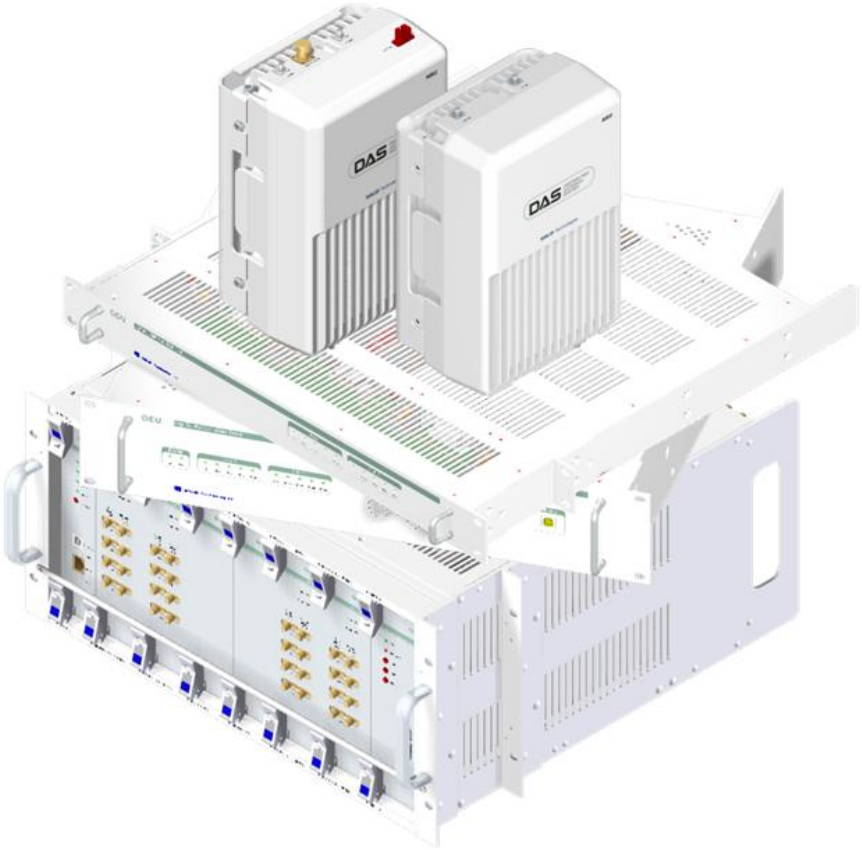
EXPRESS Single-Carrier DAS

Installation and Operations Manual



Revision Log

Revision #	Issue Date	Section	Changes
V 1.0	April 11, 2011	All	Initial Release
V 1.0	June 1, 2012	All	Added Sprint band
V 2.0	May 16, 2013	All	Revisions and updates to all sections
V 2.1	June 10, 2013	DMS	Updates to DMS-600 Information
V 2.2	November 22, 2013	Sections 8-12	Updates to installation and commissioning

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1 Introduction

1.1 Intended Audience

The EXPRESS DAS user documentation is intended for technicians responsible for planning, administering, configuring and maintaining the EXPRESS Single-Carrier Distributed Antenna System (DAS). Technicians using the manual should already have completed the EXPRESS Single-Carrier DAS online training course offered through SOLiD University.

SOLiD recommends technicians be familiar with the concepts of fiber optic cabling, networking and wireless communication technologies, and SNMP. We further recommend training programs offered through CIBET (Certified In Building Engineering Technologist) and BICSI (Building Industry Consulting Service International).

1.2 Document Conventions

The Caution icon indicates conditions or procedures that could cause personal injury or interrupt the operation of the system.

NOTE: A NOTE indicates important "heads-up" information that will assist with the installation and commissioning process.

1.3 Getting Support

To authorize technical support or to establish a return authorization for defective units, make sure you have the SOLiD serial numbers available. Serial numbers are located on the back of the unit, as well as on the box in which it was delivered. You can get additional support information by contacting SOLiD by email or telephone: support@solid.com 1-888-409-9997, Option #2

SOLiD welcomes feedback on this manual. Please send suggestions to support@solid.com with the term "Tech Pubs" in the subject line.

1.4 Safety and EMC Approvals

- FCC: This equipment complies with the applicable sections of Title 47 CFR Parts 15, 22, 24 and 90.
- ICES-003: This Class A digital apparatus complies with Canadian ICES-003.
- UL/CUL: This equipment complies with UL and CUL 1950-1 Standard for safety for information technology equipment, including electrical business equipment.
- FDA/CDRH: This equipment uses a Class 1 LASER according to FDA/CDRH Rules. This product conforms to all applicable standards of 21 CFR Chapter 1, Subchapter J, Part 1040.
- NFPA 72 Code Compliant (applicable only for equipment like the DAS Remote Optic Unit (ROU) which can be installed outdoors).

1.5 Safety Precautions

Only qualified personnel should handle the DMS-600 and EXPRESS DAS equipment. Any person involved in installing or servicing the DAS equipment should understand and follow these safety guidelines:

- Obey all general and regional safety regulations relating to work on high voltage installations, as well as regulations covering correct use of tools and personal protective equipment.
- Use this unit only for the purpose specified by the manufacturer. Do not modify or fit any spare parts that are not sold or recommended by the manufacturer. This could cause fires, electric shock or other injuries.
- To prevent electrical shock, switch the main power supply off prior to working with the DAS System or Fiber BDA. Never install or use electrical equipment in a wet location or during a lightning storm.
- When working with units outdoors, make sure to securely fasten the door or cover in an open position to prevent the door from slamming shut in windy conditions.
- Any DAS system or Fiber BDA will generate radio (RF) signals and continuously emit RF energy. Avoid prolonged exposure to the antennas. SOLiD recommends maintaining a 3-foot minimum clearance from the antenna while the system is operating.
- Do not look into the ends of any optical fiber. Laser radiation can seriously damage the retina of the eye. Do not look directly into the optical transceiver of any digital unit or exposure to laser radiation may result. Use an optical power meter to verify active fibers. Place a protective cap or hood over any radiating transceiver or optical fiber connector to avoid the potential of dangerous amounts of radiation exposure.
- Allow sufficient fiber length to permit routing without severe bends.
- Do not operate this unit on or close to flammable materials, as the unit may reach high temperatures due to power dissipation.
- For pluggable equipment, make sure to install the socket outlet near the equipment so that it is easily accessible.
- Do not use any solvents, chemicals, or cleaning solutions containing alcohol, ammonia, or abrasives on the DAS equipment. Alcohol may be used to clean fiber optic cabling ends and connectors.

2 Overview and Specifications

The EXPRESS single-carrier Distributed Antenna System (DAS) efficiently delivers wireless signals into buildings, campus environments, or any locations that are difficult to cover with traditional outdoor macro networks. EXPRESS is designed for cost-effective deployment, rapid commissioning and simplified management of in-building wireless service to meet the needs of a single wireless provider across multiple frequency bands.

EXPRESS is both flexible and sophisticated to support SISO as well as MIMO configurations. EXPRESS makes efficient use of building fiber – typically using just one fiber to connect a building. And like the ALLIANCE DAS system, SOLiD's multi-carrier DAS solution, EXPRESS is durable so it can be mounted indoors or outdoors. Plus its small footprint design requires minimal space.

By greatly improving in-building RF coverage, the EXPRESS system allows service providers and enterprise locations to deliver high-quality mobile voice and data services at any site in a building or campus environment. The system can be used to cover both public institutions and private facilities, including:

- Shopping malls
- Hotels
- Corporate and university campus areas
- Airports
- Clinics
- Subways
- Multi-use stadiums and convention centers

EXPRESS DAS supports both analog (AMPS) and digital (TDMA, CDMA and WCDMA) cellular systems through a single strand of fiber for the following communication standards and public interface protocols:

- Frequencies: VHF, UHF, 700MHz, 800MHz, 850MHz, 900MHz, 1900MHz, 2100MHz
- Voice protocols: AMPS, TDMA, CDMA, GSM, IDEN
- Data protocols: EDGE, GPRS, WCDMA, CDMA2000, LTE

EXPRESS DAS provides RF POWER CONTROL™, advanced RF filtering capabilities and 4G Certified MIMO in any band.

The system supports multiple frequencies in a single unit through the addition of plug-in modules. By delivering multiple signals with a single optical cable, the system does not require additional facilities whenever a new frequency is added.

The Express DAS platform serves two primary market segments: first as a carrier deployed coverage enhancement product for their specific frequencies and second as a low cost, public safety / single carrier product.

2.1 Features

The EXPRESS DAS system is a flexible and cost-effective solution offering:

Flexibility & Scalability

- Support for a maximum of 60 fiber-optic ports
- Clustering multiple-buildings (campus) as one coverage
- Small footprint

Modular Structures

- Upgrade by adding additional units
- Hot-swap plug-in modules for each frequency

Multi-Band, Single Operator

- Supports multiple services from one Wireless Service Provider

Low OPEX / CAPEX

- Compact and upgradable design
- Ability to utilize pre-existing infrastructure in building
- Easy installation, rapid commissioning and simplified management
- Supports SNMP (Simple Network Management Protocol v2) for web-based management
- Remote Management via TCP/IP connection
- Auto detection for remote units simplifies setup

2.2 System Components

EXPRESS DAS is comprised of several components and devices including:

- BTS Interface Unit (BIU)
- Optic Distribution Unit (ODU)
- Main Remote Unit (MRU)
- Add-on Remote Unit (ARU) (optional)
- DAS Management System (DMS-600)
- Optic Expansion Unit (OEU) (optional)

The figure shows a typical system topology with the primary components: BIU-ODU-MRU-DMS.

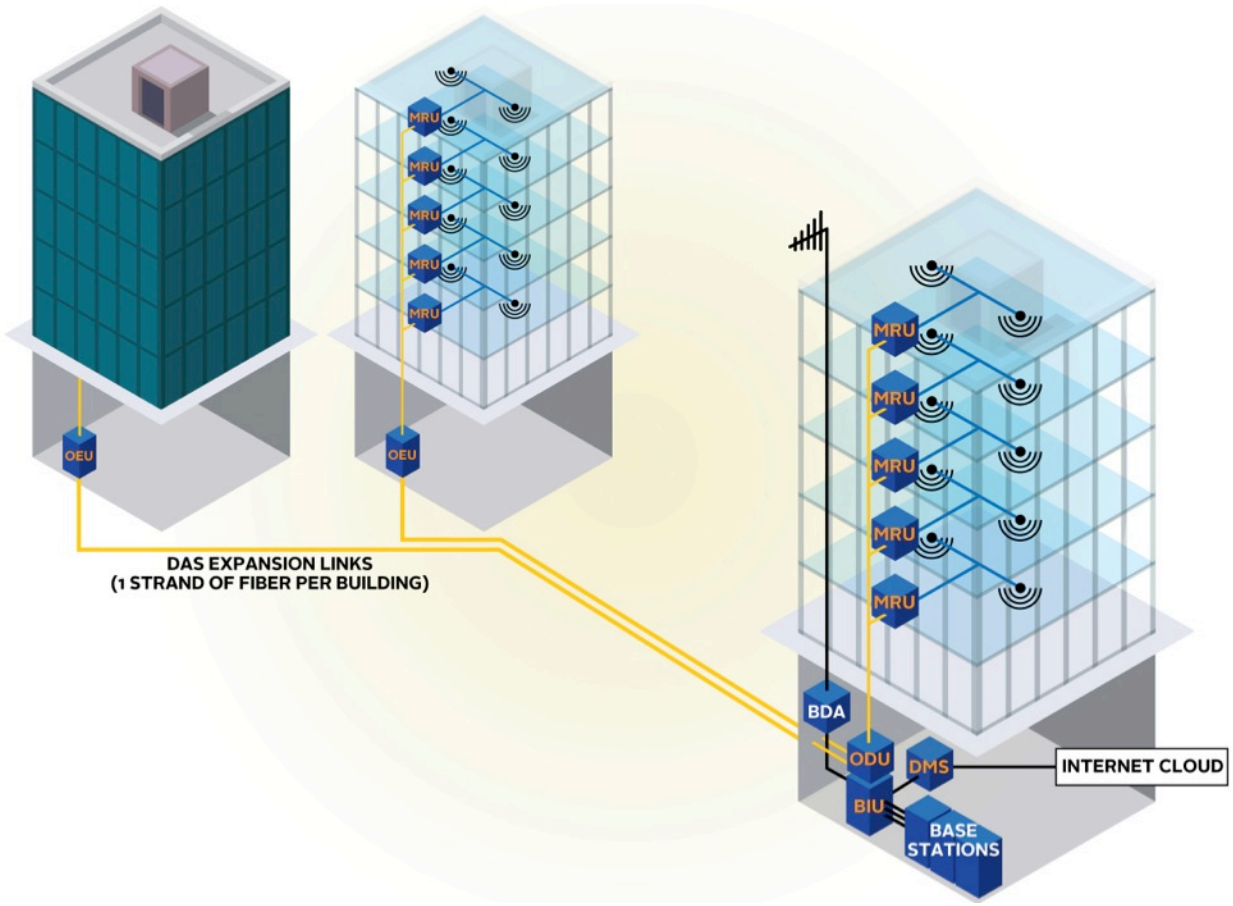


Figure 2.1 – EXPRESS Distributed Antenna System (DAS) Topology

The SOLiD EXPRESS Base Station Interface Unit (BIU), commonly referred to as the headend, receives signals from the carrier's base station and sends these to the system's Optical Distribution Unit (ODU).

The ODU converts the RF signals into optical signals and distributes them over fiber cabling to the EXPRESS Main Remote Units, or MRUs, in that sector. MRUs can be accompanied by Add-on Remote Units (ARUs), depending on the frequency bands required for each installation.

The MRU converts the optical signals back to RF signals and transports them across coaxial cable to the DAS antennae which radiate the wireless signals within the corresponding sector to the recipient's cell phone, public safety radio, smart phone, tablet or aircard.

Sending a signal back to the carrier follows the reverse path using the same equipment.

The BIU has two layers to support both SISO and MIMO configurations using separate optical fiber cable. One strand of fiber is needed for a SISO configuration, while two strands are needed for MIMO.

The DAS Management System (DMS-600) is a network management device that provides remote control and monitoring of the DAS through a standard Internet connection.

Using a single strand of fiber, the EXPRESS ODU can feed an EXPRESS Optical Expansion Unit (OEU) to extend the DAS from one building to others within the same campus. The OEU acts as a remote ODU for that distant building, feeding signals to another set of remote components.

SISO (single-input and single-output) and MIMO (multiple-input and multiple output) are available in a single unit. A MIMO configuration may be required to achieve increased communication performance – most notably in data throughput.

2.3 SISO Configuration

The figure below shows a typical SISO installation that supports four frequency bands using two modules in the BIU. The BIU CPU and BIU Power Supply occupy two of the expansion slots leaving three slots empty.

In this SISO environment, the connected ODU sends and receives the signal through a single fiber strand to and from the MRU/ARUs. From there the signal is passed forward and backward along coaxial cable to the antenna array.

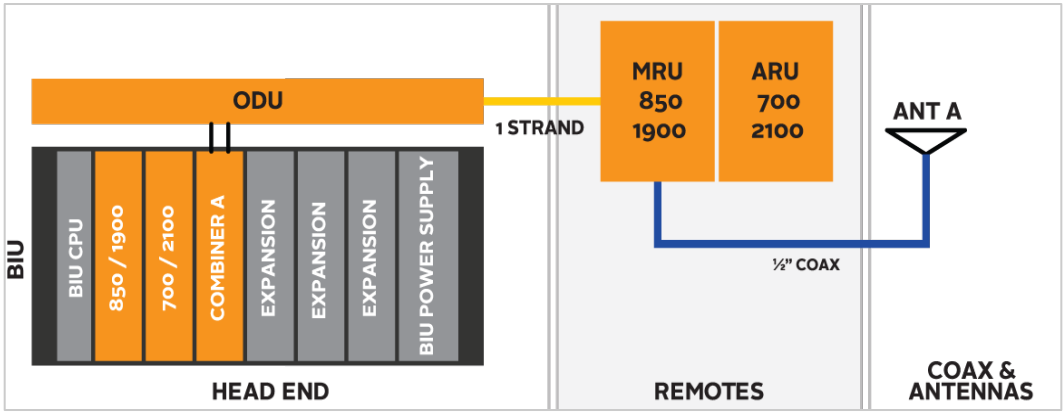


Figure 2.2 – EXPRESS DAS – SISO Configuration

2.4 MIMO Configuration

In the MIMO configuration, the BIU expansion slots are filled with another set of frequency modules and a combiner which provides the MIMO capability. The two combiners each feed their own Express ODU - shown here as an Orange "Leg A" and a Blue "Leg B." Two strands of fiber connect the respective MRU/ARU combinations and their attached antennas through coaxial cable.

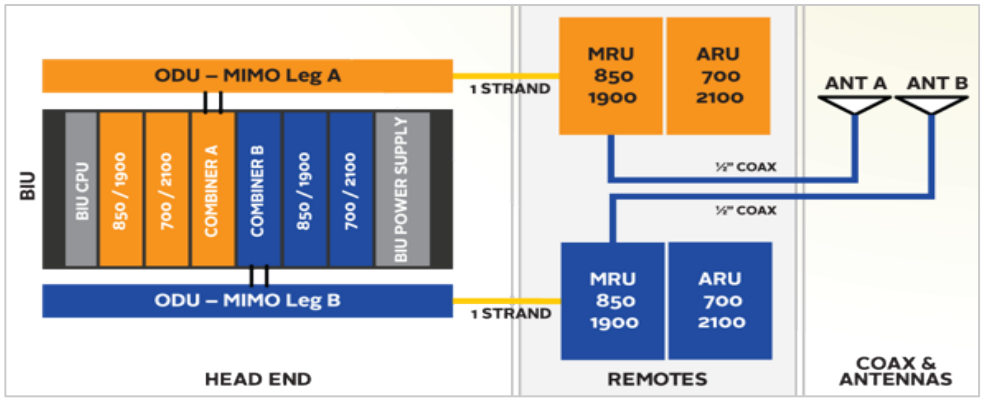


Figure 2.3 – EXPRESS DAS – MIMO Configuration

2.5 VHF/UHF Support

Support for VHF/UHF allows the EXPRESS DAS to host Public Safety and 2-Way Radio communications used by fire, police and first responders. The VHF/UHF capability is built in to the BIU, so offering support for these services does not require adding frequency modules or using additional expansion slots. However, a special VHF/UHF add-on remote unit is required to support these bands.

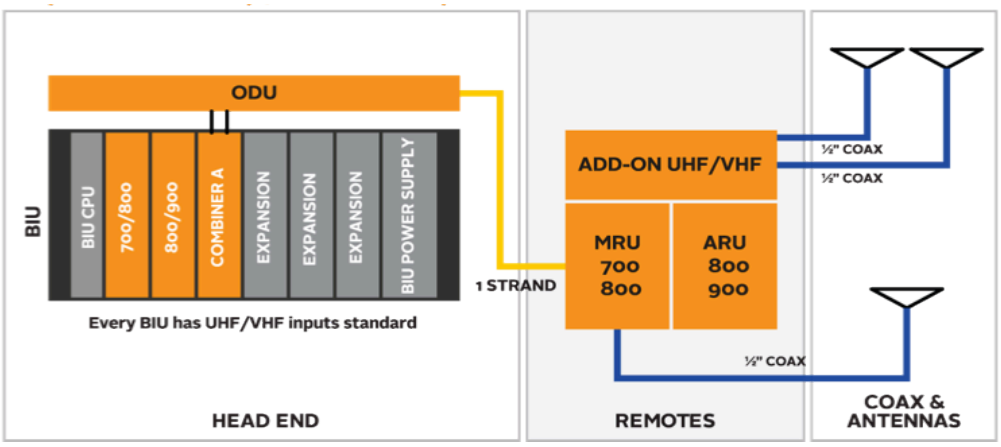


Figure 2.4 – EXPRESS DAS – VHF/UHF Configuration

2.6 System Capacities

- Each BIU supports one sector and up 6 bands (SISO and MIMO are supported for all bands).
- Each BIU can drive up to 8 ODUs (four on the SISO leg and four on the MIMO leg).
- Each BIU can support up to four OEUs.
- Each ODU can drive up to eight MRUs (or six MRUs and two OEUs).
- Only one strand of fiber is needed to connect each MRU or OEU.
- Each BIU can support up to four OEUs
- Each OEU can support up to eight MRU/ARUs
- The DMS-600 can support up to 16 sectors or BIUs.

2.7 Mechanical Specifications

Parameter	BIU	ODU	OEU
RF Connectors	4 SMA pairs (Tx, Rx) per MDBU	2 SMA	-
External Alarm connector (Dry contacts)	TB: 4pcs for output TB: 3pcs for input	-	-
Interface ports	USB (B) type and Ethernet		1 USB (B) type
Fiber connector	-	8pcs, SC/APC for MRU	1 SC/APC for ODU 8 SC/APC for MRU
LED Alarm and Status Indicator	MDBU Status Power status ALM status MCPU Power status Tx Comm Rx Comm ALM status MPSU Power status DC ALM status	DOU1 Status LD status PD1/2/3/4 status DOU2 Status LD status PD1/2/3/4 status	EWDM Status LD status PD status DOU1 Status LD status PD1/2/3/4 status DOU2 Status LD status PD1/2/3/4 status System status Power status TX1 Comm RX1 Comm TX2 Comm RX2 Comm ALM status
AC Power	-	-	
DC Power	Normal range: -48 VDC Operating range: -40.8 - -57.6VDC	Provided by BIU	
Power Consumption	SISO Mode: 162W (Including 4 SISO ODUs) MIMO Mode: 315W (Including 4 SISO ODUs and 4 MIMO ODUs)	28W (Including 2 DOUs)	40W (Including 2 DOUs)
Enclosure Dimensions	W x H x D mm 482.6 (19”) x 221.5 (5U) x 450	482.6 (19”) x 43.6 (1U) x 450	482.6 (19”) x 88.1 (2U) x 450
Weight [Full Load]	26.2Kg	6Kg	9.6Kg

Table 2.1 – Mechanical Specifications for BIU, ODU, OEU

Parameter	MRU	ARU	VHF/UHF AOR
RF Connectors	1 N-type 2SMA: optical 2SMA: RF	2SMA: optical 2SMA: RF	2 SMA Type female
External Alarm Connector (Dry contacts)	-	-	-
Serial Interface	1 USB (B) type	1 USB (B) type	-
Fiber Connector	1 SC/APC for ODU	-	-
			-
LED Alarm and Status Indicator	System status Power status Tx Comm Rx Comm ALM status Opt status	System status Power status Tx Comm Rx Comm ALM status	-
AC Power	Normal Range: 120VAC 50/60Hz Operating range 108-132VAC,50/60Hz	Same to left side	Normal Range: 120VAC 50/60Hz Operating range 108~132VAC, 50/60Hz
DC Power	Normal: -48 VDC Operating range: -40.8 - -57.6VDC	Same to left side	Normal: -48 VDC Operating range: -42 to -56V DC
Power Consumption	50W for dual band	40W for dual band	78W Chassis + 93W for VHF/UHF RDU
Enclosure Dimensions (W x H x D mm)	300 x 200 x 258	300 x 200 x 258	482.6 (19“ rack) x 268.2 x 177
Weight (Full Load) (Kg)	6.6	6.8	11

Table 2.2 – Mechanical Specifications for MRU, ARU, VHF/UHF AOR

2.8 Environmental Specifications

Parameter	BIU, ODU, OEU	MRU, ARU, VHF/UHF AOR	DMS-600
Operating Temperature (C)	-10 to +50°C	-10 to +50° C	-10 to +35°C
Operating Humidity, non-condensing	-	5% to 90%	8 to 90%

Table 2.3 – Environmental Specifications

2.9 Optic Specifications

Parameter	ODU	OEU	MRU
Optical Wavelength	Tx: 1310nm Rx: 1550nm	West optic Tx: 1550nm, Rx: 1310nm East optic Tx: 1310nm, Rx: 1550nm	Tx: 1550nm Rx: 1310nm
Output power	1.5dBm±1dBm to MRU/ARU,OEU	1dBm±1dBm to MRU/ARU 7dBm±1dBm to ODU	7dBm±1dBm to ODU
Return loss	<45dB	<45dB	<45dB

Table 2.4 – Optic Wavelength and Laser Power

2.10 Frequency Bands

Frequency Band	Description	Frequency range	
		Tx(MHz)	Rx(MHz)
700PS	P25/LTE	763 to 775	793 to 805
800PS	Public Safety/Sprint	851 to 869	806 to 824
850C	Cellular	869 to 894	824 to 849
900i	SMR	935 to 940	896 to 901
1900P	PCS	1930 to 1995	1850 to 1915
AWS	AWS-1	2110 to 2155	1710 to 1755
VHF	Public safety	136 to 174	136 to 174
UHF	Public safety (Band1)	396 to 450 450 to 512	396 to 450 450 to 512
700LTE	Long Term Evolution	728 to 757	698 to 716 777 to 787

Table 2.5 – Frequency Bands

2.11 Band Specifications

The Express DAS platform allows many band combinations as well as different output power levels within the band depending on the combination.

2.11.1 Output Power Level

Band Specifications		700PS	700LTE	800	850C	900i+PA	1900P	AWS-1	VHF	UHF
MRU	ARU									
850/1900P	700LTE/AWS	-	24dBm	-	24dBm	-	28dBm	28dBm	24dBm	24dBm
1900	800/900	-	-	25dBm	-	25dBm	30dBm	-		
1900		-	-	-	-	-	30dBm	-		
850/1900		-	-	-	25dBm	-	30dBm	-		
700PS/800	800/900	21dBm	-	21dBm	-	21dBm	-	-		

Table 2.6 – Output Power Level By Band

2.11.2 RF Specifications

Item	700PS	700LTE	800	850C	900i+PA	1900P	AWS-1	VHF	UHF
Downlink Gain	41dB	44dB	45(41)dB	44(45,41)dB	45(41)dB	48(50)dB	48(50)dB	14-39dB	14-39dB
TX Freq. Range (MHz)	764-776	728-757	851-869	869-894	929-941	1930-1995	2110-2155	136-174	385-512
RX Freq. Range (MHz)	794-806	698-716 777-787	806-824	824-849	896-902	1850-1915	1710-1755	136-174	385-512
Gain Control Range RX	20dB/step 1dB								
Spurious	<-13dBm								
Optical Link AGC	Above 10dB								
VSWR	1.4 max								
Passband ripple	5dBp-p per Band								
Optic Link Loss	Max 5dBo								
Optic Wavelength	1310nm/1550nm with WDM								
Uplink Output Power	0dBm/Total each band								
Uplink Input Power	-50dBm max								
Noise Figure	700PS, 700PS/800+800/900: 12dB; 700LTE, 1900+800/900, 850C, 900i+PA, 1900P, AWS: 8dB; VHF/UHF: 7dB								
Uplink Gain	30-50dB						25dB – 45dB		
Gain Control Range TX	25dB in 1dB steps								

Table 2.7 – RF Specifications

3 BTS Interface Unit (BIU)

As the central input unit (or headend) for all signals, the BIU independently filters, attenuates and controls each signal sent and received over the DAS. It also provides the connection point for the DMS-600 management system that allows control and command of the system.

The BIU provides forward path (downlink or Tx) signals from the base station (BTS) or bi-directional amplifier (BDA) to the system's ODUs (Optic Distribution Units). The BIU unit also separates reverse path (uplink or Rx) signals per individual frequency bands received from the ODUs. Each signal is independently filtered, attenuated, and controlled in the BIU.

The BIU offers a modular architecture allowing you to add service bands via hot swappable slide-in modules (Main Drive BTS Unit or MDBUs). The BIU supports quad band SISO and quad band MIMO in a single unit.

The following block diagram shows the BIU's primary components, functions, inputs and outputs.

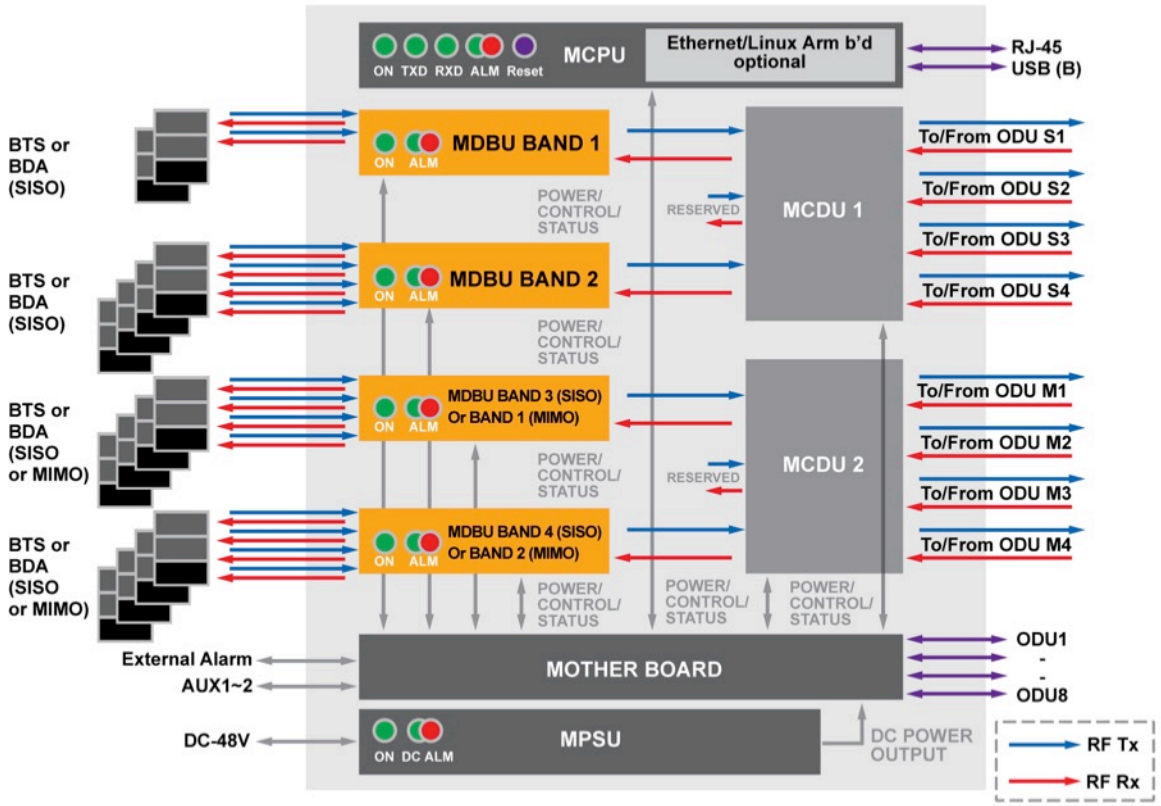


Figure 3.1 – BIU Block Diagram

3.1 BIU Specifications

The BIU mounts in a standard 19-inch rack mount frame and occupies five rack units (5U). The unit is powered from a separate DC Power Supply shelf.

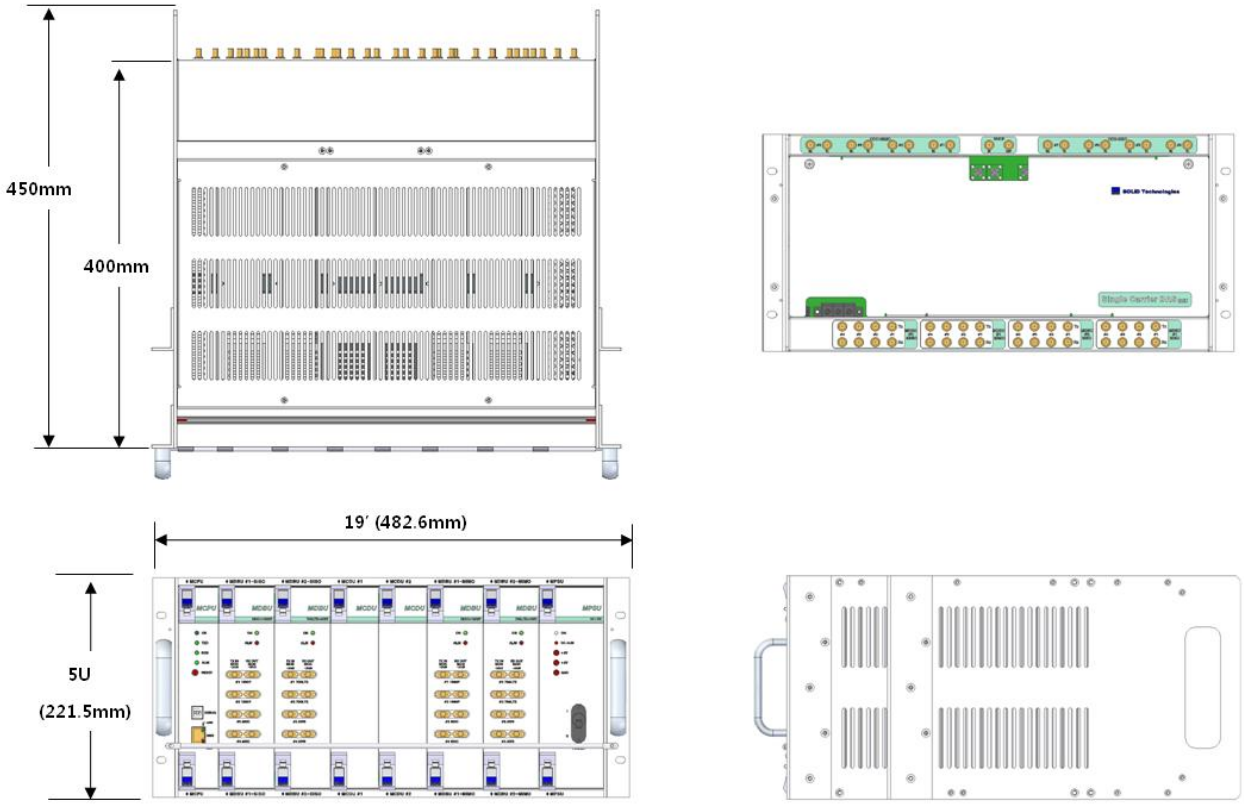


Figure 3.2 – BIU Dimensions

3.1.1 BIU Mechanical Specifications

Specification		Value
Downlink Input Power		-20 - +10dBm
Uplink Output Power		-25 - 0dBm
Nominal Impedance		50 ohm
Power Supply Voltage Range		-48V (DC : -42V - -56V)
Voltage Standing Wave Ratio VSWR		1.5:1 at all in& out ports
Monitoring level at MDBU		- 20dB
Mounting Type		19" Rack Mounting
Size (W x H x D mm)		482.6 (19") x 221 (5U) x 450
In & Output Port Type		SMA Female
Front Panel LED Indicator	SC_MDBU	Power on: Green, Alarm: Red
	SC_MCPU	Power on: Green, Alarm: Red LED flickering: Communication Status
	SC_MPSU	Power on: Green, Alarm: Red
Maximum Power Consumption		168W with 4 ODUs powered
Total Max Weight	SC_BIU_SISO	24.6kg
	SC_BIU_MIMO	26.2kg
Power consumption		SISO Mode: 168 W (Including 4 SISO ODUs) MIMO Mode: 315W (Including 4 SISO ODUs and 4 MIMO ODUs)
Type Approval & Certification		UL (UL60950-1), FCC
EMC		FCC Part15 compliant

Table 3.1 – BIU Mechanical Specifications

3.1.2 BIU Environmental Data

Specification	Value
Environmental Condition	In-door use only
Operating Temperature (Celsius)	-10° to +50°C
Operating Humidity	5 to 90% non-condensing

Table 3.2 – BIU Environmental Data

3.2 BIU Components

The BIU is comprised of several components, which are described in detail below.

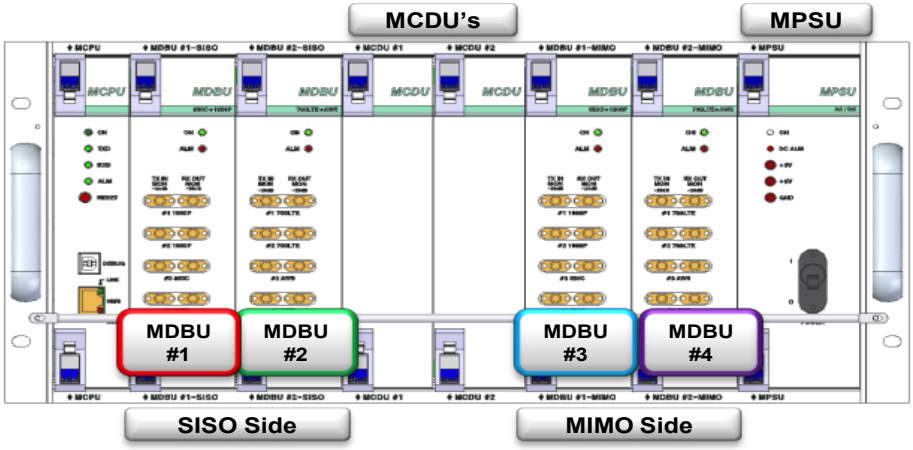


Figure 3.3 – BIU Components

Unit Name	Product No	Description
Chassis	SC_BIU_SISO SC_BIU_MIMO	SC_BIU_SISO: Includes MPSU Card, MCPU Card, MCDU Card,1 MCDU Blank and 2 MDBU Blanks SC_BIU_MIMO: Includes MPSU Card, MCPU Card and 2 MCDU Cards
Mother Board		Provides signal interface and power for each unit, four ports for dry contact output, three ports for input, two Aux ports for future usage
Main Drive BTS Unit (MDBU)	SC_MDBU	Amplify & adjust downlink RF signal Amplify & adjust uplink RF signal Max. 4 MDBUs in a single BIU
Main Combiner Divider Unit (MCDU)	SC_MCDU	Combines 4 downlink signals and divides 4 uplink signal to ODU Combines 4 uplink signals and divides 4 downlink signals to MDBU Supports VHF/UHF interface port
Main Central Processor Unit (MCPU)	SC_MCPU	Controls and monitors system status Control and monitoring with USB (B) Allows access via the Internet through Ethernet port
Main Power Supply Unit (MPSU)	SC_MPSU	Input power: DC -48V, Output power: 9V, 6V
Blank Card	SC_MCDU_B	Blank card for unused slot

Table 3.3 – BIU Components and Functions

Unit Name	Dimension (W x H x D) (mm)	Weight (Kg)	Power Consumption (W)
BTS Interface Unit – SISO	482.6 (19") x 221 (5U) x 450	13.2	7.2
BTS Interface Unit – MIMO	482.6 (19") x 221 (5U) x 450	14.2	9.6
Main Central Processor Unit	40 x 202.5 x 289.5	0.8	4.8
Main Power Supply Unit	65 x 202.5 x 294.5	2.3	
Main Combiner/Divider Unit	48.5 x 202.5 x 282.9	2	2.4
BIU Blank Card	48.5 x 202.5 x 282.9	0.3	-
	56.3 x 202.5 x 282.9	0.3	-
MDBU 1900PCS + 850 Cellular	56.3 x 202.5 x 282.9	3.0	16
MDBU 700LTE + AWS	56.3 x 202.5 x 282.9	3.0	16
MDBU 1900PCS	56.3 x 202.5 x 282.9	3.0	9
MDBU 800 IDEN + 900 IDEN	56.3 x 202.5 x 282.9	3.0	16

Table 3.4 – BIU Components -- Power Consumption, Weight and Dimension

3.2.1 Main Drive BTS Unit (MDBU)

The MDBU delivers downlink signals from the base station or BDA to mobile devices, and it delivers uplink signals from the devices to the BTS or BDA. The unit monitors downlink input levels and can automatically adjust input attenuation (ATT) using an Automatic Gain Control (AGC) function. It also uses attenuation to adjust the uplink gain.

A green LED on the front panel indicates power to the unit as well as power to the individual modules. A red LED indicates an alarm condition, meaning the module is connected to a signal source but there is an abnormal signal level.

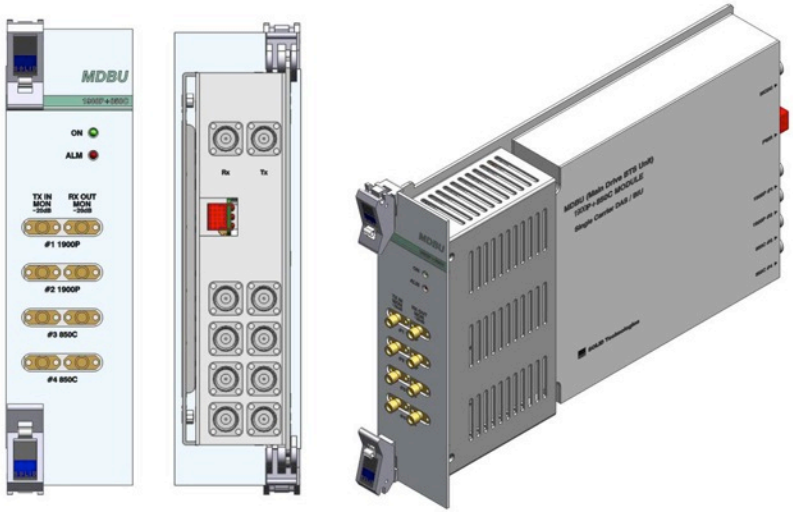


Figure 3.4 – MDBU at a glance

The MONITOR SMA ports seen at the MDBU front panel enable you to check the current levels of the downlink input and uplink output signals in current service without affecting the main service signals. **THESE PORTS ARE USED FOR TESTING PURPOSES ONLY.** All signal source connections are done on the back of the MDBU.

The BIU can support up to four MDBUs, which can vary according to the desired frequency band.

Supported frequencies are shown in the next table:

Frequency Band (SOLiD Product No.)	Service Band	Downlink (Tx)			Uplink (Rx)		
		# of Input Ports	Freq (MHz)	Band Width (MHz)	# of Output Ports	Freq (MHz)	Band width (MHz)
850Cellular + 1900PCS (SC_MDBU_850_1900)	1900 PCS	P1	1930-1995	65	P1	1850 - 1915	65
	1900 PCS	P2			P2		
	850 Cellular	P3	869-894	25	P3	824 - 849	25
	850 Cellular	P4			P4		
700LTE + AWS (SC_MDBU _700LTE_2100	700 LTE	P1	728-757	29	P1	B1: 698-716 B2: 777-787	B1: 18 B1: 10
	700 LTE	P2			P2		
	AWS	P3	2110-2115	45	P3	1710-1755	45
	AWS	P4			P4		
1900 PCS (SC_MDBU_1900	1900 PCS	P1	1930-1995	65	P1	1850-1915	65
	1900 PCS	P2			P2		
800iDEN + 900iDEN SC_MDBU_800_900	900 IDEN	P1	935-940	5	P1	896-901	5
	900 IDEN	P2			P2		
	800 IDEN	P3	851-869	18	P3	806-824	18
	800 IDEN	P4			P4		

Table 3.5 – MDBU Supported Bands and Frequencies

3.2.2 Main Combiner Divider Unit (MCDU)

The MCDU combines downlink signals received from the MDBUs, per frequency band, and then splits them for delivery to the system's Optic Distribution Units (ODUs). For the reverse path, it combines uplink signals from each of the ODUs and then divides them for delivery to the individual MDBUs. The unit supports attenuation (ATT) for input monitoring and input control.

The MCDU has a built-in port to interface with VHF/UHF signals from public safety and 2-way radio systems.

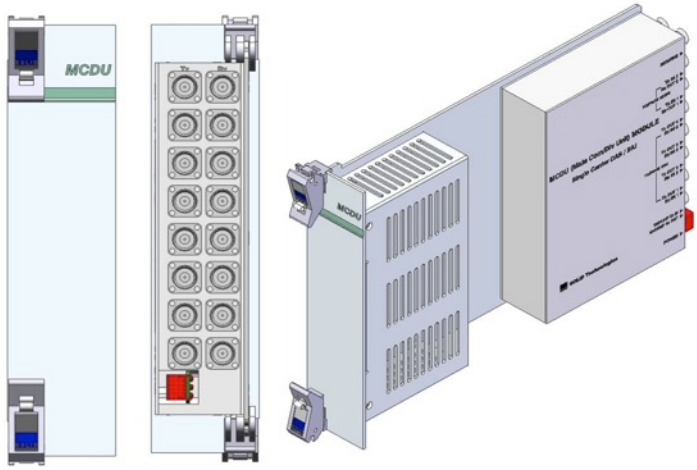


Figure 3.5 – MCDU at a Glance

The MCDU supports the VHF/UHF frequency band as shown in the following table:

Unit name	Manufacturer Product No	Description	In/out RF Port	
			Tx	Rx
VHF/UHF	SC_MCDU	Combining and dividing input signals to send to ODUs	1 Port	1 Port

Table 3.6 – MCDU – VHF/UHF Frequency Band

3.2.3 Main Central Processor Unit (MCPU)

The MCPU monitors the status of system components, and it provides an interface for commissioning and setup. The unit is equipped with an USB (B) debug port that allows you to directly connect a PC or laptop for monitoring and controlling the state of system devices. The unit also provides an Ethernet port for connection to the DMS-600 for onsite management or an IP network to enable remote monitoring, control and configuration of the system.

A green LED indicates power to the unit. Green flickering LEDs indicate downlink and uplink signals are being transmitted. Red LEDs indicate an alarm condition.

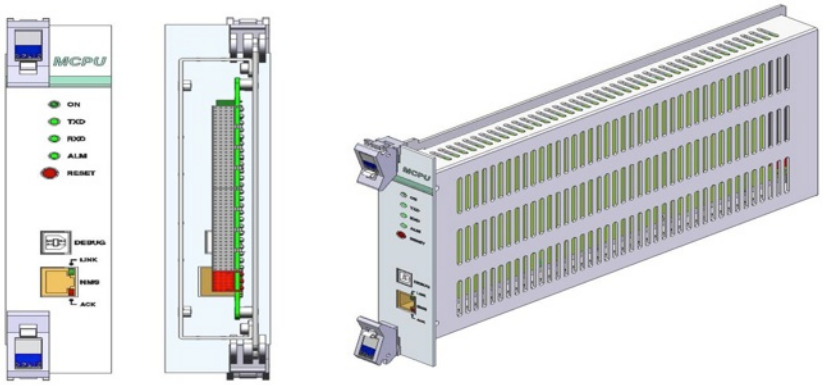


Figure 3.6 – MCPU at a Glance

The MCPU contains a lithium battery to support a Real Time Control (RTC) function. If the battery needs replacement, make sure to use the correct type to avoid risk of explosion and damage to the unit. Dispose of used batteries according to manufacturers instructions. Do not attempt to replace the lithium battery unless you have first received confirmation from SOLiD service personnel.

3.2.4 Main Power Supply Unit (MPSU)

The BIU requires -48v power, which is provided by a rack mounted DC power supply unit connected to the Main Power Supply Unit (MPSU) in the BIU. The MPSU delivers +6V and +9V DC power for components in the BIU and ODU. On the front panel, the MPSU has an output test port and LEDs to indicate power to the unit, DC Alarms and other fault conditions. You can also access the power on/off switch for the unit at the front panel.

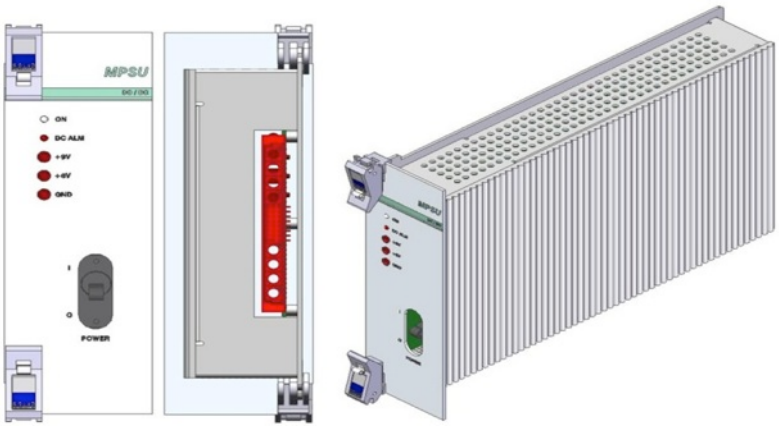


Figure 3.7 – MPSU at a Glance

3.3 BIU Front / Rear Panel – Indicators and Connectors

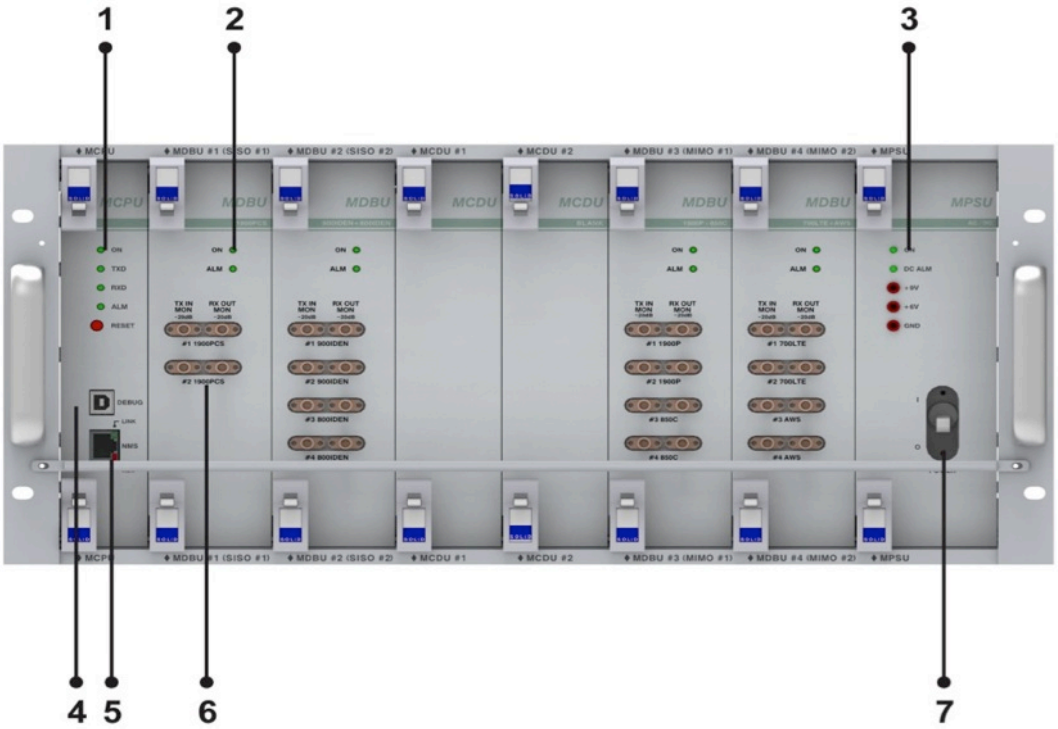


Figure 3.8 – BIU Front Panel

No.	Item	Description
1.	MCPU - Alarm LED & Reset	Communication status with devices, alarm status of entire system and reset switch
2.	MDBU LED	Shows status of MDBU (receiving power) and alarm conditions
3.	MPSU - Power Test Port & Alarm	Output DC power test port and ALM LED to show abnormal status
4.	MCPU - Debug (USB B)	Provides communication and diagnosis of devices through PC/laptop
5.	MCPU - Ethernet port	Provides remote access to system through IP network. Note: the supporting network mode is UDP protocol.
6.	MDBU - RF Monitor Ports	- 20dB Coupling below Downlink (Tx) Input Level - 20dB Coupling below Uplink (Rx) Output Level
7.	MPSU - Power switch	Power ON/OFF switch

Table 3.7 – BIU Front Panel Indicators

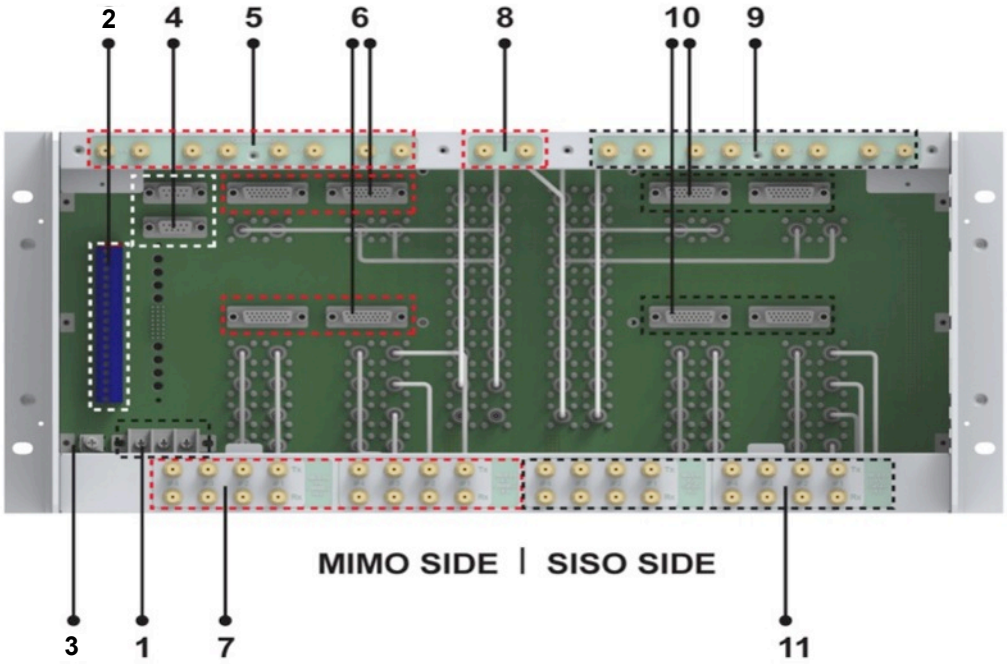


Figure 3.9 – BIU Rear Panel

No.	Item	Description
1.	DC Input Port	Input terminal for DC -48V
2.	External ALM Port	Input/output terminal for dry contact
3.	GND Port	System ground terminal
4.	AUX I/O Port	Reserved Port for future uses
5.	MIMO ODU I/O Port	RF signal interface terminal for ODU
6.	MIMO ODU signal Port	Power and signal interface terminal for ODU
7.	MIMO BTS/BDA I/O Port	Input/output interface terminal of BTS/BDA
8.	VHF/UHF I/O Port	RF signal interface terminal of VHF/UHF
9.	SISO ODU I/O Port	RF signal interface terminal for ODU
10.	SISO ODU signal Port	Power and signal interface terminal for ODU
11.	SISO BTS/BDA I/O Port	Input/output interface terminal of BTS/BDA

Table 3.8 – BIU Rear Panel Connectors

Coax wiring connecting each signal source at the back of the unit comes factory pre-installed to simplify installation. **DO NOT ATTEMPT TO CHANGE THIS WIRING**.

3.4 EXPRESS DC Power Supply (SC-RMP-480)

The SC-RMP-480 DC Power Supply is used in the headend to provide power to the BIU and ODU(s). Two BIUs can be powered with a single SC-RMP-480. The ODUs are powered through connections to the BIU and do not require separate power supplies. The SC-RMP-480 can also be used to provide power to the OEU in remote locations. The unit mounts in a 19-inch rack, comes with a power cable and provides a front access rocker power switch for turning the power on/off.

NOTE: In most instances, the SC-RMP-480 will support all devices that need power in a single sector system, but you should verify the wattage required for each configuration scenario.

3.4.1 SC-RMP-480 Features

- Auto ranging input; full range 85-264 VAC; 120-370 VDC input voltage
- Protections: Short circuit / Overload / Over temperature
- Fan cooled
- Built-in remote ON-OFF control
- Working temperature of -20C to +60C

3.4.2 SC-RMP-480 Specifications

Figure 3.10 – DC Power Supply Front View

Item	Specification	Remark
Size (W x H x D) mm	482.6 (19") x 44.5mm (½ RU) x 127	Fits a 19" rack; ½ rack depth
Weight	3.63kg, 8lbs	
Power handling	480W	

Table 3.9 – DC Power Supply Specifications

4 Optical Distribution Unit (ODU)

The ODU contains an internal optical transmitter and receiver allowing it to perform RF and optical signal conversions. The ODU receives incoming downlink RF signals from the BIU and converts them into optical signals. It then sends the optical signals to remote MRUs/ARUs through fiber optic cables. For the reverse path, the ODU converts optical signals received from the MRUs/ARUs to RF signals attenuated at -20dbm and sends them to the BIU.

The following block diagram shows the ODU's primary components, functions, inputs and outputs.

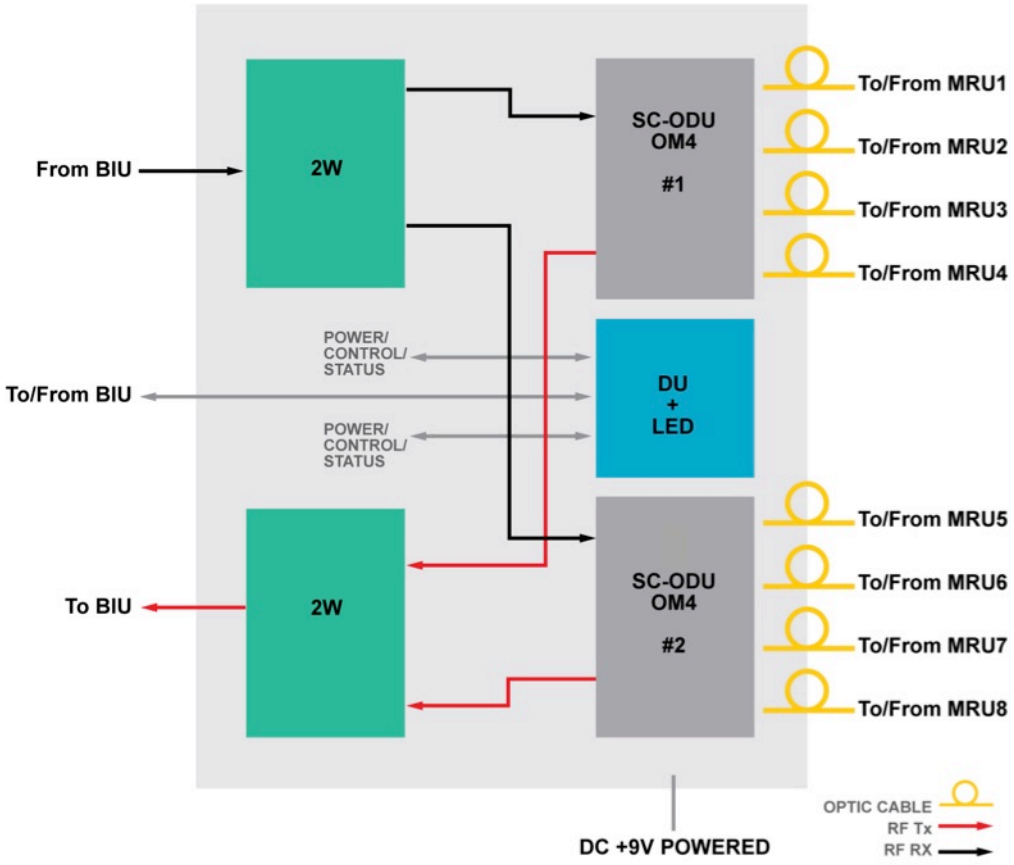


Figure 4.1 – ODU Block Diagram

4.1 ODU Specifications

The ODU mounts in a standard 19-inch rack frame and occupies one rack unit (1U). The ODU is generally co-located with the BIU from which it receives power and RF communication. Two coax cables and a power supply cable connect the two units. Up to eight ODUs can be connected with the BIU, four for the SISO and four for the MIMO paths. Each ODU can hold two Donor Optic Units, and each DOU supports four optical ports. Therefore, each ODU can provide connections to eight MRUs (or six MRUs and two OEUs).

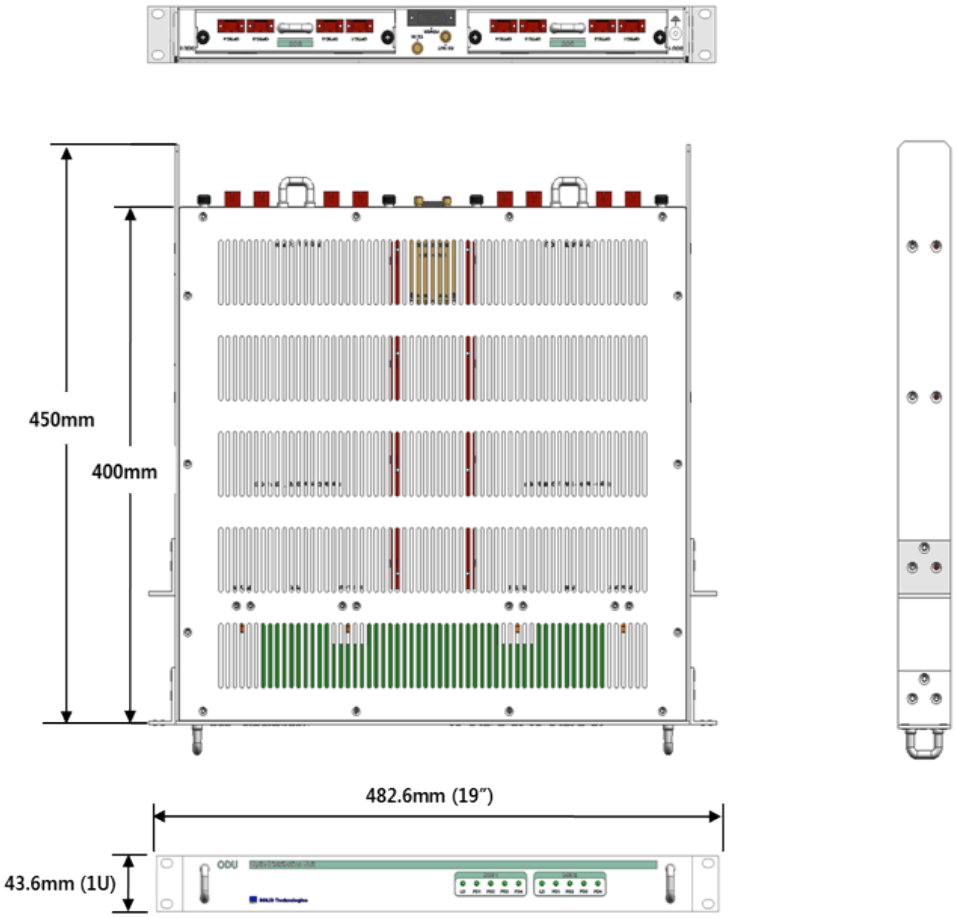


Figure 4.2 – ODU Dimensions

4.1.1 ODU Mechanical Specifications

Specification		Value
Downlink Input Power		-8dBm (VHF/UFH : -15dBm)
Uplink Output Power		-9dBm (VHF/UFH : -10dBm)
Nominal Impedance		50 ohm
Input Voltage		DC +9V
Voltage Standing Wave Ratio (VSWR)		1.8:1 at all in& out ports
Mounting Type		19” Rack Mounting (1U height)
Size (W x H x D) mm		482.6 (19") x 43.6 (1U) x 450
In & Output Port Type		SMA Female
Front Panel LED Indicator	LD	Power on: Green, Alarm: Red
	PD1 - PD4	Power on: Green, Alarm: Red LED flickering: Communication Status
Total Max Weight		5.9 kg
Type Approval & Certification		UL(UL60950-1), FCC
EMC		FCC Part15 compliant
Power consumption		28.2 W

Table 4.1 – ODU Mechanical Specifications

4.1.2 ODU Environmental Data

Specification	Value
Environmental Condition	Indoor use only
Operating Temperature (°C)	-10° to +50°C
Operating Humidity	5 to 90% non-condensing

Table 4.2 – ODU Environmental Data

4.2 ODU Components

The principal ODU component is the Donor Optic Unit, which is described below.

Unit Name	Manufacturer Product No.	Description	Remark
Optical Distribution Unit Chassis	SC_ODU_C	Common part that accepts DOUs. Provides RF connections to/from BIU.	
Donor Optic Unit	SC_ODU OM 4	Four Port Optical Unit that converts Downlink (Tx) RF signals into optical signals and converts Uplink (Rx) optical signals into RF signals	Four optical ports per DOU. Two DOUs per one ODU.
ODU Blank Card	SC_ODU_B (ODU BLANK)	Blank card for unused slot	

Table 4.3 – ODU Components

Unit Name	Dimension (WxHxD) (mm)	Weight (kg)	Power Consumption (W)
Optical Distribution Unit Chassis	482.6 (19”) x 43.6 (1U) x 450	2.5	1.2
4 Port Donor Optic Unit	169 x 33 x 302	1.7	13.5
Blank Card	169 x 33 x 302	0.4	-

Table 4.4 – ODU Components – Mechanical Specifications

4.2.1 Donor Optic Unit (DOU)

Within the ODU, converting RF signals to optical signals and back again is the job of the Donor Optic Units (DOUs). Each ODU can support up to two DOUs. Each DOU supports four optical ports, providing connections for up to eight MRUs.

The DOU uses an optic splitter to divide the optical signals into four separate signals and then distributes each to an optical port. For the uplink path, it makes the optical-electronic conversion of signals received from each optical port. The unit can perform attenuation (ATT) for optical compensation in the case of optical loss in the fiber or fiber connectors. Because of the internal Wavelength Division Multiplexing (WDM) capability, only one optical cable is required for the connection to each MRU. An internal FSK modem allows communication from remote sites.

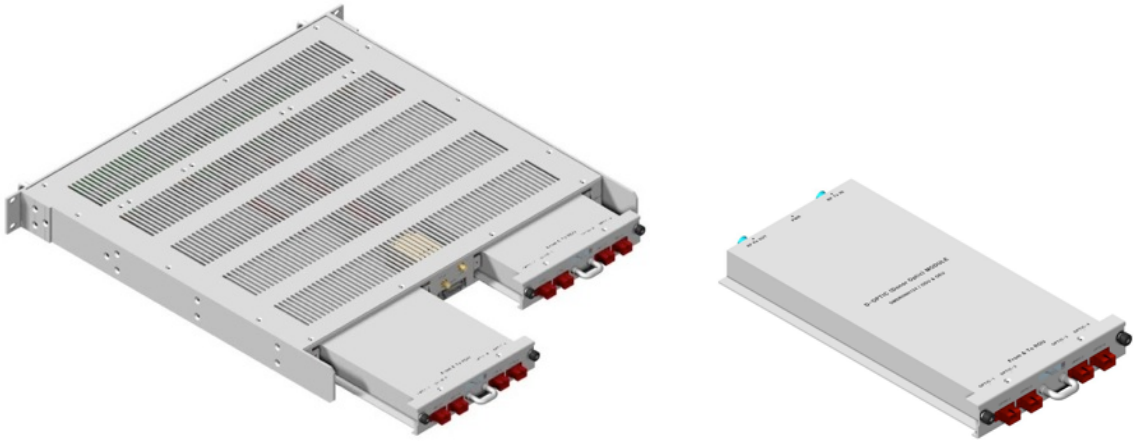


Figure 4.3 – DOU at a Glance

4.3 Donor Optic Unit Specifications

4.3.1 Optical Data

Unit Name		Donor Optic Unit	Remark
Connector	RF	PLUG-IN FEMALE / 50ohm	Analog
	Optic	SC / APC (STEP FERRULE)	
	Power/Signal	D-SUB 2 Row 15PIN MALE	
Laser Diode		1310nm(Coaxial Type)	
Photo Diode		1550nm	
Optic Loss		1dBo to 5dBo	ODU to OEU ODU to MRU

Table 4.5 – DOU Optical Data

4.3.2 Electrical Data

Service Band	Downlink (Tx)		Uplink (Rx)	
	Frequency (MHz)	Bandwidth (MHz)	Frequency (MHz)	Bandwidth (MHz)
1900 PCS	1930 - 1995	65	1850 - 1915	65
850 Cellular	869 - 894	25	824 - 849	25
700 LTE	728 - 757	29	B1: 698 - 716 B2: 777 - 787	B1: 18 B1: 10
2100 AWS	2110 - 2155	45	1710 - 1755	45
1900 PCS	1930 - 1995	65	1850 - 1915	65
900 IDEN	935 - 940	5	896 - 901	5
800 IDEN	851 - 869	18	806 - 824	18

Table 4.6 – DOU Electrical Data

4.4 ODU Front / Rear Panel – Indicators and Connectors

Each DOU and port has a set of LED indicators on the front panel. Green LEDs indicate normal optic signal levels and red LEDs indicate abnormal optic levels.

Figure 4.4 – ODU Front Panel

Item	Description
1, 2	LED indicators to check DOU module status

Table 4.7 – ODU Front Panel Indicators

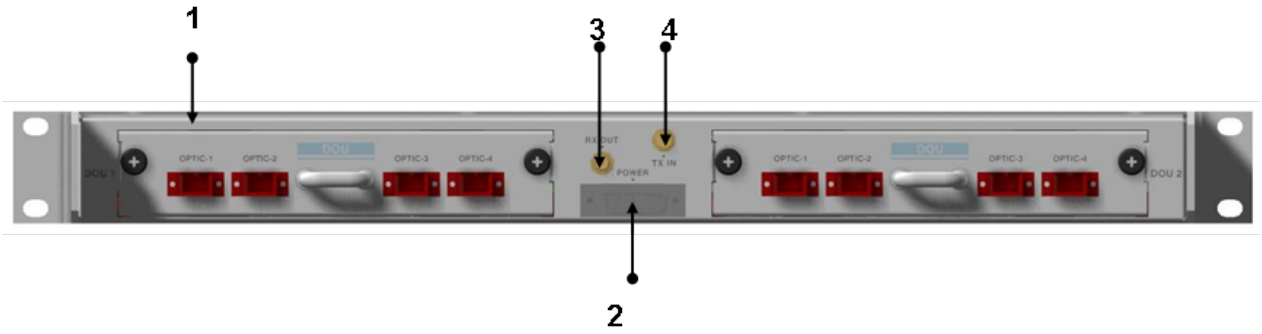


Figure 4.5 – ODU Rear Panel

No.	Item	Description
1.	Optic Port	SC/APC optical connector terminal; use one optical cable per MRU.
2.	DC I/O Port	Terminal to deliver power and status values
3.	Uplink (Rx) RF Port	Uplink RF signal interface terminal
4.	Downlink (Tx) RF Port	Downlink RF signal interface terminal

Table 4.8 – ODU Rear Panel Connectors

5 Remote Units – MRU, ARU, VHF/UHF AOR

The Main Remote Unit (MRU) receives downlink (Tx) optical signals from the ODU and converts them to RF signals. The MRU amplifies the converted RF signals, combines them, and then delivers them to the antenna port. When receiving uplink (Rx) signals through the antenna port, the unit filters out-of-band signals, converts the RF signal to optical, then sends them to the ODU (or optional OEU).

The MRU comes in both single band and dual-band configurations. The optional Add-on Remote Unit (ARU) only comes in dual-band configurations. In addition, a VHF/UHF Add on Remote (AOR) is available to support the 450MHz UHF and 150MHz VHF bands. (See the table on page 12 for currently supported bands.)

Because the MRU provides the connection to the ODU at the headend and to the antenna, this unit is required in every configuration. The ARU and VHF/UHF AOR are optional add-on units and only required to support specific bands. The ARU and AOR perform many of the same services as the MRU, but do not contain an optical module or connection to the antenna. As an exception, the UHF/WHF AOR requires a separate antenna connected to the unit.

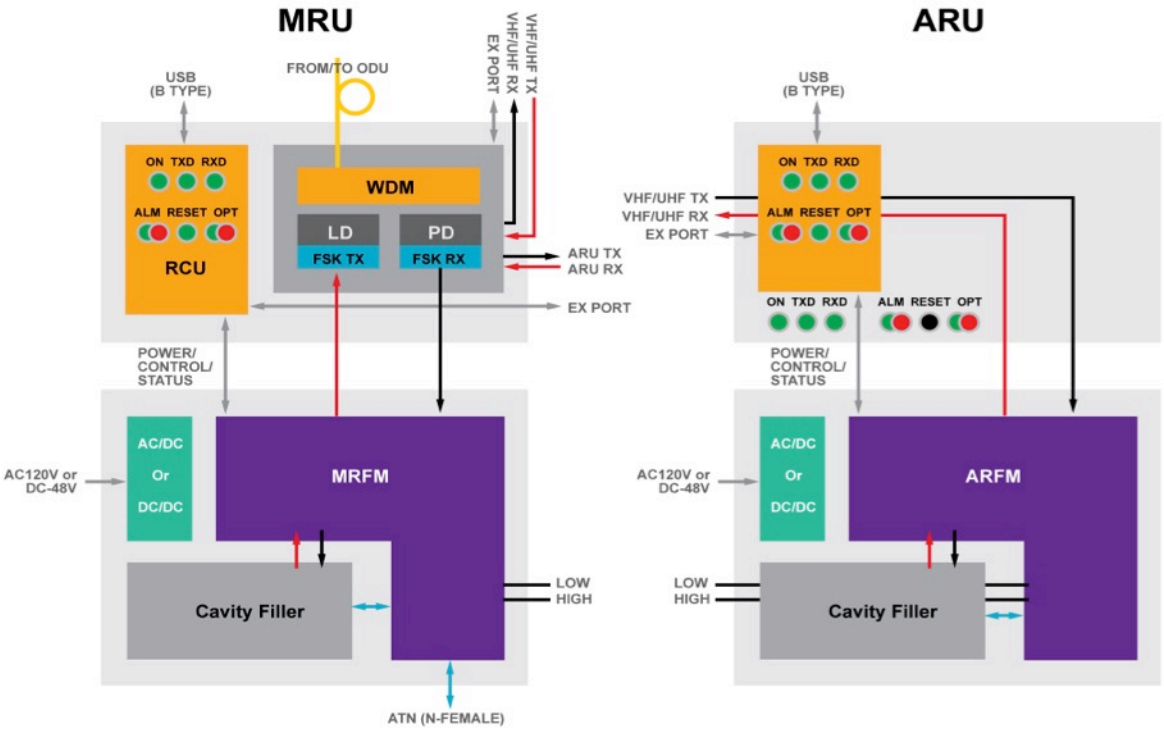


Figure 5.1 – MRU/ARU Block Diagram

5.1 MRU/ARU Specifications

The MRU and ARU cabinets are available as either indoor or outdoor models, and as either DC or AC powered units. When installed indoors, the cabinets can be wall or rack mounted. For outdoor installations, the cabinets are wall mounted either side-by-side or stacked with the ARU installed in front of the MRU. The outdoor cabinets meet both IP65 and NEMA 4 specifications for outdoor enclosures. The MRU and ARU have the same form factor. Dimensions are shown in the next figure.

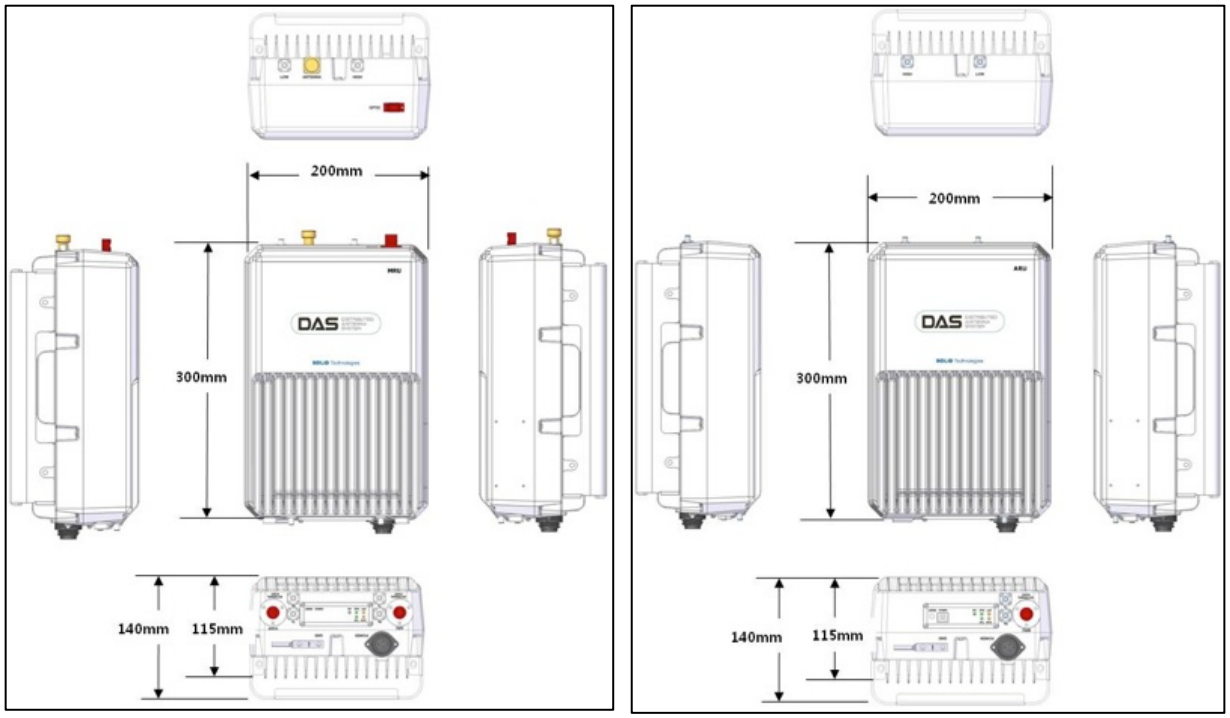


Figure 5.2 – MRU/ARU Dimensions

5.1.1 MRU/ARU Mechanical Specifications

Specification		Value
Uplink Input Power		-30 ~50dBm
Nominal Impedance		50 ohm
Power Supply Voltage Range		AC90 ~264V, Output Voltage: +25V DC: -48V(-42 to -56V), Output DC: +25V
Voltage Standing Wave Ratio (VSWR)		1.6:1 at all in and out ports
Mounting Type		Wall Mounting & 19" Rack Mounting
In & Output Port Type		N Female & SMA Female
Front Panel LED Indicator	ON	Power ON: Green, Alarm: Red
	ALM	Power ON: Green / Power OFF: Gray
	OPT	Normal: Green, Alarm: Red
	TXD	Green Flickering
	RXD	Green Flickering
Maximum Power Consumption		50W at full load
Type Approval & Certification		UL (UL60950-1), FCC
EMC		FCC Part 24 compliant

Table 5.1 – MRU/ARU Mechanical Specifications

5.1.2 MRU/ARU Environmental Data

Specification	Value
Environmental Condition & IP Rating	For indoor use, or an IP 65 / NEMA 4-rated enclosure is available for outdoor installations.
Operating Temperature (°C)	-10° to +50°C
Operating Humidity	5 to 90% non-condensing

Table 5.2 – MRU/ARU Environmental Data

5.1.3 MRU/ARU Mechanical Specifications

Unit Name	Manufacturer Product No.	Dimension (W x H x D mm)	Weight (Kg)	Power Consumption (W)
1900MHz Main Remote Unit	MRU_AC_1900	200 x 300 x 138.5	6.6	45
	MRU_AC_NEMA_1900			
	MRU_DC_1900			
	MRU_DC_NEMA_1900			
850MHz & 1900MHz Main Remote Unit	MRU_AC_850_1900	200 x 300 x 138.5	6.6	50
	MRU_AC_NEMA_850_1900			
	MRU_DC_850_1900			
	MRU_DC_NEMA_850_1900			
700MHz LTE & 2100MHz Add-on Remote Unit	ARU_AC_700LTE_2100	200 x 300 x 138.5	6.8	40
	ARU_AC_NEMA_700LTE_2100			
	ARU_DC_700LTE_2100			
	ARU_DC_700LTE_NEMA_2100			
800MHz & 900MHz Add-on Remote Unit	ARU_AC_800_900	200 x 300 x 138.5	6.8	44
	ARU_AC_NEMA_800_900			
	ARU_DC_800_900			
	ARU_DC_NEMA_800_900			
VHF/UHF AOR (includes 150/450 RDU and AC power supply)	SC_AC_150_450	482 x 268.2 x 177	13.6	78 – Chassis + 93 - RDU
VHF/UHF AOR (includes 150/450 RDU and DC power supply)	SC_DC_150_450	482 x 268.2 x 177	13.6	78 – Chassis + 93 - RDU
Flush wall mount bracket	SC-BRK	482.6 x 310.3 x 157	2.8	-
Stacking ARU wall mounting kit	SC-ARU-STK	270 x 318.3 x 164	1.6	-
19" Rack MRU/ARU mounting kit	SC-RM19	482.6 x 177 x 463	6.8	-

Table 5.3 – MRU/ARU Mechanical Specifications

5.1.4 MRU RF Specifications

Frequency Band	Product No.	Service Band	Downlink (Tx)			Uplink (Rx)	
			Freq (MHz)	Band width (MHz)	Output Power (dBm)	Freq (MHz)	Band width (MHz)
1900 PCS	MRU_AC_1900	1900 PCS	1930-1995	65	31	1850-1915	65
	MRU_AC_ NEMA_1900						
	MRU_DC_1900						
	MRU_DC _NEMA_1900						
850 Cellular + 1900 PCS	MRU_AC _850_1900	1900 PCS	1930-1995	65	28	1850-1915	65
		850 Cellular	869-894	25	24	824-849	25
	MRU_AC_NEMA _850_1900	1900 PCS	1930-1995	65	28	1850-1915	65
		850 Cellular	869-894	25	24	824-849	25
	MRU_DC _850_1900	1900 PCS	1930-1995	65	28	1850-1915	65
		850 Cellular	869-894	25	24	824-849	25
	MRU_DC_NEMA _850_1900	1900 PCS	1930-1995	65	28	1850-1915	65
		850 Cellular	869-894	25	24	824-849	25

Table 5.4 – MRU RF Specifications

5.1.5 ARU RF Specifications

Frequency Band	Product No.	Service Band	Downlink (Tx)				Uplink (Rx)		
			# of Input Port	Freq (MHz)	Band width (MHz)	Output Power (dBm)	# of Output Port	Freq (MHz)	Band width (MHz)
700LTE + AWS	ARU_AC _700LTE_2100	AWS	LOW	728-757	29	24	LOW	B1: 698-716 B2: 777-787	B1: 18 B1: 10
		AWS	HIGH	2110-2115	45	28	HIGH	1710-1755	45
	ARU_AC_NEMA _700LTE_2100	700LTE	LOW	728-757	29	24	LOW	B1: 698-716 B2: 777-787	B1: 18 B1: 10
		AWS	HIGH	2110-2115	45	28	HIGH	1710-1755	45
	ARU_DC _700LTE_2100	700LTE	LOW	728-757	29	24	LOW	B1: 698-716 B2: 777-787	B1: 18 B1: 10
		AWS	HIGH	2110-2115	45	28	HIGH	1710-1755	45
	ARU_DC_ 700LTE_NEMA_2100	700LTE	LOW	728-757	29	24	LOW	B1: 698-716 B2: 777-787	B1: 18 B1: 10
		AWS	HIGH	2110-2115	45	28	HIGH	1710-1755	45
800iDEN + 900iDEN	ARU_AC_800_900	900iDEN	LOW	935 - 940	5	26	LOW	896 - 901	5
		800iDEN		851 - 869	18	26		806 - 824	18
	ARU_AC_NEMA _800_900	900iDEN	LOW	935 - 940	5	26	LOW	896 - 901	5
		800iDEN		851 - 869	18	26		806 - 824	18
	ARU_DC_800_900	900iDEN	LOW	935 - 940	5	26	LOW	896 - 901	5
		800iDEN		851 - 869	18	26		806 - 824	18
	ARU_DC_NEMA _800_900	900iDEN	LOW	935 - 940	5	26	LOW	896 - 901	5
		800iDEN		851 - 869	18	26		806 - 824	18

Table 5.5 – ARU RF Specifications

5.2 MRU/ARU Components

As an example, the figure below shows the various components of the MRU supporting the 850 Cellular and 1900 PCS bands. These components are further explained in this section.

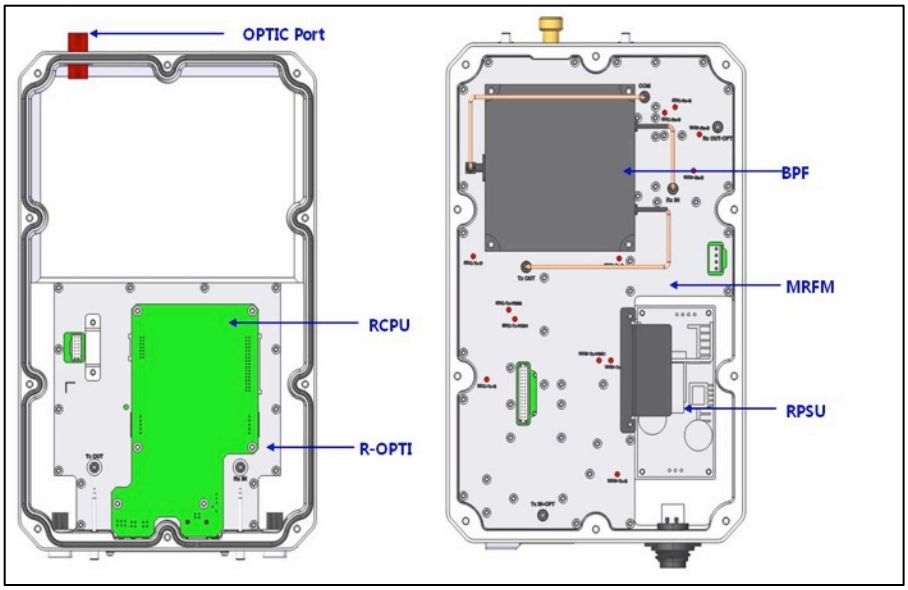


Figure 5.3 – MRU 850C+1900P Internal View

Unit Name	Description
Enclosure	Wall Mount, Rack Mount. Indoor, Outdoor Wall Mount; System operation is checked through LED panel on bottom panel
MRFM / ARFM +BPF	Main/Add-on RF Module: Filter and amplify Tx signals; Filter and amplify Rx signals; Remove other signals through BPF
RPSU	Remote Power Supply Unit: Input power: DC -48V or AC120V, Output power: 25V For 120V input of AC/DC; For -48V input of DC/DC
R-OPT (MRU Only)	Remote Optic: Convert downlink RF signals to optical; Convert uplink optical signals into RF; Compensates optical loss interval Communicates with BIU or OEU though the FSK modem
RCPU	Remote Central Processor Unit: Controls signal of each unit Monitors BIU/ODU/OEU status through FSK modem Communication

Table 5.6 – MRU / ARU Components

5.2.1 Main RF Module/Add-on RF Module (MRFM/ARFM) and Band Pass Filters

When receiving downlink (Tx) signals from each band through the R-Optic module, the MRFM/AFRM filters the signals and amplifies them with the High Power Amplifier. The unit also filters uplink (Rx) signals received through the antenna port and amplifies them as low noise to send the signals to the R-Optic module.

The unit provides attenuation (ATT) to adjust gain. The following table shows the available units per frequency band:

Combination	Unit Name	Description	BPF	
			Cavity Filter	Ceramic Filter
MRU850C + 1900P	MRFM 850C+1900P	Dual	1900PCS	850C
MRU1900P	MRFM 1900P	Single	1900PCS	-
ARU700LTE + AWS	ARFM 700LTE+2100AWS	Dual	700LTE	AWS
ARU800i + 900i	ARFM800i+900i	Dual	800iEN/900iDEN	-

Table 5.7 – Main RF Module/Add-on RF Module (MRFM/ARFM) and Band Pass Filters

5.2.2 Remote Power Supply Unit (RPSU)

The RPSU can accept DC or AC input. The DC/DC unit accepts -48VDC and outputs +25V of DC power. The AC/DC type takes 120V AC input and outputs +25V of DC power. The following table shows the acceptable input ranges for each option:

Unit	Range of input power
AC/DC	90 to 264 VAC
DC/DC	-42V to -56VDC

Table 5.8 – Remote Power Supply Unit – Range of Input Power

When ordering the MRU / ARU, make sure to specify the power type needed for your installation. The input cable is different depending on input voltage requirements.

NOTE: The RPSU does not have an ON/OFF power switch. The unit is active when power is connected.

5.2.3 Remote Optic (R-OPT)

The Remote Optic module converts optical signals into RF signals and RF back to optical. The module communicates with headend devices (the ODU and MDBU cards in the BIU) through an FSK modem. It also features internal attenuation (ATT) to compensate for optical cable loss. The optical wavelength for the downlink (Tx) path is 1310nm and for the uplink (Rx) path 1550nm. Transport is provided over a fiber strand using WDM (Wavelength Division Multiplexing) technology.

5.2.4 Remote Central Processor Unit (RCPU)

The RCPU monitors and controls each module of the MRU and ARU. A USB (B-type) port connection beneath the LED cover plate enables you to connect a PC and check device status through the SOLiD software interface.

5.3 MRU/ARU Connectors (Top / Bottom Views)

5.3.1 MRU/ARU Top View

The following figures show the top view of the MRU and ARU NEMA-rated cabinets.

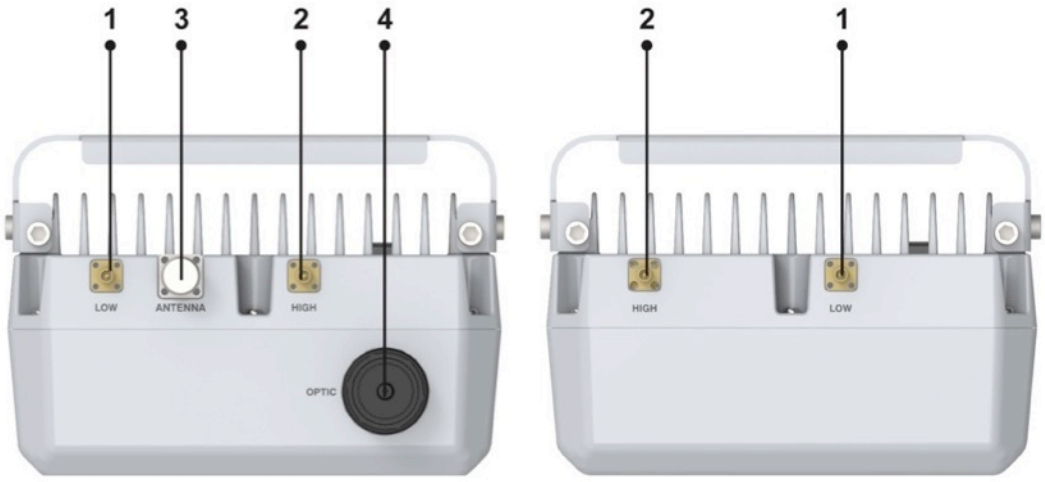


Figure 5.4 – MRU / ARU Top Connectors

No.	Item	Description
1	RF Port	Terminal for Low band RF port to connect between MRU and ARU RF
2	RF Port	Terminal for High band RF port to connect between MRU and ARU RF
3	Antenna Port (MRU Only)	Terminal for RF port to connect to antenna
4	Optic Port (MRU Only)	Terminal for Optical port to connect with fiber cable The fiber connector type is SC/APC

Table 5.9 – MRU / ARU Top Connectors

5.3.2 MRU/ARU Bottom View and Connectors

The following figure shows the bottom view of the MRU and ARU NEMA-rated cabinets. The bottom of the unit is protected with a water drip edge to prevent water intrusion.

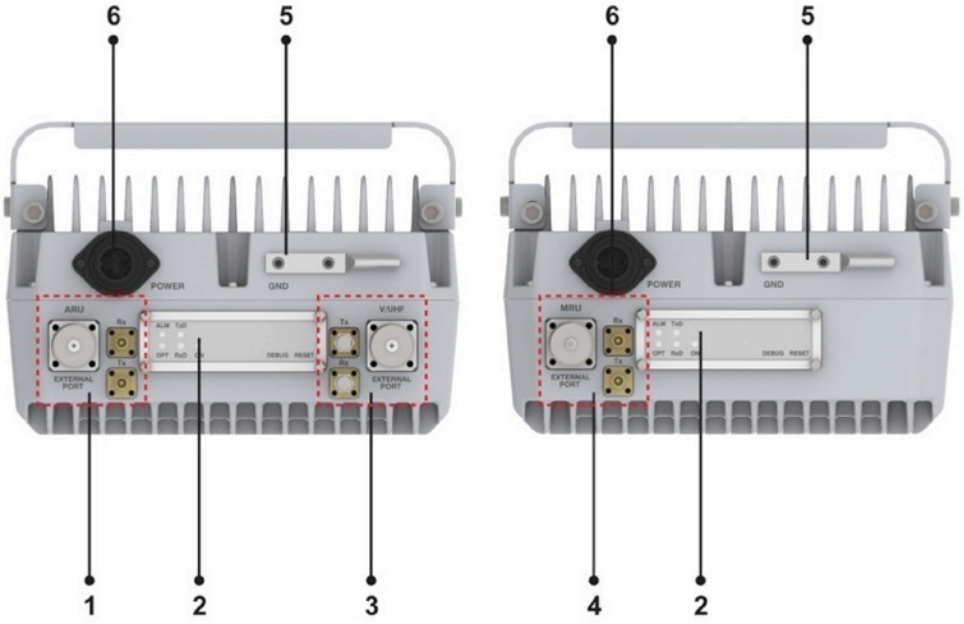


Figure 5.5 – MRU / ARU Bottom Connectors

No.	Item	Description
1	ARU Port (on MRU)	Terminal for Tx and Rx RF ports to connect MRU to ARU Terminal for signal port to interface MRU with ARU
2	LED PANEL	LED indicator panel for checking fault status. (See page 94.) USB Port to check and control device status through PC and laptop (Located below LED faceplate.)
3	VHF/UHF Port	Terminal for Tx and Rx RF ports of VHF/UHF AOR Terminal for signal port to interface with VHF/UHF AOR
4	MRU Port (on ARU)	Terminal for Tx and Rx RF ports to connect ARU to MRU Terminal for signal port to interface ARU with MRU
5	GND LUG PORT	Terminal for system ground
6	Power Port	AC 120V input port or DC-48V input port

Table 5.10 – MRU / ARU Bottom Connectors

5.4 MRU / ARU Power Ports

The type of power port on the unit will depend on the power type: -48V DC or 120V AC. A specific cable is also required for each type of MRU/ARU power supply (AC/DC or DC/DC). The figure below shows the different power connectors.

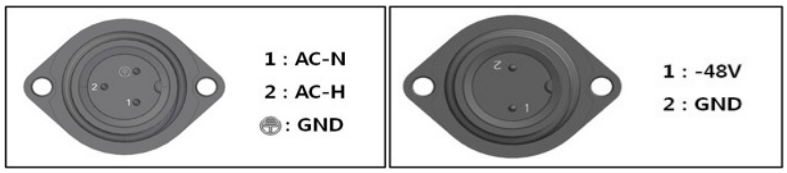


Figure 5.6 – MRU / ARU Power Connectors

5.5 VHF/UHF AOR Specifications

The AOR can mount in a standard 19-inch rack system or on a wall, either indoors or outdoors. The AOR is rated as water, dirt and earthquake proof according to NEMA 4 standards. The unit it typically co-located with the ROU, installed above, below or beside the ROU.

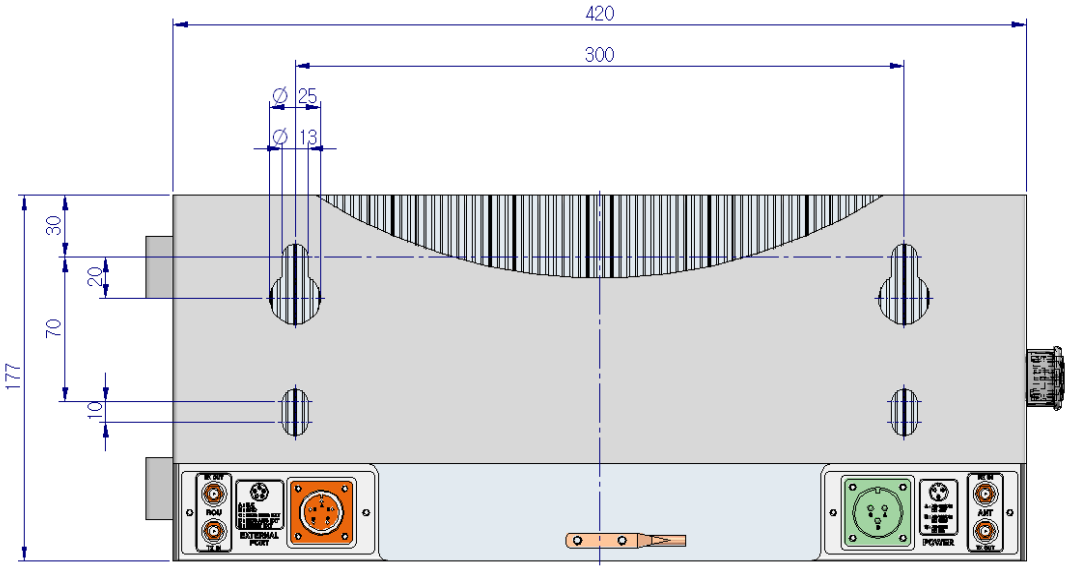


Figure 5.7 – VHF/UHF AOR at a Glance

Unit Name	Dimension (W x H x D)	Weight	Power Consumption (W)
VHF/UHF AOR Chassis	482 mm x 268.2 mm x 177 mm 19“ W x 10.16“ H x 6.96“ D	11 Kg (24.25 lbs)	78
VHF/UHF RDU	58.9 mm x 377.9 mm x 139.7 mm 2.32” x 14.88” x 5.5”		93

Table 5.11 – VHF/UHF AOR Mechanical Specifications

5.5.1 Band Specifications 150MHz VHF Public Safety

Parameters	Standard (Typical)		Remarks
	Downlink (TX)	Uplink (RX)	
Bandwidth	38MHz	38MHz	136 ~174MHz
System Ripple	≤5dB	≤5dB	-
Input Power Level	-15 to +10dBm	≤-54dBm	-
Output Power	+24dBm	-4dBm	Total
System Gain	39dB	50dB	-
Gain Control Range	14 to 39dB	30 to 50dB	-
IM3	-13dBm	-	-
IP3	-	+23dBm	-
Noise Figure	-	7dB	1 ROU

Table 5.12 – Band Specifications 150MHz VHF Public Safety

5.5.2 Band Specifications 450MHz UHF Public Safety

Parameters	Standard (Typical)		Remarks
	Downlink (TX)	Uplink (RX)	
Bandwidth	116MHz	116MHz	396-450MHz(54MHz) 450-512MHz(62MHz) Band selection
System Ripple	≤5dB	≤5dB	-
Input Power Level	-15 to +10dBm	≤-54dBm	-
Output Power	+24dBm	-4dBm	Total
System Gain	39dB	50dB	-
Gain Control Range	14 to 39dB	30 to 50dB	-
IM3	-13dBm	-	-
IP3	-	+23dBm	-
Noise Figure	-	7dB	1 ROU

Table 5.13 – Band Specifications 450MHz UHF Public Safety

5.6 VHF/UHF AOR Components

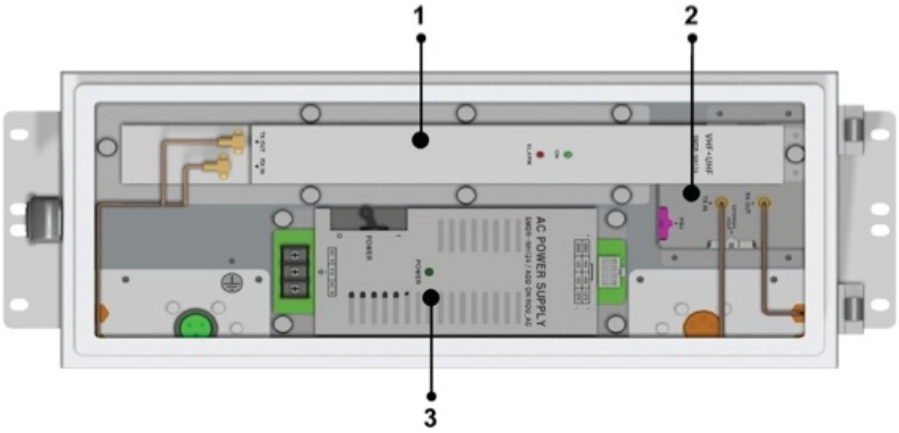


Figure 5.8 – VHF/UHF AOR Internal View

Unit Name	Product No.	Description
1. VHF+UHF Remote Drive Unit	Included with Cabinets: SC_AC_150_450 and SC_DC_150_450	Filter and high amplify downlink signals; Filter and amplify uplink signals; Remove other signals through Band Pass Filtering (Note: BPF is not included with VHF+UHF module.)
2. System Interface Unit (SIU)	Included with cabinet. Not field replaceable	Distributes power and signals of module
3. Add-on Remote (AOR) Power Supply (AC or DC)	Included with Cabinet	For AC Unit: Input AC 120V ; Output 27V, 9V, 6V
		For DC Unit: Input DC -48V (-42--56V); Output 27V, 9V, 6V

Table 5.14 – VHF/UHF AOR Components

5.6.1 AOR Remote Drive Unit (RDU)

When receiving downlink signals for each band from the MRU's R_Optic module, the RDU filters out-of-band signals and amplifies them with the high power amplifier. The unit also filters uplink signals received through the uplink antenna and amplifies them before delivering the signals to the MRU's R_Optic module. Only the 150 VHF / 450UHF RDU is available for the AOR used with the EXPRESS system.

NOTE: The 150 VHF / 450UHF RDU can also adjust gain, but it does not come fitted with a cavity filter capability. External duplexers may be required but are not provided by SOLiD."

5.6.2 AOR Power Supply Unit (PSU)

The AOR PSU provides power to the AOR and can accept either -48V DC or 120V AC input. Make sure to select the appropriate model when ordering, which will also dictate the power cable that ships with the unit. With either input, the unit provides +6V, +9V and +27V of DC power of output.

The power unit has a circuit breaker to turn the power on/off. A green LED indicates power to the unit.

5.6.3 AOR System Interface Unit (SIU)

The SIU distributes power and signals to each module. The SIU is not a field-replaceable unit.

5.7 VHF/UHF AOR Rear View Connectors

Figure 5.9 – VHF/UHF AOR Rear View Connectors

Item	Description
1. VHF/UHF RX IN	Terminal to receive the downlink signal from MRU
2. VHF/UHF RX OUT	Terminal to receive the signals from uplink antenna
3. VHF/UHF TX OUT	Terminal to transmit the uplink signal to MRU
4. Power Port	Terminal to input either AC 110V or DC-48V
5. GND Lug Port	Terminal to system ground
6. External Port	Port to connect external equipment (not currently in supported)
7. VHF/UHF TX IN	Terminal to radiate the signals to downlink antenna

Table 5.15 – VHF/UHF AOR Connectors

5.8 VHF/UHF AOR Power Ports and External Ports

The -48V DC or 120V AC power is connected through the power port. The power cable is supplied with the proper connector based on the configuration you ordered (AC/DC or DC/DC). You will need to attach the cable, but the connector only fits one way. The figure below shows the configuration of the ROU power ports.

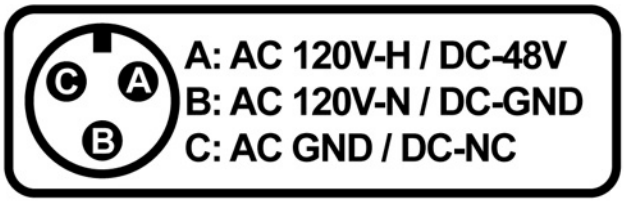


Figure 5.10 – AOR Power Port

An external port can be used to connect external equipment, although at present these ports are not used. The figure below shows the configuration of the external port.

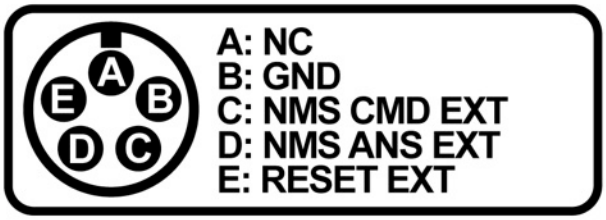


Figure 5.11 – AOR External Port

6 Optic Expansion Unit (OEU)

The optional OEU is designed to connect a DAS throughout multiple buildings or structures across a campus environment, and is used primarily to drive multiple MRUs while limiting the amount of fiber required. For example, when a signal is brought to another building, it utilizes existing fiber. To bring service to multiple MRUs in another building would multiple strands of fiber. By utilizing the OEU, only one strand of fiber is needed, thereby greatly reducing the amount of fiber required for these types of configurations.

The OEU connects to the ODU, requiring only one ODU port and a single strand of fiber. It combines downlink (Tx) signals received from the ODU and converts them to RF signals and sent to the MRU/ARUs through fiber connections. Likewise, it receives RF signals from the MRU/ARU, converts them to optical signals to send to the ODU.

The EXPRESS OEU can drive up to 8 MRUs. A maximum of two OEUs can be connected with the ODU, and up to four OEU's can be used with each BIU. The OEU uses the same Donor Optic Unit (DOU) as the ODU, and like the ODU can support a maximum of two DOUs. The following block diagram shows the OEU's primary components, functions, inputs and outputs.

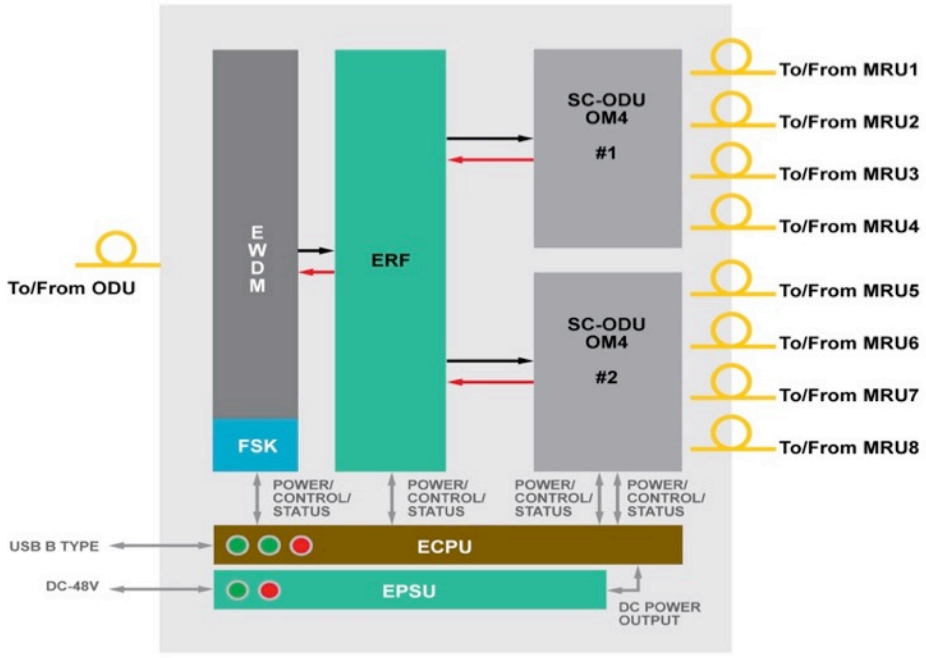


Figure 6.1 – OEU Block Diagram

6.1 OEU Specifications

The OEU mounts in a standard 19-inch rack occupying two rack units. The unit requires -48v DC input.

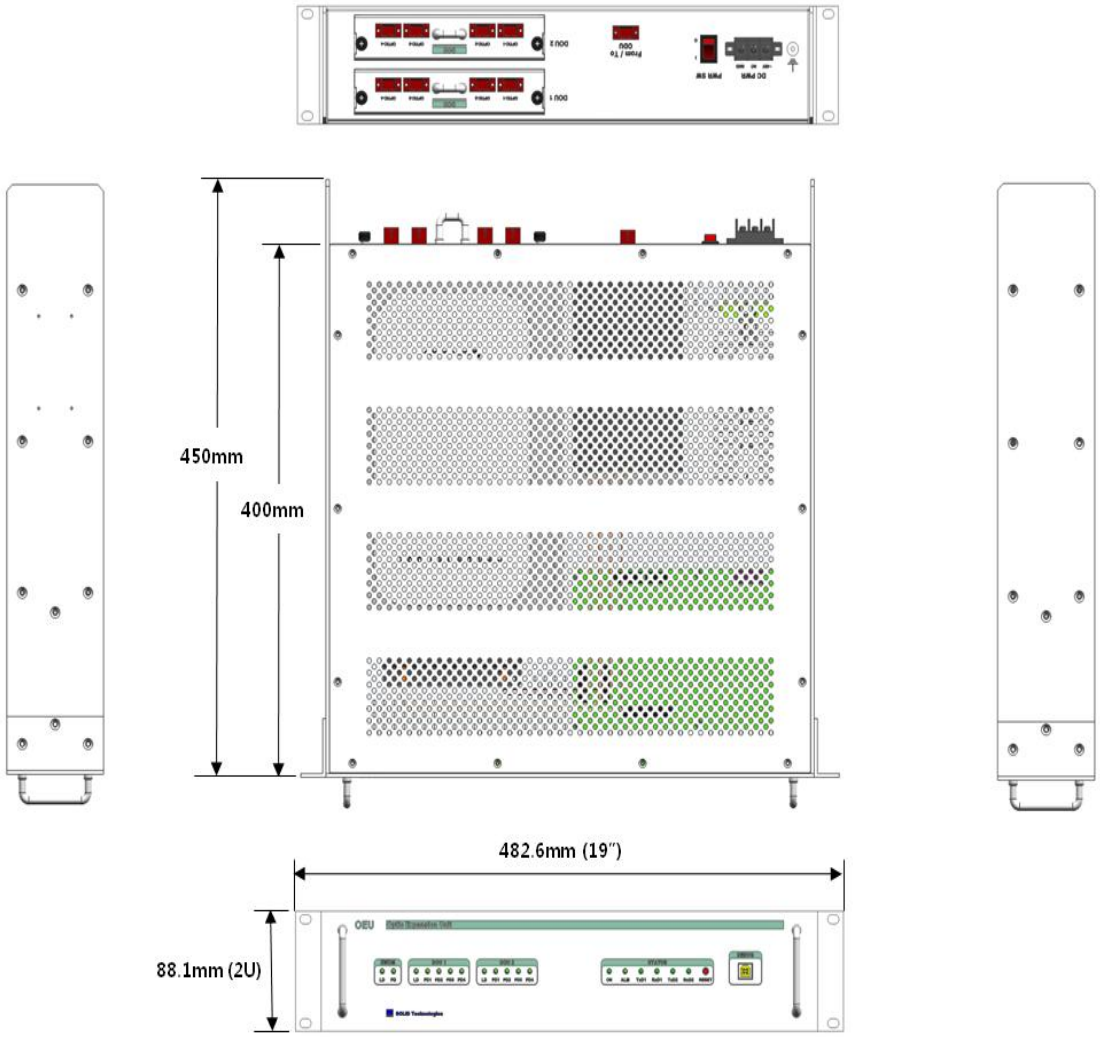


Figure 6.2 – OEU Dimensions

6.1.1 OEU Environmental Data

Specification	Value
Environmental Condition	In-building use
Operating Temperature (°C)	-10° to +50°C
Operating Humidity	5 to 90% non-condensing

Table 6.1 – OEU Environmental Data

6.1.2 OEU Mechanical Specifications

Specification		Value
Mounting Type		19” Rack Mounting. 2U height
Power Supply Voltage Range		-48V (DC: -42V ~ -56V)
Optic In & Out Port Type		SC/APC
Front Panel LED Indicator	EWDM_LD	Normal: Green, Alarm: Red
	EWDM_PD	Normal: Green, Alarm: Red
	DOU1,2_LD	Normal: Green, Alarm: Red
	DOU1,2_PD1	Normal: Green, Alarm: Red
	DOU1,2_PD2	Normal: Green, Alarm: Red
	DOU1,2_PD3	Normal: Green, Alarm: Red
	DOU1,2_PD4	Normal: Green, Alarm: Red
	STATUS_On	Normal: Green, Alarm: Red
	STATUS_TXD1	Green flicker: ECPU send NMS Tx data to BIU
	STATUS_RXD1	Green flicker: ECPU send NMS Tx data to BIU
	STATUS_TXD2	Green flicker: ECPU send NMS Tx data to MRU/ARU
	STATUS_RXD2	Green flicker: ECPU send NMS Tx data to MRU/ARU
	ALM	Green: OEU system normal (no alarm) RED: OEU System abnormal alarm
Maximum Power Consumption		40 W at full load
Total max weight		9.5kg (21 lb)
Type Approval & Certification		UL (UL60950-1), FCC
EMC		FCC Part15 compliant

Table 6.2 – OEU Mechanical Specifications

6.2 OEU Components

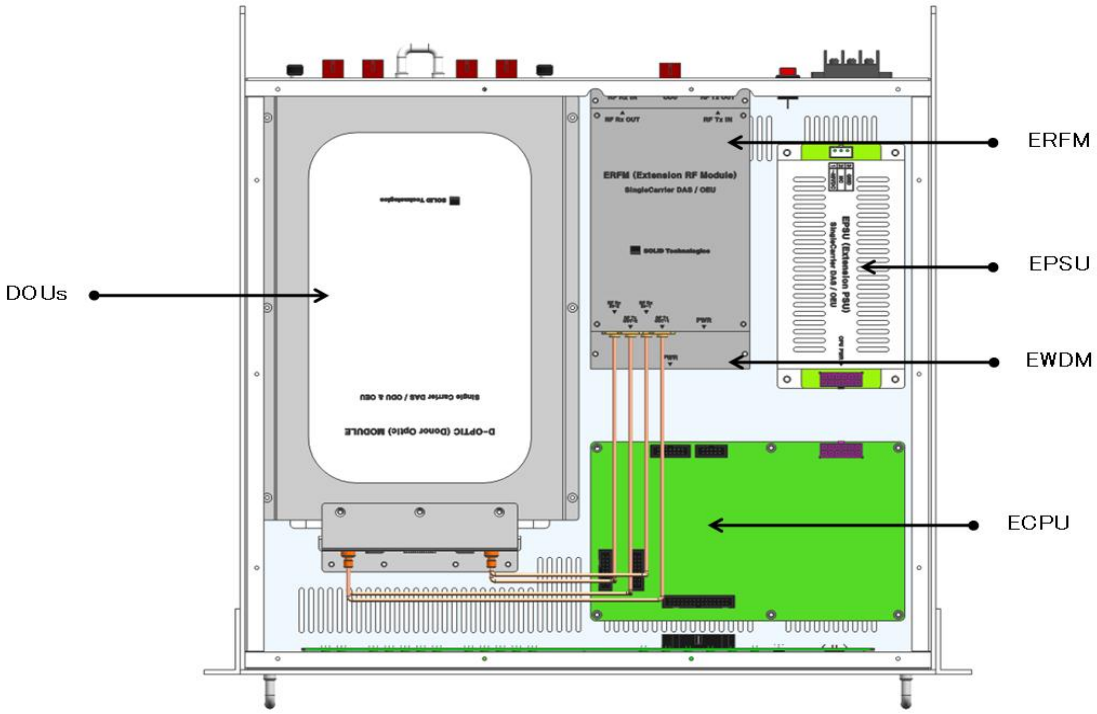


Figure 6.3 – OEU Internal View

Unit Name	Product No.	Description
Chassis	SC_OEU_C	19” rack, 2U height
EWDM		Expansion Wavelength Division Multiplexer: Converts downlink optical signals into RF signals; Converts uplink RF signals into optical signals; Compensates for optical cable loss with ODU
ECPU		Expansion Central Processor Unit: Controls and monitors system status Relays status of MRU/ARU to BIU
EPSU		Expansion Power Supply Unit: Input power: DC -48V, Output power: 9V, 6V
ERFM		Expansion Radio Frequency Module: Regenerates downlink signals and transmit FSK modem signals. Regenerate uplink signals and receive FSK modem signals.
DOU	SC_ODU OM 4	4-Port optical module (Max 2 DOUs per OEU): Converts downlink RF signals to optical signals; Converts uplink optical signals to RF signals; Provides up to four optical ports per module
Fuse	Contact SOLiD support for replacement	Provides power protection for the OEU Chassis. **NOTE**: May require replacement after power surge or if power connections are made improperly.

Table 6.3 – OEU Components

6.2.1 OEU Components – Mechanical Specifications

Unit Name	Dimension (H x W x D mm)	Weight (kg)	Power Consumption (W)
OEU Chassis	482.6 (19”) x 88.1 (2U) x 450	6.1	12
4 Port Optical Module	169 x 33 x 302	1.7 each	14
Blank Card	169 x 33 x 302	0.4	-

Table 6.4 – OEU Components – Mechanical Specifications

6.2.2 Donor Optic Unit

Within the OEU, converting RF signals to optical signals and back again is the job of the Donor Optic Units (DOUs). Each OEU can support up to two DOUs. Each DOU supports four optical ports, providing connection for up to eight MRUs. The DOU used in the OEU is the same unit as found in the ODU. See page 30 for more detail.

6.2.3 Extension Wavelength Division Multiplexer (EWDM)

The EWDM module converts the downlink signals (optical to electronic) and also the uplink signal (electronic to optical). An FSK modem provides communication with the BIU, and an attenuation feature can compensate for optical cable loss between ODUs. The EWDM has internal wave division multiplexing (WDM) functionality allowing it to connect to MRUs/ARUs through a single optical cable.

6.2.4 Expansion Central Processor Unit (ECPU)

The ECPU monitors and controls the status of the modules installed in the OEU. This unit communicates with and acts as a bridge between the BIU and MRU.

In addition, the unit has an USB-B port for connecting a PC and controlling system devices. At the front panel, an LED indicates the communication status with the BIU and the MRUs/ARUs. It also has ALM LED indicator to show if a device is faulty.

6.2.5 Expansion Radio Frequency Module (ERFM)

The ERFM reconstructs downlink and uplink signals that may have been degraded by the optical modules. This module communicates with the MRU through an internal FSK modem.

6.2.6 Expansion Power Supply Unit (EPSU)

The EPSU acts as a DC/DC Converter. The unit receives -48V and delivers +9V and +6V of DC power required for the OEU.

NOTE: The EWDM, ECPU, ERFM and EPSU are factory installed and not field replaceable. If you suspect this unit is not operating properly, contact SOLiD support.

6.3 OEU Front / Rear Panel – Indicators and Connectors

Figure 6.4 – OEU Front Panel

No.	Item	Description
1.	EWDM LED	LED indicator to check EWDM status
2.	DOU LED	LED indicator to check DOU module status
3.	System LED and Reset	Communication status with devices, alarm status of the system and reset switch
4.	USB (B Type) port for network management	USB port for communication and diagnosis of devices through PC/laptop.

Table 6.5 – OEU Front Panel Indicators

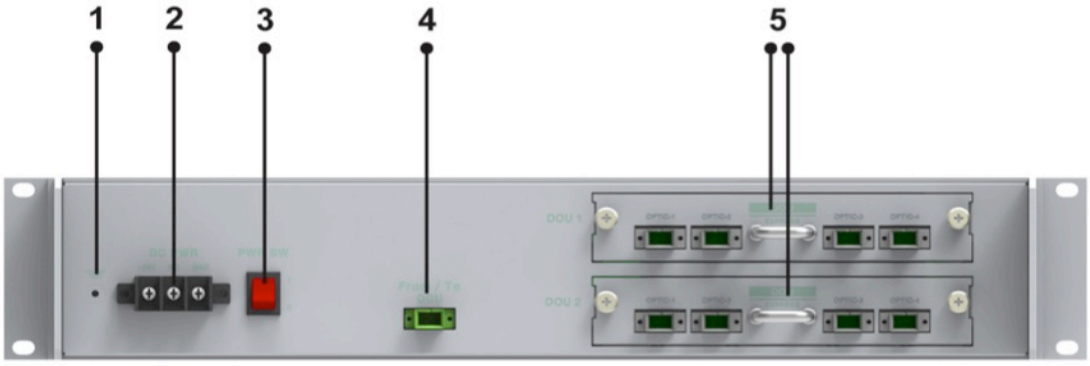


Figure 6.5 – OEU Rear Panel

No.	Item	Description
1.	GND Port	Terminal for system ground
2.	DC Input Port	Input terminal for DC -48V
3.	Power switch	Power ON/OFF switch
4.	To/From ODU Optic Port	SC/APC optical connector terminal
5.	To/From MRU Optic Port	SC/APC optical connector terminal; use one optical cable per MRU.

Table 6.6 – OEU Rear Panel Connectors

7 DAS Management System (DMS-600)

The DMS-600 is the alarming, diagnostic, and control interface for the SOLiD EXPRESS DAS system. It gathers system information from the DAS network –user management, inventory management, event log, alarm management and external relays – and transmits this data via SNMP (Simple Network Management Protocol) to a local or remote Network Operations Center (NOC) facility for monitoring. The DMS-600 provides these functions for the DAS network:

- LAN (TCP/IP) connectivity between the DMS-600 and BIU MCPU (Main Central Processor Unit)
- Graphical user interface running in web browser
- Command and control for up to 20 BIUs
- SNMP Traps to NOC
- DAS System upgrades via Web
- EasySET (Auto Commissioning)
- Inventory Management
- Filtering and clearing of System & Event log; Printing of Inventory and System & Event Log
- Exporting of Inventory and System & Event Log to CSV
- Automatic DMS system upgrades via the web (with annual maintenance package)

The figure shows the data flow between the BIU, the DMS-600 and an external NOC.

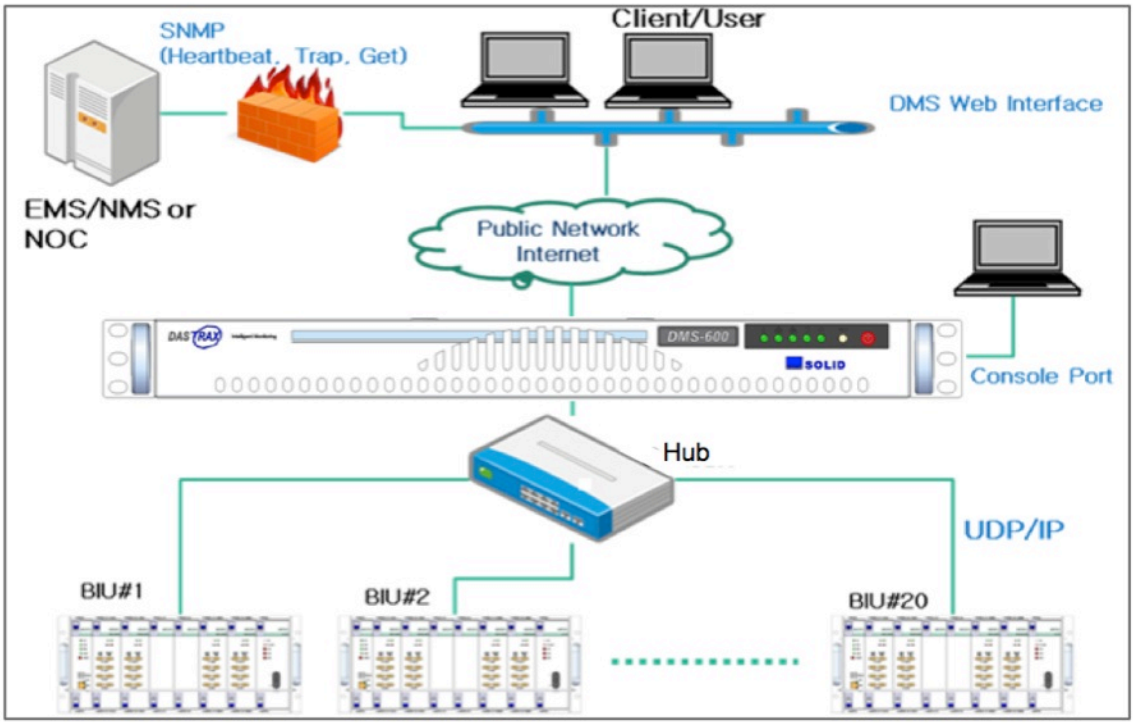


Figure 7.1 – DAS Management with DMS-600

7.1 DMS-600 Specifications

The DMS-600 mounts in a standard 19-inch rack system and occupies one rack unit. It requires 120-240V AC power input. The unit has an internal power supply and a power cable is provided.

Figure 7.2 – DMS-600 at a Glance

Item	Spec.
Dimensions (W x H x D mm)	426 (19”) x 43 (1U) x 356
Weight	6.4 kg (14 lbs) (Fully Loaded)
Buttons / LED Indicators	Power ON/OFF System RESET Power LED System Activity LED Network Activity LED System Overheat LED
Available Interface Ports	LAN Ethernet Port #1 for WAN LAN Ethernet Port #1 for BIU connection LAN Ethernet Port #1 for Local console port USB Port #1, #2
Power Specifications	AC Voltage: 100-240V, 60-50Hz Amperage: 2 amp max. Power consumption: 260 W (Fully Loaded) 6ft. cord with NEMA 5-15 plug
Operating Environment	Operating Temp: 10 ~35°C Humidity Range: 8~90% non-condensing
Safety & EMC Approvals	USA, UL Listed & FCC Canada-CUL Mark Europe / CE Mark EN 60950 / IEC 60950 Compliant CCC Certified

Table 7.1 – DMS-600 Specifications

7.2 DMS-600 Front / Rear Panel – Indicators and Connectors

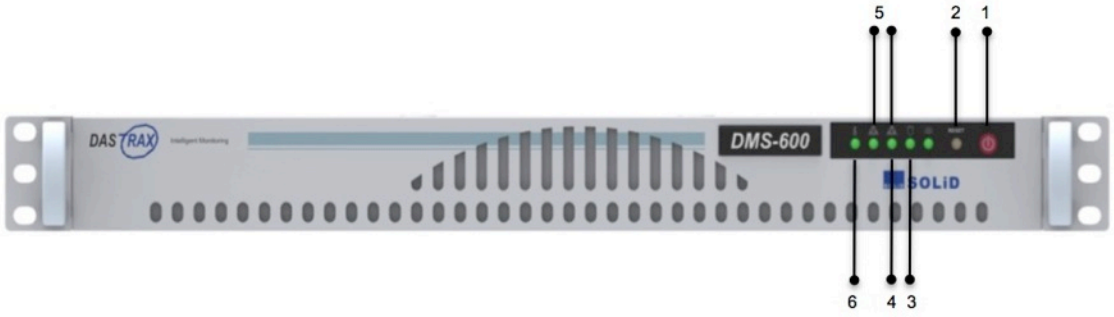


Figure 7.3 – DMS-600 Front Panel

No.	Item	Description
1.	Power switch	Power ON/OFF switch
2.	System	Reset
3.	Power LED	Green indicates unit receiving power
4.	System Activity LED	Flashing indicates system is handling a process
5.	Network Activity LED	Flashing indicates LAN Ethernet port 1 has active transmission.
6.	System Overheat LED	Output DC power test port and ALM LED to show abnormal status

Table 7.2 – DMS-600 Front Panel Indicators

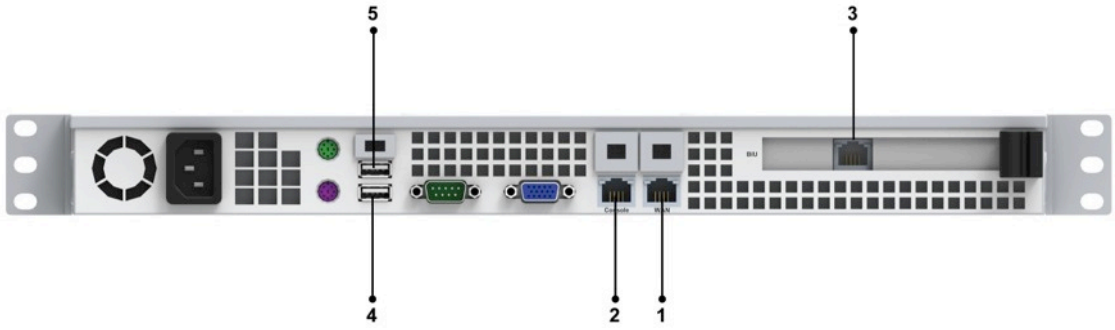


Figure 7.4 – DMS-600 Rear Panel

No.	Item	Description
1.	WAN Port	For connection to remote NOC via WAN
2.	CONSOLE Port	For connection to DMS-600
3.	BIU Port	For connection to BIU
4.	USB Port #1	For DMS-600 software upgrades (Not currently supported)
5.	USB Port #2	For dry contact alarm block (Not currently supported)

Table 7.3 – DMS-600 Rear Panel Connectors

8 Installation – Headend Equipment: BIU, Power Supply, ODU, DMS-600

This chapter explains how to install and connect the DAS equipment that comprises the system's headend:

- The Base-Station Interface Unit (BIU)
- The DC power supply
- The interface to the RF Source (BTS or BDA)
- The Optical Drive Unit(s) (ODUs)
- The DAS Management System (DMS-600)

SOLiD technicians configure and label the equipment at the SOLiD facility prior to shipping. Note labeling on all equipment. Remove each item from its packaging and inspect the hardware. Contact SOLiD Support if the product is damaged.

8.1 Before you Begin

Headend components are typically installed in a standard 19-inch rack according to these guidelines:

- The BIU requires 5U of rack space and must have 1U of free space above and below to circulate air and dissipate heat.
- The DC Power Supply requires 1U of space. It typically mounts below the BIU.
- The ODU components require 1U of space and can be stacked directly above one another. The ODU(s) mount above the BIU in the rack.
- The DMS-600 requires 1U of space but should have 1U of space above and below. The DMS-600 typically mounts above the ODU(s).

Before you begin this part of the installation process, make sure you have the following items. Those items marked with an “O” ship with the unit. The installer will supply items marked with an “X.”

Unit	Item / Action	Accessories	Tools Required	Status
BIU	Chassis rack mounting	M6 Screw (4 EA)	No.0 Screw driver (+)	X
	Ground connection	AWG #10-12 cable	No.0 Screw driver (+) Lug crimper	X
	RF cable connection to Base Station	RF SMA-P cable	Spanner (8mm)	X
	Power Shelf Mounting	M6 Screws (4 EA)	No.0 Screw driver (+)	X
	Power cable connection	DC -48V power cable (1 Pair) [AWG #12, 2 meter, with 4.5 ø square lugs at both ends]	No.0 Screw driver (+)	O
ODU	Chassis rack mounting	M6 Screws (4 EA)	No.0 Screw driver (+)	X
	Ground connection	M4 Screw (Electric Current/ 1EA)	No.0 Screw driver (+)	X
		AWG #10~1 2 Cable	No.0 Screw driver (+) Lug crimper	X
	Connection to ROU or OEU	Optic SC/APC cable (1 per ROU)		X
	Connecting with BIU	Power Cable (1EA) [700 millimeter, with D-SUB 15PIN(MALE/to BIU) connector at one end, D-SUB 15PIN (FEMALE/to ODU) connector at another end]		O
	Connection with BIU Connection with ROU or OEU	RF Cable (2EA) [SS405 White, 670 millimeter, with SMA-SP (MALE) connector at both ends]	Spanner (8mm) Torque: 8~12kgf.cm	O
		Optic SC/APC Cable	-	X
DMS	DMS-1200 rack mounting	M6 Screws (4 EA)	No.0 Screw driver (+)	X
	WAN port connection	Straight type LAN cable (1EA)		X
	BIU port connection	Straight type 2m LAN cable (1EA)		O
	Connection to power supply	AC 110-220V Power Cable		O

Table 8.1 – Tools and Accessories for Installing Headend Equipment

8.2 Install BIU Chassis

Typically, the BIU will be installed in a 19-inch equipment rack. The BIU occupies 5U of rack space.

1- When positioning the BIU in the rack, make sure to leave 1U of space between the BIU and other units for air circulation. The power shelf typically mounts below the BIU. The ODUs and DMS-600 mount above.

2- Position the BIU in the rack holding the unit by the shift handles. Insert the M6 bolts in the mounting holes and tighten the screws to secure the chassis.

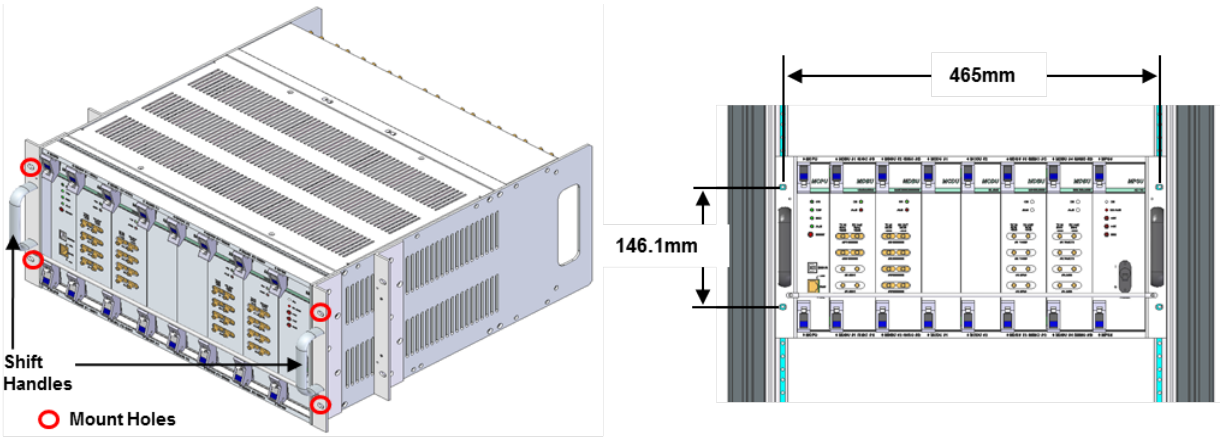


Figure 8.1 – BIU Rack Installation

8.3 Install DC Power Shelf and Connect to BIU

1- Install the DC Power Shelf in the 19-inch rack below the BIU leaving 1U of space.

2- Before connecting the power supply to the terminal block at the back of the BIU, check the voltage coming from the power supply using a voltage meter. Connect the positive "+" terminal of the volt meter with the ground “GND” terminal and then connect the negative "–" terminal of the meter with the -48V terminal. The power source should be providing -48Vdc voltage.

3- After verifying the power source, connect the DC power cable to the BIU terminal block. Connect the blue cable to the -48v terminal. Connect the black cable to the GND terminal as shown in the following figure.

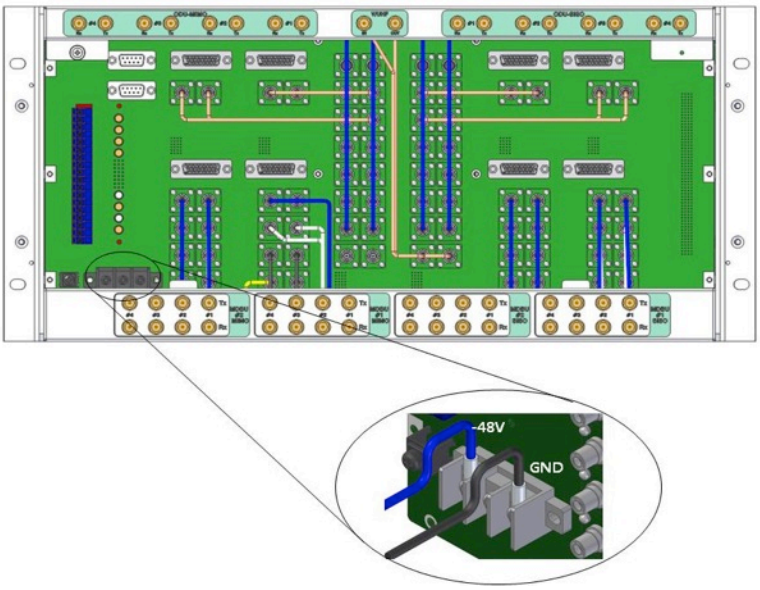
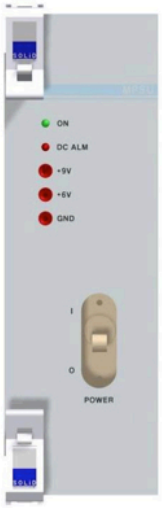


Figure 8.2 – BIU Terminal Block

If you connect the power system to the BIU with the incorrect polarity (reversing the "+" terminal and the "–" terminal connections), the unit will not operate.

4- After connecting the power supply unit, power it on using the ON/OFF switch found on the faceplate of the Main Power Supply Unit (MPSU) in the BIU. A green LED indicates power to the unit as shown in the next figure.



Power Switch	LED		Description
O	ON	⚪	Abnormal, -48Vdc not present
		🟢	Normal supply power -48Vdc
	DC ALM	🟢	Normal Status
		🔴	Failure of output Power
I	ON	⚪	Normal Status
	DC ALM	⚪	

Figure 8.3 – MPSU LED Indicators

5- Once you have verified the unit is receiving power, turn off power to the BIU. You can power on the system once you have connected the BTS or other RF source as described in the next sections.

8.3.1 BIU Power Consumption

The power supply provided for the BIU has factored in the max load for the system, but for your information, the table below shows power consumption of the BIU. Keep in mind that the BIU also supplies power to the ODU(s). Power consumption data for the ODU(s) are provided on page 74.

Part	Unit Name	Manufacturer Product No.	Power Consumption (W)	
SC_BIU_SISO Common Part	Chassis	SC_BIU_C	-	7.2W
	MCPU	SC_MCPU	4.8w	
	MPSU	SC_MPSU	-	
	MCDU	SC_MCDU	2.4W	
SC_BIU_MIMO Common Part	Chassis	SC_BIU_Chassis	-	9.6W
	MCPU	SC_MCPU	4.8W	
	MPSU	SC_MPSU	-	
	MCDU	SC_MCDU	4.8W	
MDBU	850C+1900P	SC_MDBU_850_1900	16W	
	700LTE+AWS	SC_MDBU_700LTE_2100	16W	
	1900P	SC_MDBU_1900	9W	
	800i+900i	SC_MDBU_800_900	16W	

Table 8.2 – BIU Power Consumption

8.3.2 Installing Additional MDBUs

The BIU chassis comes equipped with the correct type and number of MDBU(s) based on the configuration you ordered, and blank cards come pre-installed in unused MDBU slots. Unused ports are terminated with termination loads when the BIU is configured at the SOLiD facility.

You can expand or upgrade the DAS system at any time by installing additional MDBUs or removing existing units. The BIU accepts up to four MDBUs, and these units can be inserted in any slot. Make sure to fill unused MDBU slots with blank cards and to terminate unused ports.

1- Remove the front bar on the BIU chassis using a Phillips screw driver (+).

2- Slide the MDBU into the slot aligning the upper and lower guide rail and then lock the ejector up.

3- Install blank cards in any unused slots.

4- Install the front bar back to its original position after completing installation.

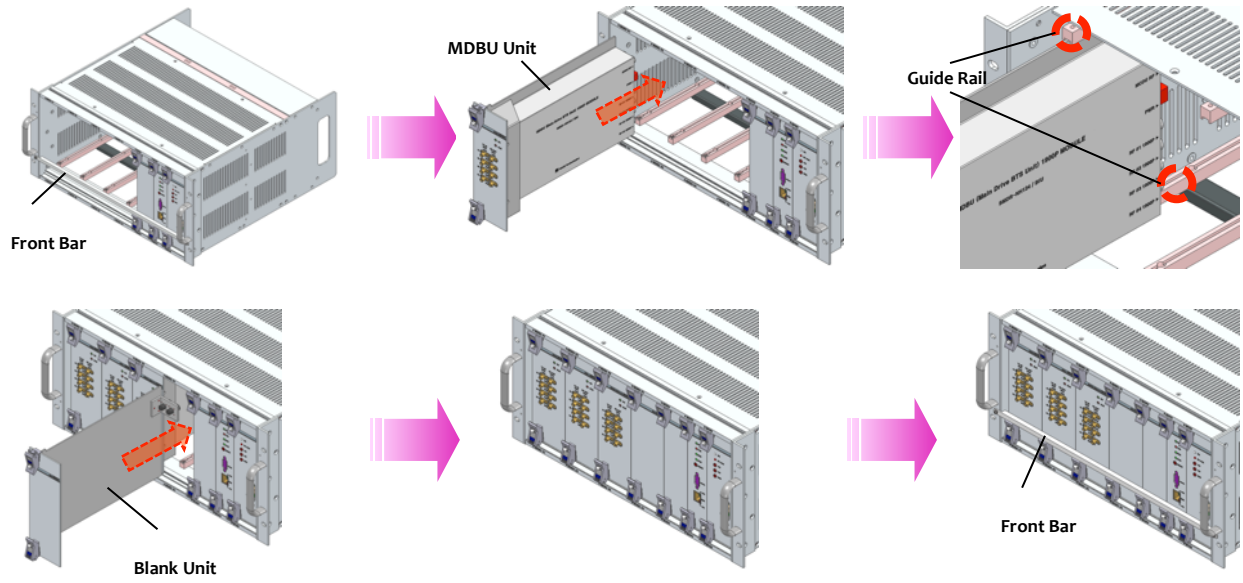


Figure 8.4 – MDBU Installation

8.4 Connect BIU to the RF Source – BTS or BDA

You can use either a Bi-Directional Amplifier (BDA) or a Base Transceiver Station (BTS) as an RF input source. When connecting to a BDA, you will need to use a duplexer or a circulator to separate Tx/Rx signals from each other.

Connection to the RF source is made through the input / output ports at the back of the BIU. Using a dual band MDBU, the BIU can easily accommodate all frequency bands. As seen in the table below, the MDBU is divided into single and dual band modules and each unit can be connected with two carrier signals per band.

Frequency Band	Manufacturer Product No.	Service Band	Downlink (Tx)			Uplink (Rx)		
			Input Port	Freq (MHz)	Bandwidth (MHz)	Output Port	Freq (MHz)	Bandwidth (MHz)
850Cellular + 1900PCS	SC_MDBU _850_1900	1900 PCS	P 1	1930-1995	65	P 1	1850-1915	65
		1900 PCS	P 2			P 2		
		850 Cellular	P 3	869-894	25	P 3	824-849	25
		850 Cellular	P 4			P 4		
700LTE + AWS	SC_MDBU _700LTE_2100	700 LTE	P 1	728-757	29	P 1	B1: 698-716 B2: 777-787	B1: 18 B1: 10
		700 LTE	P 2			P 2		
		AWS	P 3	2110-2115	45	P 3	1710-1755	45
		AWS	P 4			P 4		
1900 PCS	SC_MDBU _1900	1900 PCS	P 1	1930-1995	65	P 1	1850-1915	65
		1900 PCS	P 2			P 2		
800iDEN + 900iDEN	SC_MDBU _800_900	900 IDEN	P 1	935-940	5	P 1	896-901	5
		900 IDEN	P 2			P 2		
		800 IDEN	P 3	851-869	18	P 3	806-824	18
		800 IDEN	P 4			P 4		

Table 8.3 – Port Assignments for Connecting Input and Output to RF Source

At the rear of BIU, you will find the Tx input and Rx output ports for each MDBU as shown in the following figure. For each port, Tx and Rx signals are separated from each other and labeled as "#1, #2, #3 and #4." Refer to the table above to ensure proper connection for the input and output ports of the corresponding MDBU. It is not necessary to terminate unused ports on the BIU backplane.

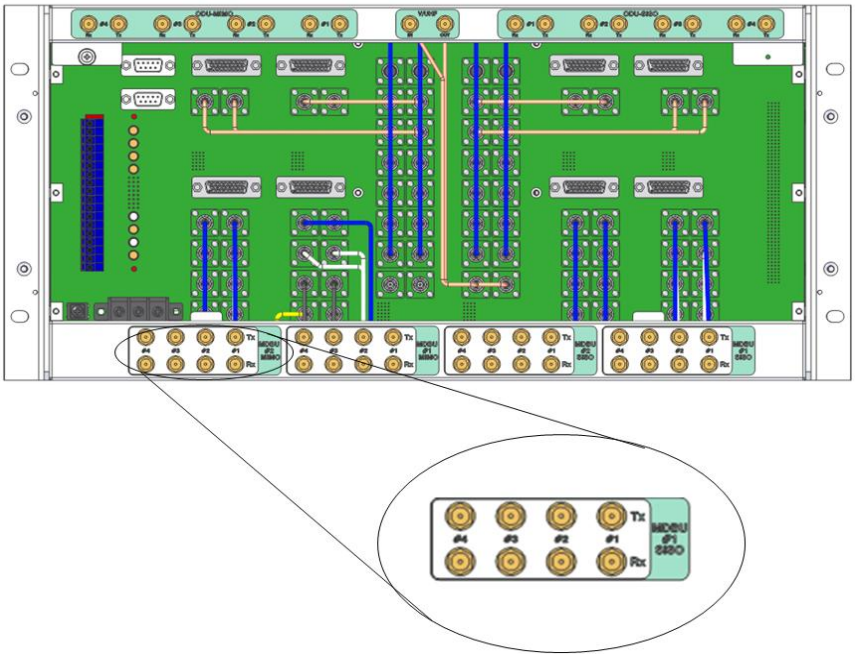


Figure 8.5 – BIU RF interface diagram

8.4.1 Connecting the BIU to a BTS

1- Use a spectrum analyzer or power meter to check signals sent from the BTS Tx. If the signals exceed input range (-20dBm~+10dBm), you can connect an attenuator between the BTS and BIU to bring the signal level into range.

2- Connect the BTS to the BIU using the RF cabling. The figure below shows an example of connecting two BTS's to the BIU backplane. One BTS supports the 800PS band and the other 700PS. It is not necessary to terminate unused ports on the BIU backplane.

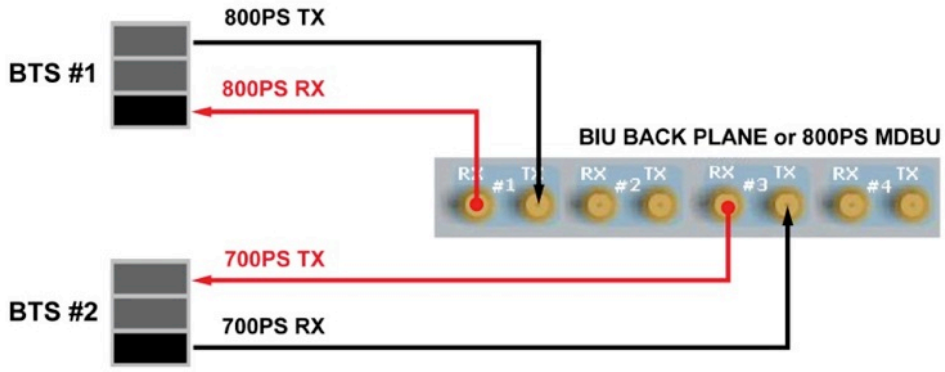


Figure 8.6 – BTS Interface to the BIU Backplane

8.4.2 Connecting the BIU with BDA

Because the BIU runs in simplex mode, when connecting to a BDA, you need to separate the BDA downlink (Tx) and uplink (Rx) signals using a duplexer.

1- Use a spectrum analyzer or power meter to check signals sent from the BTS Tx. If the signals exceed the input range (-20dBm~+10dBm) accepted by the BIU, you can connect an attenuator between the BDA and BIU to bring the signal level into range.

2- Connect a duplexer to separate the downlink and uplink signals.

3- Connect the BDA to the BIU using the RF cabling. The figure below shows an example of connecting two BDA's to the MDBU supporting the 800PS band. It is not necessary to terminate unused ports on the BIU backplane.

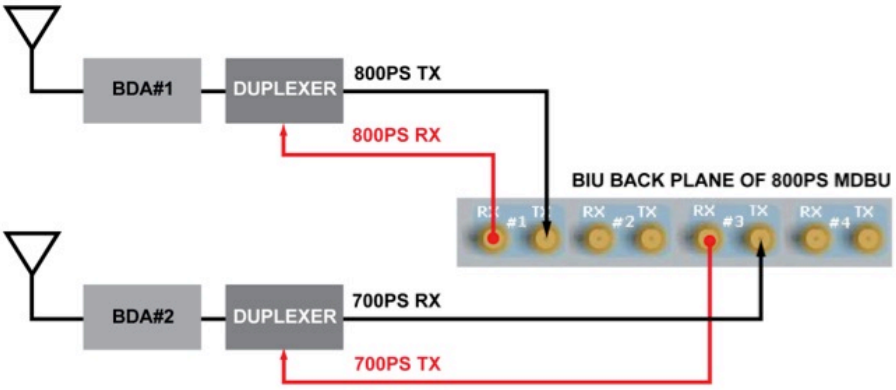
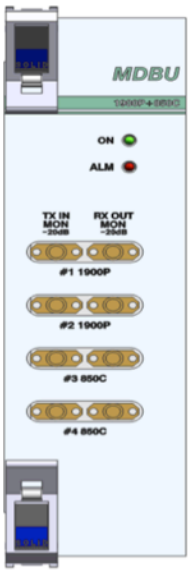


Figure 8.7 – BDA Interface to the BIU Backplane Using a Duplexer

8.4.3 Checking Power and RF Signaling

1- Once power and the RF source(s) are connected to the BIU, power on the system, and check the LED indicators at the front of each MDBU to ensure the unit is operating normally as shown in the following figure.



LED		Description
ON		Power is not supplied.
		Power is supplied.
ALM		Normal Operation
		Abnormal Operation

Figure 8.8 – MDBU LED Indicators and SMA Test Ports

The MONITOR SMA ports are used for **TESTING PURPOSES ONLY** allowing you to check current RF signals without affecting the signal source. All signal source connections are done on the back of the BIU as previously described.

8.5 Install Optical Drive Units (ODUs)

The ODU is designed for a standard 19-inch equipment rack and occupies 1U of rack space. The BIU supports up to four ODUs, depending on the system's requirements. The ODU(s) should be installed above the BIU.

1- When positioning the ODU(s) in the rack, make sure to leave 1U of space between the BIU and first ODU. This gap provides air circulation to help dissipate heat from the BIU. Multiple ODUs (up to four) can be stacked in the rack, but do not require gaps between each unit as shown in the next figure.

2- Position the ODU(s) in the rack. Insert the M6 bolts in the mounting holes and tighten the screws to secure the unit(s).

Figure 8.9 – ODU Rack Installation

8.6 Connect ODU to BIU for Power and Signaling

The ODU(s) receives power and signaling from the BIU. Four power ports and eight RF ports (four input / four output) are located at the back of the BIU for connecting up to four ODU(s). Unused RF ports should be terminated. The BIU automatically recognizes the ODU(s) as they are connected.

1- Power off the BIU before connecting the ODU(s) and remove the protective panel from the back of the BIU.

2- As shown in the figures below, connect the coaxial cables for downlink and uplink signaling from the ODU(s) to the corresponding ports on the rear panel of the BIU.

For power supply and communication, connect the supplied connector cable from the ODU(s) to the corresponding BIU port. The port numbers are printed in order. Connect ODU 1 to RF and Signal port 1, and so on.

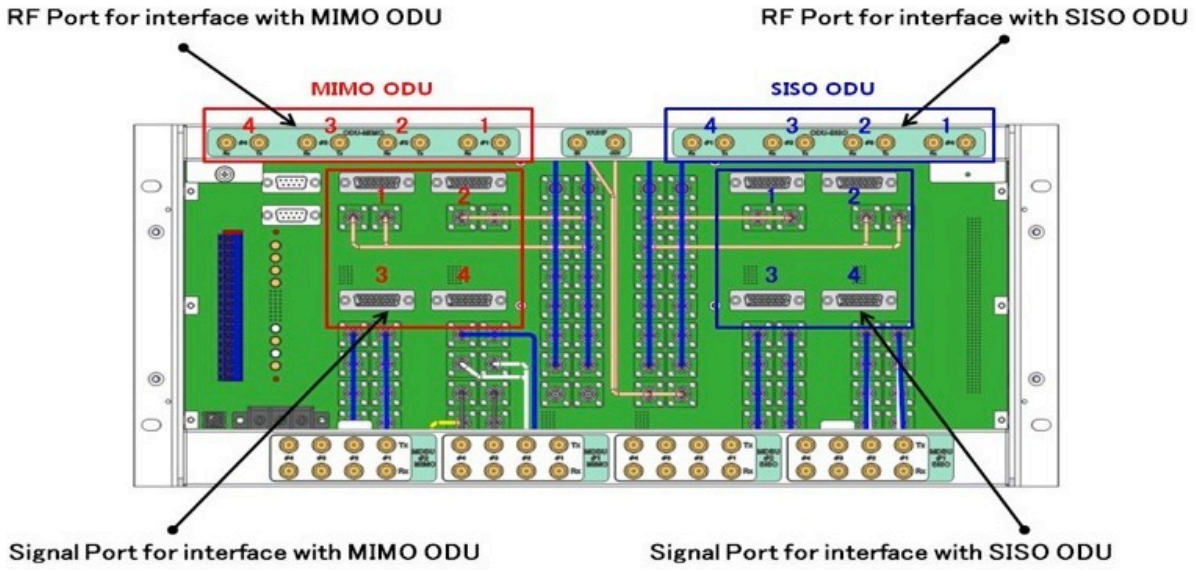


Figure 8.10 – BIU RF and Signaling Ports

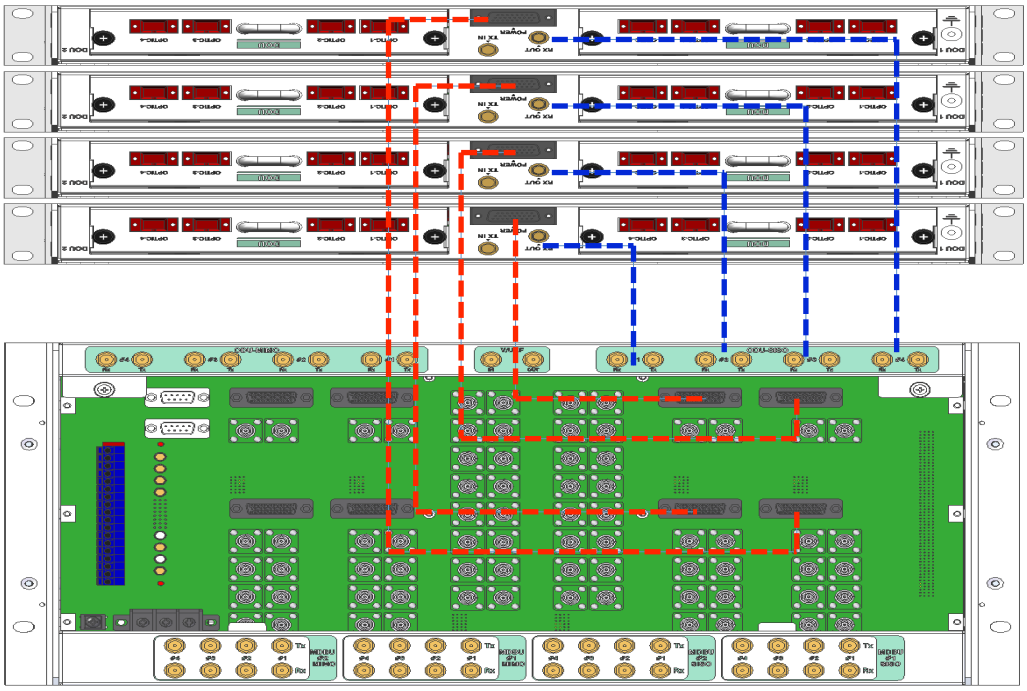


Figure 8.11 – Connecting the BIU to ODU(s)

Take care to connect the ODU(s) in the correct order and to distinguish between MIMO and SISO units. Otherwise, related devices may fail to communicate with each other or the unit may read wrong information. For unused RF Ports in an ODU expansion, make sure to terminate them using SMA terminators.

3- Once all cabling is in place, re-attach the protective panel at the back of the BIU.

4- Power on the BIU. Check the LEDs at the front of the BIU to ensure the connection with the ODU(s) is functioning correctly.

8.6.1 ODU Power Consumption

Because the BIU provides power to the ODU(s), power requirements for the DOUs are included in the BIU power budget. The power supply provided for the BIU has factored in the max load for the system, but for your information, the each Donor Optic Unit (DOU) in the ODU consumes 14 Watts, meaning a fully loaded DOU consumes 28 Watts.

Part	Unit	Power Consumption
DOU(SC_ODU_OM 4)	DOU 1	14W
DOU(SC_ODU_OM 4)	DOU 2	14W

Table 8.4 – ODU Power Consumption

8.6.2 Installing DOUs

A maximum of two DOUs can be installed in each ODU chassis. The required number of DOUs for each ODU is installed at the SOLiD facility based on the configuration you ordered. SOLiD also installs blank cards in unused DOU slots. You can expand or upgrade the DAS system at any time by installing additional DOUs or removing existing units.

For proper operation, the first DOU in the ODU should occupy the “DOU 1” slot, while a blank plate should cover the unused slot. The following figure shows the ODU with both configurations.

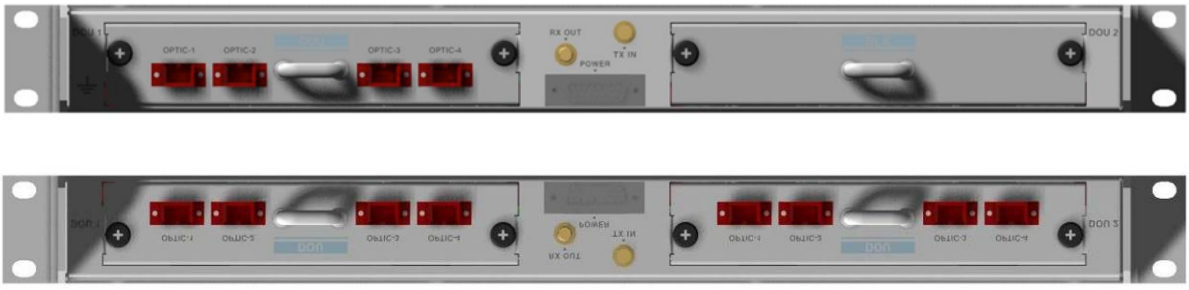


Figure 8.12 – ODU Showing One and Two DOU Configurations

8.6.3 Connecting ODU Optic Cabling

Each optical port on the DOUs can connect to an MRU using a single fiber optic cable with SC/APC connectors. When connecting to an optional OEU, optical port 4 must be used from either DOU in ODU 1 or 2. ODU 3 and 4 cannot be used for connection to the OEU.

NOTE: When purchasing, installing and maintaining the optic cables, make sure to follow the manufacturer's guidelines. Keep the fiber ends capped when not connected to prevent damage to the fiber center pins. If fiber connectors seem dirty, you can clean them with alcohol.

Figure 8.13 – SC/APC Fiber Terminations

1- Connect the fiber optic cable to the port(s) on the DOU(s).

8.7 Installing the DMS-600

The DAS Management System (DMS-600) fits in a standard 19-inch equipment rack and occupies 1U of rack space. The unit has an internal power supply and requires standard 120-240V AC power.

1- Position the DMS-600 in the rack, making sure to leave 1U of space between the DMS-600 and the uppermost ODU. This gap provides air circulation to help dissipate heat from the equipment.

2- Insert the M6 screws in the mounting holes and tighten the screws to secure the unit.

3- Connect the DMS-600 to the Ethernet port on the BIU using the supplied cable. Connect the unit to a power source (typically a wall socket) using the supplied power cable.

4- Power on the DMS-600.

9 Installation – OEU

The Optical Expansion Unit (OEU) is an optional component used for extending the EXPRESS DAS to remote locations in a campus environment. Each OEU can be equipped with a maximum of two DOUs, allowing the DAS to support an additional eight MRUs.

SOLiD technicians configure and label the equipment at the SOLiD facility prior to shipping. Note labeling on all equipment. Remove each item from its packaging and inspect the hardware. Contact SOLiD Support if the product is damaged.

9.1 Before you Begin

Before you begin this part of the installation process, make sure you have the following items. Those items marked with an “O” ship with the unit. The installer will supply items marked with an “X.”

Item	Accessories	Tools	Status
Chassis rack mounting	M6 Screws (4 EA)	No.0 Screw driver (+)	X
Ground connection	M4 Screw (Electric Current/ 1EA)	No.0 Screw driver (+)	X
	AWG #10~1 2 Cable	No.0 Screw driver (+) Lug crimper	X
Connection with ODUs/ MRUs	Optic cable [SC/APC Type]		X
Power cable connection	DC -48V power cable (1 Pair) [AWG #12, 2 meter, with 4.5 ø square lugs at both ends]	No.0 Screw driver (+)	O

Table 9.1 – Accessories and Tools List for OEU Installation

9.2 Install OEU Chassis

The OEU is typically installed in an equipment closet. The unit is designed to mount in a standard 19-inch rack and occupy 2U in height. The OEU requires a separate DC power unit, which should be mounted below the OEU.

1- When positioning the OEU in the rack, make sure to allow for 1U of space below the unit to install the DC power supply.

2- Position the OEU in the rack. Insert the M6 screws in the mounting holes and tighten the screws to secure the unit.

9.3 Install DC Power Shelf and Connect to OEU

1- Install the DC Power Shelf in the 19-inch rack below the OEU leaving 1U of space.

2- Before connecting the power supply to the terminal block at the back of the OEU, check the voltage coming from the power supply using a voltage meter. Connect the positive "+" terminal of the volt meter with the ground “GND” terminal and then connect the negative "–" terminal of the meter with the -48V terminal. The power source should be providing -48Vdc voltage.

3- After verifying the power source, connect the DC power cable to the OEU terminal block. Connect the blue cable to the -48v terminal. Connect the black cable to the GND terminal as shown in the following figure.

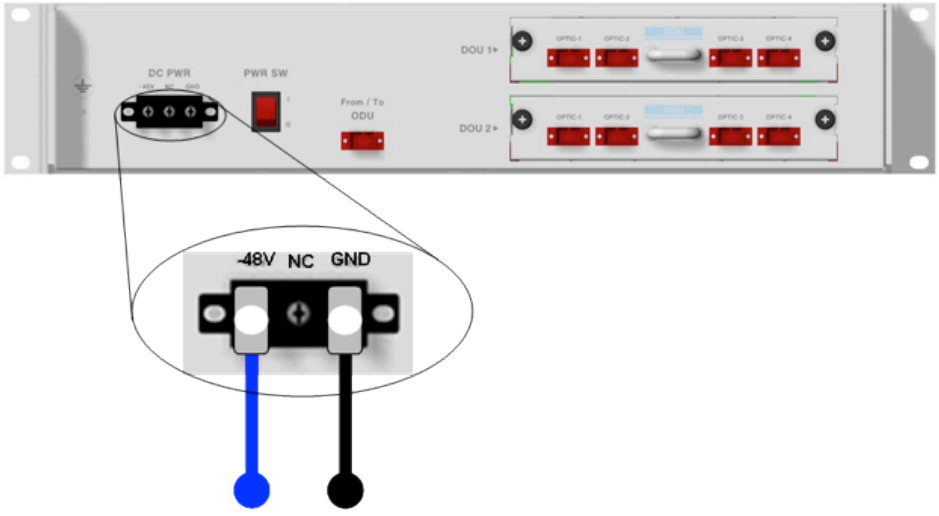


Figure 9.1 – OEU Terminal Block

If you connect the power system to the OEU with the incorrect polarity (reversing the "+" terminal and the "–" terminal connections), the unit will not operate.

4- After connecting the power supply unit to the OEU, power it on using the ON/OFF switch found on the rear panel. Check the LED indicators on the front panel. A green LED indicates the unit is receiving power.

9.3.1 OEU Power Consumption

The OEU can be equipped with a maximum of two DOUs. Depending on the quantity of DOUs, power consumption will vary as shown in the following table. A fully loaded unit uses 40 Watts.

Unit Name	Manufacturer Product No.	Power Consumption (W)
Optical Expansion Unit Chassis	SC_OEU_C	12
DOU 1	SC_ODU_OM 4	14
DOU 2	SC_ODU_OM 4	14

Table 9.2 – OEU Power Consumption

9.3.2 Installing DOUs

The OEU chassis can hold up to two DOUs. When configured with one DOU, the second DOU slot should be covered with a blank card.

For proper operation, when the unit is equipped with one DOU, it should occupy the DOU 1 slot (top slot). The following figure shows the OEU with both configurations.

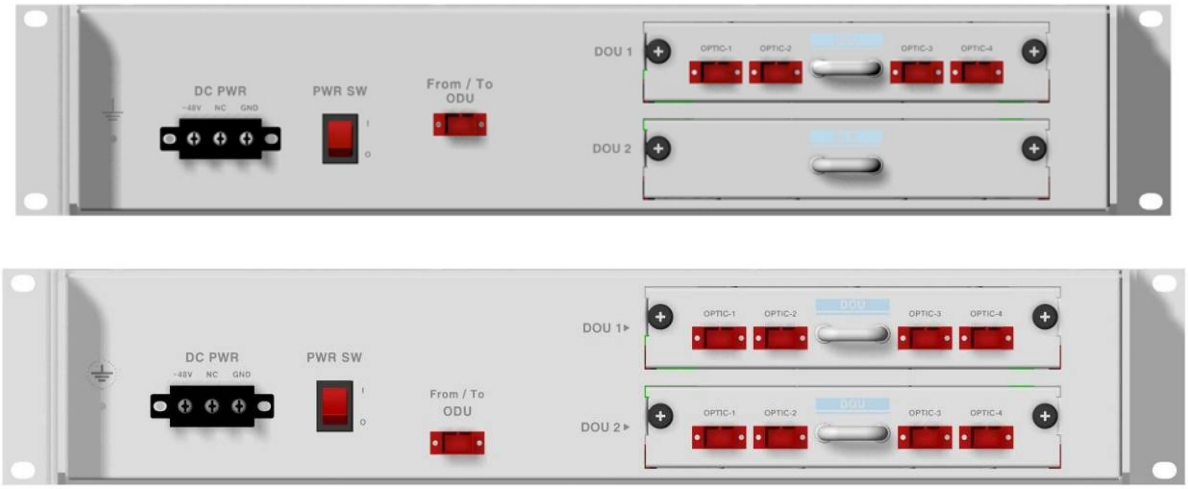


Figure 9.2 – OEU Showing One and Two DOU Configurations

9.4 Connecting the OEU to ODU(s)

The OEU connects to the ODU using SC/APC fiber cabling. Make sure to keep the fiber ends capped when not connected to the equipment to prevent damage to the fiber center pins. If fiber connectors seem dirty, you can clean them using alcohol.

1- Using the fiber optic cable, connect the OEU to the fourth optical port in the ODU optical module.

If you connect the OEU to ports 1 thru 3, it will not communicate with the BIU.

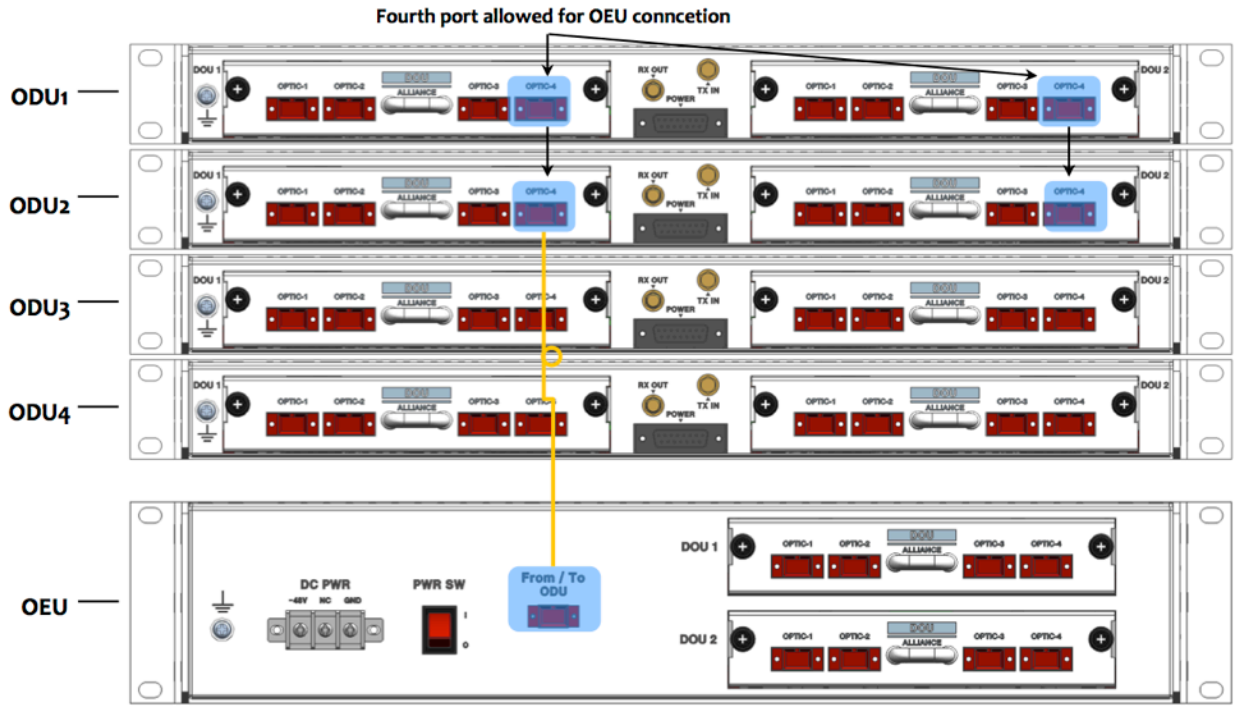


Figure 9.3 – Connecting the OEU to ODU

10 Installation – MRU and ARU

This chapter explains how to install the Main Remote Unit(s) (MRUs) and Add-on Remote Unit(s) (ARUs), and how to connect these units to the ODU(s) at the headend.

> **NOTE**: For instructions on installing the VHF/UHF Add on Remote (AOR) see page 95.

SOLiD technicians configure and label the equipment at the SOLiD facility prior to shipping. Note labeling on all equipment. Remove each item from its packaging and inspect the hardware. Contact SOLiD Support if the product is damaged.

10.1 Before you Begin

The MRU/ARU enclosures have two options: one is meant for indoor use, while the other is designed for outdoor installations and meets NEMA 4 standards to protect from water and dirt intrusion. The enclosures can be wall mounted, either side by side or stacked; they can also be installed in a standard 19" rack, either vertically or horizontally, using special mounting frames.

Before you begin this part of the installation process, make sure you have the following items. Those items marked with an "O" ship with the unit. The installer will supply items marked with an "X."

Installation Item	Accessories	Tools	Status
Wall mounting on brackets	M8 Bolts (Note: Wall mount brackets included for both MRU and ARU. All other mounting brackets are optional and available from SOLiD.)	Spanner (13mm)	X
MRU/ARU Mounting (wall brackets or rack)	M6 Wrench Bolts	Hexagon Wrench	O
Connecting Power	AC 120V power cable (1) or DC -48V power cable (1 Pair)		O
Grounding Unit	Ground cable with terminal lugs [Max. AWG #12]	No.0 Screw driver (+) Lug crimper	X
Connecting Fiber Optic to ODU (MRU only)	Optic cable [SC/APC Type]	Spanner (32mm)	X
Connecting to Antenna (MRU only)	RF cable [N-type Male] (1)	Spanner (20mm) Connector crimper	X
Communication between MRU and ARU	Communication cable (1) and SMA cable (3)		O

Table 10.1 – Tools and Accessories for Installing MRUs/ARUs

10.2 Install MRU/ARU Enclosures – Wall Mount

The MRU/ARU enclosures can be mounted on a wall either side-by-side or stacked with the ARU mounted in front of the MRU. Both units have the same dimensions as showing in the next figure:

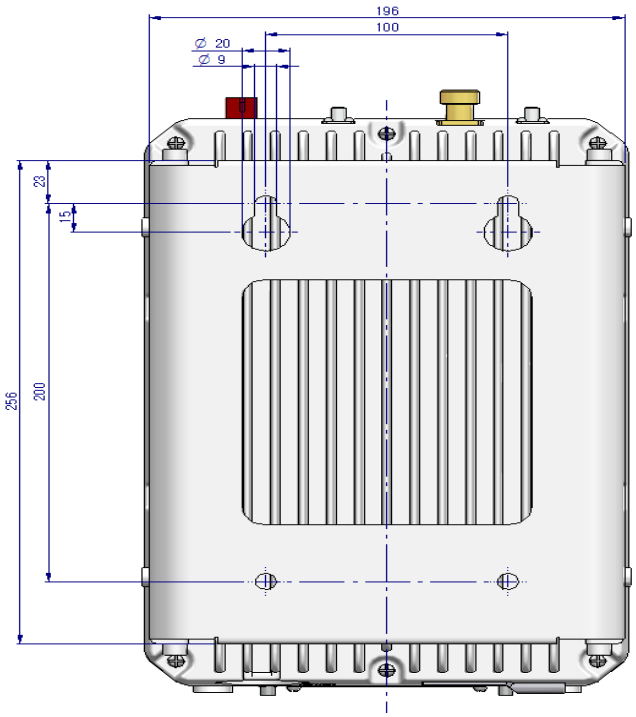


Figure 10.1 –MRU and ARU Dimensions

10.2.1 MRU/ARU Wall Mount – Side-by-Side Installation

1- To fasten the mounting bracket to the wall, first install the top two M8 mounting screws about half way in the wall.

2- Slide the bracket over the two screws, tighten them down, then install and secure the bracket with the remaining two mounting screws.

3- On the sides of the remote unit, screw the M6 wrench bolts about half way in to the heat sink enclosure. (Each unit will require four M6 wrench bolts.)

4- Position the unit so that the M6 bolts slide in to the wall bracket's mounting grooves, then tighten down the bolts.

5- Install any ARUs to the right or left of the MRU repeating steps 1 - 4.

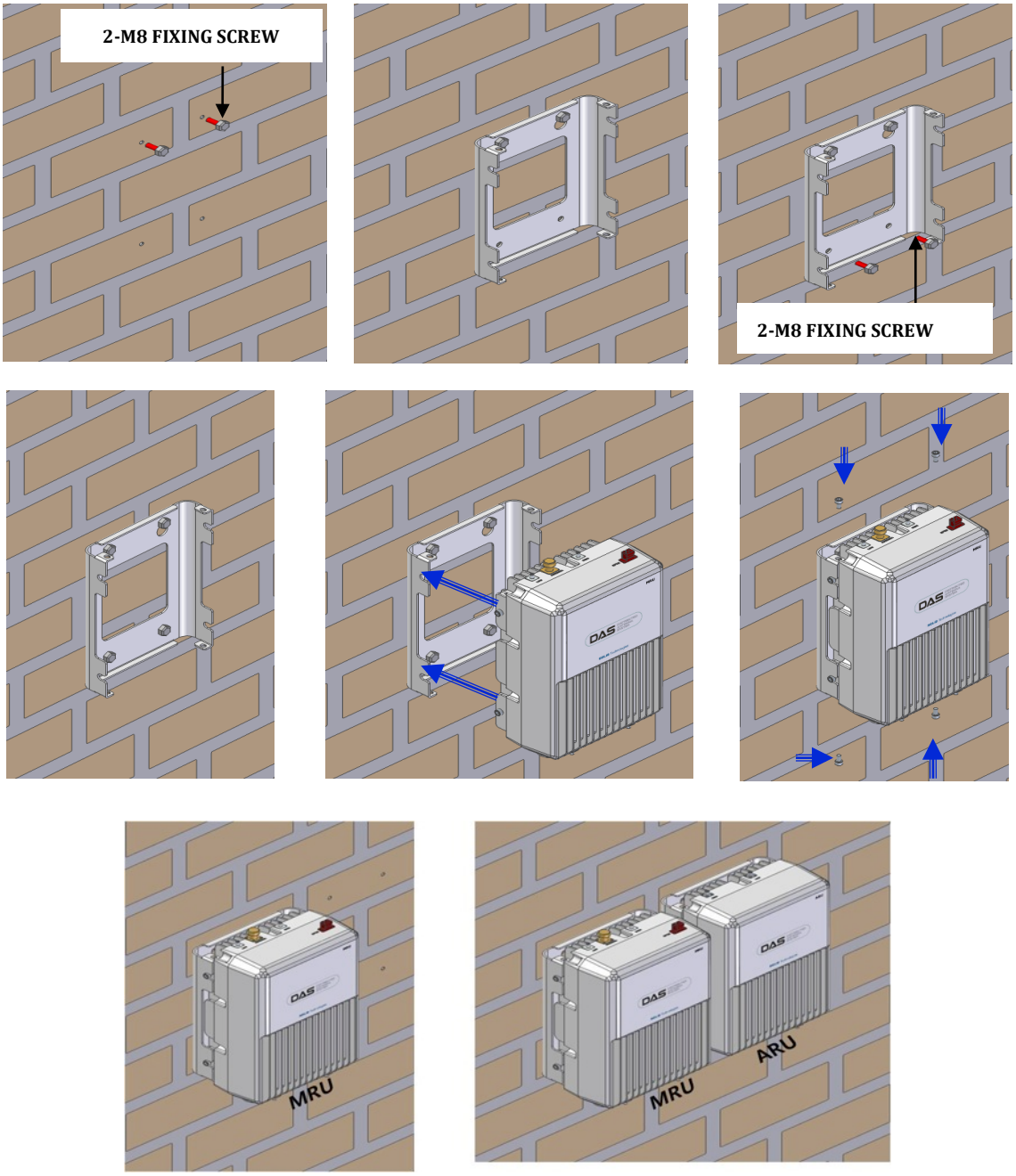


Figure 10.2 – Side-by-Side Wall Mount Installation for the MRU / ARU

10.2.2 MRU/ARU Wall Mount – Stacked Installation

If space prohibits the MRU and ARU from being mounted side by side, the units can be installed in a stacked configuration. Stacking the units requires a special bracket (part number SC-ARU-STK), which is available from SOLiD.

The next figure shows the dimension of the bracket used for stack mounting.

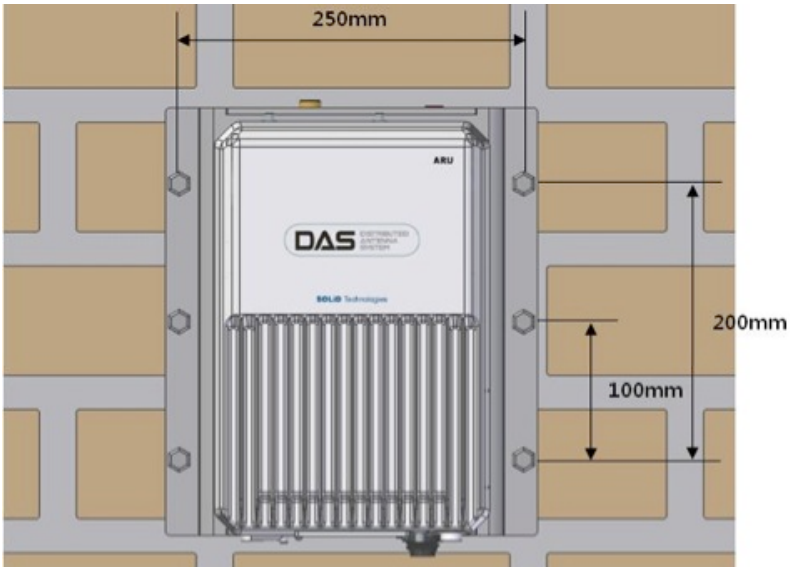


Figure 10.3 – Dimensions of Stacking Bracket

1- Using the instructions above, first install the MRU on the wall.

2- Install the bracket for stacked installation over the MRU.

3- Finally install the ARU on the bracket.

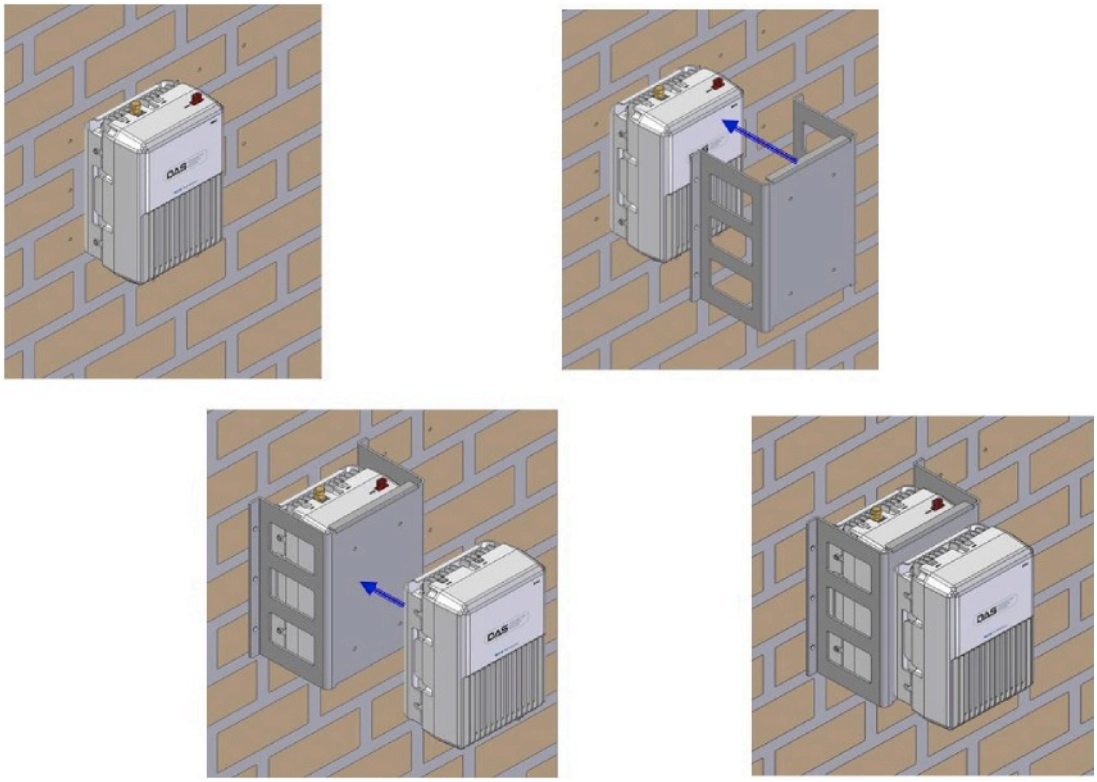


Figure 10.4 – Stack Mounting the MRU/ARU

10.2.3 MRU/ARU Rack Mount – Vertical Installation

The MRU/ARU enclosures can be mounted side-by-side in a standard 19" rack. The units are positioned upright (vertically as shown in the next figure) or on their backs (horizontally).

Vertical installation requires a special bracket (part number bracket SC-BRK), which is available from SOLiD. When the units are oriented vertically, they occupy 7U of rack space.

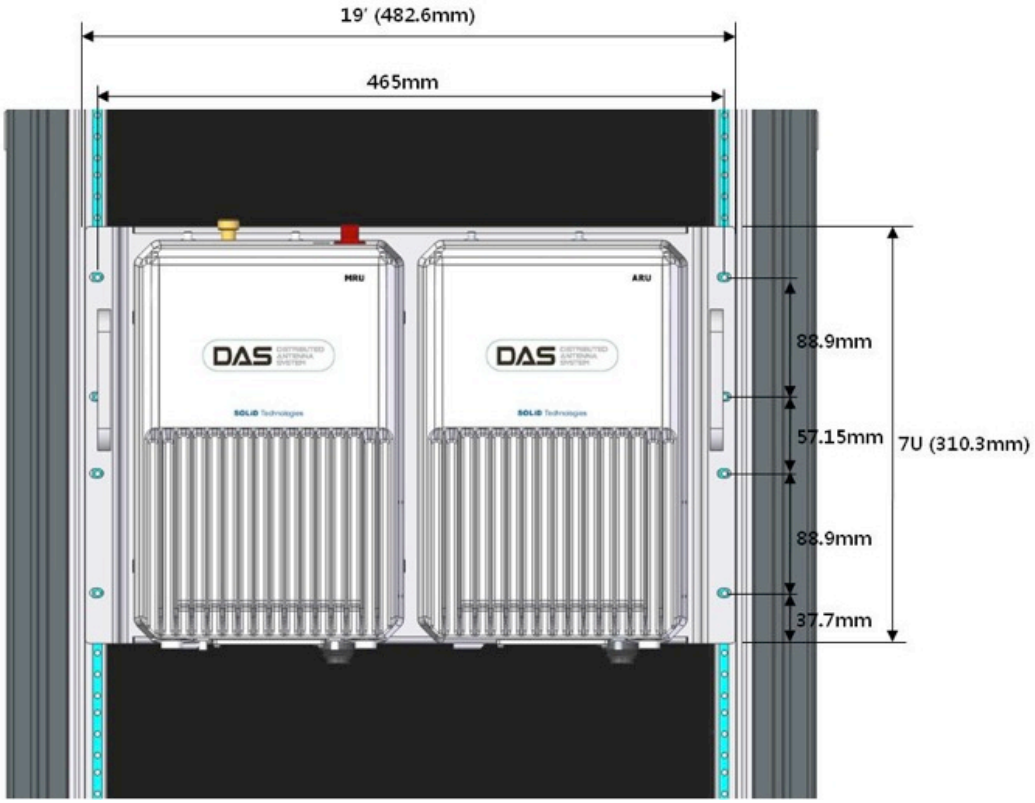


Figure 10.5 – Dimensions for MRU/ARU Vertical Rack Installation

NOTE: The MRU and ARU ship with the wall mount bracket already attached. Make sure to remove the wall mount bracket from the unit before installing in the shelf.

1- Install the vertical rack mount bracket (SC-BRK) to the 19” rack.

2- Mount the MRU and ARU to the vertical rack mount bracket. Four M8 bolts are used to secure each remote enclosure.

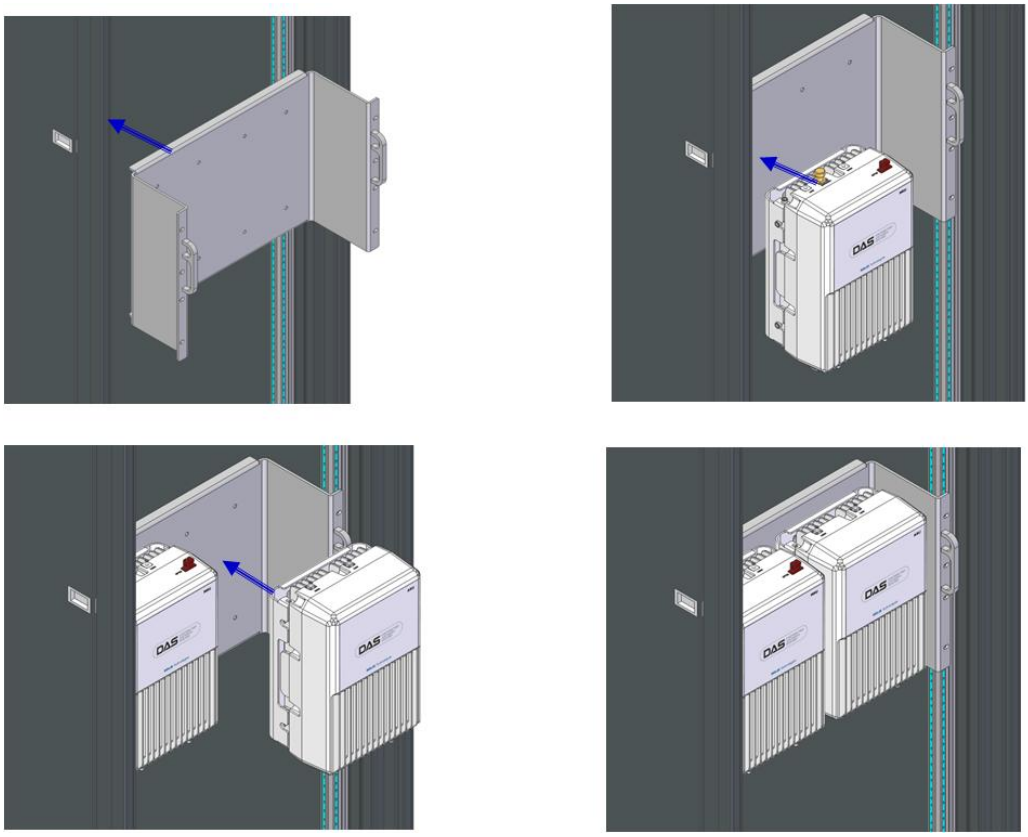


Figure 10.6 – MRU/ARU Installation Procedure for Vertical Rack

10.2.4 MRU/ARU Rack Mount – Horizontal Installation

Likewise, for installing the enclosures horizontally, a specific bracket is required (part number SC-RM19) which is available from SOLiD. When mounted horizontally (as shown in the next figure), each unit occupies 4U of rack space.

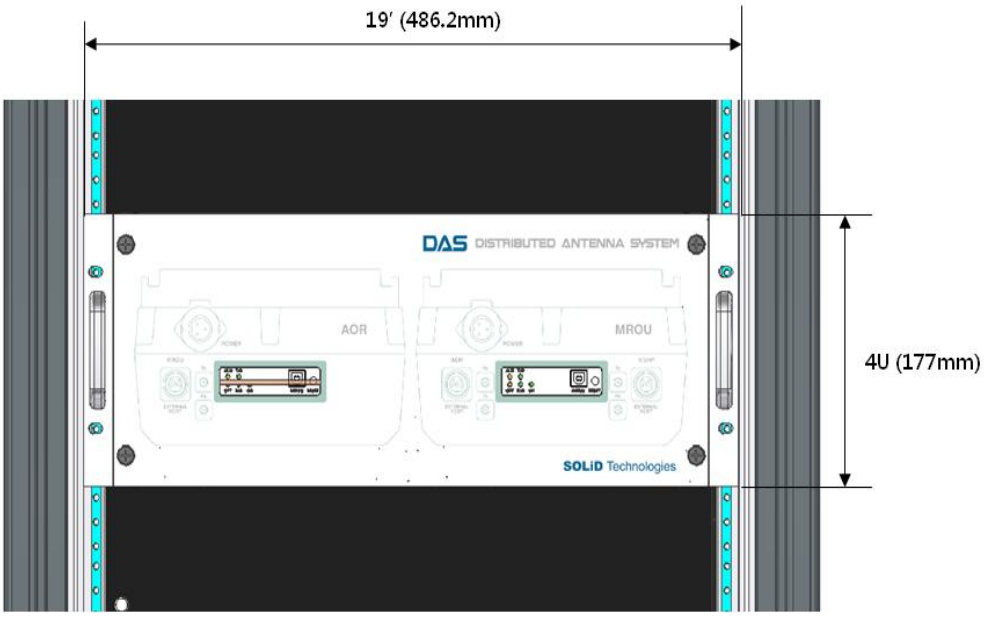


Figure 10.7 – Dimensions for MRU/ARU Horizontal Rack Installation

NOTE: The MRU and ARU ship with the wall mount bracket already attached. Make sure to remove the wall mount bracket from the unit before installing in the shelf.

1- Install the horizontal mounting bracket in the rack.

2- Open the front cover of horizontal bracket.

3- Slide in the MRU and ARU.

4- Finally, close the front cover of the horizontal bracket after completing cable connection and enclosure grounding.

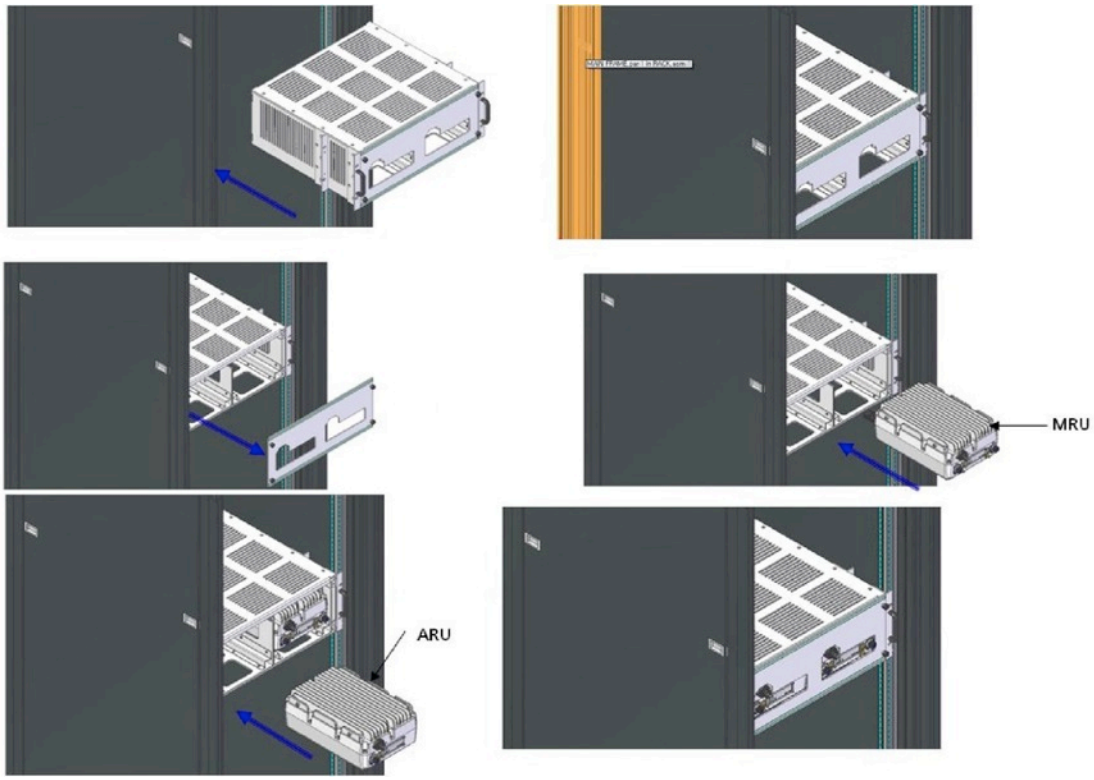


Figure 10.8 – MRU/ARU Installation Procedure for Horizontal Rack

10.3 Connect MRU / ARU Power

The MRU and ARU support both DC-48V and AC120V for input power. Make sure to order the appropriate power unit according to your installation requirements. Based on your configuration, SOLiD will ship the correct power supply unit already installed and provide the correct power cable with the proper connector attached.

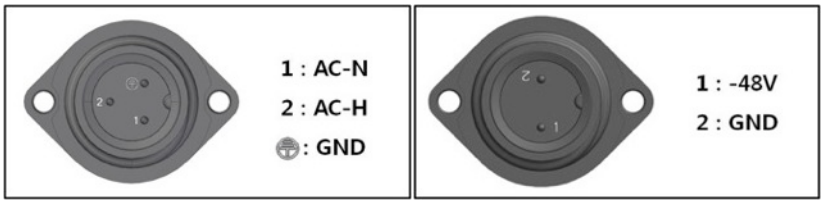


Figure 10.9 – MRU / ARU Power Ports – AC/DC and DC/DC

NOTE: The MRU / ARU do not have an ON/OFF power switch. Power is supplied to the units when the power cord is plugged into the AC source.

10.3.1 MRU/ARU Power Consumption

The following table shows power consumption for the MRU and ARU.

Part	Unit Name	Manufacturer Product No.	Power Consumption (W)
MRU	1900MHz Main Remote Unit	MRU_AC_1900	45W
		MRU_AC_NEMA_1900	
		MRU_DC_1900	
		MRU_DC_NEMA_1900	
	850MHz & 1900MHz Main Remote Unit	MRU_AC_850_1900	50W
		MRU_AC_NEMA_850_1900	
		MRU_DC_850_1900	
		MRU_DC_NEMA_850_1900	
ARU	700MHz LTE & 2100MHz Add-on Remote Unit	ARU_AC_700LTE_2100	40W
		ARU_AC_NEMA_700LTE_2100	
		ARU_DC_700LTE_2100	
		ARU_DC_700LTE_NEMA_2100	
	800MHz & 900MHz Add-on Remote Unit	ARU_AC_800_900	44W
		ARU_AC_NEMA_800_900	
		ARU_DC_800_900	
		ARU_DC_NEMA_800_900	

Table 10.2 – MRU/ARU Power Consumption

10.4 Connect Ground Terminal

The MRU and ARU each have one ground terminal port at the bottom of the unit. The ground lug is designed meeting the SQ5.5 standard.

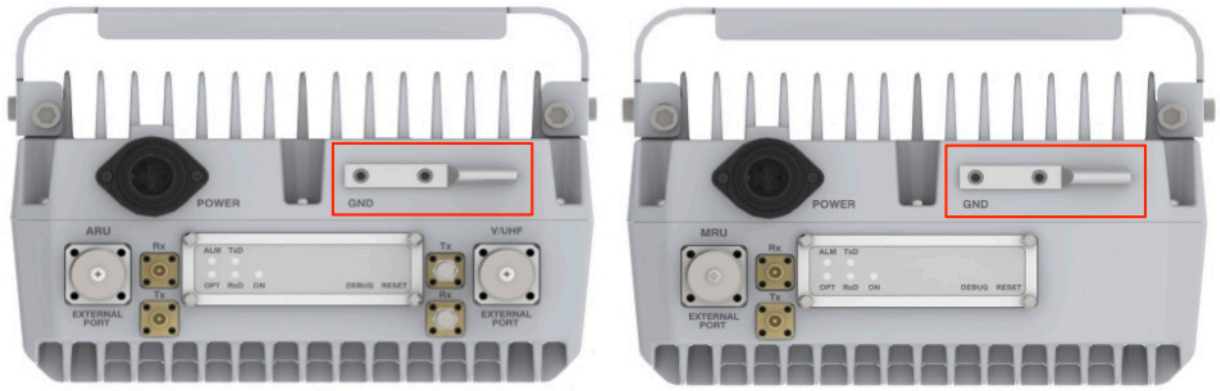


Figure 10.10 – MRU / ARU Ground Terminal

1- Take off the GND terminal port from the enclosure and connect to the ground cable. Then reconnect it to the enclosure.

2- Connect the opposite end of the ground cable to the communication GND of the building.

10.5 Connect Optical Cabling

The MRU(s) connect to the optic modules in the headend ODU(s) (or optional OEUs) using fiber optic cables with SC/APC connectors. SOLiD does not provide fiber optic cables with the DAS equipment. Only the MRU has optical port; there is no optical port on the ARU.

When purchasing, installing and maintaining the optic cables, make sure to follow the manufacturer's guidelines. To prevent the fiber interface, make sure to keep it covered until connecting the fiber strand. Keep the fiber ends capped when not connected to the equipment to prevent damage to the fiber center pins. If fiber connectors collect dirt, you can clean using alcohol.

1- Insert the fiber into the optical port of the MRU. The bend radius of the fiber should not be less than least 5 inches to minimize insertion loss and avoid damage to the optic cable.

During software commissioning, you will check to ensure the PD value of the optic module is within acceptable range (+4--1dBm).

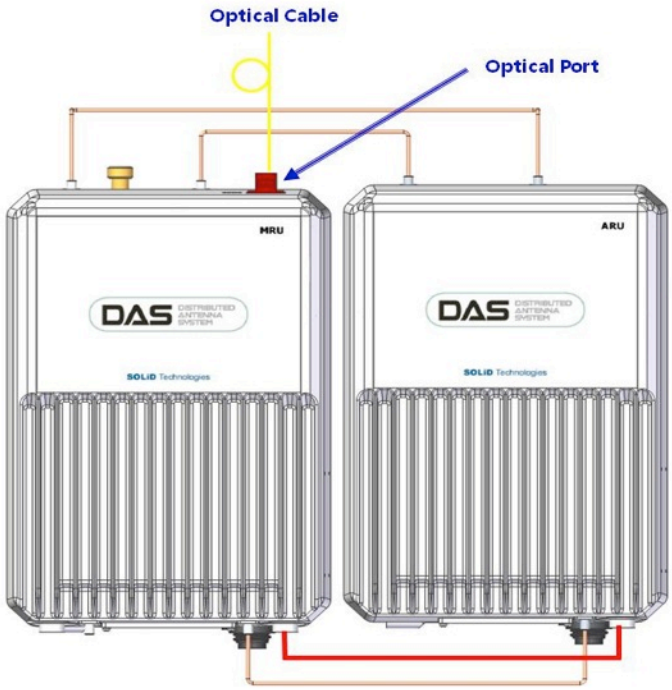


Figure 10.11 – Attaching Fiber Optic Cabling to the MRU

10.6 Connect MRU and ARU

The downlink/uplink signals for the Add-on Remote Units receive/transmit through RF ports of the MRU, so you will need to connect the units through the external port to enable this communication.

1- Make all connections between the units according to the following figure and table. Make sure to observe recommended torque values. Items marked with an "O" ship with the unit. The installer should provide items marked "X."

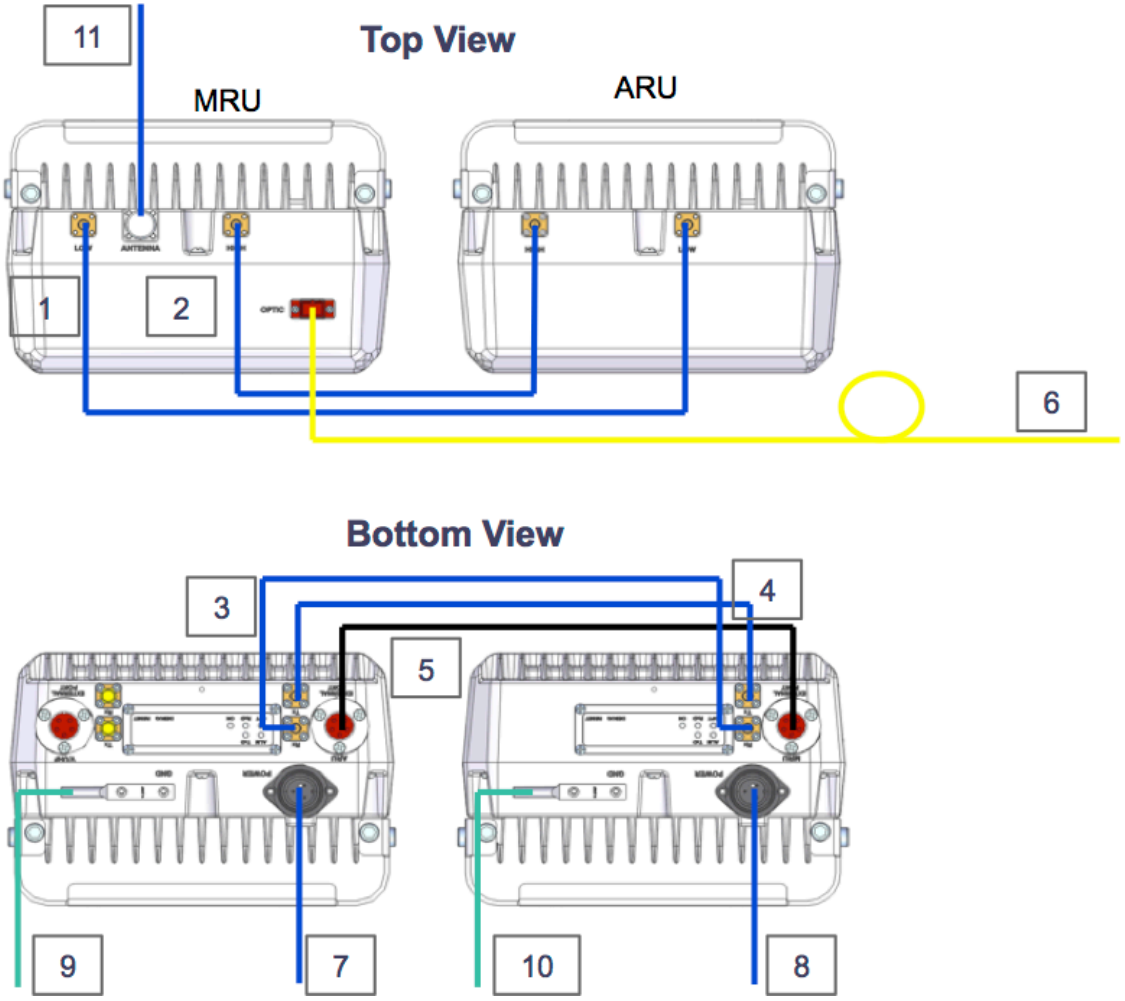


Figure 10.12 – Connecting the MRU to the ARU

No.	Item	Type	Tool	Status
1	TRX CABLE 1	RF Interface Cable (SMA Male) (Qty: 1)	Spanner (8mm) Torque 8~12kgf.cm	O
2	TRX CABLE 2	RF Interface Cable (SMA Male) (Qty: 1)	Spanner (8mm) Torque 8~12kgf.cm	O
3	RX CABLE	RF Interface Cable (SMA Male) (Qty: 1)	Spanner (8mm) Torque 8~12kgf.cm	O
4	TX CABLE	RF Interface Cable (SMA Male) (Qty: 1)	Spanner (8mm) Torque 8~12kgf.cm	O
5	SIGNAL CABLE	Data Interface Cable (Qty: 1)	-	O
6	OPTIC CABLE	Optic cable [SC/APC]	-	X
7	POWER CABLE	AC power cable or DC -48V power cable (Qty: 1)	-	O
8	POWER CABLE	AC power cable or DC -48V power cable (Qty: 1)	-	O
9	GROUND	AWG #10~12 Cable	Lug crimper	X
10	GROUND	AWG #10~12 Cable	Lug crimper	X
11	ANTENNA	RF N-Type Plug	Spanner (20mm) Torque 16.5~18.1kgf.cm	X

Table 10.3 – MRU/ARU Cable Connections

10.7 Connect Coaxial Cable and Antenna

Only the MRU has an antenna port. The ARU transmits its signal through RF cable connected to both the MRU and ARU.

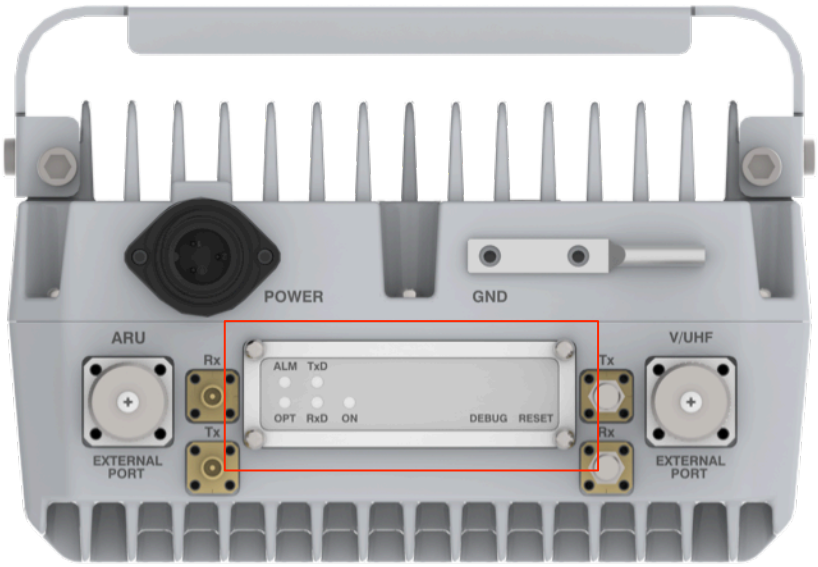
1- Before connecting the coaxial cable from the antenna to the MRU, check the Voltage Standing Wave Ratio (VSWR) value to ensure it is within specification using a SiteMaster or DTF meter. Check if the return loss is greater than 15dB or the VSWR value is less than 1.5:1. If it isn't, you may need to redo the RF connections on the cable.

2- Connect the coaxial cables to the antenna port of the MRU. Make sure the antenna connector is tightened properly and free of dirt and the debris.

NOTE: The antenna connected to the MRU is only for in-building use.

10.8 Power On MRU / ARU and Check Status

The remote units (MRU/ARU) do not have an ON/OFF power switch. Power is supplied to the units when the power cord is plugged into the AC source. Once the unit receives power, you can check the LED panel at the bottom of the unit to ensure it is operating correctly.



LED		Description
ON	⚪	Power is not supplied.
	🟢	Power is supplied.
ALM	🟢	Normal Operation
	🔴	Abnormal Operation
OPT	🟢	Optic Module: normal operation
	🔴	Optic Module: abnormal operation
TXD	🟢	Flashing when data sent to ODU (or OEU)
RXD	🟢	Flashing when data received from ODU (or OEU)

Table 10.4 – MRU LED Indicators

11 Installation – VHF/UHF Add-on Remote

Supporting VHF/UHF services requires the addition of a special VHF/UHF add-on remote (AOR). This unit will attach to the MRU instead of the standard ARU. Like the standard ARU, the VHF/UHF AOR does not contain an optical module. The optical link back to the headend is provided through the MRU. However, unlike the standard ARU, the VHF/UHF AOR requires a separate antenna connected to the unit.

SOLiD technicians configure and label the equipment at the SOLiD facility prior to shipping. Note labeling on all equipment. Remove each item from its packaging and inspect the hardware. Contact SOLiD Support if the product is damaged.

11.1 Before you Begin

Before you begin this part of the installation process, make sure you have the following items. Those items marked with an "O" ship with the unit. The installer will supply items marked with an "X."

Installation Item	Accessories	Tool	Status
Rack Mounting	M6 Screw (8EA)	No.0 Screw driver (+)	X
Wall Mounting	M12 Bolt (4EA)	Spanner (19mm)	X
Wall Mount Bracket	M8 Wrench Bolt (8EA)	Hexagon Wrench (6mm)	O
Ground Connection	M4 Screw (2EA)	No.0 Screw driver (+)	O
	Lug (1EA)	Crimping Tool	O
	AWG #10~12 Cable		X
Power Cable Connection (Specify power type when ordering.)	AC 120V power cable (1 EA) [2 meter, with MS3106A 16-10S at one end]	-	O
	DC -48V power cable (1 Pair) [AWG #12, 3 meter, with MS3106A 16-10S at one end, 4.5 ø square lugs at another end]	No.0 Screw driver (+)	O
Connection with MRU	Data interface cable (1EA) [1.5 meter, with MS3106A 14S-5S connector at both ends]	-	O
	RF Cable (2EA) [SS405 White, 1.5 meter, with SMA-SP(MALE) connector at both ends]	Spanner (8mm) Torque: 8~12kgf.cm	O
Antenna Connection	RF SMA-P Cable	Spanner (8mm) Torque: 8~12kgf.cm	X

Table 11.1 – Tools and Accessories for Installing VHF/UHF Add-on Remote

The VHF/UHF AOR can be rack or wall mounted. The cabinet is designed to be water and dirt proof so can be mounted either indoors or outdoors.

Instructions for both rack and wall mounting are contained in the following sections.

NOTE: The following instructions assume the MRU is already installed.

11.2 Installing the VHF/UHF AOR – Wall Mount

The AOR can be mounted above, below or beside the MRU. In all cases, make sure to leave adequate clearance between the units to increase airflow for effective heat dissipation. At the same time, distance between the units should not exceed the maximum values shown below. For example, because jumper cables connect at the bottom of the MRU, when the AOR is connected toward the lower side of the MRU, the maximum distance will be 700mm. When the AOR is connected at the upper side, the maximum distance will be 300mm.

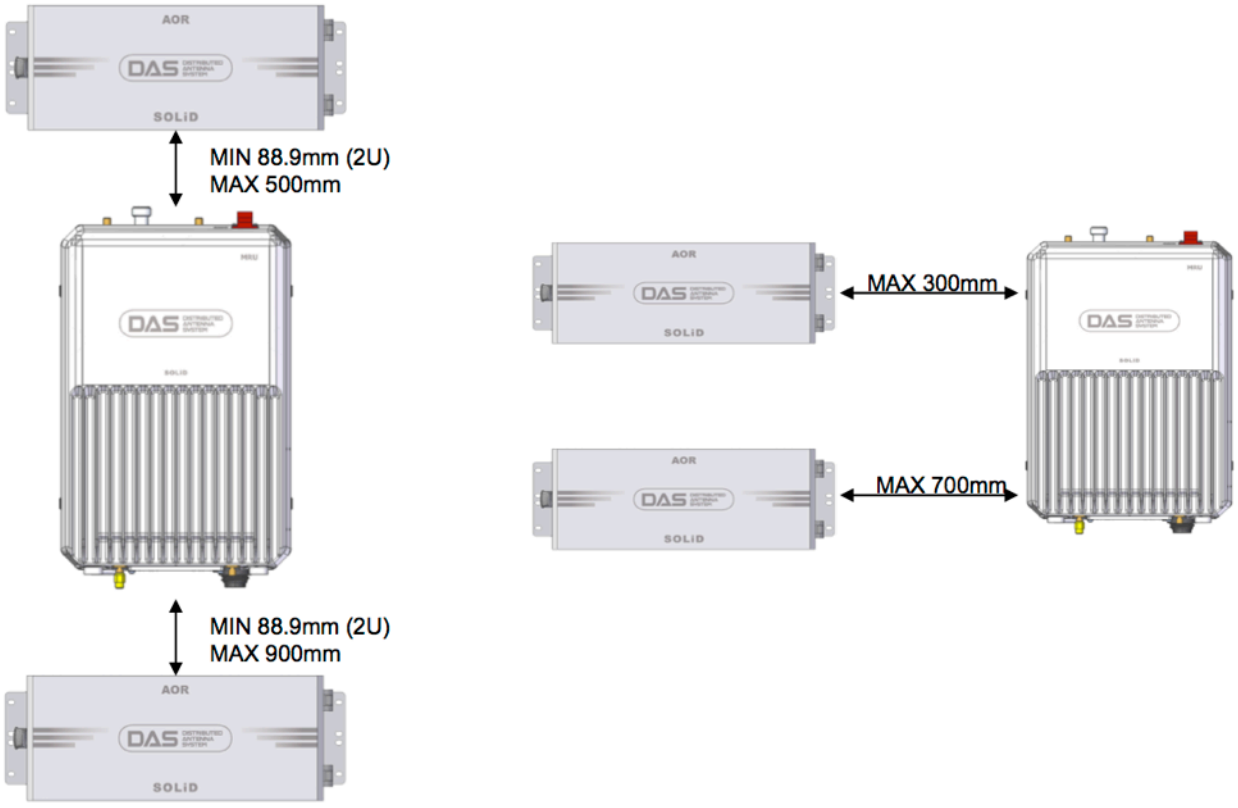


Figure 11.1 – Recommended Clearances for VHF/UHF AOR Wall Mounting

1- Install the M12 fixing screws in the wall according to the dimensions shown in the next figure.

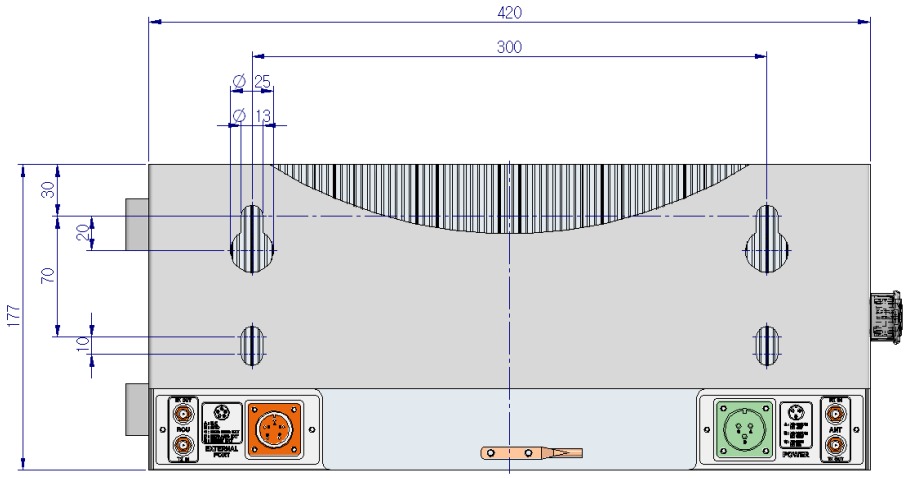


Figure 11.2 – VHF/UHF AOR Wall Mount Dimensions

2- Insert the mounting screws half way into the wall. Mount the bracket and then fully fix the screws.

3- At the top of each side of the enclosure's heat sink, insert an M5 wrench bolt and turn them in half way.

4- Position the M5 wrench bolts into the mounting groove of the mounting bracket and insert additional bolts into all the remaining fixing holes. You will need 6 M5 wrench bolts minus the bolts used for the mounting groove.

5- Tighten down all of the mounting bolts.

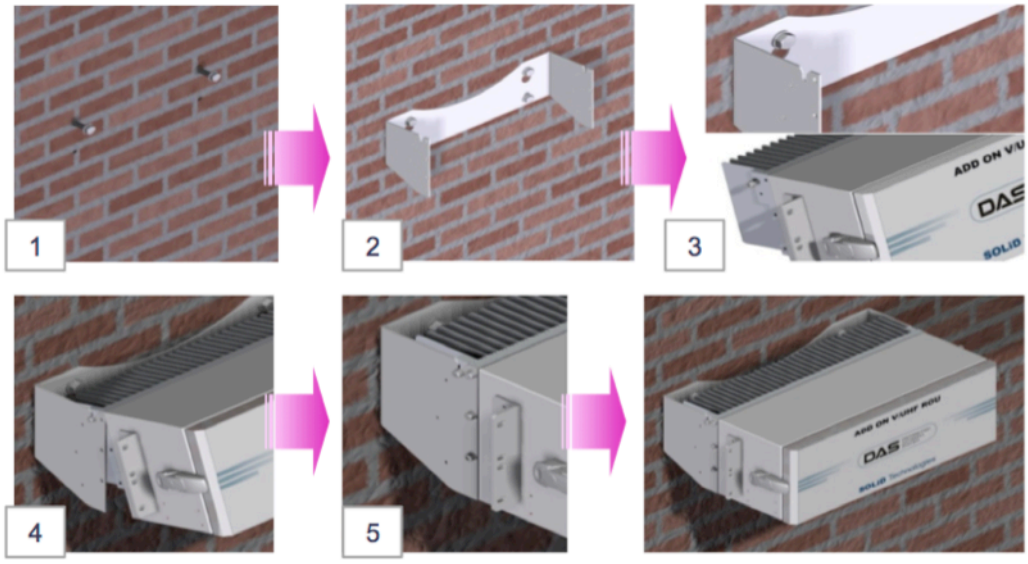


Figure 11.3 – Wall Mounting the AOR

11.3 Installing the VHF/UHF AOR – Rack Mounting

The VHF/UHF AOR can be installed in a 19-inch equipment rack, where it requires 4U of rack space. It can mount either above or below the MRU.

1- Position the unit in the rack.

When positioning the unit in the rack, make sure to leave 2U of space between it and the MRU to allow for cable installation and air circulation.

2- Insert the M6 screws in the mounting holes and tighten the screws to secure the chassis.

11.4 Installing Power Cabling

The VHF/UHF AOR supports both DC-48V and AC120V for input power. Make sure to order the appropriate power unit according to your installation requirements. Based on your configuration, SOLiD will ship the unit with the correct power supply installed and provide the correct power cable with the connector attached.

All connections are made at the back of the unit. The power connector is slotted and can only be installed one way. For your information, the following table shows the power connections.

MC Connector Numbering	Lug Naming		AOR PSU Terminal naming	
	AC	DC	AC	DC
A	AC_H	-48V	AC-H	-48V
B	AC_N	GND	AC-N	IN_GND
C	GND	DC NC	FG	FG

Table 11.2 – VHF/UHF AOR Power Connections

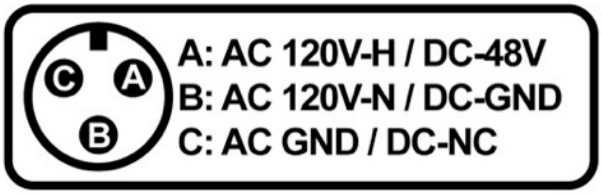


Figure 11.4 – VHF/UHF AOR Power Port

1- Connect the power cable to the PSU and to the power source.

2- Power on the unit to verify power is connected properly.

11.4.1 VHF/UHF AOR Power Consumption

The following table shows power consumption of the VHF/UHF AOR:

Unit	Part No.	Power Consumption (W)
VHF/UHF AOR	SC_AC_150_450 or SC_DC_150_450 (Includes RDU_150_450)	AOR Chassis 78W + RDU 93W

Table 11.3 – VHF/UHF AOR Power Consumption

11.5 Connecting Ground (GND) Terminal

The unit has one ground terminal port located on the rear side as shown below.

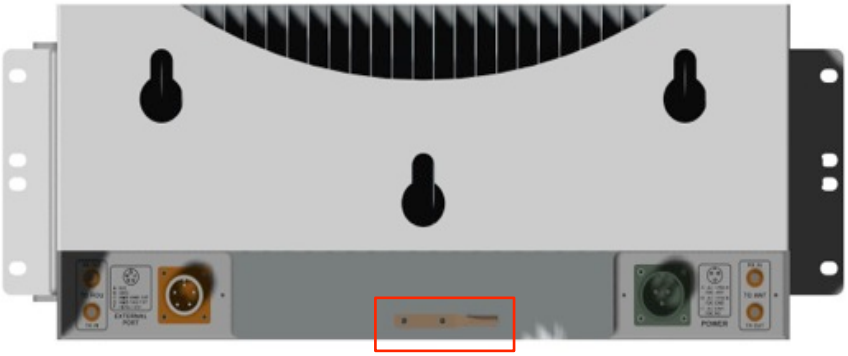


Figure 11.5 – VHF/UHF AOR Ground Port

1- Take off the GND terminal port from the enclosure and connect to the supplied ground cable. Then reconnect it to the enclosure.

2- Connect the other end of the ground cable to the communication GND of the building.

11.6 Connecting the Add-on Unit to the MRU

1- Make all connections between the units according to the following figure and table. Make sure to observe recommended torque values. Items marked with an “O” ship with the unit. The installer should provide items marked “X.”

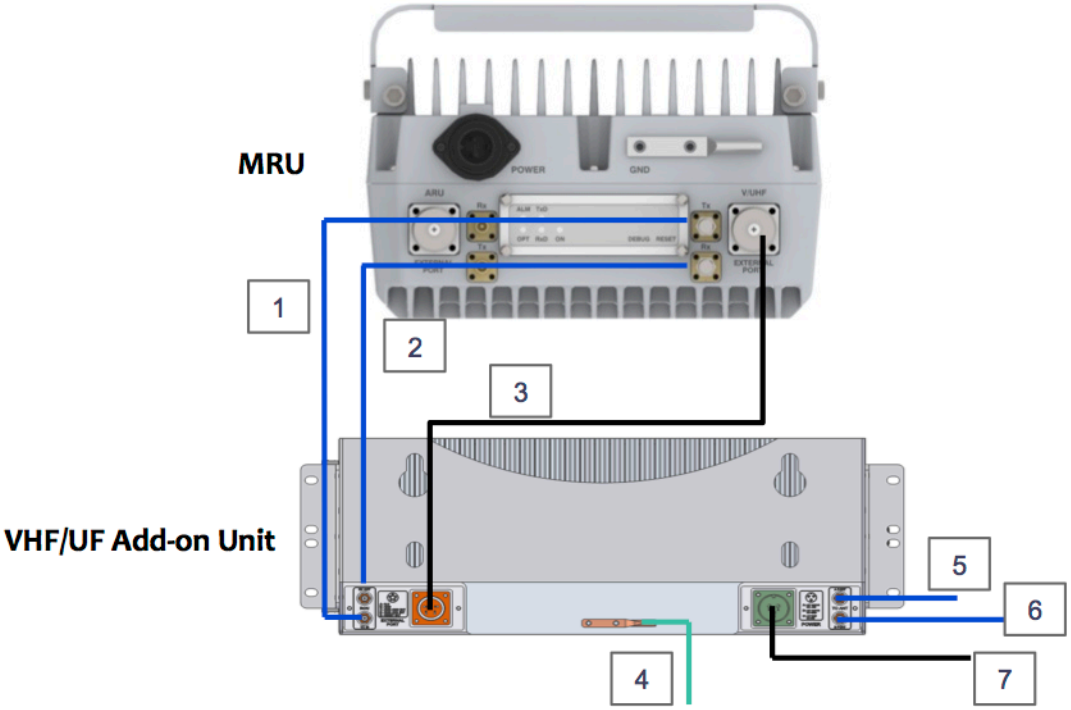


Figure 11.6 – Connecting the MRU to VHF/UHF AOR

No.	Item	Type	Torque	Status
1	Tx Cable	RF Interface Cable (SMA Male) – Qty 1	8~12kgf.cm	O
2	Rx Cable	RF Interface Cable (SMA Male) – Qty 1	8~12kgf.cm	O
3	Signal Cable	Data Interface Cable – Qty 1	-	O
4	Ground	AWG #10~12 Cable	Lug crimper	X
5	RX / SISO Antenna Cable	RF Interface Cable (SMA Male) – Qty 1	8~12kgf.cm	X
6	TX / MIMO Antenna Cable	RF Interface Cable (SMA Male) – Qty 1	8~12kgf.cm	X
7	Power Cable	AC power cable or DC -48V power cable – Qty 1	-	O

Table 11.4 – VHF/UHF AOR / MRU Connections

11.7 Connecting Coaxial Cable and Antennas

The Add-on remote unit has two antenna ports, one for the downlink (TX) and one for the uplink (RX).

1- Before connecting the coaxial cable from the antenna, check the Voltage Standing Wave Ratio (VSWR) value to ensure it is within specification using a SiteMaster or DTF meter. Check if the return loss is higher than 15dB or the VSWR is below 1.5.

2- Connect the coaxial cables to the antenna port of the add-on unit.

NOTE: A band pass filter is not required, but a third party filter can be used.

11.8 Powering On Add-on Unit and Checking Status

1- Power on the unit by moving the power supply unit's circuit breaker switch to the on ("I") position.

2- Check if the POWER LED indicator on the = PSU and the RDU are green indicating normal operation.

LED		Description
ON		No Power
		Power is supplied.
ALM		Normal Operation
		Abnormal Operation

Figure 11.7 – Power and Alarm Indicators for AOR

12 System Commissioning

This section of the manual describes how to commission the DAS once you have completed the hardware installation. The commissioning process assumes you have a basic understanding of link budgets and RF technology.

You have two options for the commissioning process: using the EasySET™ auto commissioning feature, which automatically optimizes the DAS system parameters according to factory defaults, or manually setting parameters. SOLiD recommends starting the commissioning process with EasySET™, and if necessary, adjusting system parameters using the management software.

For either option, you will need a laptop computer or PC connected to the CONSOLE port at the back of the DMS-600 server. The management software communicates through the DMS-600 with the DAS components: BIU, OEU and MRU. No special software is required to run the management program; it operates in a standard Web browser window. SOLiD recommends using Internet Explorer, Google Chrome or Mozilla Firefox.

NOTE: You can access the management software on the DMS-600 either onsite (with a laptop connected to the CONSOLE port) or remotely via the Internet (if the DMS unit is connected to a network with Internet access). SOLiD recommends performing the initial commissioning onsite.

12.1 Before you Begin

Before you begin this part of the installation process, make sure you have the following items. Those items marked with an “O” ship with the unit. The installer will supply items marked with an “X.”

Installation Item	Accessories	Status
PC to DMS-600 Connection	Standard CAT5 Ethernet Cable	O
Measuring Power Levels from Signal Sources	Spectrum analyzer	X

Table 12.1 – Tools and Accessories for System Commissioning

Also, before you begin, review this list of the most common problem areas that can affect the commissioning process.

For fiber optic cables, use single mode fiber according to these specifications:

- 5dBo link budget from ODU to OEU, from OEU to MRU, and from ODU to MRU
- Maximum back reflection is -55dB
- Recommended maximum fiber length is 10km
- SC-APC Connectors

NOTE: The max fiber length is ultimately based on the optical link budget.

Common cabling problems include:

- Crossing Rx/Tx
- Incorrect or improperly fitted connectors
- System balancing and attenuation settings

12.2 Connect DMS-600 to EXPRESS DAS

1- Make sure the DMS-600 is properly connected to the BIU. (See page 75.)

2- Make sure all components in the DAS are powered on.

3- Connect a PC or laptop to the CONSOLE port on the back of the DMS-600 unit using the supplied CAT5 cable.

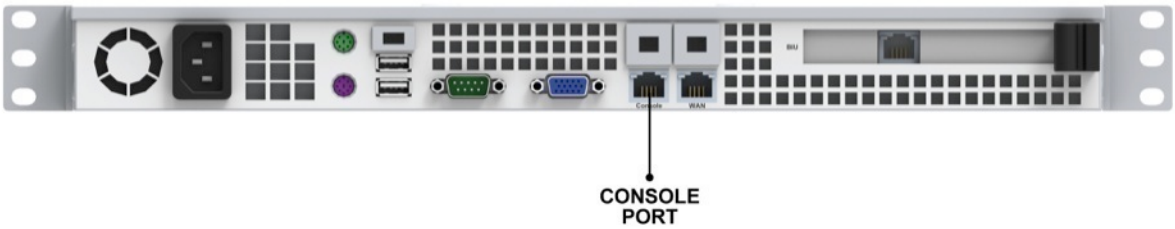


Figure 12.1 – Connecting Laptop to DMS-600

12.3 Open Management Software and Run EasySET

1- In the browser URL address bar, enter the IP address: 192.168.58.1 or the URL http://solid.local

The login screen appears.

2- Enter the username **ADMIN** and Password **1111**. (These values are set in the factory but you can change them using the SETUP menu.)

The main screen appears.

3- The main screen shows information for your site.

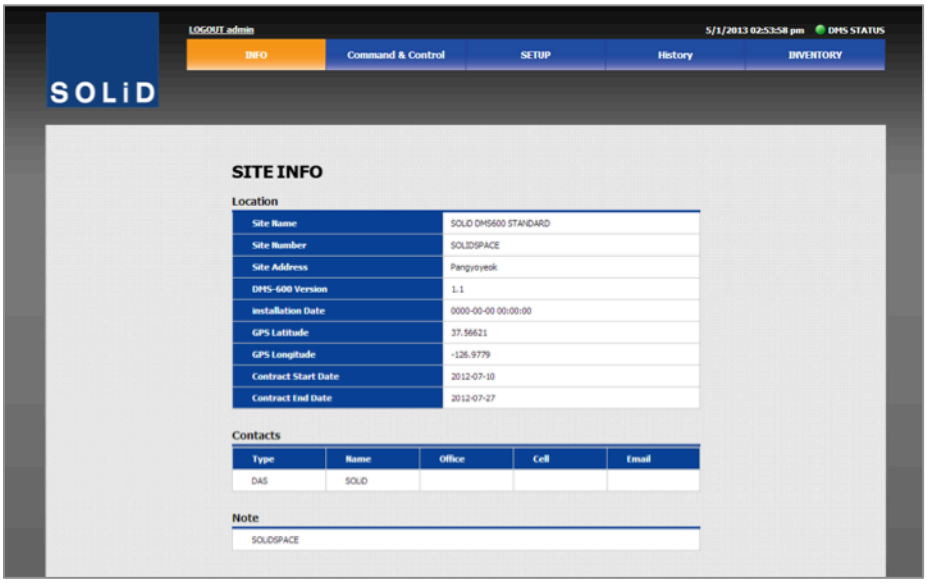


Figure 12.2 – Management Software Home Screen

4- From the Command & Control tab, click the **EasySET** menu option.

On the EasySET screen, you will see these options:

- **Commission System**: Starts the auto commissioning routines. All system parameters are set to the latest factory default values.
- **System Setup**: Enables changes to default values as necessary for specific installation requirements.

5- Choose the BIU you want to commission. Click **Connect**.

The system writes a series of command lines showing status and verifying connection to the BIU.

6- Click **Commission System**.

The EasySET window appears.

7- Click **Start**.

A progress bar indicates the auto-commissioning status. Settings performed by EasySET can be seen in the command-line window. (Pressing **Stop** will halt the process.)

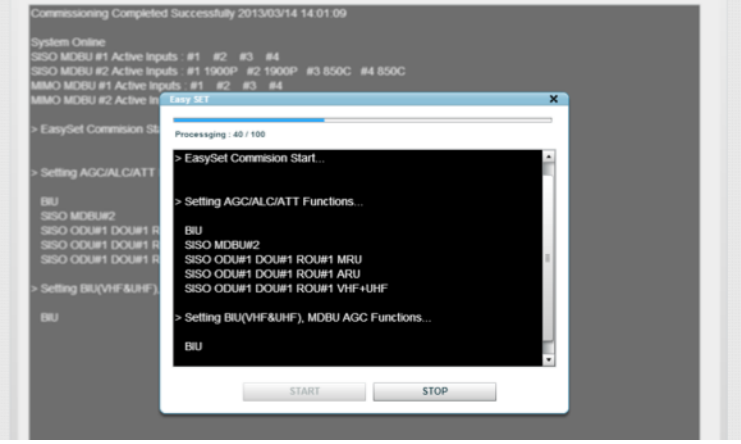


Figure 12.3 – EasySET Progress Bar

Once the commissioning procedure is complete (100/100), the final command line will show status:

- **Commissioning Successful**: No alarms reported.
- **Commissioning Failure Alarm Check of System Online**: An alarm has been reported.

8- If successful, close the pop-up window to conclude the EasySET process. If the commissioning process has failed, go to the Command & Control menu to determine the alarm condition.

12.4 Changing Factory Defaults

To meet specific performance needs for your DAS site, you can modify factory default values to desired levels before executing the EasySET function.

1- From the EasySET main screen, click **System Setup**. The following screen appears with these options:

- **Default Load**: Displays the stored default values.
- **Default Save**: Default values are applied to parameter values.
- **GET**: Displays the most recently saved parameter values.
- **SET**: Saves the changed parameters values.
- **Commission System**: Executes the EasySET commissioning process
- **EasySET Main**: Back to main Command & Control window.

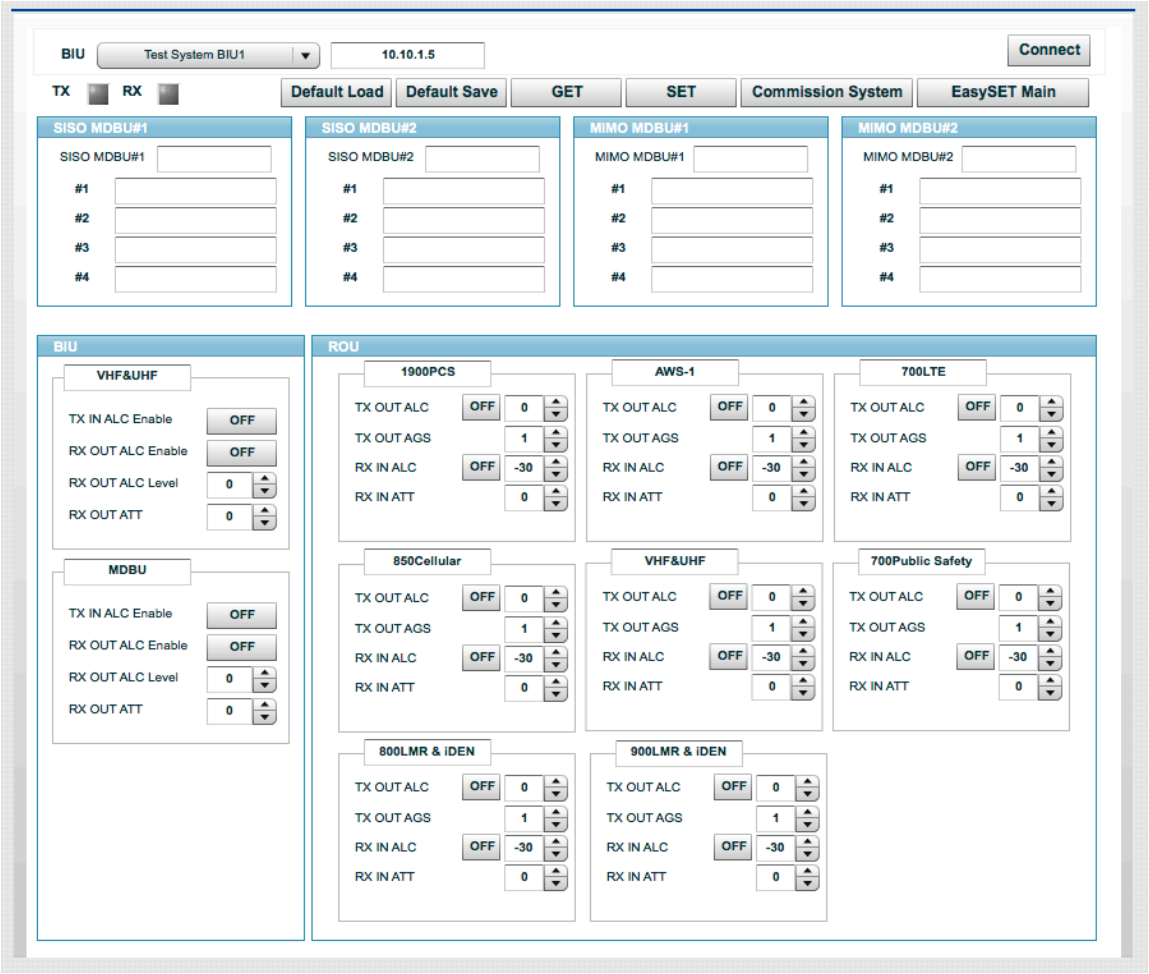


Figure 12.4 – System Setup Screen

2- Choose the BIU you want to connect to. Click **Connect**. Press **GET** to view current parameters.

3- Change values as necessary. When you are done, click **SET** to save new values. These values will be applied during the auto commissioning process.

12.5 Manual Setup

From the **Command & Control** menu, you can further customize your DAS settings such as modifying alarm thresholds and adjusting RF parameters per frequency band.

12.5.1 Load the Command & Control Menu

1- From the main screen, click **Command & Control**

2- Choose the BIU you want to connect to. Click **Connect**.

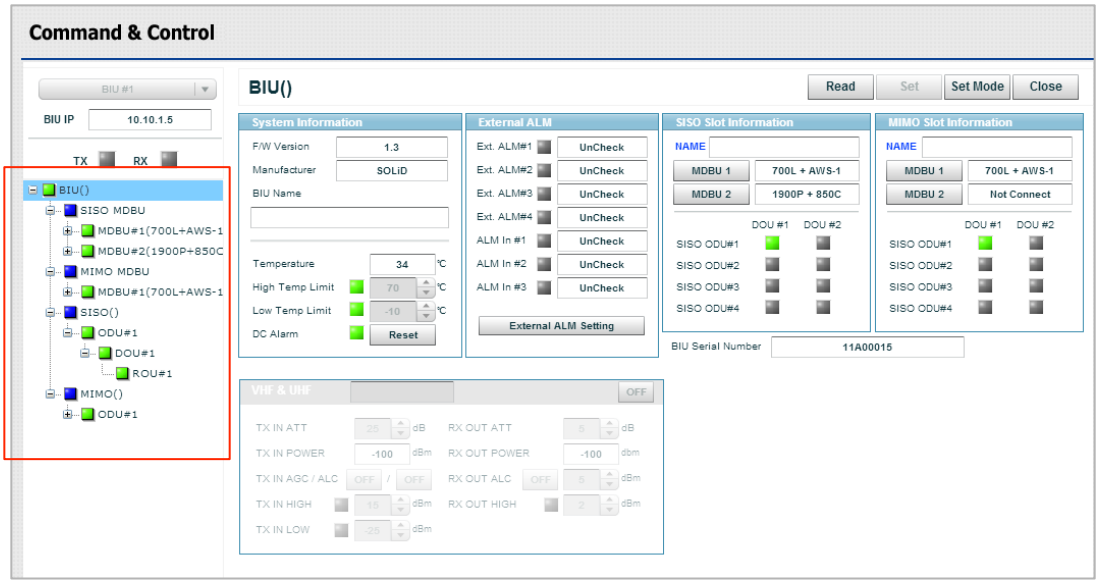


Figure 12.5 – Command & Control Screen

The Auto-ID feature detects the DAS devices currently connected and displays these in the System Tree along the left side of the display (outlined in red in the above graphic).

3- Select a device from the left menu within the BIU tree.

To read values select the **Read** button.

To change values select the **Set Mode** button.

To save values, click **Set** after changing the parameter value.

4- Click **Close** when you are done.

12.5.2 Verify all Connections

1- Check the RF input and output cabling and connectors between the BIU and the signal source (BTS or BDA) to verify all connections are attached properly.

2- Using a spectrum analyzer connected to the Monitor SMA ports at the front of the MDBUs, test the RF input signal (Tx) for each frequency band and input. Depending on the signal, this value will range between -20dBm to +10dBm per port.

3- Check the values in the management software in the Tx IN POWER field for each MDBU to verify they match the results from the spectrum analyzer.

4- In the System Tree, check that all power and optical connections are working properly for both headend and remote components. A green light indicates the connection is functioning.

5- Check that all headend and remote components are receiving power.

12.5.3 Set MDBU Parameters

1- Activate all input ports being used by selecting **ON** and then **SET**.

Turn off all ports not in use. If an unused port remains turned on, output power levels will be impacted. If there is no input signal, the Tx IN power field will show the value -100dBm.

2- Once turned on, label the input ports by clicking in the label area. Each port name can be up to 12 characters. Press **SET** when you are done.

3- For each active MDBU, turn on Tx IN AGC by selecting **ON** and then **SET**. This will automatically turn off once complete. This is a one-time setting to adjust the BIU gain against each BIU input level.

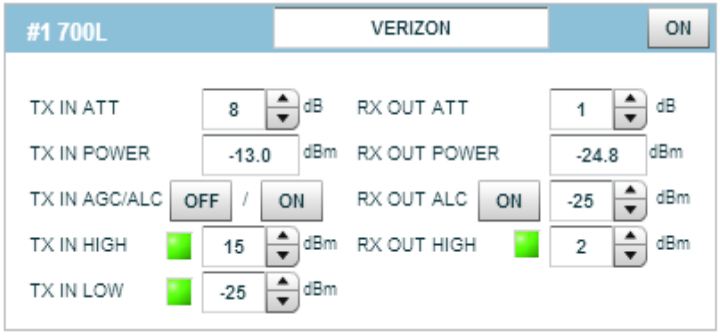


Figure 12.6 – Setting MDBU Parameters

5- Turn on Tx IN ALC by selecting **ON** and pressing **SET**.

6- Verify Rx OUT ALC is turned **OFF**.

7- Set the Rx OUT ATT to the value desired for the uplink path.

8- Verify that the value in the Tx IN POWER is within ±3dB of the downlink value measured using the spectrum analyzer.

12.5.4 Set Optic Compensation

The LD (laser diode) power light is the level of power transmitted by the ODU and received by the MRU. The PD (photo diode) power light is the level of power received by the MRU and transmitted by the ODU. The MRU can automatically compensate for optical loss, up to a maximum 5dBo.

1- Select the SISO, ODU, DOU, ROU from the System Tree menu to reach the Optic Information screen. (In the System Tree, "ROU" refers to the remote optical units such as the MRUs and ARUs.)

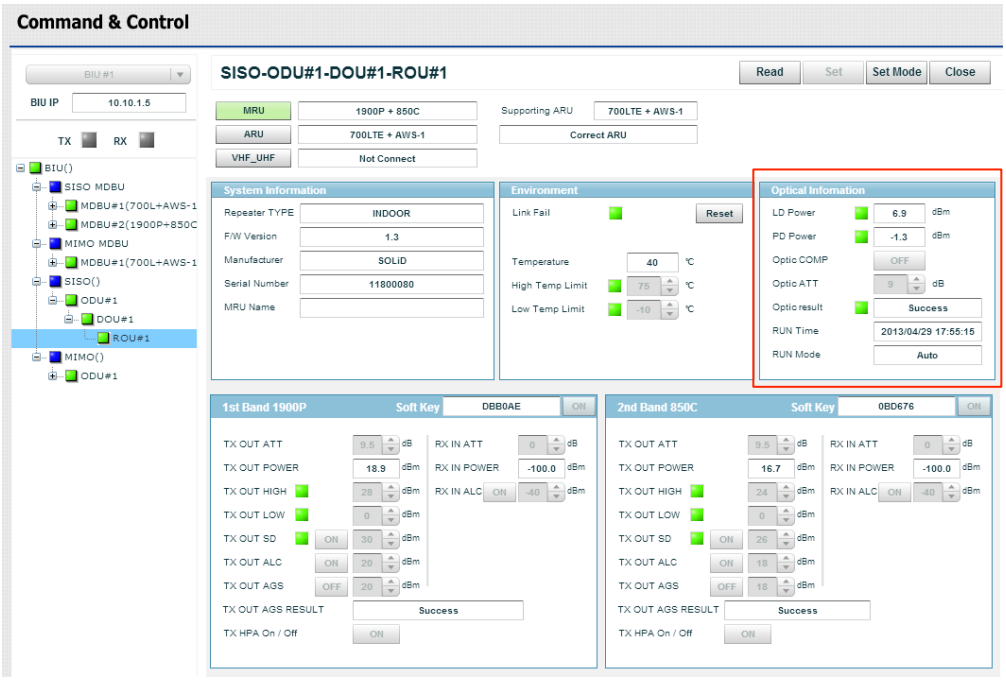


Figure 12.7 – Setting Optic Values

2- Check the LD and PD power range and OPTIC ATT to the following values:

- LD Power Range: +7 ± 1.5dBm @1550nm
- PD Power Range: +3 to 0dBm @1310nm
- Tx Optic ATT: Default 12dB

3- Set Tx OPTIC COMP of MRU to **ON**.

When you turn on OPTIC COMP, the system automatically calculates the correct compensation by using the difference between the ODU LD power and MRU PD power results.

During optical compensation, the RESULT field will display PROCESSING and then show the result:

- Success: Optic compensation is successfully performed.
- Over Optic Loss: Optic loss exceeds 5dBo.
- Communication Fail: Communication between ODU and MRU failed.

When activating OPTIC COMP (by setting it to ON), the system performs optic compensation at the MRU side and the result is applied to the ODU.

NOTE: Optic compensation depends on a working communication between the ODU and MRU. A faulty connection or a malfunctioning R_Optic or DOU module could cause a failure in this communication.

The system automatically calculates optic compensation according to the following values. Recommended values should fall between 1dBo~5dBo:

				1dBo~5dBo
LD Power [dBm]	PD Power [dBm]	LD-PD	OPT ATT[dB] 12-2* (LD-PD-1)	Optic Loss
1.5 ± 1	0.5	1	12	1dBo
	0	1.5	11	
	-0.5	2	10	2dBo
	-1	2.5	9	
	-1.5	3	8	3dBo
	-2	3.5	7	
	-2.5	4	6	4dBo
	-3	4.5	5	
	-3.5	5	4	5dBo
	-4	5.5	3	
	-4.5	6	2	6dBo

Table 12.2 – Optic Compensation

If the MRU does not perform optical compensation, there will be errors in the link budget of the system. This can cause reduced output levels and/or generate harmful spurious emissions.

12.5.5 Set MRU/ARU Parameters

1- Using the System Tree menu, select the MRU to configure.

2- Turn the relevant band on by selecting **ON** and pressing **SET**.

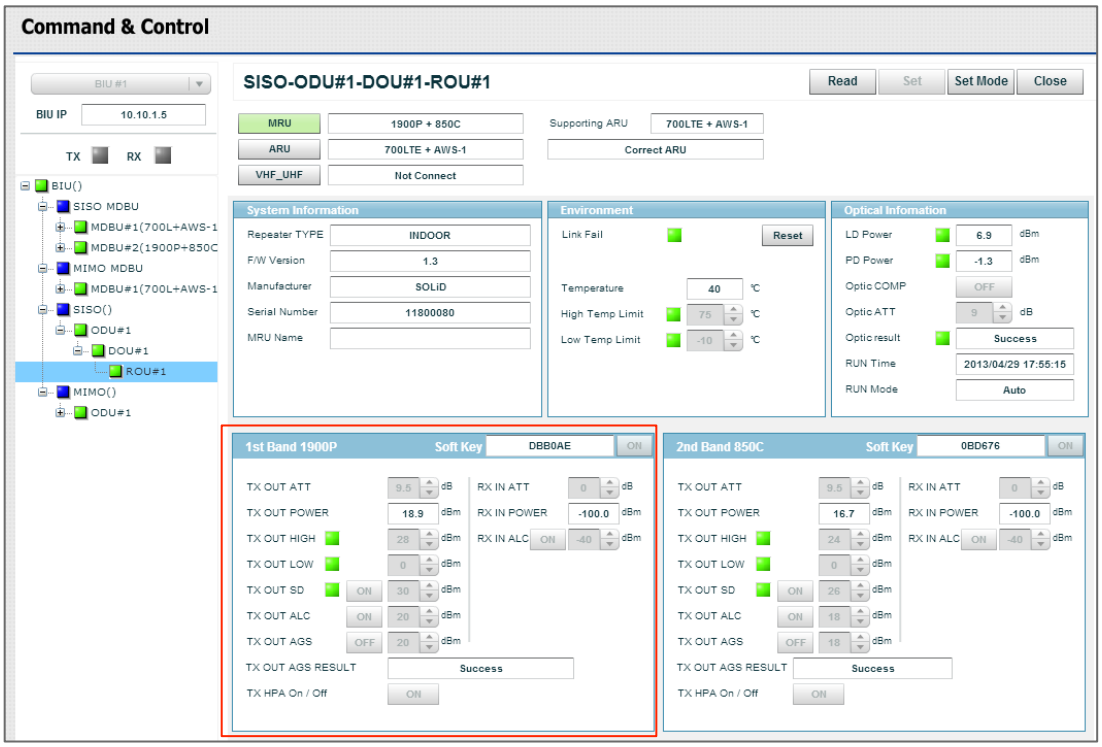


Figure 12.8 – Configuration Screen

3- Before turning on HPA, confirm that optic compensation has been performed. Click **On** TX HPA then click **Set**.

4- Click **On** Tx OUTPUT AGS then click **Set**.

When this function is turned on, the system will set the MRU gain to the target level. While the AGS function is being executed, the RESULT field will display PROCESSING and then shows the result:

- Success: The AGS function is accomplished.
- Not Operate OPTIC Comp: Optic compensation is not accomplished.
- Lack of ATT: There is no attenuation available.

If optic compensation fails, return to previous section. Otherwise, move to next step.

5- Click **On** Tx OUTPUT ALC then click **Set**.

Once AGS is performed, the ALC (Auto Level Control) function will maintain the set target level.

6- Click **On** Tx OUTPUT SD then click **Set** to turn on the auto shutdown feature.

(See page 119 to learn more about this feature.)

7- Set the Tx ROU parameters for AGS, ALC, SD and TX OUT HIGH/LOW levels according to the requirements of your site.

8- Set the Rx ROU parameter for ATT levels depending on your requirements.

9- Set Rx IN ALC level to -50dBm.

12.6 System Acceptance

Before the DAS goes live, you can validate that you have successfully completed the commissioning process and all components are functioning properly by checking signal levels for both the uplink and downlink paths as shown in the following figures. The table shows suggested link budget values, which will vary according to the configuration and frequencies of your system.

The validation process requires a signal generator and a spectrum analyzer. Set the spectrum analyzer to: 10 kHz resolution bandwidth, 3 kHz video bandwidth, 1 MHz frequency span.

NOTE: During system acceptance, make sure the system is operating within the recommended frequencies according to each band. See the table on page 11.

12.6.1 Validating the Uplink Path

1- Using the signal generator, set the desired Rx frequency and the output power to -50dBm.

2- Using the spectrum analyzer, verify the power level at the end of the cable connecting to the MRU.

3- In the management software, verify the PD optical power.

4- Using the spectrum analyzer, check the RF level at the Rx port of the ODU chassis.

5- Using the spectrum analyzer, check the RF level at the end of the cable connecting to the BIU ODU Rx port.

6- Using the spectrum analyzer, check the levels coming from the Rx monitor test ports at the front of the MDBU. This value should be -20dBm.

7- Using the spectrum analyzer, check the levels coming out of the MDBU Rx port at the back of the BIU that goes back to signal source (BTS or BDA).

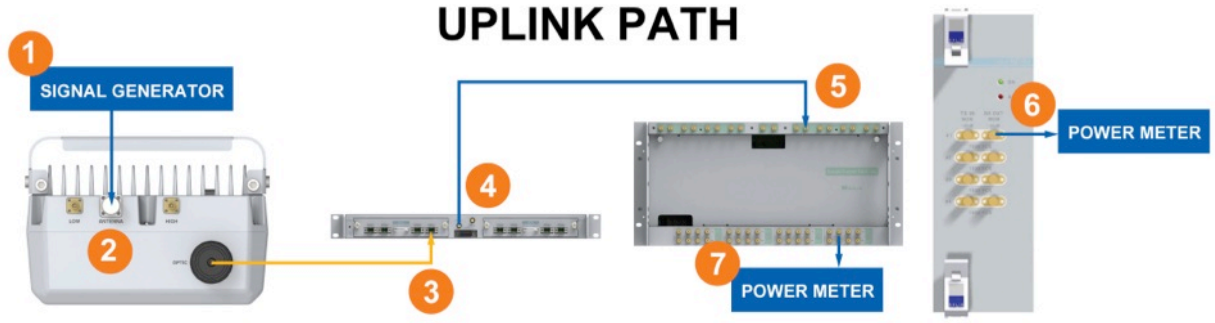


Figure 12.9 – Validating the Uplink Path

Step / Band	800	850	900	1900	2100
1	-50dBm	-50dBm	-50dBm	-50dBm	-50dBm
2	-50dBm ±1dB	-50dBm ±1dB	-50dBm ±1dB	-50dBm ±1dB	-50dBm ±1dB
3	+4 to -3dBm	+4 to -3dBm	+4 to -3dBm	+4 to -3dBm	+4 to -3dBm
4	-7dBm±2dB	-7dBm±2dB	-7dBm±2dB	-7dBm±2dB	-7dBm±2dB
5	-7dBm±2dB	-7dBm±2dB	-7dBm±2dB	-7dBm±2dB	-7dBm±2dB
6	-20dBm±2dB	-20dBm±2dB	-20dBm±2dB	-20dBm±2dB	-20dBm±2dB
7	0dBm±2dB	0dBm±2dB	0dBm±2dB	0dBm±2dB	0dBm±2dB

Table 12.3 – Recommended Test and Link Budget Values Per Band for Uplink Path

12.6.2 Validating the Downlink Path

1. Using the signal generator, set the desired Tx frequency and the output power to 0dBm.

2. Using the spectrum analyzer, verify the power level at the end of the cable connecting to the MDBU Tx port at the BIU.

3. Using the spectrum analyzer, check the levels coming from the Tx monitor test ports at the front of the MDBU. When the signal source is 0dBm, this value should be -20dBm.

4. Using the spectrum analyzer, check the levels coming from the BIU ODU Tx port.

5. Using the spectrum analyzer, check the levels at the end of the cable connection to the Tx port on the ODU.

6. In the management software, verify the LD optical power.

7. Using the spectrum analyzer, check the levels coming out of the antenna port at the bottom of the MRU.

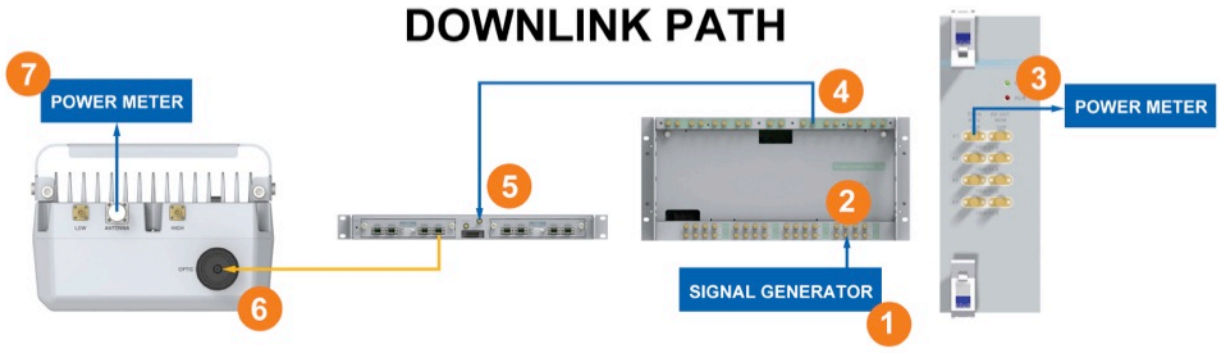


Figure 12.10 – Validating the Downlink Path

Step / Band	800	850	900	1900	2100
1	0dBm	0dBm	0dBm	0dBm	0dBm
2	0dBm±1dB	0dBm±1dB	0dBm±1dB	0dBm±1dB	0dBm±1dB
3	-20dBm±2dB	-20dBm±2dB	-20dBm±2dB	-20dBm±2dB	-20dBm±2dB
4	-8dBm±2dB	-8dBm±2dB	-8dBm±2dB	-8dBm±2dB	-8dBm±2dB
5	-8dBm±2dB	-8dBm±2dB	-8dBm±2dB	-8dBm±2dB	-8dBm±2dB
6	+7dBm±1.5dB	+7dBm±1.5dB	+7dBm±1.5dB	+7dBm±1.5dB	+7dBm±1.5dB
7	+25dBm±2dB	+26dBm±2dB	+25dBm±2dB	+30dBm±2dB	+30dBm±2dB

Table 12.4 – Recommended Test and Link Budget Values Per Band for Downlink Path

If the measured values for your system match the table above, congratulations! You have successfully completed the installation and commissioning process. If not, consult the tables below, which explain fault indicators and suggested remedies.

12.7 Alarm Troubleshooting

This section of the manual explains alarm indicators in the management software and provides tips on resolving alarms.

No	LED Status	Description
1		Normal Status
2		Abnormal or Warning Status

Table 12.5 – Alarm Indicators in Management Software

12.7.1 ODU Alarm Troubleshooting

Unit	ALARM	Cause	Management
DOU	Overload Alarm	Tx input level to DOU is too high	Check output power of MDBU Check input power of MDBU
	LD POWER	Failure of DOU PSU not at +9V	Replace DOU Using DVM, check voltage of +9V
	PD POWER	Optical loss is too high Loose optical port Over-curvature or cut optical cable MRU power supply turned off	Using optical power meter, check received optical power level Check MRU power

Table 12.6 – ODU Alarm Indicators in Management Software

12.7.2 BIU Alarm Troubleshooting

Unit	ALARM	Cause	Management
MPSU	DC ALM	Output over current Output low voltage	Using DVM, check -48/ +9/+6V voltage levels Pull out each module (MDBU, MCPU) and find failed module Replace MPSU
MCPU	High Temp Limit	Incorrect setting of upper temp limit level Exceeding operating temp range Failure of temp sensor	Adjust upper temp limit level Check operating temp range Replace MCPU
	Low Temp Limit	Incorrect setting of lower temp limit level Exceeding operating temp range Failure of temp sensor	Adjust lower temp limit level Check operating temp range Replace MCPU
	Ext.ALM#1~4	External device alarm Cross-connect of N.O and N.C Failure of relay component in the MCPU	Reconnect N.O and N.C Replace MCPU
	ALM In #1~3	External device alarm Cross-connect GND and ALM In Wrong setting of active high/low	Reconnect GND and ALM In Set again for active high/low Replace MCPU
MDBU	Tx IN HIGH	Input power exceeds high limit level	Reset high limit level Check input power of MDBU using spectrum analyzer Replace MDBU
	Tx IN LOW	Input power falls below low limit level	Reset low limit level Check input power of MDBU using spectrum analyzer Replace MDBU
	Rx OUT HIGH	Output power exceeds high limit level	Reset high limit level Check output power of MDBU using spectrum analyzer Replace MDBU

Table 12.7 – BIU Alarm Indicators in Management Software

12.7.3 MRU Alarm Troubleshooting

Unit	ALARM	Cause	Management
RCPU	LINK FAIL	Loose optical cable MRU power supply is off Optical loss is too high Over-curvature or cut optical cable	Check the optical cable Check MRU power supply Using optical power meter, check received optical power level Replace MRU
	High Temp Limit	Exceeding upper temp limit level Exceeding operating temp range Failure of temp sensor	Adjust upper temp limit level Check operating temp range
	Low Temp Limit	Exceeding lower temp limit level Exceeding operating temp range Failure of temp sensor	Adjust lower temp limit level Check operating temp range
ROPTIC	PD POWER	Optical loss is too high Loose optical cable Over-curvature or cut optical cable BIU power supply is off Loose signal cable between BIU and ODU	Using optical power meter, check received optical power level Check BIU power supply Check signal cable between BIU and ODU
	LD POWER	Failure of R-optic PSU not at +9V	Replace MRU
	Tx OPTIC RESULT	Optical loss is too high No communication with BIU	Using optical power meter, check received optical power level Check optical cable connection
RFM	Tx OUT HIGH	Output power exceeds high limit level	Reset high limit level Check output power of MRU using spectrum analyzer
	Tx OUT LOW	Output power falls below low limit level	Reset low limit level Check input power of MDBU using spectrum analyzer
	Tx OUPTU SD	Exceeding power level Output power exceeds SD limit level	Check SD limit level Reset output power level Turn HPA on

Table 12.8 – MRU Alarm Indicators in Management Software

12.7.4 OEU Alarm Troubleshooting

Unit	ALARM	Cause	Management
EPSU	DC Alarm	Output over current Output low voltage	Using DVM, check -48V/+9V/+6V voltage levels Check each module (DOU, EWDM, ERFU) and find failed module Replace EPSU
ECPU	High Temp Limit	Incorrect setting of upper temp limit level Exceeding operating temp range Failure of temp sensor	Adjust upper temp limit level Check operating temp range
	Low Temp Limit	Incorrect setting of low temp limit level Exceeding operating temp range Failure of temp sensor	Adjust lower temp limit level Check operating temp range
	LINK FAIL	Loose optical cable BIU power supply is off Optical loss is too high Over-curvature or cut cable	Check the optical cable Check BIU power supply Using optical power meter, check received optical power level
EOPTIC	PD POWER	Loose optical cable BIU power supply is off Optical loss is too high Over-curvature or cut cable	Check the optical cable Check BIU power supply Using optical power meter, check received optical power level
	LD POWER	Failure of R-optic PSU not at +9V	Replace MRU
	RESULT	Optical loss is too high No communication with BIU	Using optical power meter, check received optical power level Check optical cable connection
DOU	Overload Alarm	Tx input level to DOU is too high	Check output power of MDBU Check input power of MDBU
	LD POWER	Failure of DOU PSU not at +9V	Replace DOU Using DVM, check voltage of +9V
	PD POWER	Loose optical cable MRU power supply is off Optical loss is too high Over-curvature or cut cable	Check the optical cable Check MRU power supply Using optical power meter, check received optical power level

Table 12.9 – OEU Alarm Indicators in Management Software

13 Appendix – Additional Functions

This chapter describes additional functions of the EXPRESS DAS.

NOTE: This material is offered "for your information." The system software automatically performs many of the functions described here. Others are user-defined functions already covered in the commissioning section.

13.1 Shutdown Function (Tx Output Shutdown)

The DAS has an automatic shutdown function to protect the headend and remote units when normal operating conditions cannot be maintained. For example, the DAS shuts down automatically when the composite downlink output power exceeds the values defined as average for the device for more than five seconds. This time period can be adjusted in the management software.

After automatic shutdown, the DAS may automatically restart in order to assess whether the temporary condition has changed. If the condition is still detected, the DAS will shutdown again. This cycle will be repeated five times. After the fifth time, if the condition is still detected, the DAS will shutdown permanently.

NOTE: A permanent shutdown will produce a fault alarm and will be reported to the Network Operating Center (NOC) through the DMS-600.

13.2 Total Power Limit Function (Tx Output ALC)

In order to protect the HPA and prevent spurious emissions, you can set maximum output power limits. To do this, in the management software, turn on the ALC function and set the limit level. If the output power exceeds the defined value, the output attenuator is adjusted to bring the output power back to within the set limits. The output attenuator's adjustment range is 25dB max. If output power decreases, attenuation is decreased using the AGC function to return to the initial attenuation level.

13.3 Automatic Output Power Setting Function (Tx Output AGC)

To make it easier to set initial output power, you can set the output power to the desired level and turn on the AGC function. The system will automatically set output power to this level.

After you set the AGC level, the RESULT window will indicate the outcome:

- Success: The AGC function is properly completed.
- Not Operate OPTIC Comp: Optic Comp is not executed.
- Lack of ATT: There is no attenuation available.

If the result is not successful, the system will return the changed ATT to the initial ATT level.

13.4 Input Power AGC Function (Tx Input AGC)

Besides using a spectrum analyzer, you can also determine the input power value through the management software's power display window. You can use the Tx IN AGC function to automatically set internal attenuation depending on the input level. The attenuation is automatically set based on -20dBm of input. The table below shows Tx IN ATT as a function of the Tx IN POWER. For making these settings manually, you can use the table to set the attenuation depending on the input level.

Tx IN POWER	Tx IN ATT	Tx IN POWER	Tx IN ATT	Tx IN POWER	Tx IN ATT
-20dBm	0dB	-9dBm	11dB	+1dBm	21dB
-19dBm	1dB	-8dBm	12dB	+2dBm	22dB
-18dBm	2dB	-7dBm	13dB	+3dBm	23dB
-17dBm	3dB	-6dBm	14dB	+4dBm	24dB
-16dBm	4dB	-5dBm	15dB	+5dBm	25dB
-15dBm	5dB	-4dBm	16dB	+6dBm	26dB
-14dBm	6dB	-3dBm	17dB	+7dBm	27dB
-13dBm	7dB	-2dBm	18dB	+8dBm	28dB
-12dBm	8dB	-1dBm	19dB	+9dBm	29dB
-11dBm	9dB	0dBm	20dB	+10dBm	30dB
-10dBm	10dB				

Table 13.1 – Attenuation (ATT) Level Values

13.5 Input Power Limit Function (Tx Input ALC)

A Tx input Auto Level Control function built into the BIU can limit input power levels if the increase past the limit set by the input AGC function. For example, in the case where the 850 cellular band has two input ports to support both two different carriers, these input powers may be different from each other. There is an input attenuator in the first stage of the MDBU. Through the input AGC function, the input ATT is adjusted according to input power. If input power increases, the input ATT is adjusted to limit the this increase. If the input power decreases, the input ATT will return to the initial ATT setting.

13.6 Optic Loss Compensation

The DAS can automatically compensate for optical loss up to a maximum 5dBo. To turn on this feature, set Tx OPTIC COMP of the MRU to ON and ensure the MRU/ARU is properly communicating with the ODU or OEU. For 1dBo of optical loss, set the Tx OPTIC ATT at 1dB; for 5dBo of optical loss, set Tx OPTIC ATT at 4dB. OPTIC COMP works only one time before it stays dormant.

LD POWER is the output level of the MRU Laser Diode, which is sent back to the headend by the MRU. PD POWER is the input level of the Photo Diode signal from the headend. The figure below shows a screenshot for Optical Information in the MRU setup screen.

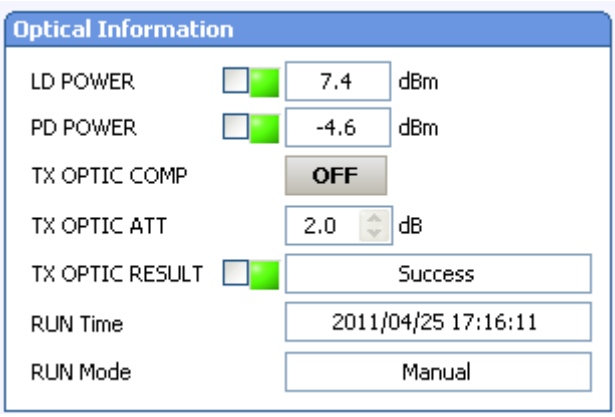


Figure 13.1 – Optical Loss Information

During optical compensation, the RESULT field will display PROCESSING and then show the result:

- Success: Optic compensation is successfully performed
- Over Optic Loss: Optic loss exceeds 5dBo
- Communication Fail: Communication between the ODU and MRU failed.

14 Appendix – EXPRESS Part Numbers

Description	Part Number
BIU (Base Station Interface Unit) Signal Source Inputs	
BIU - MIMO (Includes DC/DC PS, MCPU Card, 2 MCDU Cards) NOTE: Input Power -48VDC. Power supply not included.	SC_BIU_MIMO
BIU - SISO (Includes DC/DC PS, MCPU Card, MCDU Card, 3 Blanks) NOTE: Input Power -48VDC. Power supply not included.	SC_BIU_SISO
DMS Supporting Bracket	SC_DMS_BRK
MCDU Combiner Module for the SC_BIU	SC_MCDU
Blank Input Module for the SC_BIU	SC_MCDU_B
EXPRESS BIU CPU	SC_MCPU
1900MHz Input Module for the SC_BIU	SC_MDBU_1900
700MHz LTE & 2100MHz Input Module for the SC_BIU	SC_MDBU_700LTE_2100
700MHz PS & 800MHz PS Input Module for the SC_BIU	SC_MDBU_700_800
800MHz & 900MHz Input Module for the SC_BIU	SC_MDBU_800_900
850MHz & 1900MHz Input Module for the SC_BIU	SC_MDBU_850_1900
Blank Input Module for the SC_BIU	SC_MDBU_B
Power Supply for the SC_BIU	SC_MPSU

Table 14.1 – BIU Part Numbers

Description	Part Number
ODU/OEU Optical Distribution and Expansion Units	
Blank Optical Module for the ODU	SC_ODU_B / SC_OEU_B
Optical Distribution Unit Chassis	SC_ODU_C
4 Port Optical Module	SC_ODU_OM_4 / SC_OEU_OM_4
OEU Chassis. NOTE: Input Power -48VDC. Power supply not included.	SC_OEU_C

Table 14.2 – ODU/OEU Part Numbers

Description	Part Number
MRU and ARU (Main and Add-on Remote Units)	
1900 MHz Main Remote Unit - AC Power	MRU_AC_1900
1900 MHz Main Remote Unit - AC Power - NEMA	MRU_AC_1900_N
1900 MHz Main Remote Unit - DC Power	MRU_DC_1900
1900 MHz Main Remote Unit - DC Power - NEMA	MRU_DC_1900_N
700 MHz & 2100 MHz Main Remote Unit - AC Power	MRU_AC_700_2100
700 MHz PS & 800 MHz PS Main Remote Unit - AC Power - NEMA Enclosure	MRU_AC_700_800_N
700 MHz PS & 800 MHz PS Main Remote Unit - DC Power - NEMA Enclosure	MRU_DC_700_800_N
850 MHz & 1900 MHz Main Remote Unit - AC Power	MRU_AC_850_1900
850 MHz & 1900 MHz Main Remote Unit - AC Power - NEMA Enclosure	MRU_AC_850_1900_N
850 MHz & 1900 MHz Main Remote Unit - DC Power	MRU_DC_850_1900
700MHz LTE & 2100 MHz Add-on Remote Unit - AC Power	ARU_AC_700LTE_2100
700MHz LTE & 2100 MHz Add-on Remote Unit - AC Power - NEMA Enclosure	ARU_AC_700LTE_2100_N
700MHz LTE & 2100 MHz Add-on Remote Unit - DC Power	ARU_DC_700LTE_2100
800 MHz & 900 MHz Add-on Remote Unit - AC Power	ARU_AC_800_900
800 MHz & 900 MHz Add-on Remote Unit - AC Power - NEMA	ARU_AC_800_900_N
800 MHz & 900 MHz Add-on Remote Unit - DC Power	ARU_DC_800_900
800 MHz & 900 MHz Add-on Remote Unit - DC Power - NEMA	ARU_DC_800_900_N
150MHz VHF & 450MHz UHF Amplifier Module with AC Add-on Cabinet - NEMA	SC_AC_150_450
150MHz VHF & 450MHz UHF Amplifier Module with DC Add-on Cabinet - NEMA	SC_DC_150_450
Stacking MRU Wall Mounting Kit (Stacks ARU on top of MRU)	SC_ARU_STK
AC Power Supply Unit for MRU/ARU	SC_PUS_AC
19" Rack MRU/ARU Chassis (4U Rack Space Requirement)	SC_RM19
Vertical Rack Mount MRU/ARU (9U Rack Space Requirement)	SC_RU_BRK

Table 14.3 – MRU and ARU Part Numbers

Description	Part Number
DMS-600 (DAS Management System)	
DAS Management System (DMS) for EXPRESS	DMS_600
DAS Management System (DMS) for EXPRESS. NOTE: Sprint use only	DMS_700

Table 14.4 – DMS-600 Part Numbers

Description	Part Number
LBU (LINK BALANCER UNIT)	
LINK BALANCER UNIT - 2100MHz / 2100MHz, 50dB UL/DL Variable Attenuation	LBU_2121F0V4
LINK BALANCER UNIT - 700MHz / 700MHz, 50dB UL/DL Variable Attenuation	LBU_7070FOV4
LINK BALANCER UNIT - 800MHz / 800MHz, 50dB UL/DL Variable Attenuation	LBU_8080F0V4
LINK BALANCER UNIT - 850MHz / 1900MHz, 50dB UL/DL Variable Attenuation	LBU_8519F0V4
LINK BALANCER UNIT - 850MHz / 850MHz, 50dB UL/DL Variable Attenuation	LBU_8585F0V4
LINK BALANCER UNIT - 1900MHz / 1900MHz, 50dB UL/DL Variable Attenuation	LBU_1919F0V4

Table 14.5 – Link Balancer Unit Part Numbers

15 Appendix – Glossary of Terms

The following terms, acronyms and abbreviations appear in this manual :

Attenuation (ATT) – Reducing signal strength during transmission. **Attenuation** is the opposite of amplification.

Automatic Gain Control (AGC) – AGC is widely used in communication systems to maintain constant signal strength by varying the amplifier gain.

Band Pass Filter (BPF) – A device that passes frequencies within a certain range and rejects (attenuates) frequencies outside that range.

Base Station Interface Unit (BIU) – The unit in the SOLiD DAS topology that receives, combines, and filters all the signal sources, and then sends them to the ODU.

Coaxial Cable – Cable used for transmitting high-frequency signals. The coaxial cables handle all frequencies at one time from below 150MHz to over 3GHz. Also called: coax cable.

Distributed Antenna System (DAS) – A network made up of several components that work together to provide wireless service within a building or campus environment.

Donor Antenna – An antenna mounted outside, usually on top of a building, designed to obtain the maximum signal and coverage for a specific repeater system. Donor antennas can be a Yagi, Grid, or Omni-Directional.

Frequency Shift Keying (FSK) – A frequency modulation scheme in which digital information is transmitted through discrete frequency changes of a carrier wave.

Hot Swappable – A feature that allows one module to be removed while another module maintains all other services.

MIMO – Abbreviation for Multiple-Input and Multiple-Output. The use of multiple antennas to improve communication performance.

Multi-Mode fiber – A type of optical fiber commonly used for communication over short distances, such as within a building or on a campus.

NFPA 72 Code – A standard in the enforcement of fire code regulation published by the National Fire Protection Association.

Optical Distribution Unit (ODU) – The ODU converts the RF signal to an optical signal and transmits it via fiber to the MRU.

Optical Expansion Unit (OEU) – The unit in the SOLiD DAS topology that expands a DAS to include multiple buildings and structures using only one strand of fiber.

Optical Fiber – A thin, glass or plastic thread that carries information in the form of light**:** a fiber- optic thread.

Radio Frequency (RF) – Electromagnetic wave frequencies used for communications signals, including radio, television broadcasting, cell phone, and satellite transmissions.

Received Signal Strength Indication– the ratio of pilot power to total power for each sector.

EC/Io – The Ec/I0 is the energy per chip per interference density measured on the pilot channel; it is effectively the signal strength of the pilot channel.

Main Remote Unit (MRU) – The unit in the SOLiD DAS topology that amplifies each of the signals individually, and then sends the signals to the antennas via coax.

SAW filtering – Surface Acoustic Wave filtering cleans up the RF signal, overcomes the thermal noise, and allows for properly filtered signals to be transported over the optical medium.

SNMP – (Simple Network Management Protocol) is an Internet-standard protocol for managing devices on IP networks.

Remote Drive Unit (RDU) – Filters and high amplifies DOWNLINK (Tx) signals; Filters and amplifies UPLINK(Rx) signals.

Voltage Standing Wave Ratio – The ratio between the maximum standing wave amplitude and the minimum standing wave value.

Wavelength Division Multiplexing (WDM) – In fiber optic communications, wavelength-division multiplexing is a technology that multiplexes a number of optical carrier signals onto a single optical fiber by using different wavelengths of laser light.