Diablo data

Diablo Data Slingshot Node

CMTS Hardware Description

Diablo Data, LLC

https://www.diablodata.com

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Statement

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Foreword

Related Manuals

Diablo Data Slingshot CMTS Safety and HW Installation Manual

Content Introduction

This manual describes the external interfaces, internal modules, and accessories of the DIABLO DATA SLINGSHOT CMTS. Read this manual carefully. This manual is divided into the following chapters:

Chapter 1 Product overview: Describes the appearance, dimensions, and front/rear view of the DIABLO DATA SLINGSHOT CMTS.

Chapter 2 Internal modules: Describes the internal modules of the DIABLO DATA SLINGSHOT CMTS, including the DOCSIS module, power module, and RF module.

Chapter 3 Accessories: This section mainly introduces the types and parameters of pluggable modules.

Target Audience

This Manual is applicable to the following readers:

- ✓ Field installation staff
- ✓ Network planning staff
- ✓ Technical support staff
- ✓ System maintenance staff

Conventions in the Manual

1. Conventions on General Format

Format	Meaning
Calibri	All English texts except titles are prepared by use of Calibri font.

2. Special Information

The following are examples of how special information is presented in this document.

 Danger — Danger indicates that the described activity or situation may result in serious personal injury or death, for example, high voltage or electric shock hazards.

 Warning — Warning indicates that the described activity or situation may, or will, cause equipment damage or serious performance problems.

 Note — Note indicates that the information is, or may be, of special interest.

Statement: your understanding will be greatly appreciated if any contents of this Manual may not be sufficiently in conformity with the actual product due to the constant update and improvement of product and technology. For product update information, please contact Diablo Data or visit our website at https://www.diablodata.com.

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Chapter 1 Product Overview

DIABLO DATA SLINGSHOT CMTS is a field integrated platform designed with modular components. The platform includes a DOCSIS module, RF module and power module.

1.1 Appearance and Dimensions

Dimensions: 168 mm (H) x 379 mm (W) x 256 mm (D)

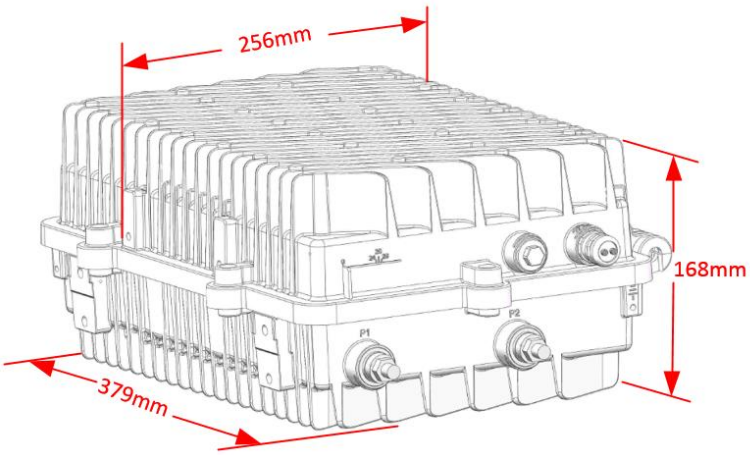


Fig. 1.1-1 Appearance and dimensions of the DIABLO DATA SLINGSHOT CMTS

1.2 External Interfaces

This section mainly introduces the details of the external interface of DIABLO DATA SLINGSHOT CMTS equipment.

The external interface of the DIABLO DATA SLINGSHOT CMTS equipment is shown in the figure below, and the interface description is shown in the table below.

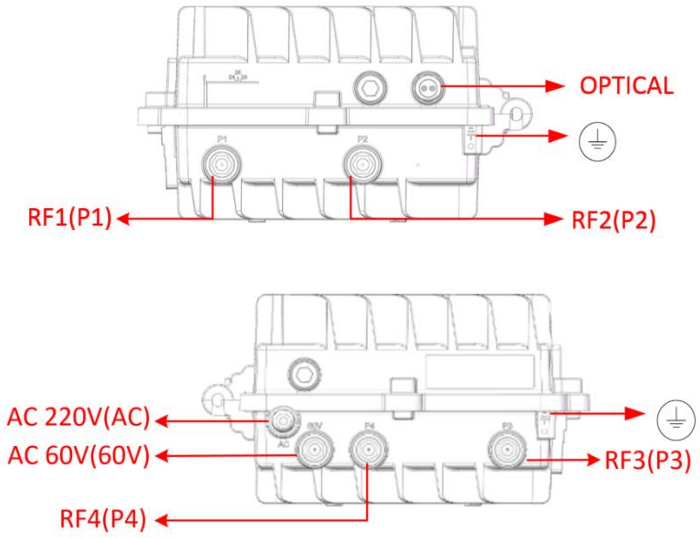


Fig. 1.2-1 Schematic diagram of product external interface

Table 1.2-1 DIABLO DATA SLINGSHOT CMTS product external interface description

Silk screen	Interface	Description
P1, P2, P3, P4	RF output interface	Mixed signal output interface (RF1, RF2, RF3, RF4)
OPTICAL	Optical fiber interface	Optical signal input access interface
AC	AC 220/110V	Only used for the AC 220 V/AC 110 V line-power supply
60V	Independent power supply interface of AC 60V	Only used for the AC 60 V/AC 90 V coaxial-power supply
⏚	Ground	Used for grounding the equipment

Note:

DIABLO DATA SLINGSHOT CMTS product supports two (2) powering options; AC 220V or AC 110V building power, or AC 90V / 60V coaxial power supply, but only one option at a time.

DIABLO DATA SLINGSHOT CMTS provides two grounded screw holes. As shown below, any screw hole can be used for grounding.

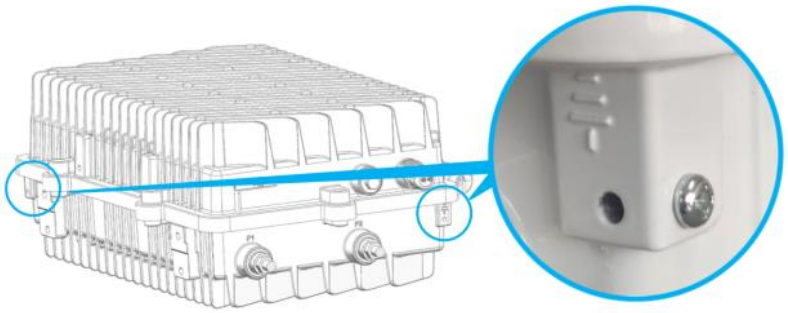


Fig. 1.2-2 Grounding screw hole position

Warning:

There is possible risk of personal injury or equipment damage due to inaccurate or faulty ground cabling.

1.3 Overall Specification

This section mainly introduces the size, weight and power consumption of DIABLO DATA SLINGSHOT CMTS.

Table 1.3-1 DIABLO DATA SLINGSHOT CMTS overall specification

Item	Parameters
DIABLO DATA SLINGSHOT CMTS (Long x Width x Depth)	379mm×256mm×168mm
Weight	<10kg
Maximum power consumption	75W
IP code	IP67

Note:

IP67: International Protection Marking, IEC 60529, also known as IP Code, usually consists of four-bit identifiers.

1. The third digit represents “Dust tight”: No ingress of dust, complete protection against contact (dust tight).
2. The fourth digit represents “Immersion up to 1 meter”: Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1m of submersion).

1.4 Basic Principles

This section introduces the basic principles of DIABLO DATA SLINGSHOT CMTS products.

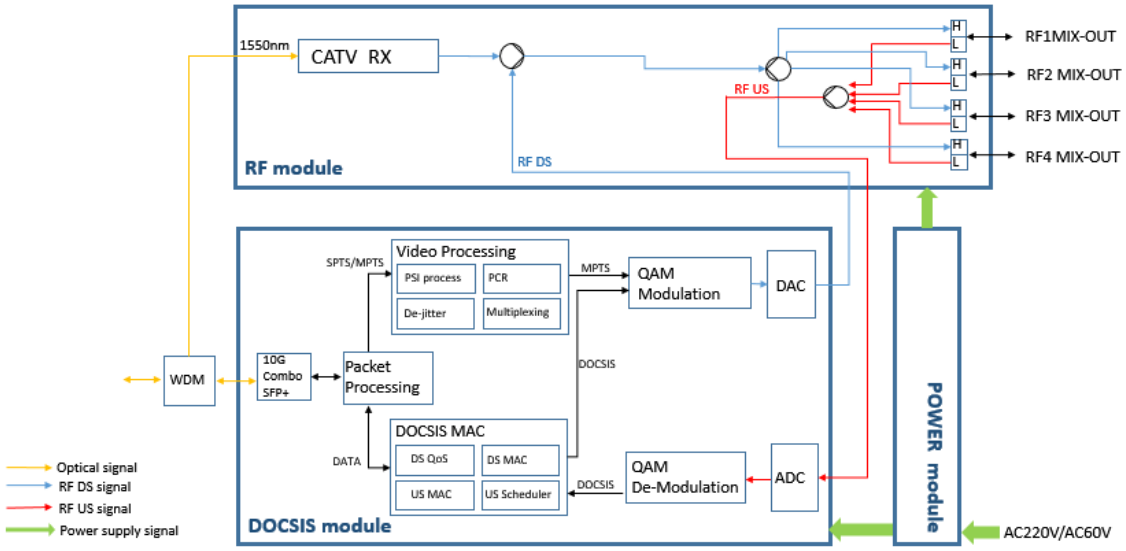


Fig. 1.4-1 The basic principles of DIABLO DATA SLINGSHOT CMTS products

Table 1.4-1 Functional block diagram of DIABLO DATA SLINGSHOT CMTS product

Module	Function
CWDM	DIABLO DATA SLINGSHOT CMTS products support CWDM components (CWDM is an optional component, if CWDM is not used, dual-fiber connection can be used). CWDM components are generally used in situations where there are only two optical fibers between the front-end computer room and the optical node, and CWDM combined wave can save one optical fiber. The head-end facility combines data signals with CATV signals through CWDM combiner and transmits them on a backbone optical fiber. The optical node separates DOCSIS data signals from CATV signals through the built-in CWDM components in DIABLO DATA SLINGSHOT CMTS.
DOCSIS module	The main function of DOCSIS module is to transmit data between the service network and RF cable network devices (cable modems). 1. In the downstream direction, the data signal is modulated to the radio frequency signal, and the modulated signal is sent to the cable distribution network. 2. In the upstream direction, the RF signal is demodulated by the DOCSIS RF Module, and the demodulated data signal is transmitted to the service network via the DOCSIS MAC packet processing, PON / Ethernet encapsulation and other relevant networking stages.
RF module	DIABLO DATA SLINGSHOT CMTS RF module consists of a RF amplifier module (including an optical receiver) and two RF interface modules: 1. Radio Frequency Amplifier Module: Provides the function of CATV optical signal reception and downlink amplification.

Module	Function
	2. Radio Frequency Interface Components: Achieves upstream / downstream attenuation adjustments, up-down combining and port monitoring circuitry.
POWER module	One of the following two specifications of power supply module can be selected (two modules are not supported at the same time): 1. AC60V/90V coaxial power supply module 2. AC110V/220V local power supply module

1.5 Power Supply Principle

The Diablo Data CMTS equipment can be powered by AC110V/AC220V local power supply or AC60V/AC90V coaxial power supply.

1.5.1 AC110V/AC220V Power Supply Principle

The AC110V/AC220V power supply module provides power to the DOCSIS and RF modules. The schematic diagram of the power supply is shown in the following figure.

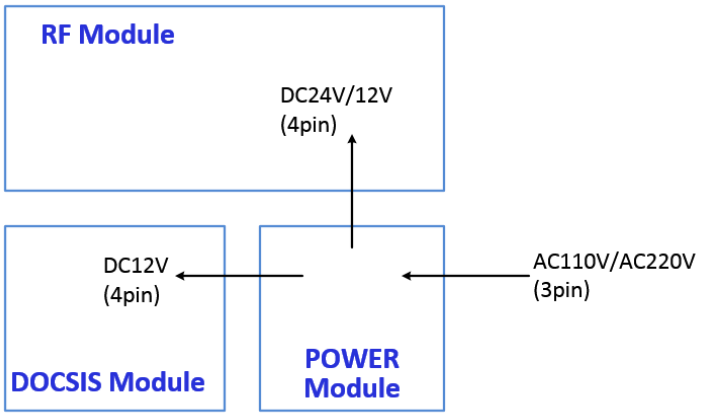


Fig. 1.5-1 AC110V/AC220V power supply principle

1.5.2 AC60V/AC90V Power Supply Principle

Coaxial power supply refers to power supplied from equipment connected via coaxial cable. Diablo Data CMTS equipment can accept coaxial power through an **independent coaxial power supply port** or any **RF signal output port**.

1. When an RF signal output port (RF 1-4) is used to introduce the AC60V / AC90V power source, insert the overcurrent plug at the fuse position corresponding to the specific RF port, and disconnect the fuse at all other RF ports.
2. When selecting **independent power supply port** for AC60V / AC90V power supply, insert the SHUNT position into the overcurrent plug, the other RF ports FUSE position are disconnected.

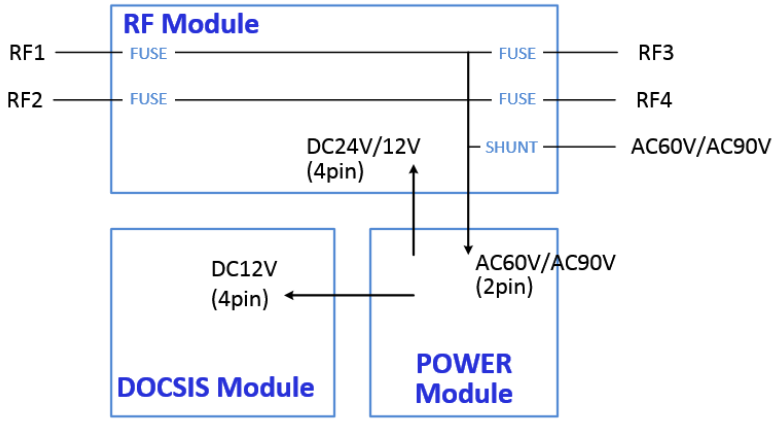


Fig. 1.5-2 AC60V / AC90V power supply principle

1.5.3 Overcurrent Principle

RF1-4 can pass the current of AC60V / AC90V. It is necessary to insert the overcurrent plug at the fuse position of the corresponding RF port, and disconnect the fuse position of other RF ports. (The use of overcurrent function has no relationship with the selection of AC110V / AC220V or AC60V / AC90V power module.)

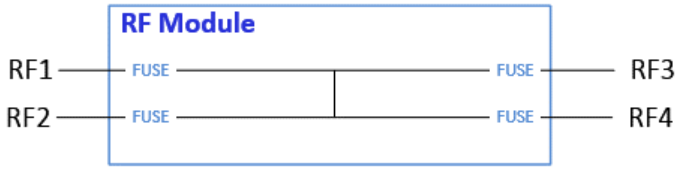


Fig. 1.5-3 Overcurrent principle

⚠ Warning:

1. It is forbidden to supply power to both ports at the same time, which will cause short circuit of two input power supplies.
2. If it is necessary to plug and unplug fuse with equipment powered on, in order to ensure safety, please use pointed nose pliers for operation.
3. Do not install 75Ω load connector on AC60V / AC90 independent power supply port.

1.5.4 Overcurrent Plug Position

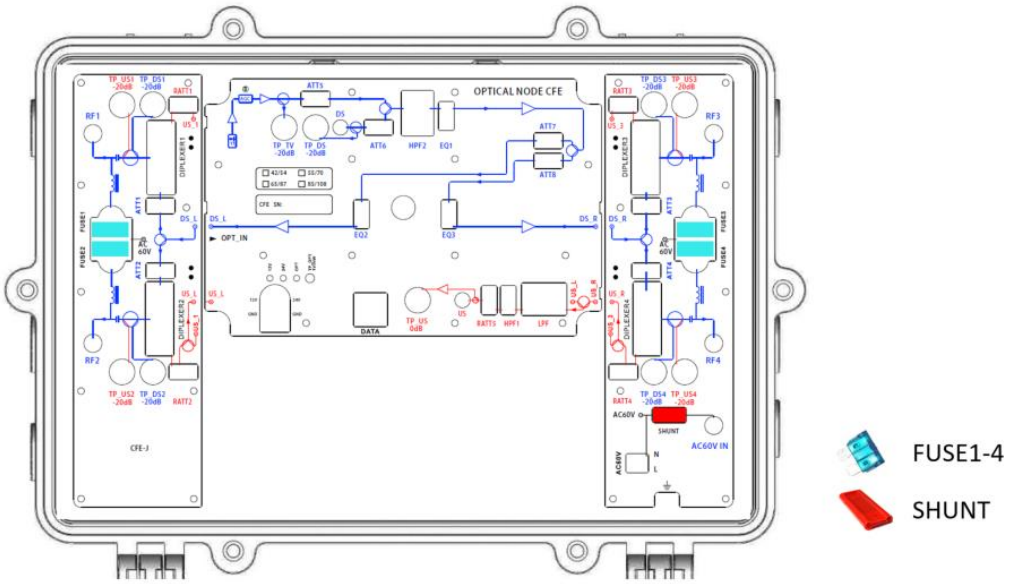


Fig. 1.5-4 Position of FUSE 1 ~ 4 and SHUNT

1.6 Equipment Label

1.6.1 SN Label

DOCSIS module, Power module, RF module and device shell have S/N label, serial number is 17 bits.

Fig. 1.6-1 S/N label

Table 1.6-1 S/N definition

Code	Implication	Description
YYMM	Date of manufacture	YY stands for year, number, 2 digits; MM stands for month, number, 2 digits;
AAAAAABBB	Specification code	Represents the abbreviation of 9-bit product code, consisting of capital letters and numbers, the first must be letters.
NNNN	Serial number	The serial number increases with the production quantity from 0001.

1.6.2 MAC Label

MAC (Media Access Control) address, used to define the location of network devices. The MAC address is 12 bits, and the MAC address pasted on the shell is consistent with the MAC address of the main board of DOCSIS module. The MAC address label is shown in the figure below.

Fig. 1.6-2 MAC label

1.6.3 Equipment label location

There are 4 SN stickers and 2 MAC stickers on equipment, as shown in the figure below.

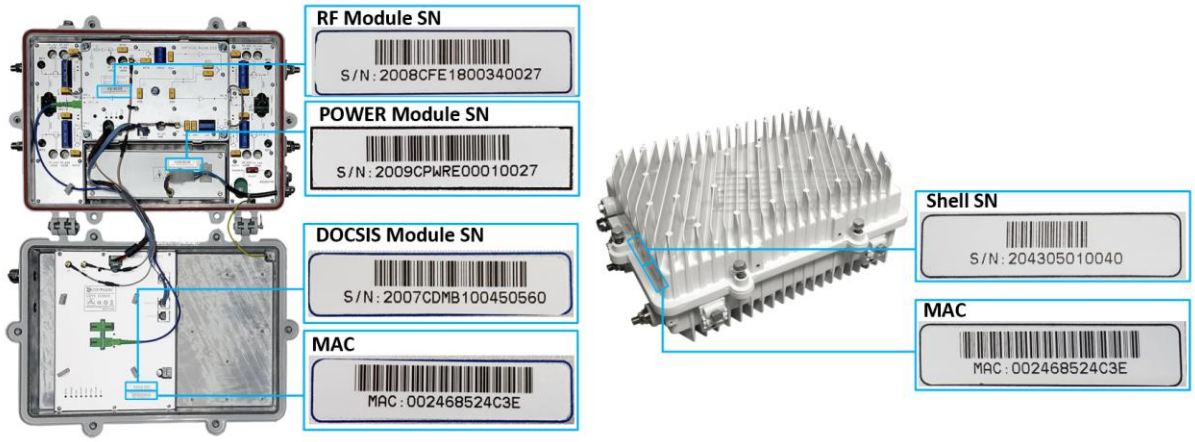


Fig. 1.6-3 Sticker location

Chapter 2 Internal Modules

DIABLO DATA SLINGSHOT CMTS is composed of a DOCSIS module, power module and RF module. The RF amplification component in the RF module can be replaced quickly. This chapter mainly introduces the hardware and functional specifications of each module in DIABLO DATA SLINGSHOT CMTS equipment.

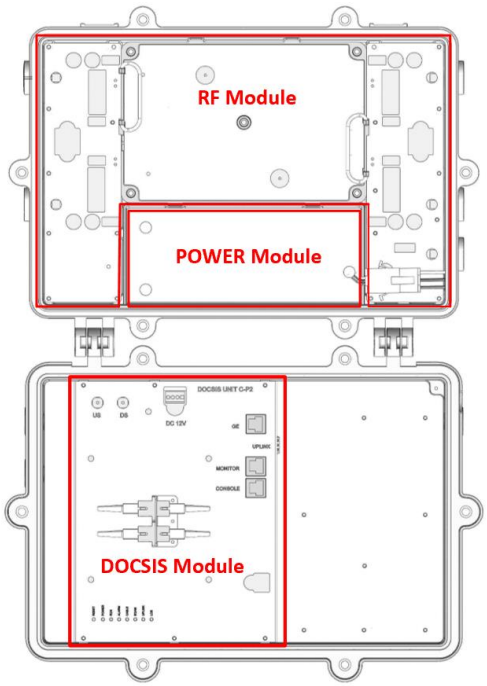


Fig. 1.6-1 Schematic diagram of DIABLO DATA SLINGSHOT CMTS module

2.1 DOCSIS Module

DIABLO DATA SLINGSHOT CMTS DOCSIS module provides DOCSIS upstream and downstream processing capabilities (specific channel capabilities and specifications are detailed in the product specifications), supports EQAM functions, provides 10GE/XPON SFP+ interface, supports GE/EPON/GPON, and 10G EPON/XG(S) -PON/10GE interconnection. The internal interface diagram of DOCSIS module is shown in Fig. 1.6-1, and the interface description is shown in Table 2.1-1.

2.1.1 Interface/Key Description

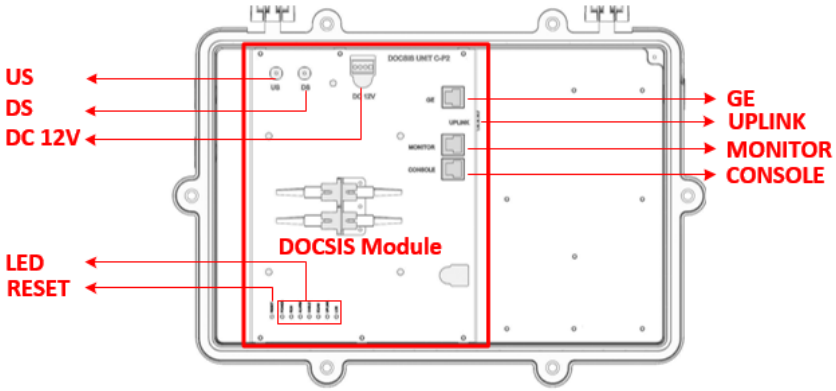


Fig. 2.1-1 Internal interfaces and keys of the DOCSIS module

Table 2.1-1 Description of the internal interfaces and keys of the DOCSIS module

Label	Interface type	Function description
UPLINK	SFP+	1*SFP+ optical interface Support GE | 10GE optical module Support EPON | 10G EPON | GPON | XG (S) - PON ONU optical module
GE	RJ45	GE management network interface / reserve
CONSOLE	RJ45	Configuration serial interface. It provides the local maintenance and remote maintenance functions, and uses console commands to configure the system through software such as HyperTerminal or Putty. The baud rate is 115,200 bit/s.
MONITOR	RJ45	External (RF module) manages the serial interface
DC12V	4pin	12V power supply interface on the main board
US	SMB	RF upstream input interface, connected with US of RF module
DS	SMB	The RF downstream output port is connected with the DS of the RF module.
RESET	Key	Device hardware reset button. If the button is pressed for less than 5 seconds, the device will be reset; if the button is pressed for more than 5 seconds, the device will be restored to the factory settings.

2.1.2 LEDs Description

There are 7 LEDs on the DOCSIS module.

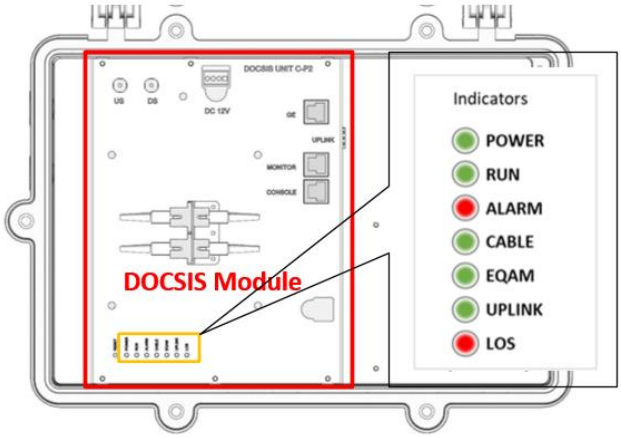


Fig. 2.1-2 LEDs of the DOCSIS module

Table 2.1-2 Description of LEDs on DOCSIS module

Label	Color	Indicator name	Description
POWER	Green	Power indicator	Always on: DC12V power supply is normal Off: no DC12V power supply or DC12V abnormality
RUN	Green	Running status indicator	System initialization phase: Flash: system initializing Off: system initialization not completed
			System uplink mode adaptation phase: Always on: the system is in uplink adaptation
			System uplink connection (both PON and SW are applicable) stage: Slow flash: the system is in uplink connection
			System auto deployment phase: Always on: the system is automatically getting the configuration
			System in operation: Slow flash: normal operation of the system
ALARM	Red	Alert indicator	Always on: alarm occurs Off: no alarm
CABLE	Green	CM online indicator	When the CM online indicator works normally (RUN indicator flashes slowly): Always on: has CM connection (including connecting and online CM) Off: no CM connection
			In addition, during system deployment, when the RUN status indicator is always on the CABLE light indicates the following: Off: the system is in uplink mode adaptation Flash: automatically getting and loading a configuration
EQAM	Green	EQAM function indicator	Always on: EQAM signal is normal Flash: EQAM signal abnormal Off: EQAM signal off

Label	Color	Indicator name	Description
UPLINK	Green	Link connection status indicator	When the uplink is PON (including specifying PON or adaptive recognition as PON): Always on: completed online registration of ONU Off: online registration of ONU is not completed
			When the uplink is Ethernet (GE / 10GE) (including designated Ethernet or self-adaptive identification as Ethernet): Flashing: GE / 10GE uplink connected or uplink data transmission Off: GE / 10GE uplink is not connected
LOS	Red	LOS warning indicator	Flash: uplink is PON, optical link is abnormal. Off: optical link is normal.

2.2 RF Module

The RF module consists of a RF amplifier component (including an optical receiver) and two RF interface components:

1. RF amplifier component: provides the functions of CATV optical signal reception and downstream amplification.
2. RF interface component: used to achieve up-down attenuation adjustments, up-down combining and port monitoring circuitry.

The RF amplifier component can be quickly replaced and unplugged, as shown in the figure below.

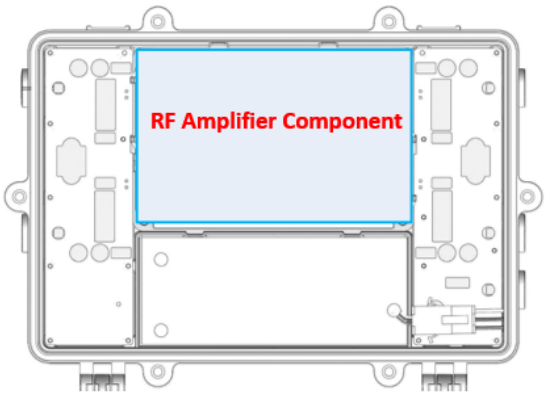


Fig. 2.2-1 Schematic diagram of RF amplifier component

Appearance

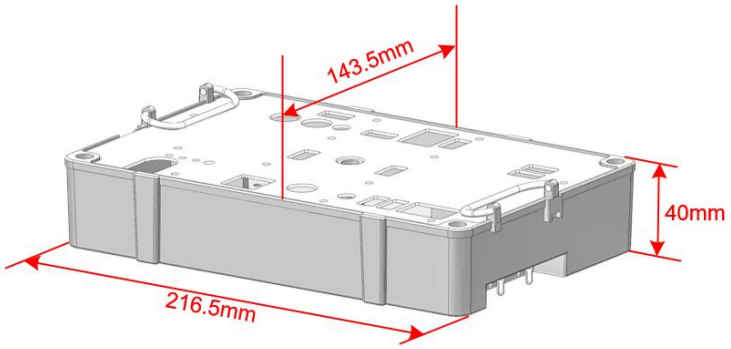


Fig. 2.2-2 Appearance and dimensions of the RF amplifier component

Parameter

Table 2.2-1 RF amplifier component parameter specification table

Specifications	Parameter
Dimension	216.5mm x 143.5mm x 40mm
Net Weight	3kg
Power Consumption	36W
Number of RF ports	4
Maximum output level(Single port)	108dbuV
Pluggable EQ and ATT circuit adjustment	Support
Frequency division	Support 42/54MHz, 65/87 MHz, 85/108 MHz (frequency dividers of different specifications need to be replaced according to requirements)
Passband	5MHz ~1GHz

2.2.1 Interface Description

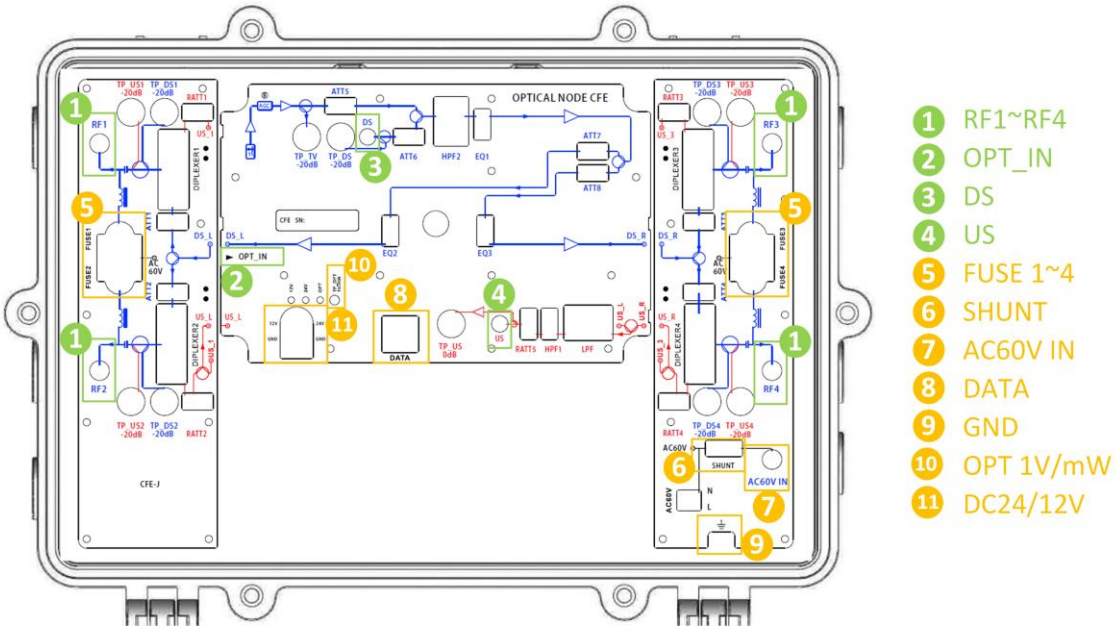


Fig. 2.2-3 Schematic diagram of internal interface of RF module

Table 2.2-2 Internal interface description of RF module

Number	Label	Interface type	Description
1	RF1~4	Test position	Used for fixing KS connector, coaxial power supply or overcurrent test point.
2	OPT_IN	SC/APC	CATV optical receiver interface
3	DS	SMB	RF downstream input port, DS connection with DOCSIS module.
4	US	SMB	RF upstream output port, DS connection with DOCSIS module
5	FUSE1~4	Fuse jack	Fuse position for each RF port AC60V power supply or pass the current.
6	SHUNT	SHUNT jack	When AC 60V is supplied, it is the position of independent power supply.
7	AC60V IN	Test position	Fixed for KS connector, or AC 60V/ AC 90V stand-alone power supply test point.
8	DATA	RJ45	The communication serial port between RF module and DOCSIS module connects the MONITOR port of DOCSIS module.
9	GND	GND position	The grounding position inside the equipment
10	OPT 1V/mW	Test point	Optical receiver optical power 1V/1mW monitoring point. The multimeter is used to measure the voltage value here. The reading divided by 1V/1mW is the optical power value received by the optical receiver.
11	DC24/12V	4PIN socket	DC power supply for RF module.

2.2.2 LEDs/Key Description

RF module provides three LEDs: 24V power LED, 12V power LED and optical signal LED.

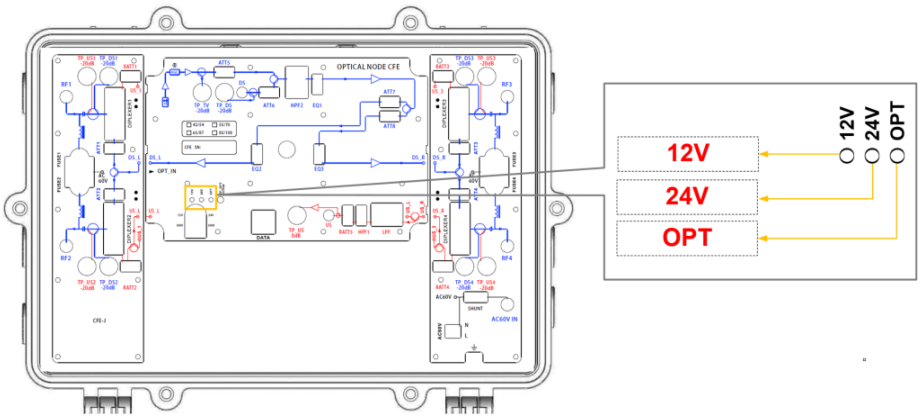


Fig. 2.2-4 RF module LEDs diagram

Table 2.2-3 RF module LEDs instructions

Type	Label	Color	Description
12V DC power supply indicator	12V LED	Green	Always on: normal DC12V power supply Off: no or abnormal DC12V power supply
24V DC power supply indicator	24V LED	Green	Always on: normal DC24V power supply Off: no or abnormal DC24V power supply
Optical signal indicator	OPT	Red / Green / Orange	Green: When the receiving power is -10~+2dBm Orange: When the receiving power is less than -10dBm or the receiving power is too low Red: When the receiving power is greater than + 2dBm

2.2.3 Downstream RF Circuit

Instructions for the use of RF platform are shown in the following figure.

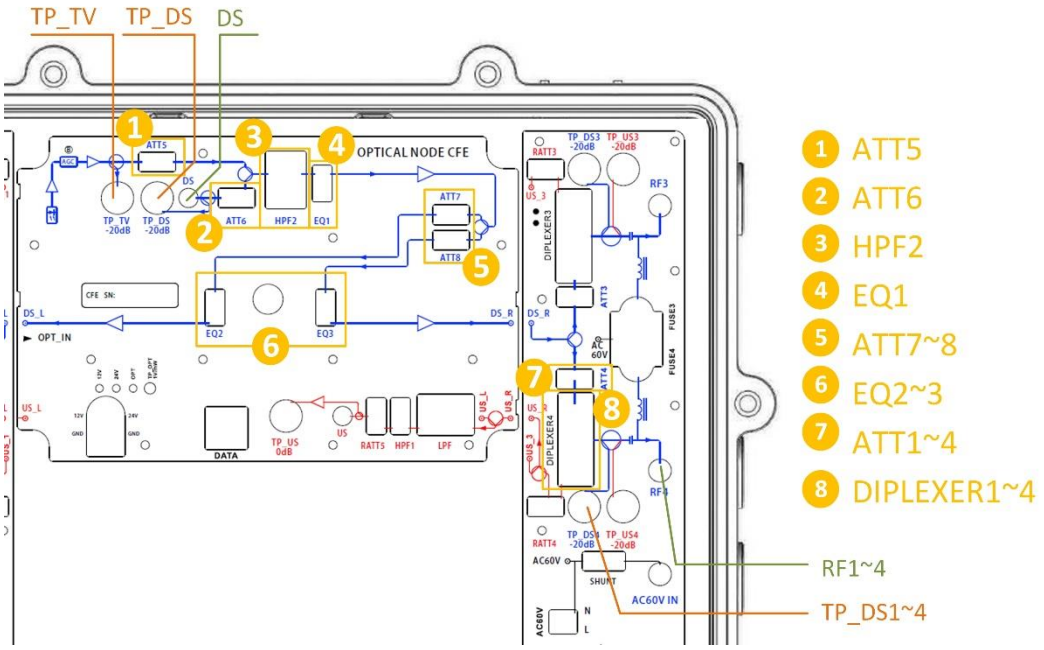


Fig. 2.2-5 Downstream schematic diagram of RF platform

According to the direction of signal transmission, the following is explained:

①ATT5 is a TV signal attenuator, default is 0dB.

②ATT6 is DOCSIS downstream main signal attenuator, default is 0dB.

③HPF2 is a high-pass filter for DS and TV mixed signals, which can filter unused low-frequency band filters and reduce signal noise.

④EQ1 is the downstream mixed signal main equalizer, which can be adjusted according to the actual needs and defaults to 0dB.

⑤ATT7~8 are independent attenuators of the first stage 2-way splitter branches of downstream mixed signals. By default, they are all 4 dB, which can be adjusted according to actual needs.

⑥EQ2~3 is the equalizer of the first stage 2-way splitter branch of the downstream mixed signal, which can be adjusted according to actual needs by default of 8dB.

⑦ATT1~4 is the independent attenuator of the second stage 2-way splitter branch of the downstream mixed signal. By default, all the attenuators are 0 dB, which can be adjusted according to actual needs.

⑧DIPLEXER1~4 is a duplexer, which can be plugged and unplugged. The duplexers at different frequency should be replaced according to customer's needs. At the same time, the high and low pass filters at corresponding frequency points should be replaced.

TP_DS1~4 are the monitoring points corresponding to the mixed signal output of each downstream branch, and the four monitoring points are -20dB relative to the output RF1~4.

TP_TV is the monitoring point of TV signal and - 20dB relative to TV signal.

TP_DS is the downstream main signal monitoring, which is - 20dB relative to DS point.

DS is connected with DS signal line of DOCSIS mainboard.

RF1 ~ 4 is a mixed interface of up and down signals, which can be used for fixing the KS connector, coaxial power supply or overcurrent test points.

⚠ Warning

If the output level of DOCSIS signal at four RF output ports is too high or too low, the output level of DOCSIS signal at all output ports can be increased or decreased by adjusting ATT6. The adjustment range supported by the equalizer is 0-20dB.

2.2.4 Upstream RF Circuit

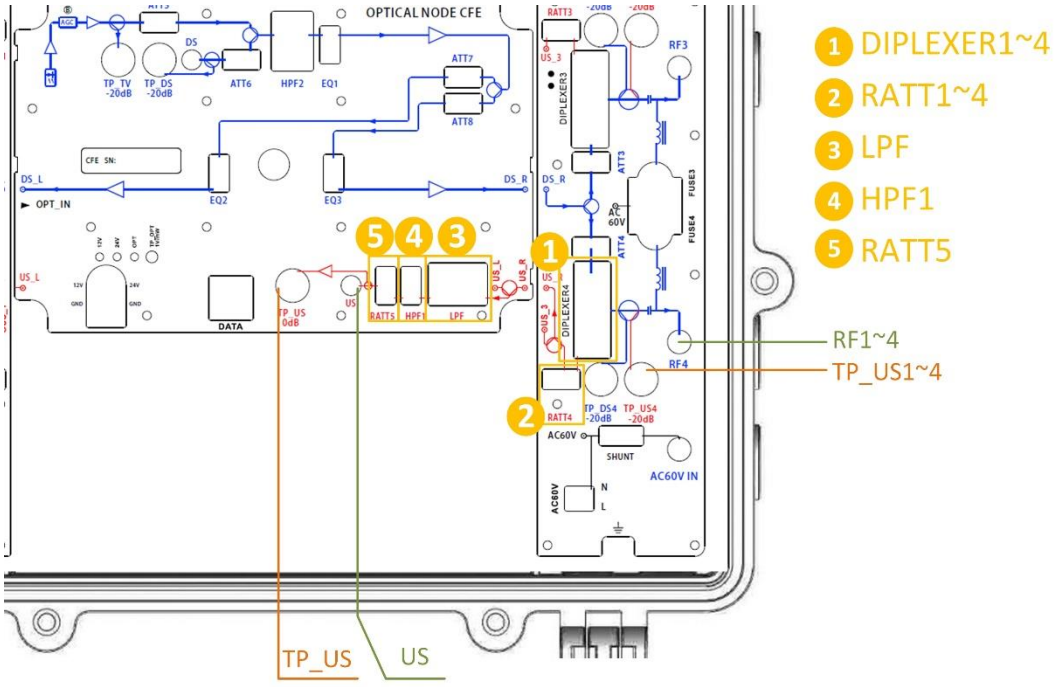


Fig. 2.2-6 Upstream schematic diagram of RF platform

According to the direction of signal transmission, the following is explained:

①DIPLEXER1~4 is a duplexer, which can be plugged and unplugged. The duplexers at different frequency should be replaced according to customer's needs. At the same time, the high and low pass filters at corresponding frequency points should be replaced.

②RATT 1-4 is an independent attenuator corresponding to each upstream branch, default is 0 dB, which can be adjusted according to the actual network needs and with the equipment receiving power equality.

③LPF is an upstream low-pass filter. Select different bandwidth filters to replace according to customer needs.

④HPF is an upstream high-pass filter (optional), which can filter the low frequency band which is not used in the upstream and reduce the link noise. A 20MHz or 30MHz high pass filter can be selected and configured as a 0dB attenuator by default.

⑤RATT5 is an upstream main attenuator with a default value of 0dB. It can be adjusted according to the actual network needs and with the equipment receiving level.

TP_US1~4 is the monitoring point corresponding to each upstream branch, and is - 20dB relative to the input RF1~4.

TP_US is the upstream signal monitoring, which is 0dB relative to US.

US is connected to the US signal line of DOCSIS motherboard.

RF1 ~ 4 is a mixed interface of up and down signals, which can be used for fixing the KS connector, coaxial power supply or overcurrent test points.

When RATT 1 ~ 5 values are the default values (the default value is 0), the upstream attenuation built in the device is 13dB.

2.3 Power Module

This section introduces the appearance and parameters of the power module. AC60V/90V coaxial power supply or AC110V/220V local power supply can be selected.

2.3.1 Appearance

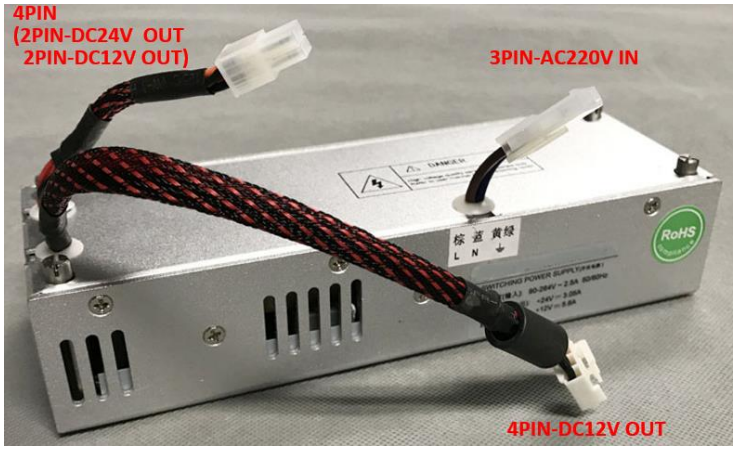


Fig. 2.3-1 AC 220V power module

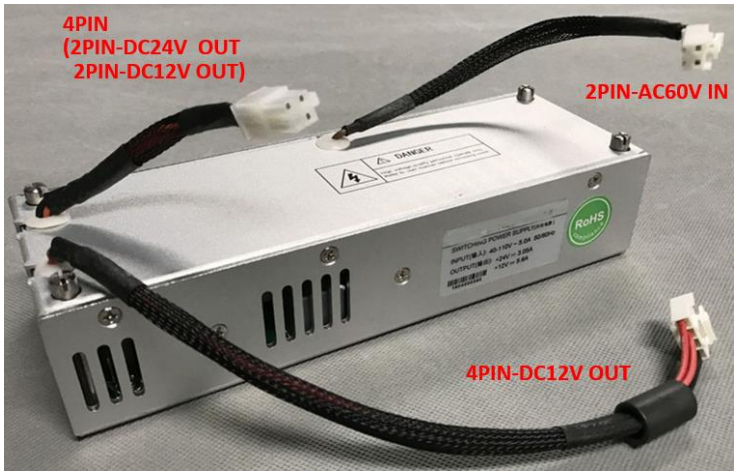


Fig. 2.3-2 AC 60V power module

2.3.2 Parameter

Table 2.3-1 Specifications of the power module

Parameter	Specifications	
	AC220V	AC60V
Physical dimension (Long x Width x Depth)	200mm*80mm*42mm	
Net weight	0.60kg	
Operating temperature	-40~75℃	
Power supply	AC	
Input rated voltage	AC110V/AC220V	AC60V/AC90V
Input operating voltage range	90V~265V	36V~110V
Input operating frequency	50~60Hz	
Maximum output power consumption	100.8W	

Chapter 3 Accessories

3.1 Pluggable Module

This section introduces the types and parameters of pluggable networking modules.

Industrial optical modules have different operating characteristics than commercial optical modules. Industrial modules operate nominally between - 40 and 85℃, while the normal working temperature of commercial modules is 0 to 70℃. Therefore, if the operating temperature exceeds the range of 0 - 70℃, the use of commercial modules may lead to the failure of normal operation.

It is recommended to use industrial optical modules.

The packaging types of optical modules supported by DIABLO DATA SLINGSHOT CMTS devices are SFP and SFP+. As follows:

Table 3.1-1 Various types of optical/electrical modules

 SFP package GE optical module	 SFP+ package 10GE optical module	 SFP package PON optical module

3.1.1 GE Industrial Optical Module

Table 3.1-2 Parameter of GE industrial optical module

No.	1	2
Wavelength	TX: 1310nm RX: 1550nm	TX: 1550nm RX: 1310nm
Package	SFP	SFP
Rate (Gbps)	1.25	1.25
Connector	BIDI LC/UPC	BIDI LC/UPC
Fiber type	Single mode	Single mode
Transmission distance	20km	20km
Launched power range (dBm)	-9~-3	-9~-3
Receive power range (dBm)	-23~-3	-23~-3

3.1.2 10GE Industrial Optical Module

Table 3.1-3 Parameter of 10GE industrial optical module

No.	1	2
Wavelength	TX: 1270nm RX: 1330nm	TX: 1330nm RX: 1270nm
Package	SFP+	SFP+
Rate (Gbps)	10	10
Connector	BIDI LC/UPC	BIDI LC/UPC
Fiber type	Single mode	Single mode
Transmission distance	20km	20km
Launched power range (dBm)	-3~3	-3~3
Receive power range (dBm)	-14.5~0.5	-14.5~0.5

3.1.3 GPON / EPON Industrial Optical Module

Table 3.1-4 Parameter of GPON / EPON industrial optical module

Type	Class B+
Wavelength	TX: 1310nm RX: 1490nm
Package	SFP
Rate (Gbps)	TX: 1.25 RX: 2.5
Connector	SC/UPC
Fiber type	Single mode
Launched power range (dBm)	0.5~5
Receive power range (dBm)	-28~-8

3.1.4 10G PON Industrial Optical Module

Table 3.1-5 Parameter of 10G PON industrial optical module

Type	PR30
Wavelength	TX: 1270nm RX: 1577nm
Package	SFP+
Rate (Gbps)	TX: 10 RX: 10
Connector	SC/UPC
Fiber type	Single mode
Launched power range (dBm)	4~9
Receive power range (dBm)	-28~-8

3.2 Auxiliary Materials

3.2.1 Power Supply Cable and Ground Wiring

The power supply cable refers to the electrical cables used to provide electric power to enable the chassis to function normally. Ground wiring refers to the electrical cables used to protect the device from lightning and external interferences.

AC Power Supply Cable

Depending on your geographic region, device power will require a regional-specific power cord. Connect one end of the power cord to the DIABLO DATA SLINGSHOT CMTS and insert the other end into an outlet.

The DIABLO DATA SLINGSHOT CMTS supports the following power cable types:

Table 3.2-1 Specifications of national standard power cable

National	External view	Specifications
European		Type F : Black extended pin (D2-02)/European standard (2 round)
American		Type B:Black extended pin (D2-02)/American standard (1 round, 2 flat)
English		Type G:Black extended pin (D2-02)/ English standard (2 round, 1 flat)
Italian		Type L:Black extended pin (D2-02)/ Italian standard (3 round)

PGND Cable

The PGND cable is any electrical cable used to protect the device from lightning and interference.

Fig. 3.2-1 PGND cable

Technical Parameters

Table 3.2-2 Technical parameters of the PGND cable

Parameter	Description
Type of electrical cable	Electronic power cable
DC resistance of the internal conductor	0.78Ω/km
Maximum current	110A
Conductor cross-section area	4mm^2

3.2.2 Serial Cable for Local Maintenance

The serial cable is used for device configure or to perform local maintenance on the device.

Applications

The serial cable is used for configure or to perform local maintenance.

Cable connection steps are as follows:

- One end of the serial cable is an 8-pin RJ45 connector, which is connected to the maintenance serial port of the CMTS.
- The other end is a DB9 female connector to connect to the serial port of the maintenance terminal.

Exterior and Structure

The serial cable for local maintenance is shown in the following figure.

Fig. 3.2-2 Serial cable for local maintenance

Technical Parameters

The technical parameters of the serial cable for local maintenance are shown in the following table.

Table 3.2-3 Technical parameters of the serial cable for local maintenance

Parameter	Description
Connector type	DB9 female + 8-pin network port/DB25 female
Type of electrical cable	Symmetric twisted pair cable
Diameter of the inner conductor	0.38mm
Wire gauge of the inner conductor	28AWG (cross-sectional area ≈ 0.08mm·)
Number of Cores	Octa-core

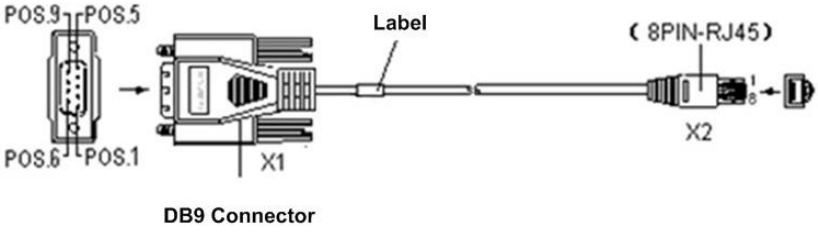


Fig. 3.2-3 RJ45-DB9 serial cable structure diagram

The DB9 line order is shown in the following figure:

Fig. 3.2-4 DB9 line order

RJ45	Signal	DB-9	Signal
1	RTS	8	CTS
2	DTR	6	DSR
3	TXD	2	RXD
4	SG	5	SG
5	SG	5	SG
6	RXD	3	TXD
7	DSR	4	DTR
8	CTS	7	RTS

3.2.3 Network Cable

The network cables are used to enable the CMTS to communicate with the service network, as well as to facilitate local maintenance and remote access.

Applications

There are two types of network cables, straight-through and crossover:

Straight-through network cables are used to facilitate the communications between the terminal device and the network or for local maintenance and remote access to the device.

Crossover cables are used for direct communications between two terminal devices.

Exterior and Structure

Both straight-through and crossover network cables look the same externally, as shown in the figure below.

Fig. 3.2-5 Network cable

The structure of the network cable is shown in the following figure.

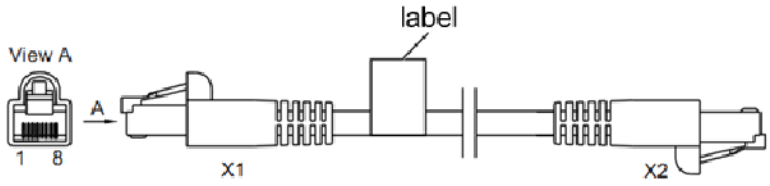


Fig. 3.2-6 Structural view of a network cable

Connections

The connections of a straight-through cable are shown in the following table.

Table 3.2-4 Connections for a straight-through network cable

X1 pin	Core line color	X2 pin
1	White and orange	1
2	Orange	2
3	White and green	3
4	Blue	4
5	White and blue	5
6	Green	6
7	White and brown	7
8	Brown	8

The following table shows the connections for the network cross cables.

Table 3.2-5 Connections of network cross cables

X1 pin	Core line color	X2 pin
1	White and orange	3
2	Orange	6
3	White and green	1

X1 pin	Core line color	X2 pin
4	Blue	4
5	White and blue	5
6	Green	2
7	White and brown	7
8	Brown	8

Technical Parameters

The following table shows the technical parameters of the network cables.

Table 3.2-6 Technical parameters of network cables

Parameter	Description
Connector (X1/X2) type	RJ45 connector (commonly known as the crystal head)
Type of electrical cable	3 types of non-shielded twisted pair (UTP-3), 5 types of non-shielded twisted pair (UTP-5) or shielded twisted pair (STP)
Characteristic impedance	100.0Ω
Diameter of the inner conductor	0.510mm
Breakdown voltage	500.0V
DC resistance of the internal conductor	93.8Ω/km
Number of Cores	Octa-core
Frequency range	0–100MHz
Frequency attenuation	22dB/100m@100MHz

3.2.4 Optical Fiber

Common optical fiber cables may be either single-mode or multi-mode. Multi-mode optical fibers are usually orange, but also have other colors, marked as MM. Multi-mode optical fibers usually work near 850nm, and the transmission distance is usually several hundred meters to several kilometers. Single-mode optical fibers are yellow and labeled SM. They usually work in the range of 1310-1550nm, and the transmission distance is usually more than 1 kilometer.

⚠ Warning:

Please do not look directly at the optical interface as the optical interface may emit invisible rays when it is not connected to the optical connector or not covered by the anti-dust cap. If the optical interface is not fitted to an optical connector, please make sure that it is covered with the anti-dust cap.

Table 3.2-7 Common optical connectors

 SC/PC type optical connector	 LC/PC type optical connector
 FC/APC (left) and FC/PC (right) type optical connector	 SC/APC type optical connector

3.3 Other Components

3.3.1 Dual-fiber Metal Connector

The dual-fiber metal connector is installed at the OPTICAL interface end of the CMTS enclosure. It is used for fiber access and provide waterproof protection. Each plug can support the access of two pieces of fiber at most.

The Dual-fiber metal connector is shown in Fig. 3.3-1.

Fig. 3.3-1 Actual Photo of a Dual-fiber Waterproofing Metal Plug

The specifications of the dual-fiber waterproof metal plug are as shown as follows:

Table 3.3-1 Specification for dual-fiber metal connector

Parameter	Description
Metal connector	CCNA5/8L-H2-03
Screw thread	NPT5/8
Fiber diameter parameter	2-3mm

3.3.2 Wavelength Division Multiplexer

DIABLO DATA SLINGSHOT CMTS products provide support for CWDM components. CWDM components are generally used in situations where there are only two optical fibers between the headend and the optical node. CWDM can save one optical fiber.

The headend combines the data signal with the CATV signal through the CWDM combiner to transmit on a backbone optical fiber. The optical node separates the data signal from the CATV signal through the built-in CWDM component in the DIABLO DATA SLINGSHOT CMTS device.

Fig. 3.3-2 CWDM schematic

The CWDM schemes supported by DIABLO DATA SLINGSHOT CMTS include the following:

Table 3.3-2 CWDM scheme supported by SLINGSHOT

DATA signal		CATV signal	
DATA transmission protocol	**Central wavelength**	**Modulation mode**	**Central wavelength**
IEEE 802.3av asymmetry 10G EPON	1310nm/1577nm	AM	1550nm
IEEE 802.3av symmetric 10G EPON	1270nm/1577nm	AM	1550nm
ITU-T G.987 XG-PON	1270nm/1577nm	AM	1550nm
EPON/GPON	1310nm/1490nm	AM	1550nm

Table 3.3-3 Specification parameters of SLINGSHOT built-in CWDM component

Parameter	CWDM component 1 specification	CWDM component 2 specification
Optical power	<300mW (24.77dBm)	<300mW (24.77dBm)
COM interface	1260 ~ 1620nm	1260 ~ 1560nm
PASS interface	1523.5 ~ 1565nm	1540 ~ 1560nm
REF interface	1260 ~ 1510nm 1571.5 ~ 1620nm	1260 ~ 1360nm 1480 ~ 1500nm
Insertion loss	PASS: <0.8dB REF: <0.6dB	PASS: <0.8dB REF: <0.6dB
Isolation	PASS: >30dB	PASS: >30dB

Parameter	CWDM component 1 specification	CWDM component 2 specification
	REF: >15dB	REF: >15dB

3.3.3 Flange Plate

DIABLO DATA SLINGSHOT CMTS defaults to two fiber flanges (headers) for interface conversion or fiber interconnection.

One flange is used for CATV optical receiver, and the other flange is used for the conversion of uplink SFP interface optical fiber.

Fig. 3.3-3 SC/APC-SC/APC Flange Diagram

The equipment is equipped with one conversion optical fiber, which is used for the conversion from the optical fiber interface of the network link optical module to the optical fiber interface on the flange, so as to facilitate the access of user data optical fiber.

The conversion optical fiber is shown in the following figure:

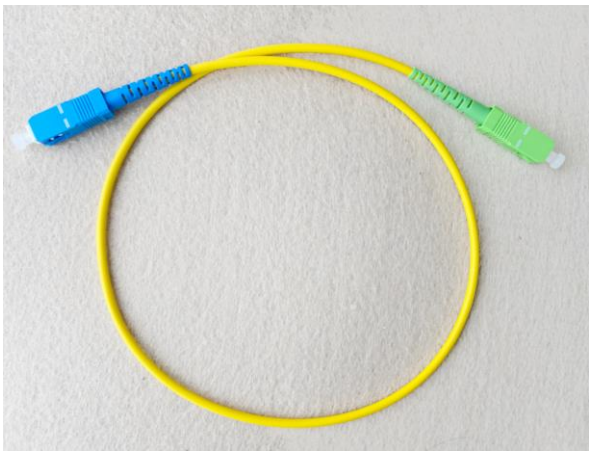


Fig. 3.3-4 SC/APC-SC/UPC Conversion Optical Fiber Diagram

When the upper interface is Ethernet uplink interface, the optical module interface is LC / UPC; when PON is uplink, the optical module interface is SC / UPC.

The following table shows the three flange types available. If you need other flange specifications, please order them separately.

Table 3.3-4 Specification of flange

Flange Type	Specification
1	Dual optical fiber flange bracket / provide 2 (SC-APC / SC-APC) flanges

Flange Type	Specification
2	Dual fiber flange bracket / provide 2 (FC-APC / SC-APC) flanges
3	Dual optical fiber flange bracket / provide 1 (FC-APC / SC-APC) flange for optical receiver / provide 1 (SC-APC / SC-APC) flange for data optical fiber interface

The following table shows the types of conversion optical fibers that can be selected.

Table 3.3-5 Specification of conversion optical fiber

Convert fiber optical type	Specification	Applicable scenarios
1	SC / APC-SC / UPC conversion fiber / length 0.82M	PON uplink
2	SC / APC-LC / UPC conversion fiber / length 0.82M	Ethernet uplink

3.3.4 Screws Package

During the installation of DIABLO DATA SLINGSHOT CMTS equipment, the standard mounting ears of the equipment can be used. If the standard mounting ears is not used, the screw package and hanging support can be selected for installation in other ways. The specification of screw package is shown in the figure below:

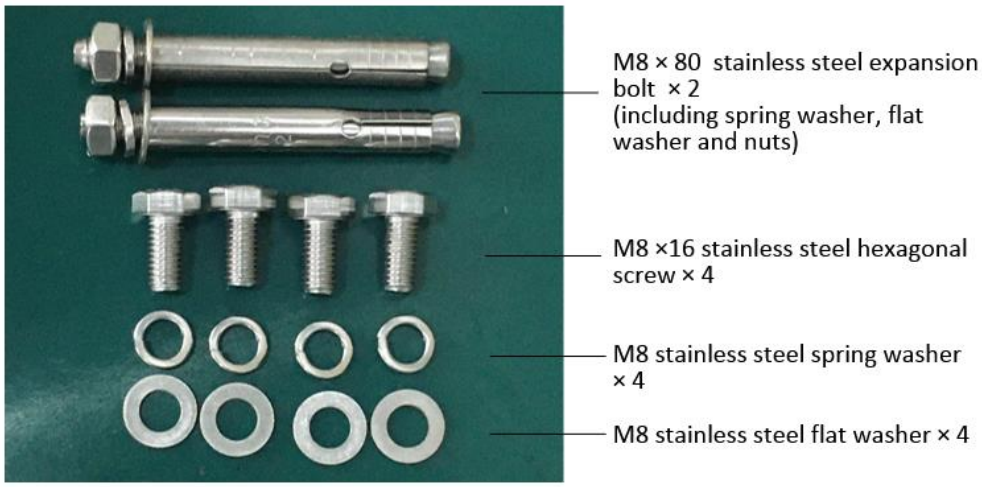


Fig. 3.3-5 Screw package schematic diagram

Table 3.3-6 Specification of screws package

Parts list	Quantity
M8*16 stainless steel hexagonal screw	4
stainless steel expansion bolt (including spring washer, flat washer and nuts)	2
M8 stainless steel flat washer	4
M8 stainless steel spring washer	4

Note:

In the DIABLO DATA SLINGSHOT CMTS installation manual, when describing "Iron bar installation" and "back iron bar installation", the "M8 nut" in the optional screw package mentioned above should be used. Use the M8 nut from the expansion bolt set.

3.3.5 Heat Dissipation Auxiliary Screw

Specification of heat dissipation auxiliary screw: M8 * 35, 2pcs.

The equipment is equipped with 2 heat dissipation auxiliary screw as standard. In order to enhance the heat dissipation effect, it is strongly recommended to install two heat dissipation auxiliary screw when the equipment is installed by steel wire or bar, leaving enough space for hot air to flow to achieve effective heat dissipation.

Fig. 3.3-6 Heat dissipation auxiliary screw

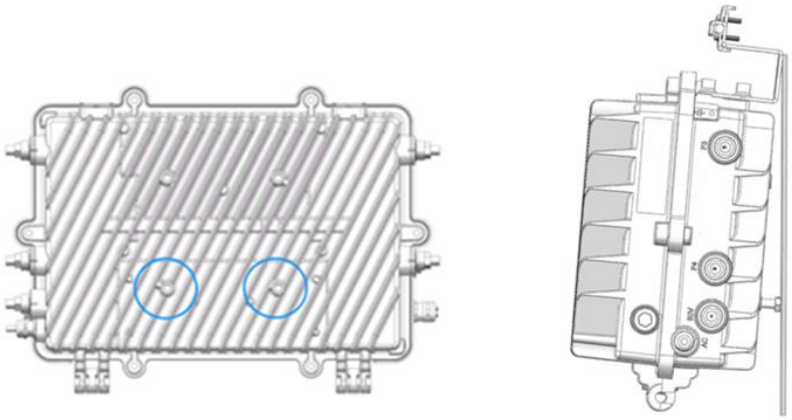


Fig. 3.3-7 Location of heat dissipation auxiliary screw hole

3.3.6 Mounting Ears

DIABLO DATA SLINGSHOT CMTS equipment can be installed with standard mounting ears. If no mounting ears is used, standard screws package or optional bracket can be installed in other ways. The specifications of the mounting ears are as follows:

Fig. 3.3-8 Mounting ears schematic diagram

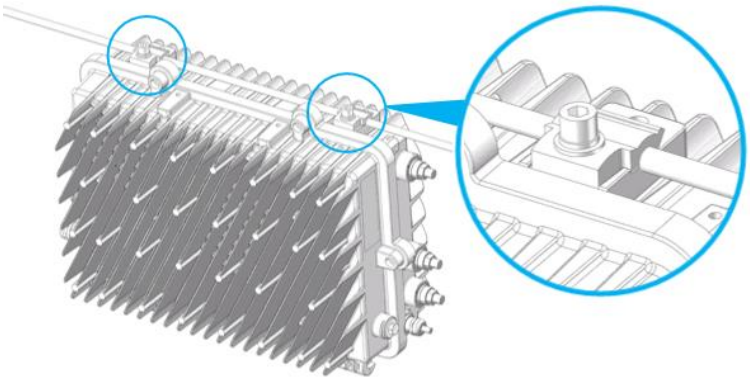


Fig. 3.3-9 DIABLO DATA SLINGSHOT CMTS installation diagram when using mounting for ears steel wire or a bar

3.3.7 Bracket

The bracket is an optional accessory. DIABLO DATA SLINGSHOT CMTS equipment can be installed by standard screws package or optional bracket in other ways if not suitable for mounting ears during installation. The bracket is shown as follows:

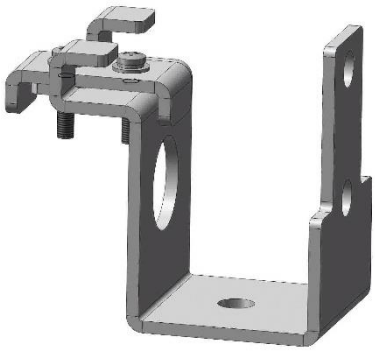


Fig. 3.3-10 bracket schematic diagram

The use of brackets can be applied to the installation of steel wire or a bar, iron bar and onto a wall.

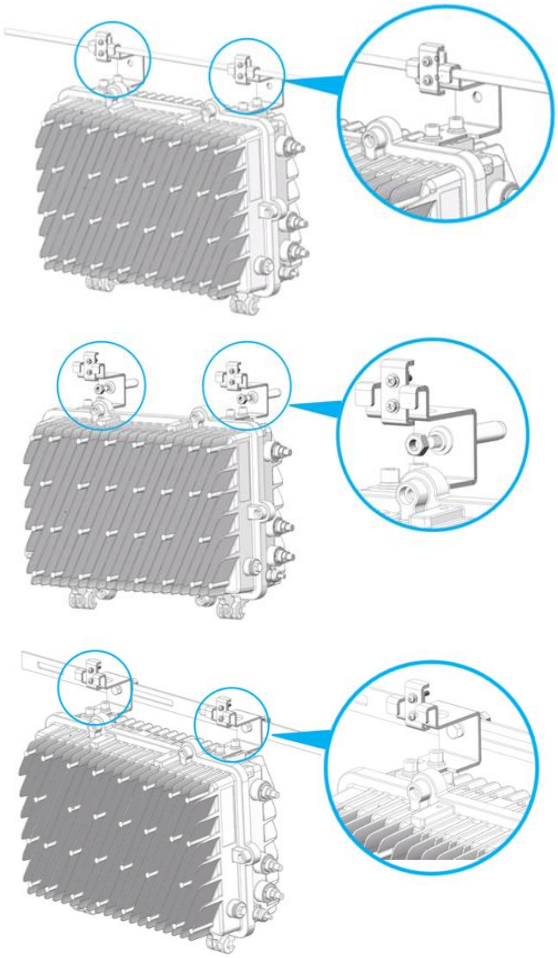


Fig. 3.3-11 DIABLO DATA SLINGSHOT CMTS installation diagram using bracket.

3.3.8 Overcurrent Switch/Fuse

The overcurrent switch/fuse is a pluggable electronic device with a fusing function which controls whether the AC60V power supply is on or off. When it is inserted, the circuit is connected, and when it is unplugged the circuit is open. When the current is exceeded the allowable nominal current then the fuse will blow-out to protect the circuit.

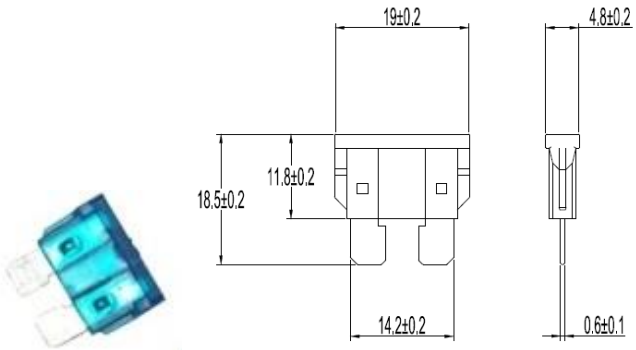


Fig. 3.3-12 Schematic diagram for the overcurrent switch/fuse

Unit: mm (Inch)

Overcurrent capability: 15A

3.3.9 High-pass Filter

A high-pass filter is a device combined of capacitance, inductance, and resistance parts which allows signals above a certain frequency to pass through, but significantly suppresses any signals below this frequency.

A high pass filter (HPF1 aperture in RF module) for reducing "bottom-end noise of upstream channel" is shown as follows:

Fig. 3.3-13 Schematic diagram for the High-pass Filter

The specifications for the high-pass filter are shown below:

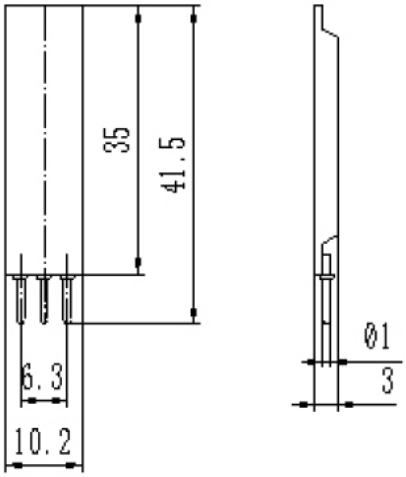


Fig. 3.3-14 Schematic diagram for the specifications of the High-pass Filter

Table 3.3-7 High pass filter specifications

Working Frequency	20-1000MHz	30-1000MHz
Impedance	75Ω	75Ω
Insertion loss	≤1.0dB	≤1.0dB
Return loss	≥15dB	≥15dB
Isolation	≥40dB@5-15MHz	≥40dB@5-15MHz

The position of high pass filter is shown in the figure below:

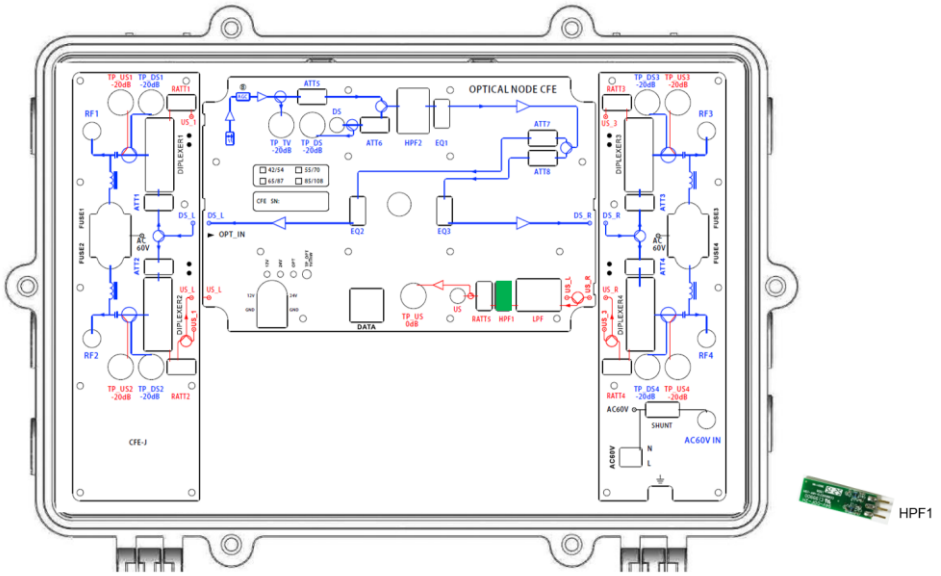


Fig. 3.3-15 Position of high pass filter

3.3.10 Frequency Divider

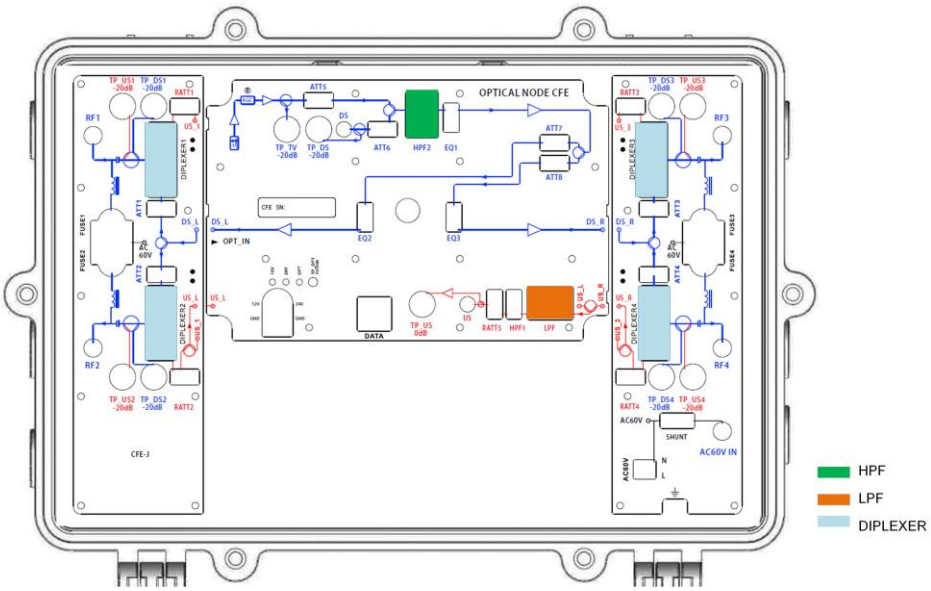
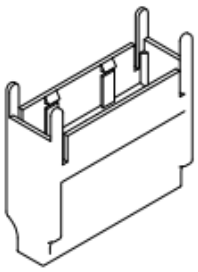
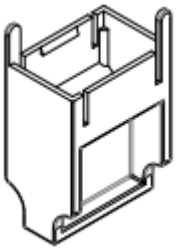
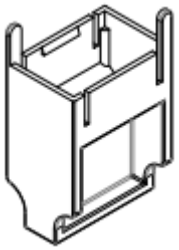


Fig. 3.3-16 Schematic diagram of frequency divider position

The RF amplifier module may use different frequency dividers depending on the coaxial network frequency division required for your installation.

Table 3.3-8 Frequency divider specifications

Type		DIPLEXER	LPF	HPF
Appearance				
Structural diagram				
Size		37*37*13mm	37*22.2*15.2mm	37*22.2*15.2mm
Inclusive Quantity		4	1	1
Silk screen	North American standard 42/54 frequency division	DPX 42/54	LPF 5-42	HPF 54-1218
	55/70 frequency division	DPX 55/70	LPF 5-55	HPF 70-1218
	European standard 65/87 frequency division	DPX 65/87	LPF 5-65	HPF 87-1218
	European standard 85/108 frequency division	DPX 85/108	LPF 5-85	HPF 108-1218
	North American & DOCSIS3.1 standard 204/258 frequency division	DPX 204/258	LPF 5-204	HPF 258-1218

When replacing the frequency divider, please insert it in the direction of the silk screen, and the white dot on the frequency divider shell is aligned with the black dot on the silk screen of the RF cover plate.

Fig. 3.3-17 Silk screen of frequency divider

Diablo data

Annex 1 Abbreviations

AC	Alternating Current
ATT	Attenuation
APC	Angle Physical Contact
CATV	Community Antenna Television
CM	Cable Modem
CMC	Cable Media Converter
CWDM	Coarse Wavelength Division Multiplexing
DC	Direct Current
DOCSIS	Data-over-Cable Service Interface Specification
DS	Downstream
EQ	Equalizer
EQAM	Edge Quadrature Amplitude Modulation
ETH	Ethernet
GE	Gigabit Ethernet
GPON	Gigabit Passive Optical Network
HPF	High-Pass Filter
LOS	Loss of signal
MAC	Media Access Control
MER	Modulation Error Ratio
MHz	Megahertz
MGMT	Management
ONT	Optical Network Terminal
PON	Passive Optical Network
POST	Power On Self-Test
PCMM	Pulse Code Modulation Multiplexer
RF	Radio Frequency
SFP	Small Form-factor Pluggable
SNR	Signal to Noise Ratio
SC	Square Connector
S/N	serial/number
TP	Test Point
US	Upstream
UPC	Ultra Physical Contact
WDM	Wavelength Division Multiplexing