

Submarine Network Product Series and Solution

FiberHome Marine Network Equipment Co., Ltd.

ADD: Floor 6, Xinyuan Building, No.2073, Gaolan Port Avenue, Gaolan port Economic Zone, Zhuhai City, China

TEL: +86-756-6967101 HTTP: www.fiberhome.com E-mail: support@fiberhome.com

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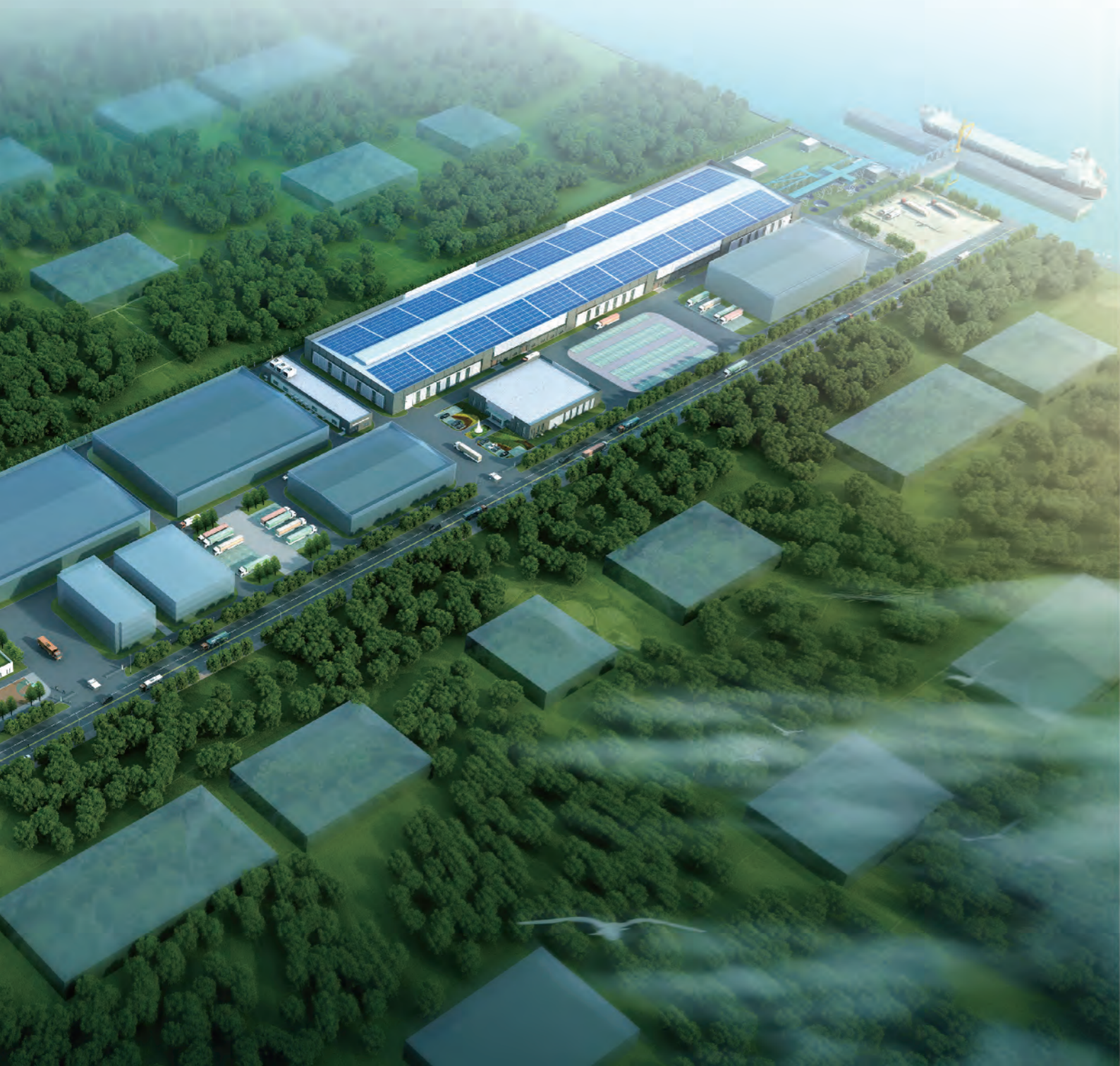


FiberHome Marine

FiberHome Marine Network Equipment Co., Ltd. is an outstanding provider of marine network solutions, which is a wholly-owned subsidiary of FiberHome Telecommunication Technologies Co., Ltd.

FiberHome Marine is mainly engaged in the overall solutions for marine market information technology and construction of marine IT communication system, including products offering, marine communication system design, installation, maintenance, value-added services, etc. The company provides complete marine network solutions integrated with transmission equipments, submarine cables, submarine repeaters, power feeding equipment, etc.

Our vision is to be a leading company in marine network in the world.



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Submarine Network Applications

- **Land to Land Communications**

Providing long distance, high stability, large capacity and high speed communication service between land to land by repeatered submarine network system.

- **Land to Island Communications**

Providing short distance, high stability, large capacity and high speed communication service between land to island by repeaterless submarine network system.

- **Submarine Observation**

Monitoring submarine geological movement, temperature change, water flowing and other factors to forecast the natural disaster and guarantee the safety of seashore and offshore activities.

- **Offshore Wind Power and Drilling Platform**

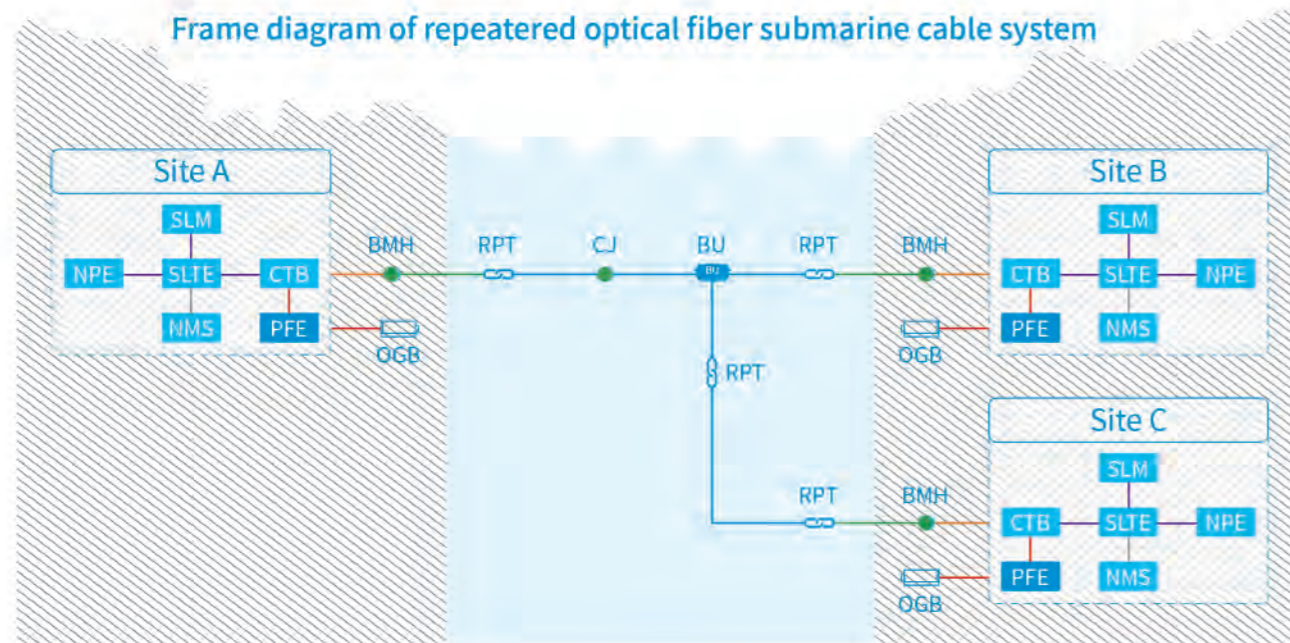
Providing communication service for offshore wind power and drilling platform.

Submarine Network System

Repeatered Submarine Network System

In a repeatered submarine cable system, one or more repeaters are included. All the cables installed in shallow sea and deep sea are defined as Repeatered Submarine Optical Fiber Cable, and the conductors in the cable are used for feeding power to repeater, and the power supply will be transported under a certain current. The length of cable between repeaters and characteristics of cabled fibers should match the distance between the repeaters.

Frame diagram of repeatered optical fiber submarine cable system



Symbol	Explanation
CTB	Cable Terminal Box
SLTE	Submarine Line Terminal Equipment
SLM	Submarine Line Monitor
NMS	Network Management System
PFE	Power Feeding Equipment
BMH	Beach Man Hole
CJ	Cable Jointing Box
BU	Branching Unit
RPT	Repeater

Symbol	Explanation
[Blue box]	Equipment needed for both repeatered and repeaterless system
[Green box]	Equipment needed for repeatered system
[Blue line]	Repeatered optical fiber submarine cable for deep sea
[Green line]	Repeatered optical fiber submarine cable for shallow sea
[Orange line]	Repeatered optical fiber submarine cable for landing section
[Purple line]	Intra station cable
[Red line]	Power feeding cable/optical interface
[Black line]	Communication cable/system interface

Repeaterless Submarine Network System

In a repeaterless submarine cable system, no repeater is included, but ROPA may exist in the cable route. In such system, all the cables installed in shallow sea and deep sea are defined as Repeaterless Submarine Optical Fiber Cable. The conductors that may be contained in the cable are used for testing purpose only and not for power supply. The length of cable and characteristics of cabled fibers should meet the requirements for transmission distance and transmission rate.



BMH	Beach Man Hole
DA	Double Armor Cable
SA	Single Armor Cable
LW	Light Weight Cable
ROPA	Remote Optically Pumped Amplifier

Symbol	Explanation
[Green line]	Double Armor Cable
[Orange line]	Single Armor Cable
[Blue line]	Light Weight Cable

Submarine Observation Network

Function

Shore-based Equipment

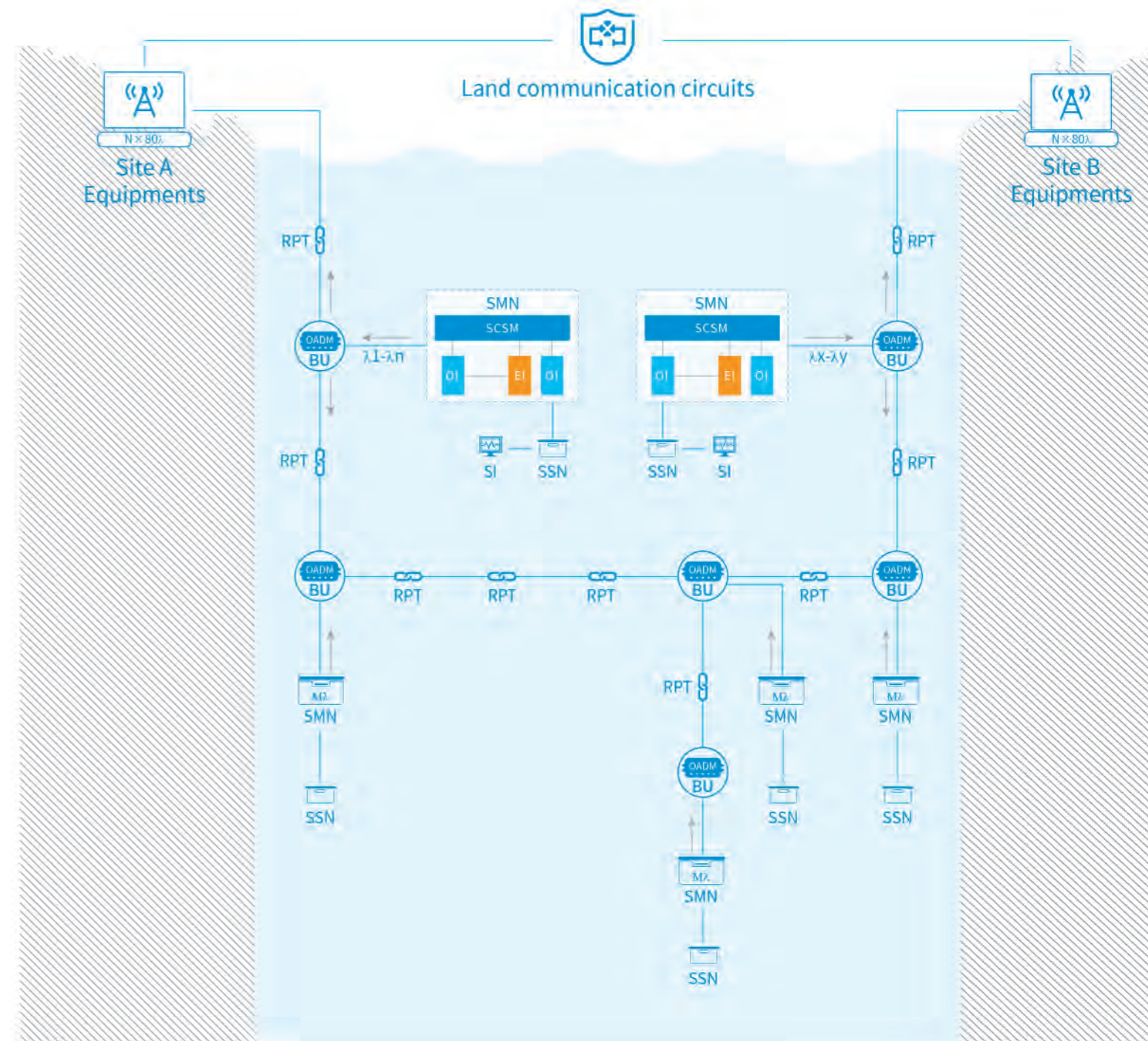
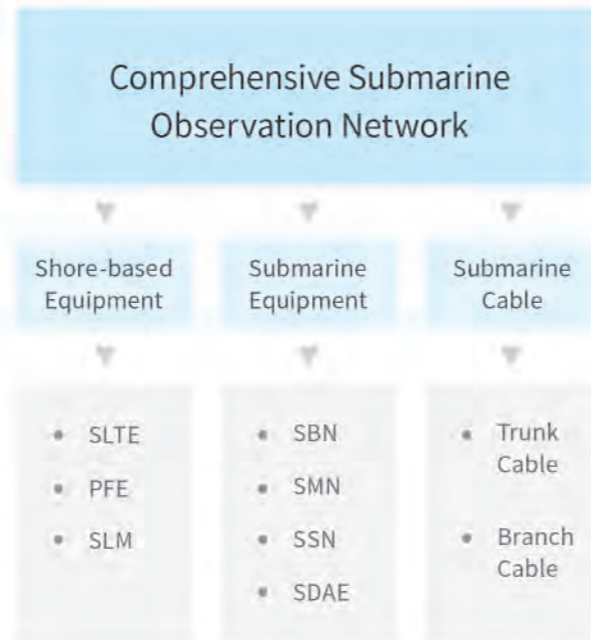
- Information processing and distribution
- Remote power supply
- Line monitoring
- Interconnection and interoperability with terrestrial optical networks

Submarine Equipment

- Information distribution/acquisition/uploading
- Signal relay amplification
- Power relay distribution and control

Submarine Cable

- Providing a stable and reliable signal transmission channel
- Power transmission conductor



SLTE	Submarine Line Terminal Equipment
PFE	Power Feeding Equipment
SLM	Submarine Line Monitor
SBN	Submarine Backbone Nodes
SMN	Submarine Main Nodes
SSN	Submarine Secondary Nodes
SDAE	Submarine Data Aggregation/ Timing Equipment

RPT	Repeater
BU	Branching Unit
OADM	Optical Add-drop Multiplexer
SCSM	Service Convergence/ Switching Matrix
OI	Optical Interface
EI	Electrical Interface
SI	Scientific Instrument

Submarine Network Wet Plant Products



1

Repeater



2

Remote Optically Pumped Amplifier



3

OADM Branching Unit



4

Passive Branching Unit



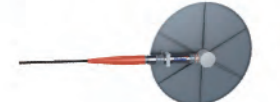
5

Nodes



6

Ocean Ground Beds



7

Submarine Optical Fiber Cables



Repeater



Features and Performance

Features

- Max. fiber capacity: 8 pairs
- Span: 80-120km
- Max. water depth: 8000m
- Operation temperature: -20~+35°C
- EDFA optical amplification

Performance

- Customized gain specification
- SLM, COTDR or electrical path for fault locating
- High strength nickel titanium material armor
- UJ technology for wide applicability
- High reliability for lifespan over 25 years

RPT	Repeater
EDFA	Erbium Doped Fiber Amplifier
SLM	Submarine Line Monitor
COTDR	Coherent Optical Time-domain Reflectometry
UJ	Universal Joint



• Products can be customized, included but not limited to the above

Remote Optically Pumped Amplifier



Features and Performance

Features

- Max. fiber capacity: 8 pairs
- Max. transmission distance: 500km
- Max. water depth: 8000m
- Operation temperature: -20~+35°C
- ROPA optical amplification technology

Performance

- Extending the transmission distance for repeaterless submarine cable systems
- Flexible application scenarios
- High reliability for lifespan over 25 years

ROPA	Remote Optically Pumped Amplifier
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• Products can be customized, included but not limited to the above

OADM Branching Unit



Features and Performance

Features

- Max. fiber capacity: 48 pairs
- Max. water depth: 8000m
- Operation temperature: -20~+35°C
- Support OADM

Performance

- Compact structure, small size, light weight
- Flexible power switching
- UJ technology for wide applicability
- Easy transport, easy installation
- High reliability for lifespan over 25 years



OADM Optical Add-drop Multiplexing

UJ Universal Joint

• Products can be customized, included but not limited to the above

Passive Branching Unit



Features and Performance

Features

- Max. fiber capacity: 48 pairs
- Max. water depth: 6000m
- Operation temperature: -20~+35°C
- Support repeatered and repeaterless system

Performance

- Compact structure, small size, light weight
- UJ technology for wide applicability
- Easy transport, easy installation
- High reliability for lifespan over 25 years



UJ Universal Joint

• Products can be customized, included but not limited to the above

Nodes



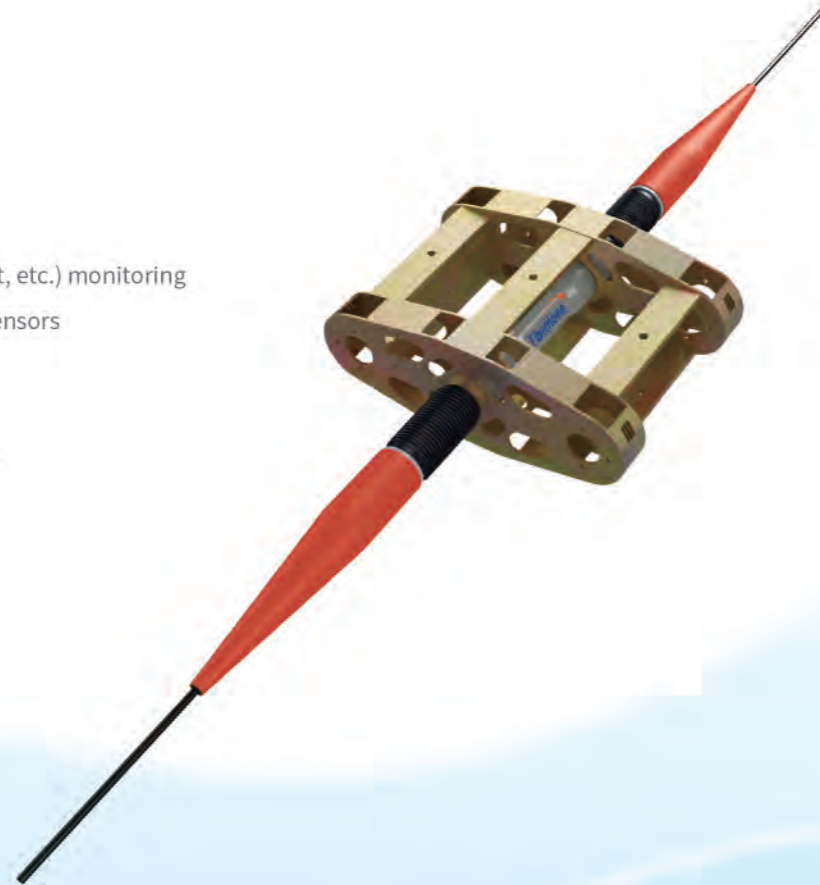
Features and Performance

Features

- Max. water depth : 3000m
- Power supply mode : constant voltage(DC 10kV)/constant current(DC 1.5A)
- Output voltage : 375V/48V/24V/12V
- Max. output power:5kW
- Transmission rate : 100Gbit/s
- Operation temperature: -20°C~+35°C
- SIIM :4

Performance

- 7×24 data (temperature/voltage/current, etc.) monitoring
- Other functions depend on connected sensors
- Easy installation, easy maintenance
- UJ technology for wide applicability
- High reliability for lifespan over 25 years



UJ Universal Joint

SIIM Scientific Instrument Interface Module

- Products can be customized, included but not limited to the above

Ocean Ground Beds

The OGB can support two types of grounding mode.

- In seabed surface grounding mode, the anodes or plates of the OGB are simply placed on the seabed.
- In buried grounding mode, the rods or the plates are buried in seabed near the beach or in deep water.

The OGB has to be permanently saturated with sea-water in both two modes.



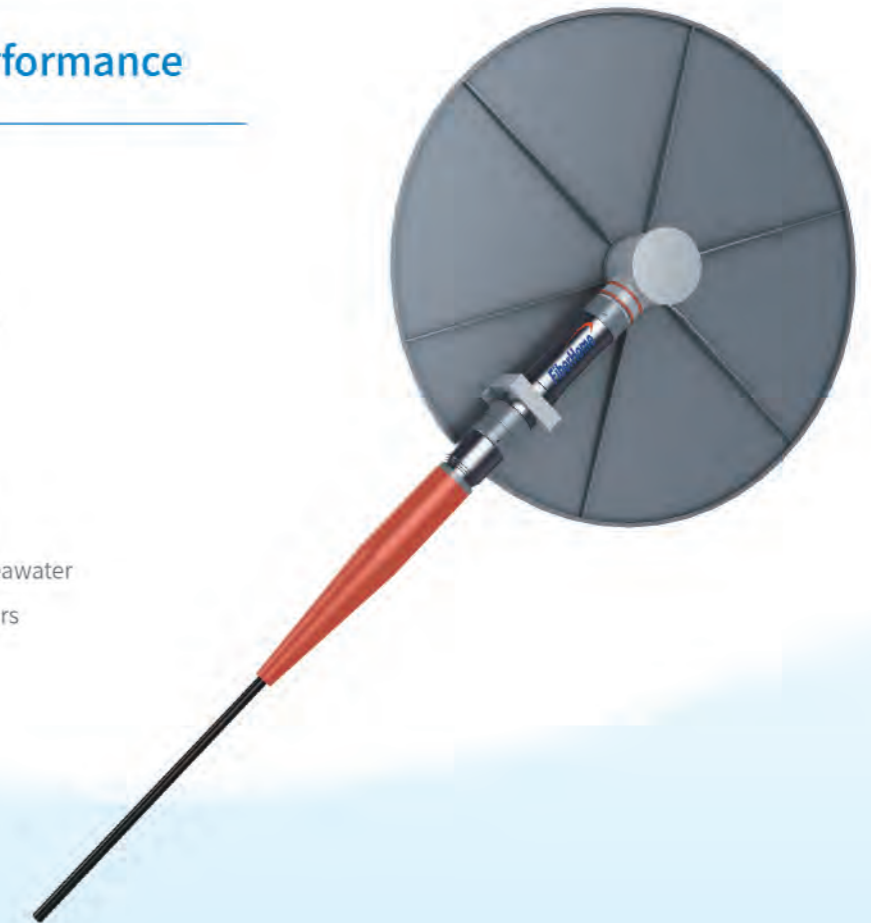
Features and Performance

Features

- Ground resistance: <math><5\Omega</math>
- Weight: 350kg
- Operation temperature: -20°C~+50°C

Performance

- UJ technology for wide applicability
- Easy installation, easy maintenance
- Outstanding corrosion resistance of seawater
- High reliability for lifespan over 25 years



OGB Ocean Ground Beds

- Products can be customized, included but not limited to the above

Submarine Optical Fiber Cables

Submarine Optical Fiber Cables

- FHOC-RA-SM (FiberHome Optical Cable-Rock Armor-Single Mode)
- FHOC-DA-SM (FiberHome Optical Cable-Double Armor-Single Mode)
- FHOC-SA-SM (FiberHome Optical Cable-Single Armor-Single Mode)
- FHOC-LWP-SM (FiberHome Optical Cable-Light Weight Protection-Single Mode)
- FHOC-LW-SM (FiberHome Optical Cable-Light Weight-Single Mode)



FHOC-RA-SM



FHOC-DA-SM



FHOC-SA-SM

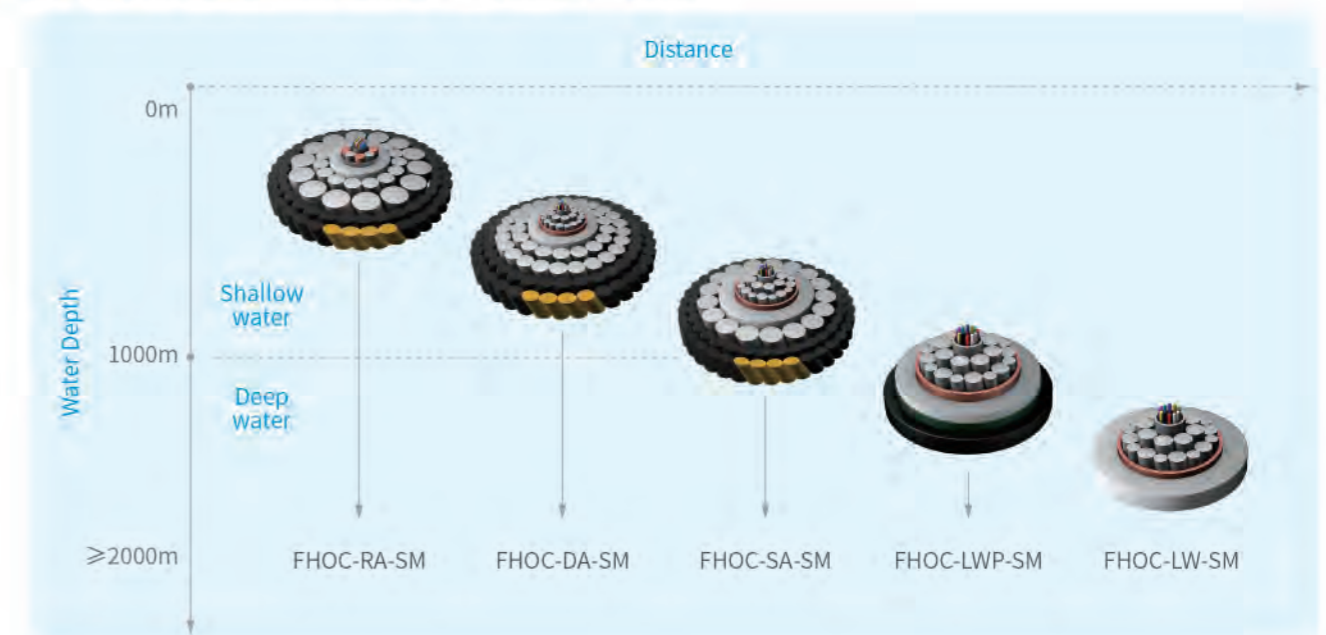


FHOC-LWP-SM



FHOC-LW-SM

Application of submarine optical fiber cables



Performance

- High transmission capacity
- Long continuous length
- Low loss, low impedance
- High voltage DC power supply
- Strong tensile strength, strong armor protection
- UJ technology for wide application

Applications

- Shallow sea or deep sea installation
- Ocean or intercontinental communication network
- Ocean observation system

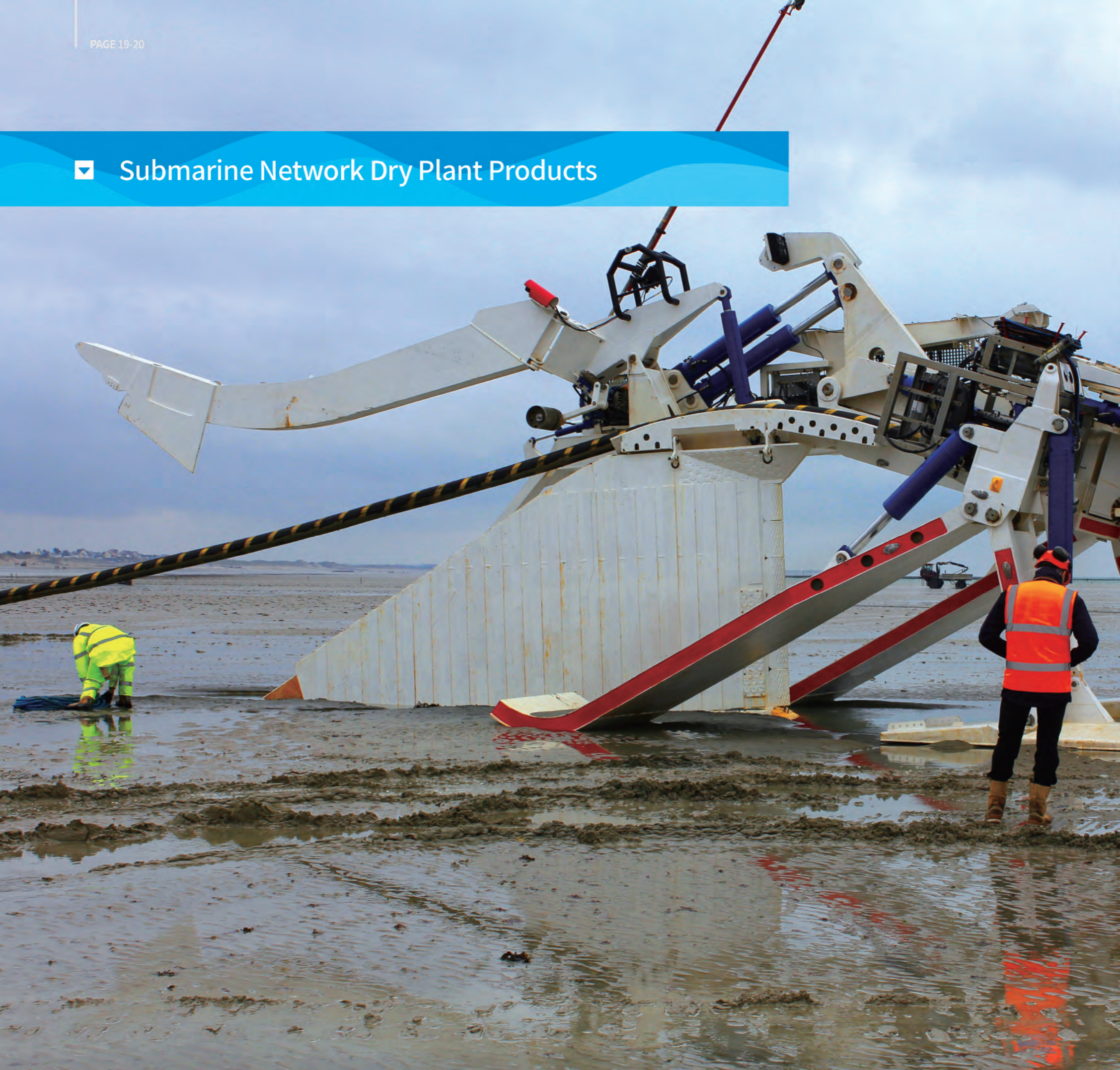
Temperature performance

- Operation temperature: -20 ~ +50°C
- Storage temperature: -30 ~ +60°C

UJ Universal Joint

• Products can be customized, included but not limited to the above

Submarine Network Dry Plant Products



1

Submarine Line Terminal Equipment



2

Submarine Line Monitor



3

Power Feeding Equipment



Submarine Line Terminal Equipment



FONST 6000 U Series

Ultra-large capacity

- 25.6Tbit/s cross-connect capacity for service grooming and dispatching.
- 400G backplane bandwidth per slot to support 100G/200G/400G data rate.
- 40/48 to 80/96 wavelengths scalable transmission capability for SMF.

Excellent security and reliability

- Multiple network-level protection schemes and ASON/GMPLS network management capabilities to protect services
- Comprehensive equipment protection for power supply devices, fans, and system control board 1+1, and cross-connection resource pools.

Excellent stability

- Ultra-long haul and ultra-long span transport
- Support FEC, super FEC, PM-QPSK technology
- Support distributed Raman amplification technology
- Monitor and self-adaptive adjustment for power, dispersion, OSNR and Q value

High maintainability

- Support statistical analysis and automatic optimization of performance parameters including optical power, OSNR and error rate (Q value). The system will generate reports and optimize them automatically
- Support optical channel power automatic balance, automatic optimization, automatic compensation, and automatic card discovery to reduce the cost of maintenance
- Support standard G.709 interface and provides abundant OTN overhead for wavelength services
- Support 1588V2 time and frequency synchronization protocol
- Provide physical layer clock synchronization and Ethernet time synchronization
- Advanced IAMS for network performance supervision, fault isolation, degradation precaution
- Advanced tool OTN Planer for network planning and simulation

Full service bearing

- STM-1/4/16/64/256
- OC3/12/48/192/768
- FE/GE/10GE/40GE/100GE
- FC100/200/400/800/1200
- OTU1,OTU2,OTU3,OTU4

SLTE	Submarine Line Terminal Equipment
SMF	Single-mode Fiber
OSNR	Optical Signal to Noise Ratio

OTN	Optical Transport Network
FEC	Forward Error Correction
OTU	Optical Transform Unit

Submarine Line Monitor



Principal functions of SLM

- Elective probe light wavelength (1562.23nm, 1563.05nm, 1563.87nm)
- Power switch command create
- 15-minute fast fault location function
- Cotdr technology
- Simple network management protocol
- Software package loading



In service mode

- Collecting/querying/importing the baseline.
- Starting the comparison test in single-test mode or periodic mode. Alarms can also be provided if needed.
- Querying the historical "comparison test" result.
- Starting a manual test.
- Querying the historical test result.

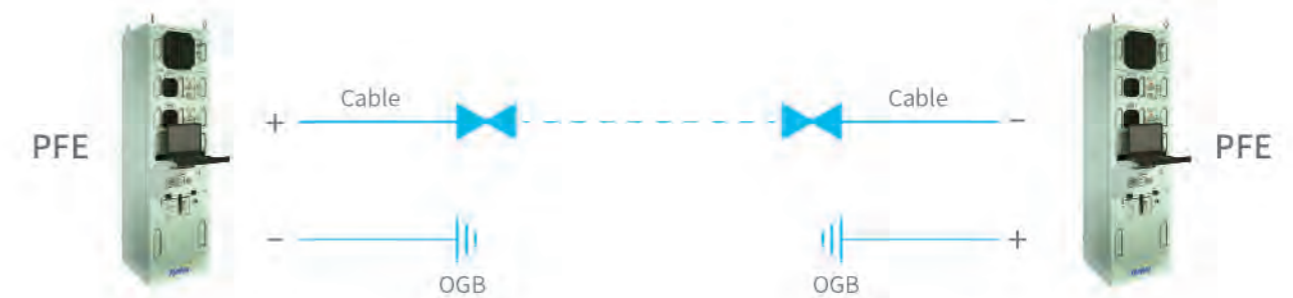
Out of service mode

- Collecting/querying/importing the baseline.
- Locating the fault points when service is interrupted.
- Security control prevents misoperation of starting an out-of-service test.
- Querying the historical test result.
- Supports quick locating of the fault span within 15 minutes.

SLM	Submarine Line Monitor
NMS	Network Management System
COTDR	Coherent Optical Timedomain Reflectometry

• Products can be customized, included but not limited to the above

Power Feeding Equipment



Performance

- Provide redundant converters and LCU
- Adopt LCU for programming, monitoring, alarm and diagnosis
- Full array dry contact closure for remote site alarm detection
- Provide electrode function
- Safely replace converters or test load without affecting power feeding
- Full local and remote monitoring via Ethernet connection
- Full-featured programming, monitoring, alarms, diagnosis and ramping functions are provided via LCU module

Specification

- Output voltage: maximum: 6kV, nominal: 5kV
- Output current: maximum: 1.2A, nominal: 1.0A
- Output power: 5kW for 1+1 redundancy
- Input voltage: -40.5 to -60 VDC
- Current ripple: maximum output for peak to peak up to 10mA
- Voltage ripple: maximum output for peak to peak up to 0.2%
- Current stability: 0.1% (constant load) after preheating for 4 hours
- Operating temperature: 5 ~ +40°C operating
- Storage temperature: -40 ~ +85°C storage

OGB	Ocean Ground Beds
PFE	Power Feeding Equipment
LCU	Line Control Unit

• Products can be customized, included but not limited to the above

Submarine Cable UJ and Accessories



1 UJ & UQJ



2 Drawing Head



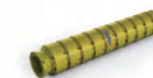
3 Hand-off



4 Bend Stiffener



5 Bend Restrictor



6 Metal Cable Protection Tube



7 Polyurethane Protection Tube



Submarine Cable UJ and Accessories

UJ & UQJ

- Connection and maintenance for submarine cable (both deep sea and shallow sea)
- Max. water depth for UJ and UQJ: 8000m
- High strength, excellent sealing performance, outstanding seawater corrosion resistance



UJ Universal Joint
UQJ Universal Quick Joint

Drawing Head

- The drawing head needs to be used with drawing net, and can significantly reduce the torsion strength of the submarine cable due to the automatic rotary reduction function during the installation.



Hand-off

- The Hand-off is made of high-quality stainless material in Harvard structure, and can press and fix the armoring layers of the submarine cable.



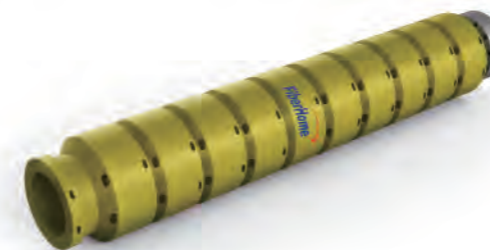
Bend Stiffener

- The bend stiffener is used for joint parts of equipment and cable to reduce fatigue and damage caused by the marine environment, and increasing intensity of the joint to avoid excessive bending.



Bend Restrictor

- The bend restrictor can be customized according to the diameter of the cable and the bending radius. With the specific lock-up radius and loading capacity, it can prevent the excessive bending of the cable.



Metal Cable Protection Tube

- The metal cable protection tube is made of high strength and corrosion resistant metal material which can protect the landing part cable from rocky terrain and falling impact.



Polyurethane Protection Tube

- The polyurethane protection tube is made of flexible polyurethane material, and can be used as the outer protection of the submarine cable under conditions of cable crossing, cable landing and rock penetration.



Submarine Network Construction Service

Turnkey Solution

STEP
01



Owner Planning

- Set target
- Fund preparation
- Looking for partners

STEP
02



Desktop Study & Route Design

- Site landing
- Marine geology
- Hydrologic regime
- Risk evaluation
- Environment evaluation
- Construction permits

STEP
03



System Design

- Cable selection & site equipments
- Fiber optical configuration
- Repeater specification
- Segment distance
- Network management system
- System design block diagram

STEP
04



Route Survey

- Route survey
- Marine depth
- Marine topography
- Marine geology

STEP
05



Product Supply

- Site equipments
- Submarine optical fiber cables
- Repeater & branching unit
- Accessories

STEP
06



Construction

- Land portion
- Cable loading
- Customs clearance
- Route clearance & pre-lay grapnel run
- Cable deploy

STEP
07



Owner Acceptance

- Test & perform
- Documentation

STEP
08



Maintenance

- Device maintenance
- Cable maintenance
- Upgrade system

Typical Cases

Project Name: PP Telecommunication Submarine Project between Malaysia and Indonesia

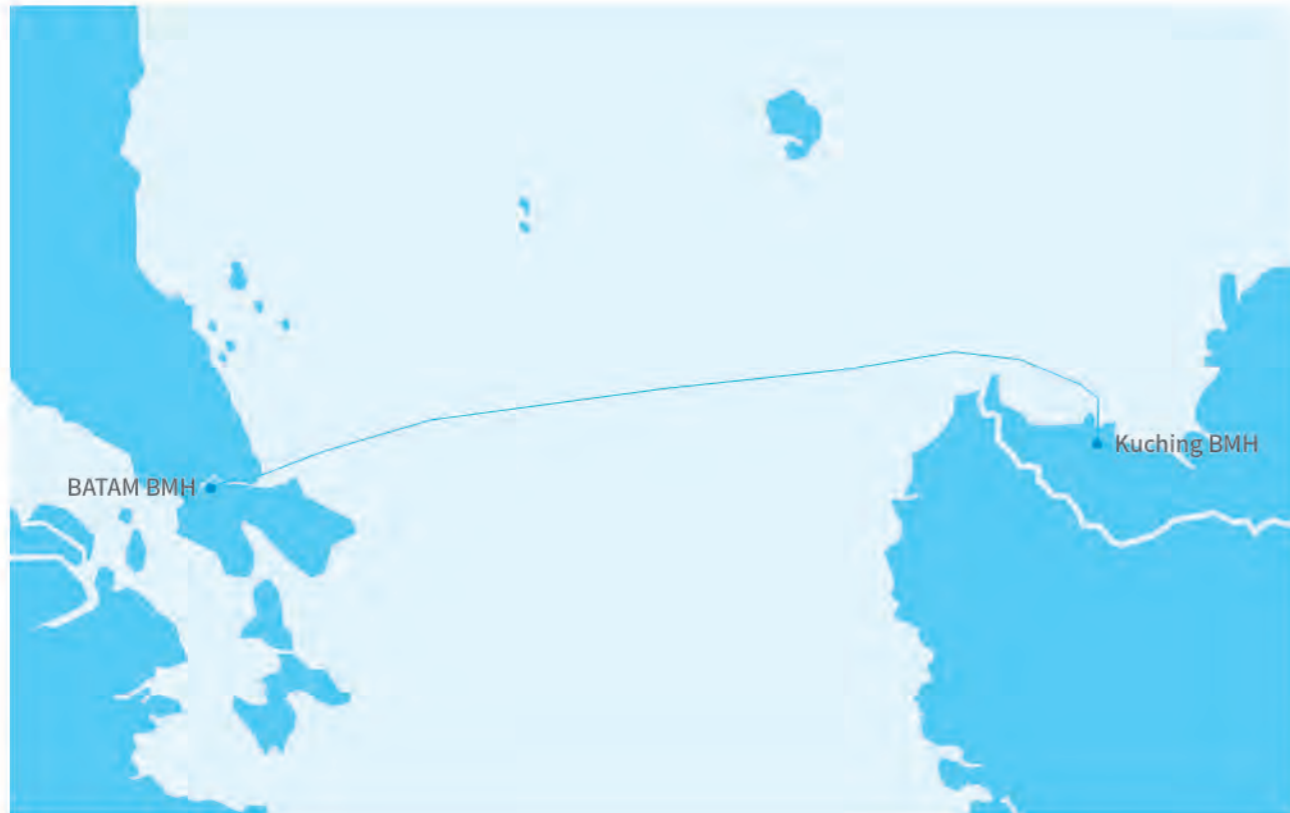
Investor: PP Telecommunication, Malaysia

Landing Sites: Kuching & Batam

FiberHome Working Scope: Turnkey Solution

Year of implementation: 2018

Total Submarine Length: 800km



Project Name: Malaysia MDSCS-Malaysia Domestic Submarine Cable System Project

Investor: TM, Malaysia

Landing Sites: Kuantan, Mersing, Kuching, Miri, Labuan, Kota

Product upgrade to 100G

FiberHome Working Scope: Transmission

Year of implementation: 2016



Reference Standards

ITU-T G.652	Characteristics of a single-mode optical fiber and cable
ITU-T G.654	Characteristics of a cut-off shifted single-mode optical fibre and cable
ITU-T G.971	General features of optical fibre submarine cable systems
ITU-T G.972	Definition of terms relevant to optical fibre submarine cable systems
ITU-T G.973	Characteristics of repeaterless optical fibre submarine cable systems
ITU-T G.974	Characteristics of regenerative optical fibre submarine cable systems
ITU-T G.975	Forward error correction for submarine systems
ITU-T G.976	Test methods applicable to optical fibre submarine cable systems
ITU-T G.977	Characteristics of optically amplified optical fibre submarine cable systems
ITU-T G.978	Characteristics of optical fibre submarine cables
ITU-T G.979	Characteristics of monitoring systems for optical submarine cable systems
IEC 60793-2-50	Optical fibres - Part 2-50: Product specifications – Sectional specification for class B single-mode fibres
IEC 60794-1-2	Generic specification-Basic optical cable test procedures
GJB 4489	General specification for submarine optical fiber cable
GJB 5652	Specification for closure of submarine optical fiber cable
GB/T 18480	Generic specification- submarine optic fiber cable

Clients

