

Data Sheet

MS Plus Portable

Portable System for Partial Discharges Measurement

Model: MSP-P01 v01



CHARACTERISTICS

- ❖ 4x Channels for partial discharge measurement with 10/12/14 bit of resolution to 100 Msp.
- ❖ 1x Channel for voltage reference measurement with 10/12/14 bit of resolution to 100 Msp (using only 3x PD channels by selection in the front).
- ❖ Capture synchronization by means of optical synchronization input signal of internal synchronization signal.
- ❖ Output of repetition of synchronization optical pulse.
- ❖ Communication 10/100 Fast Ethernet by RJ45 connection and 2x optical fiber.
- ❖ Selectable power input for 110-220V 50-60Hz and for +12V_{DC}.
- ❖ Power output of +12V_{DC} filtered to power UHF-HF converter.
- ❖ Protection systems against overvoltages in all channels.
- ❖ Protection fuse for voltage reference channel.
- ❖ External indicators of operation and network connection by optical ports.
- ❖ Envelope with IP65 protection.
- ❖ Equipment robust and compact.
- ❖ Temperature sensor in the plate and temperature sensor in the housing.

DESCRIPTION

The MS Plus Portable equipment is the ideal solution for the measurement of partial discharges in timely or temporary monitoring services. It contains the measuring electronics inside a suitcase with IP65 degree of protection for use in outdoor installations. Inside it has space to transport all the necessary accessories to be able to realize the capture of partial discharges and make a complete diagnosis. It allows to complete a measure of partial discharges in less than 30 minutes being able to extend the time to a temporary monitoring of several days.

This equipment allows the capture of partial discharge and voltage reference signals to obtain the frequency and phase offset parameters. It has functions to configure the armed with synchronization, or by synchronization input signal by optical fiber or by forced internal synchronization. The system allows the transmission of raw partial discharges and voltage reference signals to be transmitted to a central control PC (CAS). The control of the equipment is done from the server PC through an Ethernet network connection through any of the three available ports (1 electrical and 2 optical).

The MS Plus Portable measuring instrument is designed to operate in a dedicated network with an available bandwidth of 100 Mbps. It can be installed in series with other measurement systems to perform monitoring with multiple measurement points.

The way to synchronize the network of measurement systems can be through a CSS-VR synchronization system, a CSS-GPS system or using its own synchronization function when the equipment is at the head of the fiber optic synchronization network.

INTERCONNECTION ELEMENTS

Front panel:



1	Input supply: 110-220 V _{AC} 50-60 Hz or 12 V _{DC}	V _{IN}
2	4x Channels for partial discharges	PD ₁ -PD ₄
3	Channel for voltage reference	V _{REF}
4	Screw and nut M6 for ground connection	⏚
5	Emitter and receiver of optical fiber for synchronization	SYNC
6	Input link for transmitter and receiver for fiber optic network (connection from previous PC or MS)	LINK IN
7	Output link for transmitter and receiver for fiber optic network (connection to next MS)	LINK OUT

Internal panel:



1	Network connector by copper cable	ETHERNET
2	Selector for power type (AC/DC)	POWER SELECTOR
3	Auxiliar input supply connector	V _{IN}
4	Power on switch	Power ON
5	Fiber optic connection LEDs	Link IN/ Link OUT
6	Function selector for 4th channel DP/VR	Select VRef-PD4
7	Fuse holder for voltage reference	50 mA

TECHNICAL SPECIFICATIONS

Partial discharges measuring channels	
Input connector	BNC female
Input impedance	50Ω
Coupling	AC
Configurable voltage range	From ±20mV to ±20V
Vertical resolution	10/12/14 bits
Peak Detection Bandwidth	0 - 50 MHz
Sampling rate	100 MS/s
Memory depth	2 MS per channel
Overvoltage protection	Passive and active controlled by software
Analogic filters	Enabled by software: - High-pass of 16 kHz - Bandpass of 1 MHz - 35 MHz
Channels for voltage reference measurement	
Input connector	Neutrik NAC3MPA 3 P
Input impedance	4,2 kΩ
Coupling	AC
Configurable voltage range	From ±60mV to ±400V
Vertical resolution	10/12/14 bits
Bandwidth	0 – 1MHz
Sampling rate	100 MS/s
Memory depth	2 MS
Overvoltage protection	Fuse 500 mA
Trigger function	
Trigger condition	Trigger manual or optical reception of the synchronization signal
Trigger generation	Control ON and OFF of signal of optical synchronization emission by software
System general functions	
Analogic power control	Shut down by recorder's software
Positioning reading	Orientation sensors
Housing	
Box dimensions + connectors	538 x 406 x 269 mm 3x HFCT compartments + 1x CSS-GPS compartment
Weight	16,5 kg
IP code	IP65
Temperature ranges	
Storage temperature	From -20°C to 70° C
Operation temperature	From -15°C to 40°C
Temperature sensors	Temperature sensors in plate and in housing

Network control functions	
IP configuration control	Static IP (editable)
Reception of control orders	TCP 1000 (editable)
Functions of network capture	
Recorders IP configuration	Dynamic IP (editable)
Reception of control orders	TCP 53270 (editable)
Communication by network cable	
Connector type	RJ-45 IP65
Communication protocol	IEEE 802.3
Speed	10/100 Fast Ethernet
Type of cable	RJ-45 8 pin
Communication by optical fiber	
Connector type	LC IP67
Communication protocol	IEEE 802.3
Speed	10/100 BaseFX
Type of fiber	Multimode in μm (50/125) (62,5/125) (100/140) (200)
Indicators	Link LED in panel
Input of optical fiber synchronization	
Connector type	LC IP 67
Wavelength	850 nm
Type of fiber	Multimode in μm (50/125) (62,5/125) (100/140) (200)
Output of repetition of optical fiber synchronization	
Connector type	LC IP67
Wavelength	850 nm
Type of fiber	Multimode in μm (50/125) (62,5/125) (100/140) (200)
Reach	2,5 km
Optical power	0,17 mW (for 1 m of fiber)
Pulse distortion	< 1 ns
Input supply	
Connector type +12V	Neutrik NL4FX 4P
Voltage level +12V	+12 V DC
Connector type 110-230V	Neutrik NL4FX 4P
Voltage level 110-230V	110-240V (50-60Hz) AC
Consumption	25 W
Indicators	Led de alimentación en el panel interior

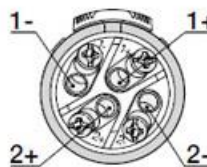
ENVELOPE DIMENSIONS



Dimensions in mm

POWER CONNECTION

A Neutrik NL4FX connector with 4 poles (1+, 1-, 2+ and 2-) is used to power up the MS Plus Portable. Depending on the mounting of the power cable, it can be used in two different ways:



a) 110-230 V_{AC} supply:

To use the MS Plus Portable equipment with 110-230 V_{AC}, the Neutrik NL4FX connector is assembled with poles 2+ and 2- connected to the phase and neutral of the input power signal, respectively. The internal panel selector must be setted to 110-220 V_{AC}, then push the switch power on button.

To mount the 110/230 V_{AC} power connector, the external ground wire should be left in the connector with a metric 6 washer to connect to the front screw.



External connection

b) 12 V_{DC} supply:

To use the MS Plus Portable with 12 V_{DC}, the Neutrik NL4FX connector is assembled with poles 1 + and 1- connected to the positive and negative terminals of the 12 V_{DC} battery or source, respectively. The internal panel selector must be setted to 12 V_{DC}, then push the switch power on button.

The equipment has two female Neutrik NL4MP connectors, one on the front panel of the equipment and another on the internal panel, giving the option to use any of them for power.



Internal connection and power selector

EQUIPMENT FEATURES

The MS Plus Portable unit has 4 measuring channels. Synchronization of signal captures from sensors sensitive to partial discharges (see DIAEL HFCT and UHF sensor manual) can be performed in three different ways:

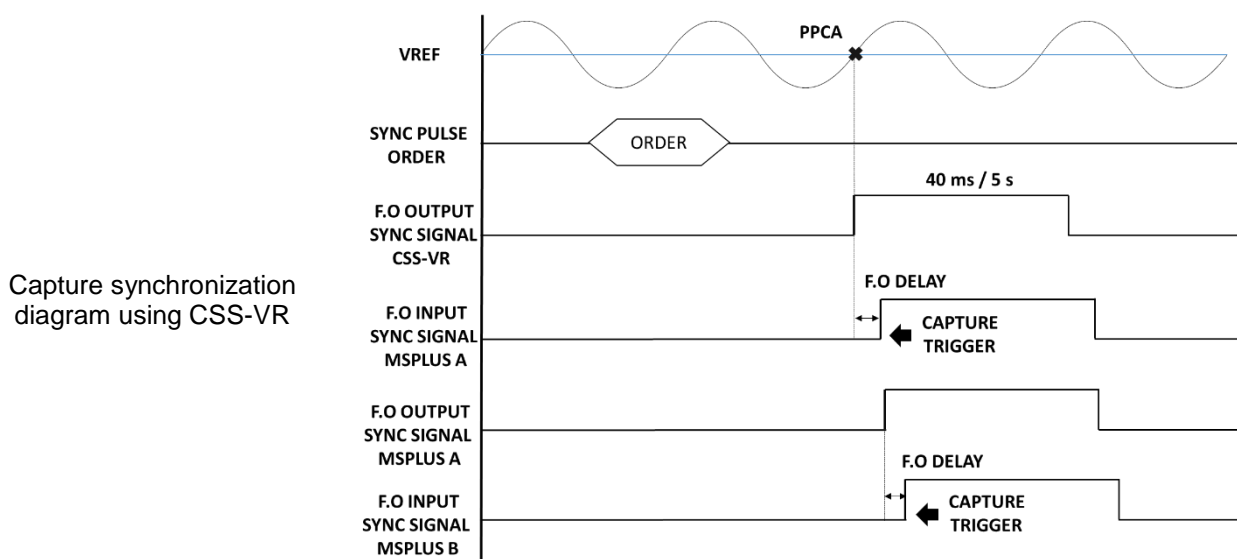
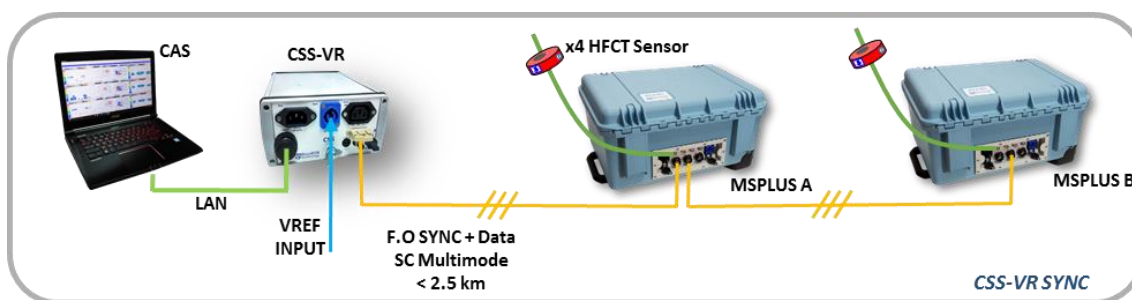
i. Synchronization of captures by receiving fiber-optic pulses from CSS-VR equipment:

After the Ethernet network receives the synchronization command, the CSS-VR generates the synchronization pulse with the fiber optic emitter at the instant it detects the ascending zero crossing (PPSA) of the voltage reference signal.

The synchronization pulse will travel along the fiber optic line to the MS Plus Portable receiver. The internal sync signal detector will trigger the measurement, determining the timing of the synchronized capture. The received synchronization signal is forwarded to the next measurement element.

With this configuration, the four input channels of the MS Plus Portable can be used as partial discharge measurement channels. The voltage reference signal is taken by the CSS-VR equipment, and therefore the captures will be synchronized with the ascending zero passage of the VREF signal that allow to place the discharges in the pattern solved in phase.

This provision requires a fiber optic cable long enough to reach all the measurement equipment installation. A CAS control unit can handle from one to eight measurement systems connected in series by optical fiber, and synchronized by the same CSS-VR equipment. The following figure is an example with two units in series very practical for tests in substations (cable joints and transformers).



ii. Synchronization of captures by receiving optical fiber pulses from the CSS-GPS equipment:

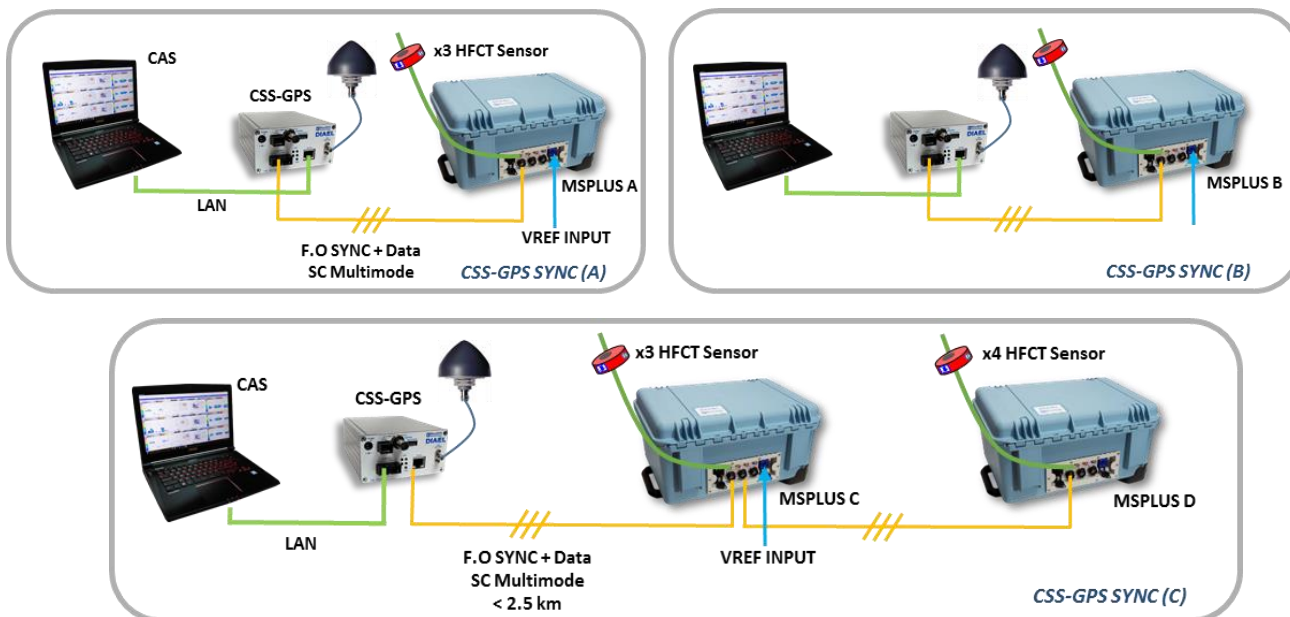
In this case, the pulse-per-second (PPS) synchronization generated by the CSS-GPS equipment is used autonomously. The fundamental requirement will be to have sufficient GPS signal coverage (see the CSS-GPS user's manual for more information).

The PPS pulse generated at the optical output of the CSS-GPS equipment will reach the MS Plus Portable receiver. The internal sync signal detector will trigger the measurement by determining the timing of the synchronized capture.

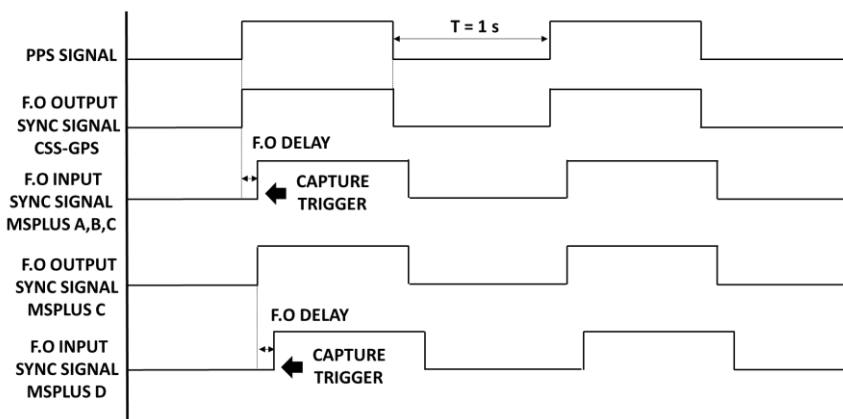
With this configuration, it is necessary that at least one of the MS Plus Portable of the installation uses 3 channels of partial discharge measurement and the fourth channel as reference voltage input. It is necessary to analyze the voltage reference signal with a synchronized MS Plus Portable that provides frequency and phase parameters of the ascending zero crossing to be able to place the discharges in the pattern solved in phase.

This provision has the advantage of not requiring fiber optic lines between two measuring equipment installed at different points in the installation. In order to visualize the pattern solved in phase during the measurement, will be necessary to use the fourth channel to analyze the voltage reference VREF, in addition each MS Plus Portable will need its own equipment of synchronization CSS-GPS.

A CAS control unit can handle from one to eight measurement systems connected in series by optical fiber, and synchronized by the same CSS-GPS. Below are three subsystems (A) (B) and (C) with one CSS-GPS unit, very practical for tests in underground lines (medium and high voltage).



Capture synchronization diagram using CSS-GPS



iii. Synchronization of captures by reception of fiber optic pulses from other MS Plus Portable equipment:

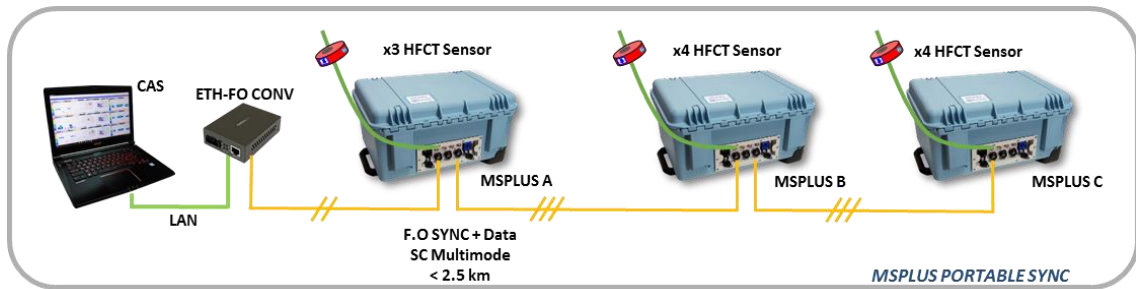
There is also the possibility of using one MS Plus Portable as a synchronizer, and can generate sync pulses to the optical synchronization output.

The generated pulse will travel through the fiber optic line until it reaches the receiver of the next MS Plus Portable equipment. The internal sync signal detector will trigger the measurement, determining the timing of the synchronized capture.

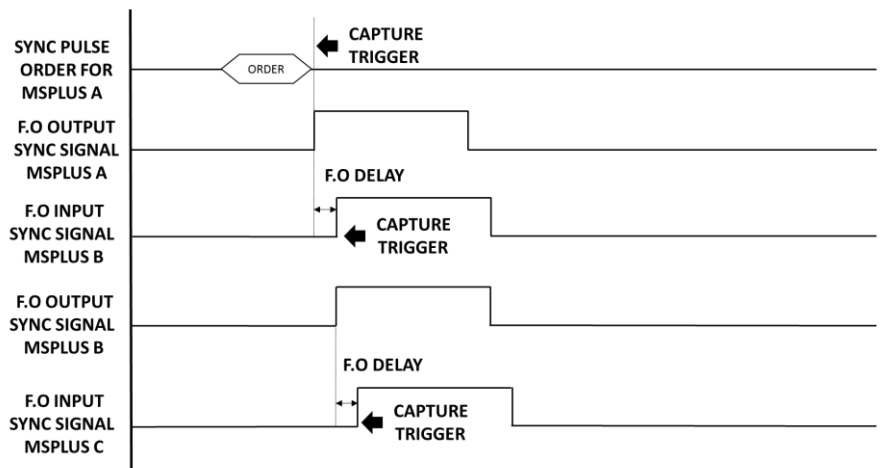
With this configuration, it is necessary that at least one of the MS Plus Portable of the installation uses 3 channels of partial discharge measurement and the fourth channel as reference voltage input. It is necessary to analyze the voltage reference signal with a synchronized MS Plus Portable that provides frequency and phase parameters of the ascending zero crossing to be able to place the discharges in the pattern solved in phase.

A Fast Ethernet (10/100 Mbps) to multimode optical fiber converter must be used between the first MS Plus Portable and the CAS unit.

This provision does not require the use of the CSS synchronization system but requires the use of an Ethernet-To-Fiber converter. It will be necessary to use fiber optic cables between the measuring equipments located at different points in the installation, and the sync pulse generation occurs at a random instant of the VREF voltage signal.



Capture synchronization diagram using MS Plus Portable

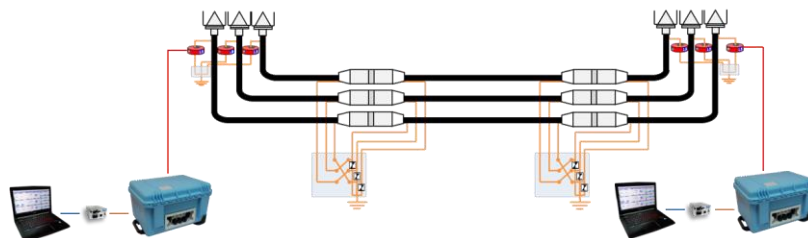


PD LINE SOLUTION

Adapted solution for the diagnosis in cable systems of any length. This solution enables the automatic defects detection through GPS synchronized measurements performed simultaneously by two operators.

Components

- 2 x MS Plus Portable
- 6 x HFCT Sensor
- 2 x GPS Synchronization system
- 1 x Control and Analysis unit
- 2 x PD-Advanced Software license

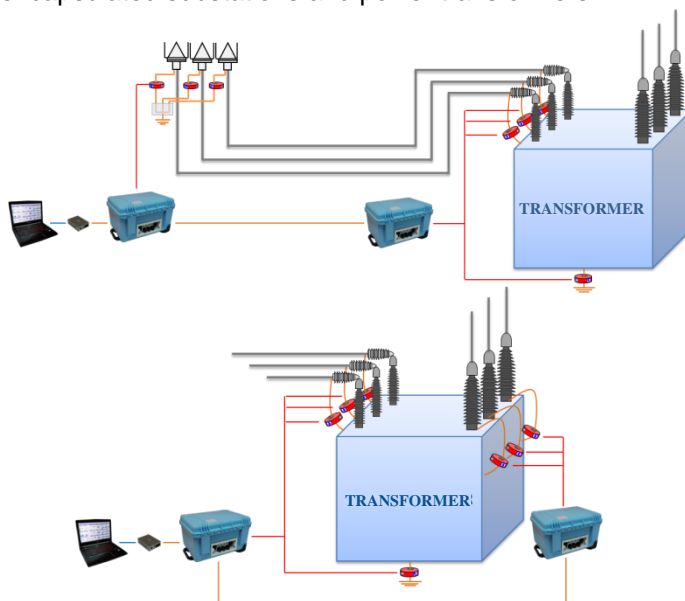


PD SUBSTATION & TRANSFORMER SOLUTION

Using two MS Plus Portable synchronized with optic fiber, a single operator can automatically detect and locate defects in encapsulated substations and power transformers.

Components

- 2 x MS Plus Portable
- 7 x HFCT Sensor
- 1 x Optic fiber ethernet converter
- 1 x Control and Analysis unit
- 1 x PD-Advanced Software license

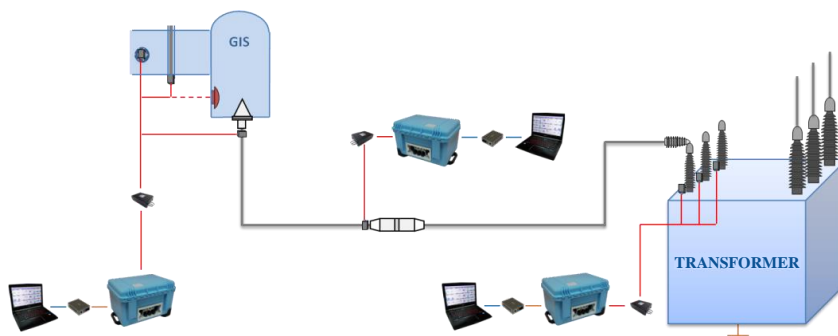


PD UHF SOLUTION

Solution for a precise location of defects in elements located at short distances. This solution permits identify the origin of the defect in GIS compartments and to ratify PD sources in cable accessories and transformer connections.

Components

- 1 x MS Plus Portable
- 3 x UHF Sensor
- 1 x UHF-HF Converter
- 1 x Optic fiber ethernet converter
- 1 x Control and Analysis unit
- 1 x PD-Plus Software License



SAFETY RECOMMENDATIONS

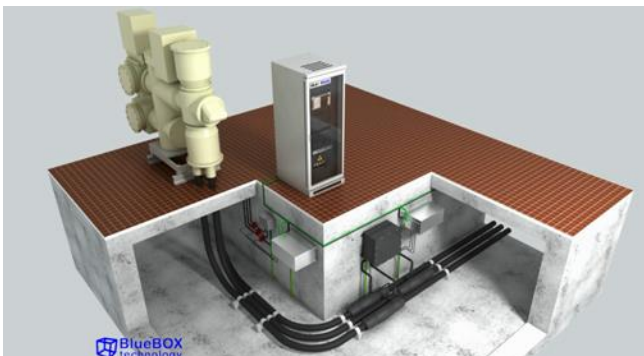
For any handling of the equipment, be sure to connect the equipment ground with the general reference ground before making any type of connection. For any type of interconnection between elements it is mandatory to use insulated gloves specific for the proper voltage.

It is advisable to keep the fiber optic connectors for communication and synchronization covered with their caps during storage. The accumulation of dust on the connectors may cause system crashes due to loss of optical signal.

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Contacto



DIAEL, S.L.

Phone: +34 911 392 579
www.diael.com

Sales

Mr. Santiago Alarcón
C/ de las Peñuelas, 38, Local 2
28005 Madrid (España)
Phone: +34 699 442 165
E-mail: santiago.alarcon@diael.com