz	
☐ Radio Module Type	UHF BAND	VHF band not supported	
Radio Module 3			
☐ RF Signal Switch	On		
☐ UL Attenuation	0	dB	
☐ DL Attenuation	0	dB	
☐ UL Centre Freq	0	MHz	
☐ DL Centre Freq	0	MHz	
☐ Radio Module Type	NORMAL BAND	VHF band not supported	
Radio Module 4			
☐ RF Signal Switch	On		
☐ UL Attenuation	0	dB	
☐ DL Attenuation	0	dB	
☐ UL Centre Freq	0	MHz	
☐ DL Centre Freq	0	MHz	
☐ Radio Module Type	NORMAL BAND	Supports all bands	

Figure 26. Gain Adjustment on AU-PS-A (Digital Board)

Gain Adjustment on MP-PS-A

The downlink attenuator settings determine the maximum composite output power level at the antenna port.

The uplink attenuator settings determine the balance between the uplink and downlink signals.

To adjust the downlink and uplink gain:

1. Log in the RU WebOMT, and go to the Band Configuration section.
2. Locate the fields and set the appropriate values:

RF Signal Switch - Turn On / off the signal transmission.

UL Attenuation - UL attenuation to reduce the uplink input power, range 0 – 20 dB

DL Attenuation - DL attenuation to reduce the composite output power, range 0 – 20 dB

3. Click Set to save the settings.
4. Go to System Info section to check the downlink output composite power and VSWR.

Note: Increased UL attenuation will affect the Noise Figure. The UL noise floor has to be taken into consideration.

For reference, the Noise figure is lower than 4 with 0 attenuation and increased to 13 with 15 dB attenuation.

Note: It is recommended that no more than 10 dB attenuation be set.

Device ID: 00000000

Device Sub ID: 1

Dev Type: MP-PS-A

Dev Name: DAS MP-PS

Online User

1 11.7.1.1

DAS Topo **Band Configuration** System Info LAN Connectivity

Radio Module 1			
☐	UL Freq low	136	MHz
☐	UL Freq high	174	MHz
☐	DL Freq low	136	MHz
☐	DL Freq high	174	MHz
☐	RF Signal Switch	On	
☐	UL Attenuation	0	dB
☐	DL Attenuation	0	dB

Radio Module 2			
☐	UL Freq low	442	MHz
☐	UL Freq high	512	MHz
☐	DL Freq low	442	MHz
☐	DL Freq high	512	MHz
☐	RF Signal Switch	On	
☐	UL Attenuation	0	dB
☐	DL Attenuation	0	dB

Figure 27. Gain Adjustment on RU WebOMT



MID POWER - PS

Advanced
Support Tetra/P25/DMR/PMR/LTE

Device ID:	00000000
Device Sub ID:	1
Dev Type:	MP-PS-A
Dev Name:	DAS MP-PS
Online User	
1	IP 11.7.1.1

DAS Topo Band Configuration System Info LAN Connectivity			
Radio Module 1			
☐	UL Centre Freq	0	MHz
☐	DL Centre Freq	0	MHz
☐	UL Input-power	<-75	dBm
☐	DL Output-power	<10	dBm
☐	VSWR	--	
☐	Radio Module Type	VHF BAND	
☐	Serial Number	*****	
Radio Module 2			
☐	UL Centre Freq	0	MHz
☐	DL Centre Freq	0	MHz
☐	UL Input-power	<-75	dBm
☐	DL Output-power	<10	dBm
☐	VSWR	--	
☐	Radio Module Type	UHF BAND	
☐	Serial Number	*****	

Figure 28. Check Output Power and VSWR

Alarm Settings

Alarm Severity

The CrossFire System supports four different alarm levels – Warning, Minor, Major, and Critical.

To set up the appropriate alarm severity:

1. Log in the WebOMT, and go to the Alarms section.
2. Select the appropriate severity in the drop-down box for the alarm in use.
3. Click Set to save the settings.
4. Wait 3 minutes after completing the setup, then query to see if there is an alarm.

Blank Indicator means alarm disabled.

Green color means no alarm.

Red color means the alarm is triggered.

Note: All alarms are default disabled at the factory. Disable the alarms not in use to avoid false alarms.

Note: Power Interruption Alarm and Battery Failure Alarm can **NOT** be enabled if there is no accumulator installed.

All Select Settings Alarms Channel/Band Maintenance					
Device Alarms DownLink Input-power Alarms Alarm Thresholds					
Alarm					
☐	Power1 Failure Alarm			Disable	✓ Support AC power only
☐	Power2 Failure Alarm			Disable	✓ Support AC power only
☒	Over-temperature Alarm			Disable	✓
☐	LO1 Unlocked Alarm			Warning	✓
☐	LO2 Unlocked Alarm			Disable Warning Minor Major Critical	
☐	LO3 Unlocked Alarm				
☐	LO4 Unlocked Alarm				
☐	Radio Module 1 DL ALC Over Range Alarm				
☐	Radio Module 2 DL ALC Over Range Alarm				
☐	Radio Module 3 DL ALC Over Range Alarm			Disable	✓
☐	Radio Module 4 DL ALC Over Range Alarm			Disable	✓

Figure 29. Alarm Severity Setup

External Alarm

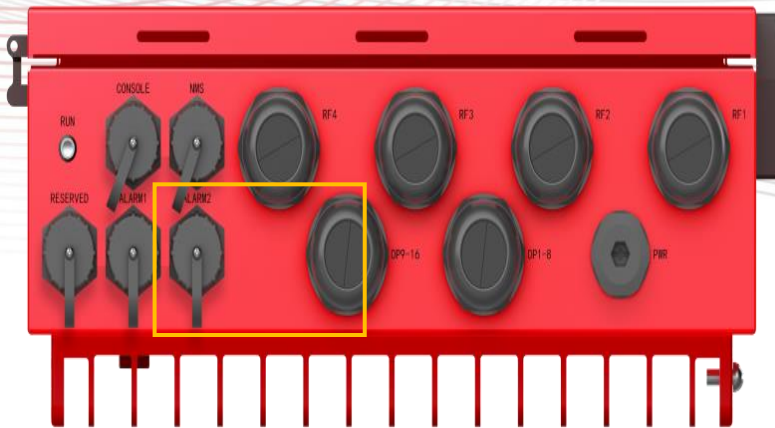
The CrossFire system supports external alarms inputs such as UPS failure, condition of air, entrance guard, etc.

External Alarm of AU-PS-A

The external alarms are input to a RJ45 interface located on the front panel of AU-PS-A. See Figure 30 for the detailed PIN configuration of this connector. The external alarms can be monitored as normally closed or normally open

Use the following steps to view and configure the external alarms.

1. Log in the AU-PS-A OMT, and go to the Element **Alarms** section.
2. Select the appropriate alarm level for external alarm in use at the bottom of the page.
3. Click **Set** to save the settings.
4. Go to the **Alarm Thresholds** section
5. Type **External alarm name** and select **Normally closed** or **Normally open** mode.
6. Click **Set** to save the name.



1	RJ-45 External Alarm Interface 1	External Output Alarm 1~4
2	RJ-45 External Alarm Interface 2	External Input Alarm 1~4

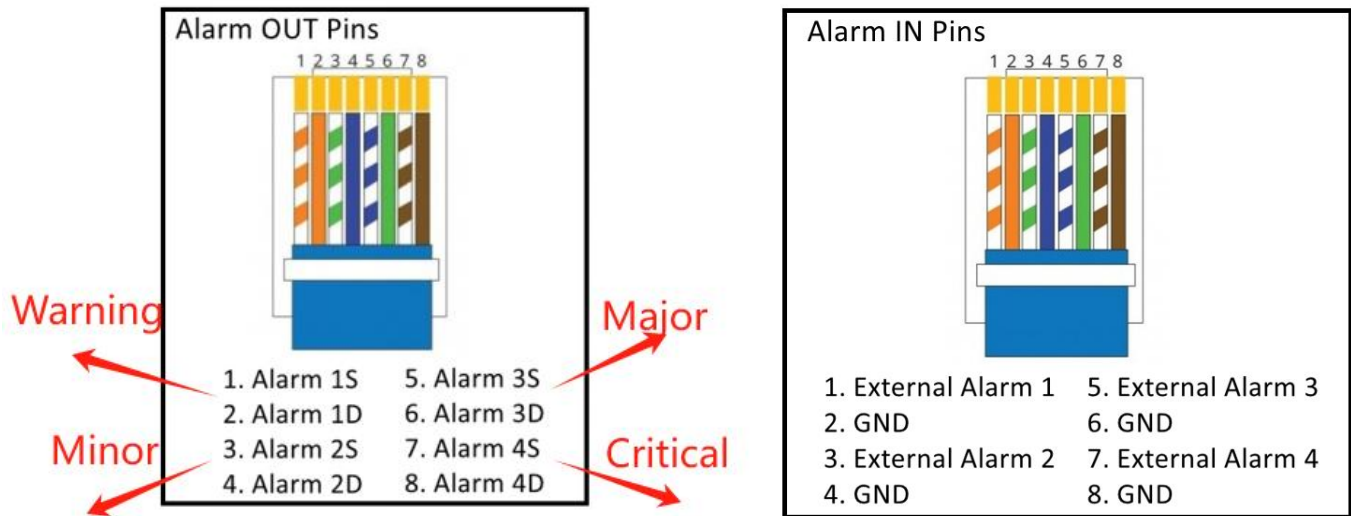


Figure 30. RJ45 Pins Description

☐	External Alarm 1		Warning	✓
☐	External Alarm 2		Warning	✓
☐	External Alarm 3		Warning	✓
☐	External Alarm 4		Warning	✓

Figure 31. External Alarms on AU-PS-A OMT

External Alarm				
☐	External Input Alarm 1 Mode Select	Normally open	✓	
☐	External Input Alarm 2 Mode Select	Normally open	✓	
☐	External Input Alarm 3 Mode Select	Normally open	✓	
☐	External Input Alarm 4 Mode Select	Normally open	✓	
☐	External Input Alarm 1 Label	null		20 characters
☐	External Input Alarm 2 Label	null		20 characters
☐	External Input Alarm 3 Label	null		20 characters
☐	External Input Alarm 4 Label	null		20 characters
☐	External Output Alarm(warning) Mode Select	Normally open	✓	
☐	External Output Alarm(minor) Mode Select	Normally open	✓	
☐	External Output Alarm(major) Mode Select	Normally open	✓	
☐	External Output Alarm(critical) Mode Select	Normally open	✓	
☐	External Output Alarm(warning)			
☐	External Output Alarm(minor)			
☐	External Output Alarm(major)			
☐	External Output Alarm(critical)			

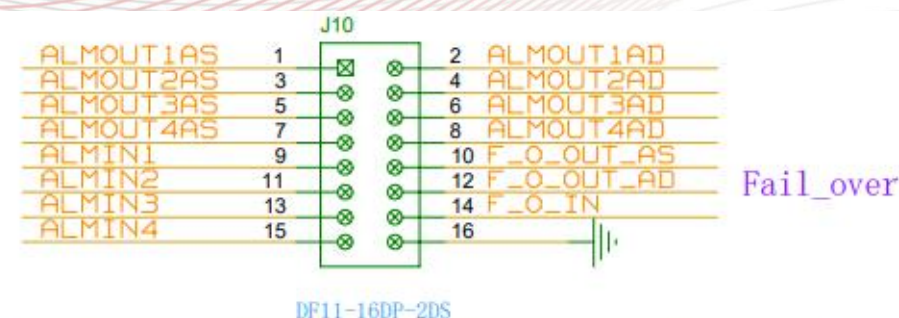
Figure 32. External Alarms Name and mode

External Alarm of MP-PS-A

The external alarms are connected to the MP-PS-A using a special interface located on the front panel of the MP-PS-A (4 x Inputs, 4 x Outputs). See Figure 33 for detailed PIN configuration of this connector. The external alarms can be monitored as normally closed or normally open.

Use the following steps to view and configure the external alarms.

1. Log in the MP-PS-A OMT, and go to the **Element Alarms** section.
2. Select the appropriate alarm level for external alarm in use at the bottom of the page.
3. Click **Set** to save the settings.
4. Go to the **Alarm Thresholds** section
5. Type **External Alarm Label, External Alarm Level** and select **Normally closed** or **Normally open** mode.
6. Click **Set** to save the name.



ALMOUT1	Active RF-emitting devices malfunction
ALMOUT2	Active system component malfunction
ALMOUT3	Reserved
ALMOUT4	Reserved
EXALMIN1	Loss of AC power
EXALMIN2	Battery charge failure
EXALMIN3	Loss of battery capacity
EXALMIN4	Remote shutoff

Figure 33. Socket Pins Description

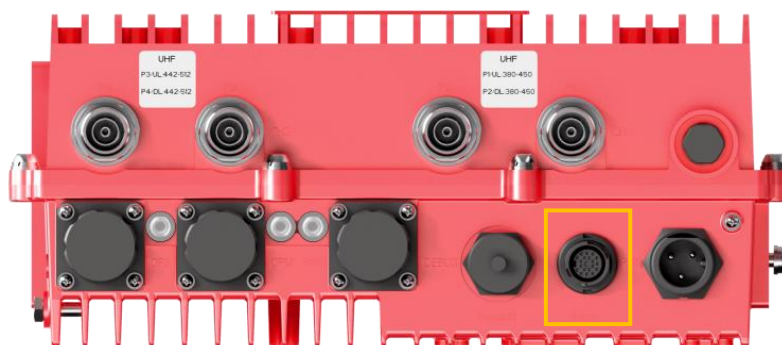


Figure 34. External Alarm Port on MP-PS-A

☐	Loss of AC power	☐	Disable	✓
☐	Battery charge failure	☐	Disable	✓
☐	Loss of battery capacity	☐	Disable	✓
☐	Remote shutoff	☐	Disable	✓

Figure 35. External Alarms on MP-PS-A OMT

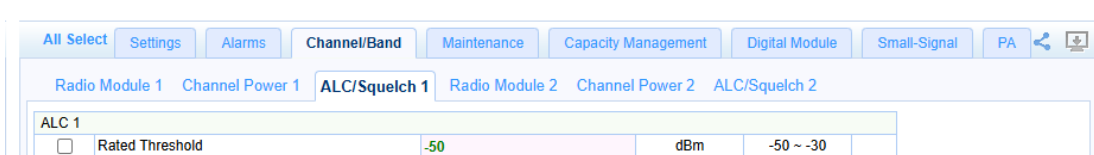
External Alarm				
☐	Loss of AC power Mode	Normally open	✓	Input Alarm 1 Mode
☐	Battery charge failure Mode	Normally open	✓	Input Alarm 2 Mode
☐	Loss of battery capacity Mode	Normally open	✓	Input Alarm 3 Mode
☐	Remote shutoff Mode	Normally open	✓	Input Alarm 4 Mode
☐	Loss of AC power Label	NA		20 bytes
☐	Battery charge failure Label	NA		20 bytes
☐	Loss of battery capacity Label	NA		20 bytes
☐	Remote shutoff Label	NA		20 bytes
☐	Active RF-emitting devices malfunction Mode	Normally open	✓	Output Alarm 1 Mode
☐	Active system component malfunction Mode	Normally open	✓	Output Alarm 2 Mode
☐	Reserved 1 Mode	Normally open	✓	Output Alarm 3 Mode
☐	Reserved 2 Mode	Normally open	✓	Output Alarm 4 Mode
☐	Active RF-emitting devices malfunction	●		Output Alarm 1 Indication
☐	Active system component malfunction	●		Output Alarm 2 Indication
☐	Reserved 1 Indication	●		Output Alarm 3 Indication
☐	Reserved 2 Indication	●		Output Alarm 4 Indication

Figure 36. External Alarms Name and mode

MP-PS-A Uplink ALC Threshold Configuration

Only UHF/VHF bands can support MP-PS-A Uplink ALC Threshold Modification.

1. Login to MP-PS-A OMT and go to Channel/Band Section.
2. Go to ALC/Squelch 1 page.
3. Configure the Rated Threshold within the range from -50 to -30dBm.



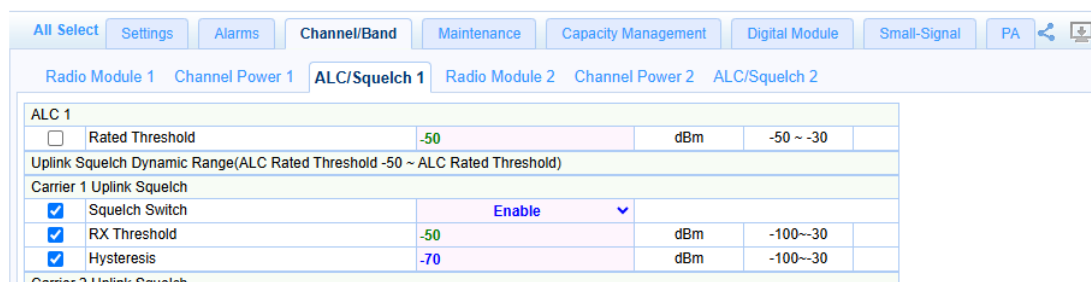
Channel/Band			
Radio Module 1	Channel Power 1	ALC/Squelch 1	Radio Module 2
ALC 1			
☐	Rated Threshold	-50	dBm -50 ~ -30

MP-PS-A Uplink Noise Floor Squelch

This uplink noise floor squelch feature is valid only for Channelized filters. Can manage the 12 channels individually.

1. Login to MP-PS-A OMT and go to Channel/Band Section.
 2. Go to ALC/Squelch 1 page.
 3. Configure the Carrier Uplink Squelch.
- Squelch Switch - Enable or Disable
 - RX threshold - Upper Limit@ Power Increasing
 - Hysteresis - Lower Limit@Power Decreasing

For example, RX threshold is set to -50dBm and Hysteresis is set to -70dBm. So when uplink input power is increasing, uplink output will be turned on until the input power is greater than -50dBm. And when uplink input power is decreasing, uplink output will be turned off until the input power is lower than -70dBm.



Channel/Band			
Radio Module 1	Channel Power 1	ALC/Squelch 1	Radio Module 2
ALC 1			
☐	Rated Threshold	-50	dBm -50 ~ -30
Uplink Squelch Dynamic Range(ALC Rated Threshold -50 ~ ALC Rated Threshold)			
Carrier 1 Uplink Squelch			
☒	Squelch Switch	Enable	
☒	RX Threshold	-50	dBm -100~-30
☒	Hysteresis	-70	dBm -100~-30
Carrier 2 Uplink Squelch			

Master/Slave AU-PS-A Transition

Slave AU-PS-A is used for upgrading the CrossFire system to support up to 4 discrete bands in SISO or MIMO formats. Each AU-PS-A is factory-set to be the Master AU-PS-A.

To change a Master AU-PS-A to slave.

1. Power on the AU-PS-A which will be set to be the Slave AU-PS-A.
2. Login to the AU-PS-A OMT and go to the Maintenance section.
3. Go to the Engineering section and locate the Advanced Command section at the bottom of the page.
4. Select Slave AU-PS-A from the drop-down menu and click Set to save the settings.
5. Wait for the AU-PS-A to reboot automatically and then connect to the CrossFire system.
6. Login the AU-PS-A OMT and verify the device type in the field of Site Info on the homepage.

Note: Do NOT connect the AU-PS-A to the CrossFire system before being set to Slave AU-PS-A.

Advanced Command	
☐ 0ae7	Master / Slave AU
☐ 0ba1	Hardware Reset
☐ 0b09	Alarm Initialization
Test Mode	
☐ 0014	Module UL Ripple Test Enable

Master AU ✓
 Master AU
 Slave AU

Figure 38. Master / Slave AU-PS-A Transition

Site Info	
Device ID:	00000000
Device Sub ID:	1
Dev Type:	MP-PS-A
Dev Name:	DAS MP-PS

Figure 39. Device Type Check

Screenshot

When you require BTI assistance to troubleshoot the system, use the Screenshot function to save all the parameters and send the compression file to the BTI technicians.

To use the Screenshot function:

1. Log in to the OMT. Click Query all to obtain all the parameter values of the specified page.
2. Click Screenshot button at the top of the main page to capture.
3. Click the Configuration button to access the configuration page.
4. Check box for the Screenshot file and click the Download button to download it to the local disk.

Note: Query all the parameters before Screenshot.

Note: Verify the name and the date of the screenshot file before download.

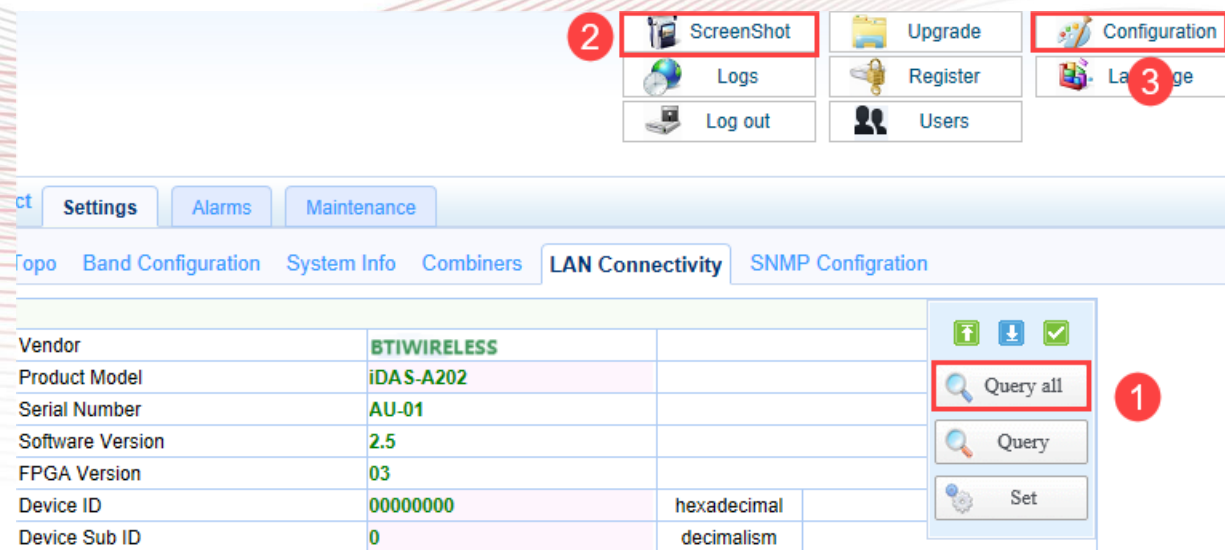


Figure 40. Screenshot Steps

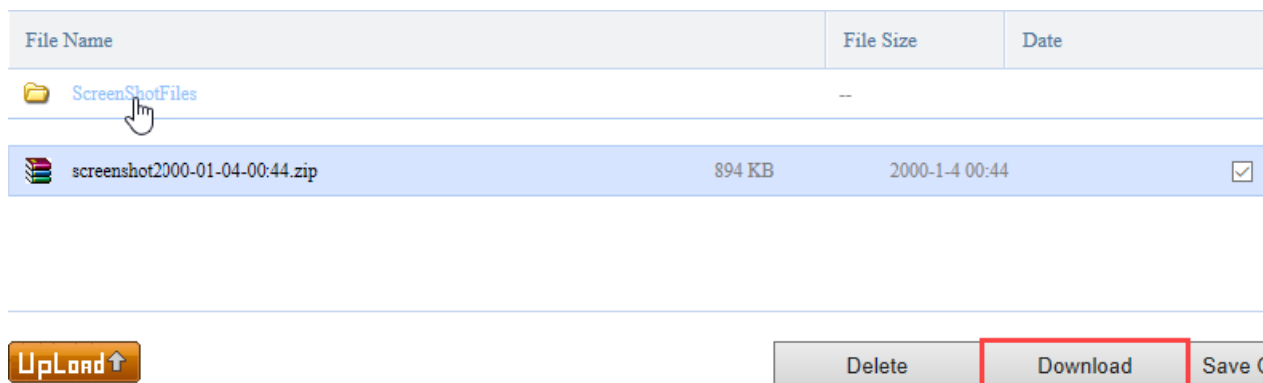


Figure 41. Download Screenshot File

Backup/Restore Configuration

The CrossFire system supports to backup and restore the configuration files.

Back-Up Configurations

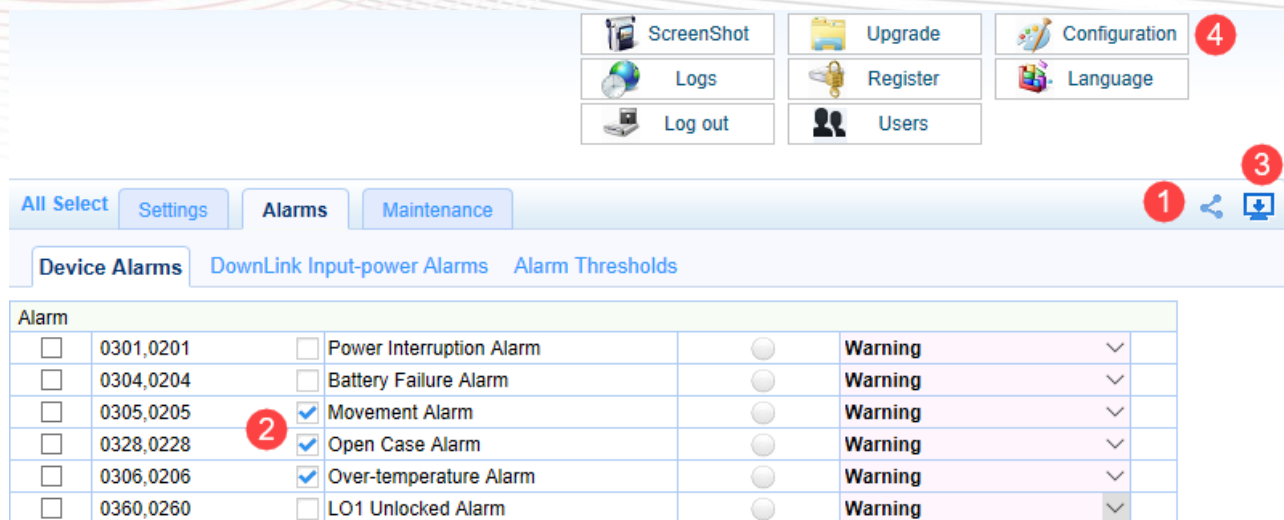
To create a back-up file:

1. Log in to the OMT and click the icon  to show/hide the parameter ID.
2. Check boxes for the parameters you want to back up.
3. Click the icon  to save the settings.
4. Click the button Configuration to access the page for configuration management.
5. Click the button Save Configurations to create a back-up file.
6. Check box of the back-up file and click the button Download to save the file to the local disk.
7. Click the button Delete to delete the unwanted backup files.

Note: The button  is only enabled after checking the selected parameter.

Note: The parameters have to be saved once per sub-tab.

Note: Do NOT back-up Power Interruption Alarm and Battery Failure Alarm if there is no accumulator installed.



The screenshot shows the OMT Configuration Management page. At the top, there are buttons for ScreenShot, Upgrade, Configuration (4), Logs, Register, Language, Log out, and Users. Below these are tabs for All Select, Settings, Alarms (1), and Maintenance (3). The Alarms tab is active, showing sub-tabs for Device Alarms, DownLink Input-power Alarms, and Alarm Thresholds. The Device Alarms sub-tab is selected, displaying a table of alarm settings. A red circle with the number 2 highlights the 'Movement Alarm' row.

Alarm	Parameter ID	Alarm Name	Status	Severity	Action
☐	0301,0201	Power Interruption Alarm	☐	Warning	▼
☐	0304,0204	Battery Failure Alarm	☐	Warning	▼
☒	0305,0205	Movement Alarm	☐	Warning	▼
☒	0328,0228	Open Case Alarm	☐	Warning	▼
☒	0306,0206	Over-temperature Alarm	☐	Warning	▼
☐	0360,0260	LO1 Unlocked Alarm	☐	Warning	▼

Figure 42. Create a back-up file

File Name	File Size	Date	
ScreenShotFiles	--		
iDAS-A202_Engineering_param_4E76_2000-1-9_223550.zip	491 B	2000-1-9 22:35	☒

Upload ↑
6
5
Delete
Download
Save Configuration
Load Configuration

Figure 43. Download the back-up file

Configuration



Save Configuration Succeed!
Create configuration file succeed:iDAS-A202_Engineering_param_2000-1-9_232715.zip!

Detail
Close

Figure 44. Create a backup file successfully

Restore Configurations

Backup files created can be used to restore a known state to devices in the system. This may be helpful if a failed device is replaced with a “blank” device, or to copy known configurations into devices to speed up a large configuration.

To restore the configurations.

1. Log in to the OMT and click the button Configuration to access the configuration page. (6 in Figure 10)
2. Click the button Upload to upload a backup file and check box.
3. Click the button Load Configuration to restore the configurations.
4. Click the button Delete to delete the unwanted backup files.

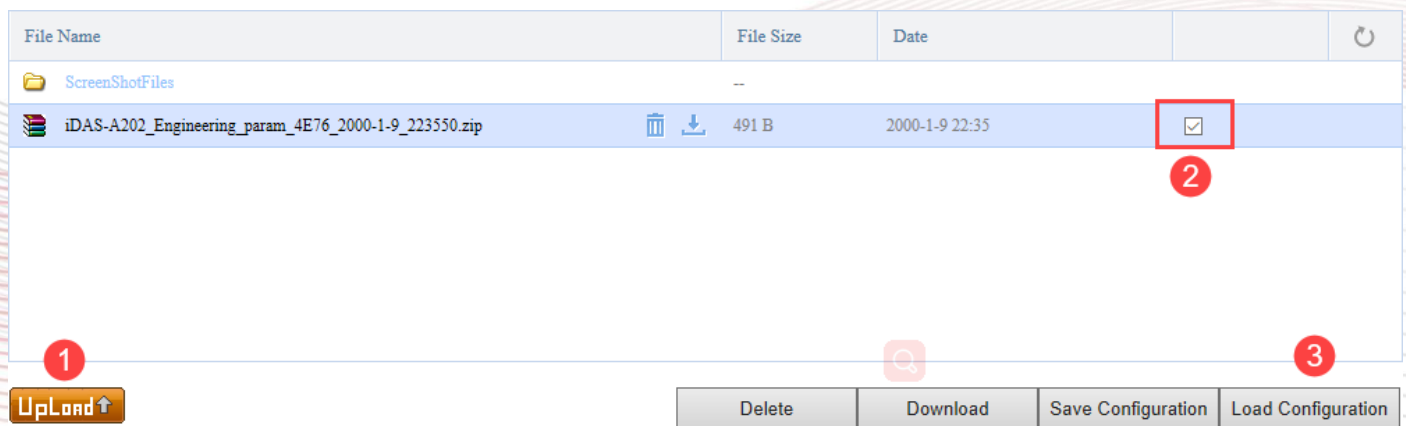


Figure 45. Restore a back-up file

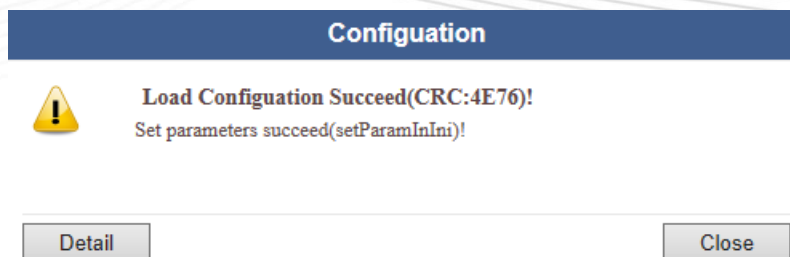


Figure 46. Restore configurations successfully

Software Upgrade

The CrossFire system supports local upgrade via OMT and remote upgrade via SFTP.

The Master AU-PS-A consolidates the management of software upgrades for the entire system and saves the last software package information for AU-PS-A and MPRU. Slave devices will compare the local software with the latest information saved in Master AU-PS-A by checking CRC at run time. If the CRC is different, slave devices will be synchronized via the current software package from Master AU-PS-A. Therefore, when a slave device is replaced, its software will be upgraded automatically without any additional operation.

Note: If it is the Master AU-PS-A to be replaced in a system, ensure that the software packages stored in the old and new AU-PS-A are identical. If not identical, upload and upgrade the software before connecting the new Master AU-PS-A to the system.

To check the software packages:

1. Log in the Master AU-PS-A OMT, and go to the Maintenance section.
2. Go to the Software Package Info section and click on Query all to check all software package version.

Digital Info Engineering Software Package Info Factory Command			
Package Info			
☐	Current AU Software Filename	iDAS_AUPS_A212_V1.0TT_ACA	Clear
☐	AU CRC Check	ACAF	
☐	Current MPPS Software Filename	iDAS_MPPS_R232_V1.0t30_28C	Clear
☐	MPPS CRC Check	28CF	

Figure 47. Checking Software Package Version

Local Upgrade

The CrossFire system supports local sync-upgrade. There are two steps for the system software local sync-upgrade. First, upload the software package to the master AU-PS-A. Second, slave devices will be synchronized automatically via the master AU-PS-A if the CRC is different. Please make sure the upgrading from the lowest level device to the highest level device (MPRU -> AU-PS-A). The AU-PS-A must be the last one to be upgraded.

To upgrade the software locally:

1. Log into the WebOMT on the Master AU-PS-A. Click the Upgrade button on the main page to navigate to the software upgrade page.

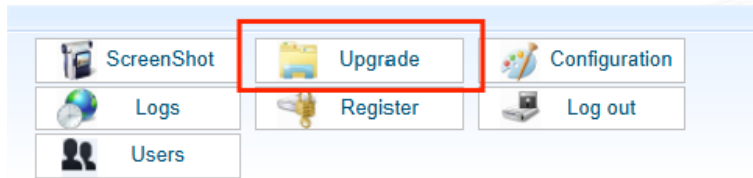


Figure 48. Software Upgrade 1

2. On the software upgrade page, as shown in Figure 49, click the Upload button to upload the software package file.

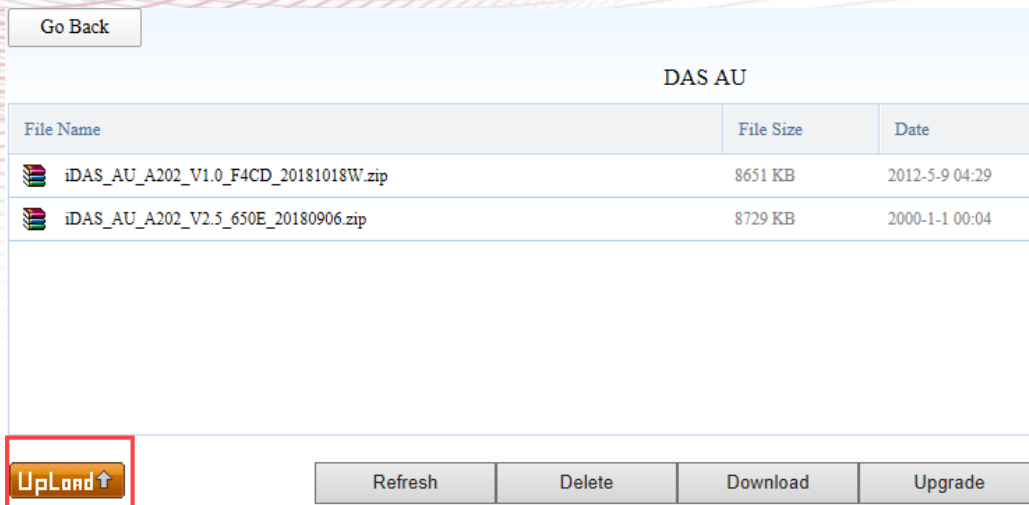


Figure 49. Software Upgrade 2

Note: The master AU-PS-A software storage is currently limited to 50MB. Please be aware of not exceeding the limitation and check that the software package size is as large as its size in local after uploading. Uploading and upgrading software packages will fail if there is no more storage. Delete some packages with the old version to continue the upgrade.



3. After the software package uploads successfully, check box and click the Upgrade button to start to upgrade.

Figure 50. Software Upgrade 3

4. After the upgrade has been completed and devices reset, log in to the devices' OMT and go to Maintenance -> Software Package to confirm that the software version is correct.
5. And then go to Settings -> LAN Connectivity to confirm that the software version is correct.

Figure 51. Software Version Check

Note: If the software version is not incompatible, please upgrade the same software again to make upgrade completed.

Remote Upgrade

To configure for remote upgrade:

1. Log in the Master AU-PS-A OMT, and go to the LAN Connectivity Section.
2. Go to the SFTP Settings section at the bottom of the page.
3. Set the appropriate values in the fields and click Set to save the settings.

Server IP Addr (SFTP) - The IP address of the SFTP server.

Server Port (SFTP) - The port of SFTP Server.

SFTP Username - Username to access the SFTP server.

SFTP Password - Password to access the SFTP server.

Upgrade File path - The file path to obtain the software package from SFTP server,

Upgrade Filename - The name of the software package file.

SFTP File Transfer Control - Start / Cancel the software upgrade.

4. Select Start Upgrade and click Set to enable software upgrade.
5. Check the software version after the software upgrade is completed.

SFTP Settings		
☐	Server IP Addr (SFTP)	10.7.3.93
☐	Server Port (SFTP)	22
☐	SFTP Username	root
☐	SFTP Password	12345678
☐	Upgrade Filepath	//
☐	Upgrade Filename	iDAS_AUPS_A202_V2.8_26F3...
☐	SFTP File Transfer Control	Start Upgrade ✓

Figure 52. Setting up Remote Upgrade via SFTP

Note: Remote upgrade software WITHOUT the preceding configurations if the system connects to BTI NMS.

Note: Ensure that the SFTP server is running and the software package has been stored in the specified directory.

Note: If the software version is not incompatible, please upgrade the same software again to make the upgrade completed.

Fiber Chained Switch Over (Loop Back)

Fiber Chained Switch over enables the systems remaining link even if there is a disconnection in the link, such as fiber is broken or one middle device shut down.

Connect the whole system as Figure 53 to link additional fiber from RU4 back to AU.

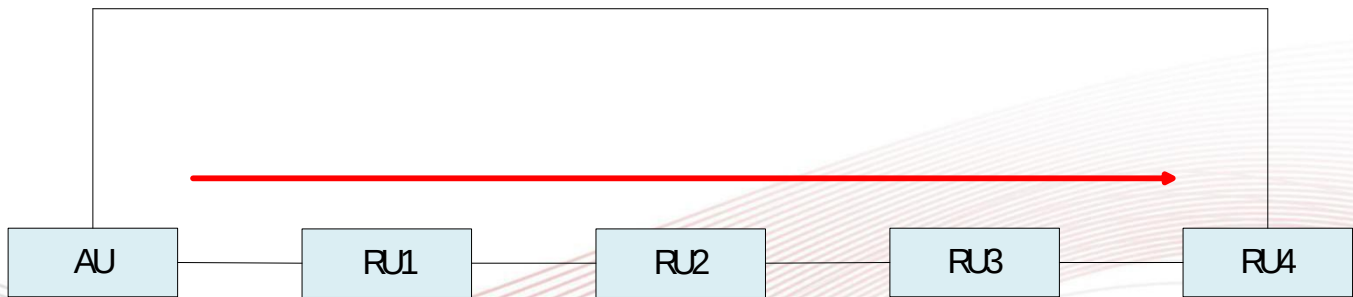


Figure 53. AU - RU (1)

When fiber is broken between RU1 and RU2 as Figure 54, the additional fiber will alternately connect RU4 to AU to make the entire system alive.

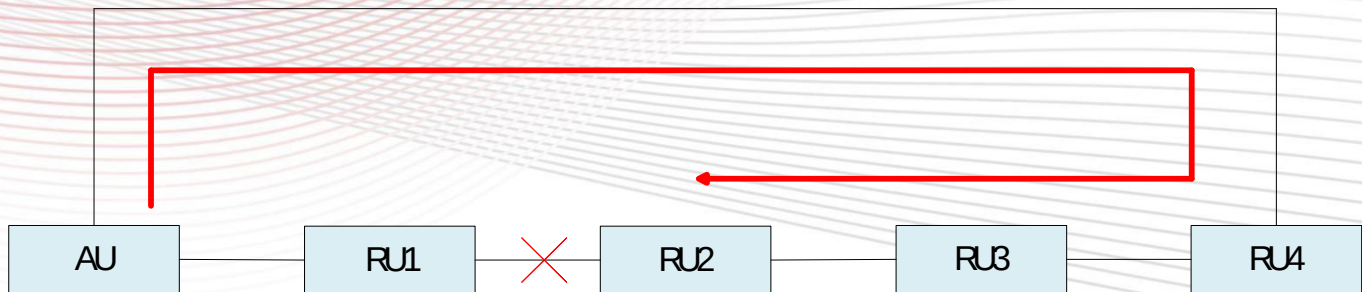


Figure 54. AU - RU (2)



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