



HRHU1444S-B

User & Installation Manual



Document History

[illegible]



About this manual

This manual describes installation, commissioning, operation and maintenance of the **Fiplex Five Band Remote Unit HRHU1444S-B**, and **Fiplex Control Software (FCS)**.

The first part of the manual describes the Fiber DAS hardware and the second part describes the software.

Hardware and software mentioned in this manual are subjected to continuous development and improvement. Consequently, there may be minor discrepancies between the information in the manual and the performance and design of the hardware and software. Specifications, dimensions and other statements mentioned in this manual are subject to change without notice.

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Abbreviations

AGC	Automatic Gain Control
AMPS	Advanced Mobile Phone Service
ARFCN	Absolute Radio Frequency Channel Number
BCCH	Broadcast Control Channel (GSM broadcast channel time slot)
BS	Base Station, BS antenna = towards the base station
CDMA	Code Division Multiple Access
DC	Direct Current
DCS	Digital Communication System (same as PCN)
DL	Downlink signal direction (from base station via Signal Booster / Master / Remote to mobile station)
DPLX	Duplex filter
EEPROM	Electrical Erasable Programmable Read Only Memory
EGSM	Extended Global System for Mobile communication
ETACS	Extended Total Access Communication System
ETSI	European Telecommunications Standard Institute
FCS	Fiplex Control Software
GSM	Global System for Mobile communication
HW	Hardware
LED	Light Emitting Diode
LNA	Low Noise Amplifier, uplink and downlink
MS	Mobile Station, MS antenna = towards the mobile station
OL	Overload
OMS	Operation and Maintenance System
PA	Power Amplifier
PCN	Personal Communication Network (same as DCS)
PCS	Personal Communication System
pFOMS	Portable Fiplex Operation and Maintenance Software
PS	Power Supply
RF	Radio Frequency
RSSI	Received Signal Strength Indication
SW	Software
UL	Uplink signal direction (from mobile station via Signal Booster / Master / Remote to base station)
WEEE	Waste of Electric and Electronic Equipment



Safety



Caution!

This manual lists a set of rules and warnings to be accomplished when installing, commissioning and operating a Fiber DAS Master Optical Unit from FIPLEX. Any omission may result in damage and/or injuries to the System and/or the System Operators or Users.

If an instruction is not clear or you consider is missing, please contact immediately to Fiplex. See www.fiplex.com for contact information.



Dangerous Voltage Warning

Any personnel involved in installation, operation or service of this equipment **must** understand and obey the following:

The power supply unit supplied from the mains contains dangerous voltage level, which can cause electric shock. Switch the mains off prior to any work in such equipment. Any local regulations are to be followed when servicing MOUs.

Authorized service personnel only are allowed to service repeaters while the main is switched on.



R&TTE Compliance Statement

This equipment complies with the appropriate essential requirements of Article 3 of the R&TTE Directive 1999/5/EC.



Station Ground

BTS chassis, MOU, feeders, donor antenna, service antenna/s and auxiliary equipment (splitters, tabs, .etc) are required to be bonded to protective grounding using the bonding stud or screw provided with each unit.



Electrostatic Discharge

Static electricity means no risk of personal injury but it can severely damage essential parts of the equipment, if not handled carefully.

Parts on the printed circuit boards as well as other parts in the unit are sensitive to electrostatic discharge.

Never touch printed circuit boards or uninsulated conductor surfaces unless absolutely necessary.

If you must handle printed circuit boards or uninsulated conductor surfaces, use ESD protective equipment. Never let your clothes touch printed circuit boards or uninsulated conductor surfaces.



Disposal of Electric and Electronic Waste

Pursuant to the WEEE EU Directive electronic and electrical waste must not be disposed of with unsorted waste. Please contact your local recycling authority for disposal of this product.



Class 1 Laser.

MOU1x Series is equipped with Class 1 Laser according to EN 60825-1.

Cautions:

Never look directly into the laser beam.

Never point a laser beam at a person.

Do not aim the laser at reflective surfaces.

Fibers carry transmission power in both direction due to the use of WDM

Never view a laser pointer using an optical instrument, such as binocular or a microscope.

Never handle non-dark fibers.

CLASS 1
LASER
PRODUCT



RF Exposure.

As a part of a Telecommunications System, MOU1x is not intended to radiate signals and meets EMC directives, but within the System may have cables and antennas that are potential sources of radiating. Contact the System Design to verify the compliance of the Exposure to Non-Ionising Radiation.



FCC Compliance

Part 90 and Part 20 Signal Booster

This is a 90.219 CLASS B DEVICE

WARNING: This **NOT** a **CONSUMER** device. It is designed for intallation by **FCC LICENSEES** and **QUALIFIED INSTALLERS**. You **MUST** have an **FCC LICENSE** or express consent of an FCC Licensee to operate ths device. You **MUST** register Part 90 Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may resul in significat forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.



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

ATTENTION: FCC regulation mandate that the ERP of type B signal boosters should not exceed 5W, therefore the maimum antenna gain should be 0dBi or less and maintain a minimum separation of 133.03cm from all persons.



Product Description

The HRHU1444S is a VHF, UHF Low, UHF Mid, UHF High and PS800 five band Fiber Remote Unit that transmits in the Downlink frequencies of:

VHF: 151-162MHz

UHF Low: 460.4-460.7MHz and 453-454MHz

UHF Mid: 482.5-484.2MHz

UHF High: 506.4-507.3MHz

PS800: 851-869MHz

And receives in the Uplink frequencies of:

VHF: 158-161MHz

UHF Low: 465.4-465.7MHz and 458-459MHz

UHF Mid: 485.7-487.2MHz

UHF High: 509.4-510.3MHz

PS800: 806-824MHz

The Digital Remote Unit is a RF-to-Fiber and Fiber-to-RF conversion system. These conversions are made using FPGA based Digital Signal Processing. It provides amplification to the RF signals needed to provide signal amplification into the target area.

Each band has separate filtering modules and amplifier modules, so no interference can be produced between the five systems.

Each band has a separate intermediate filtering. The intermediate filtering is done using FPGA based Digital Signal Processing that is capable of handling 24 filters in each one of the five Uplink bands and 24 filters in each one of the five Downlink bands.

The center frequency and BW of each one of the filters can be tuned via a software interface.

Each filter can be programmed to have different bandwidth. The user can select between the following different filters:

15KHz, 20KHz, 30KHz, 45KHz.

The advantages of using digital signal transportation over fiber are to avoid the addition of the fiber analog noise when it is used to transport analog signals. Along with this, the UL squelch of the Digital Remote Unit works not only per channel but also per time slot, this makes the Fiplex Digital DAS solution unique by its outstanding management of the UL noise.

This Remote Unit uses a heavy duty IP67/NEMA4X cabinet for outdoor usage, and it's designed to be wall mount or standard 19" rack (a special mounting kit has to be ordered)

For more details refer to the product datasheet.



Mechanical specifications

Product Parts

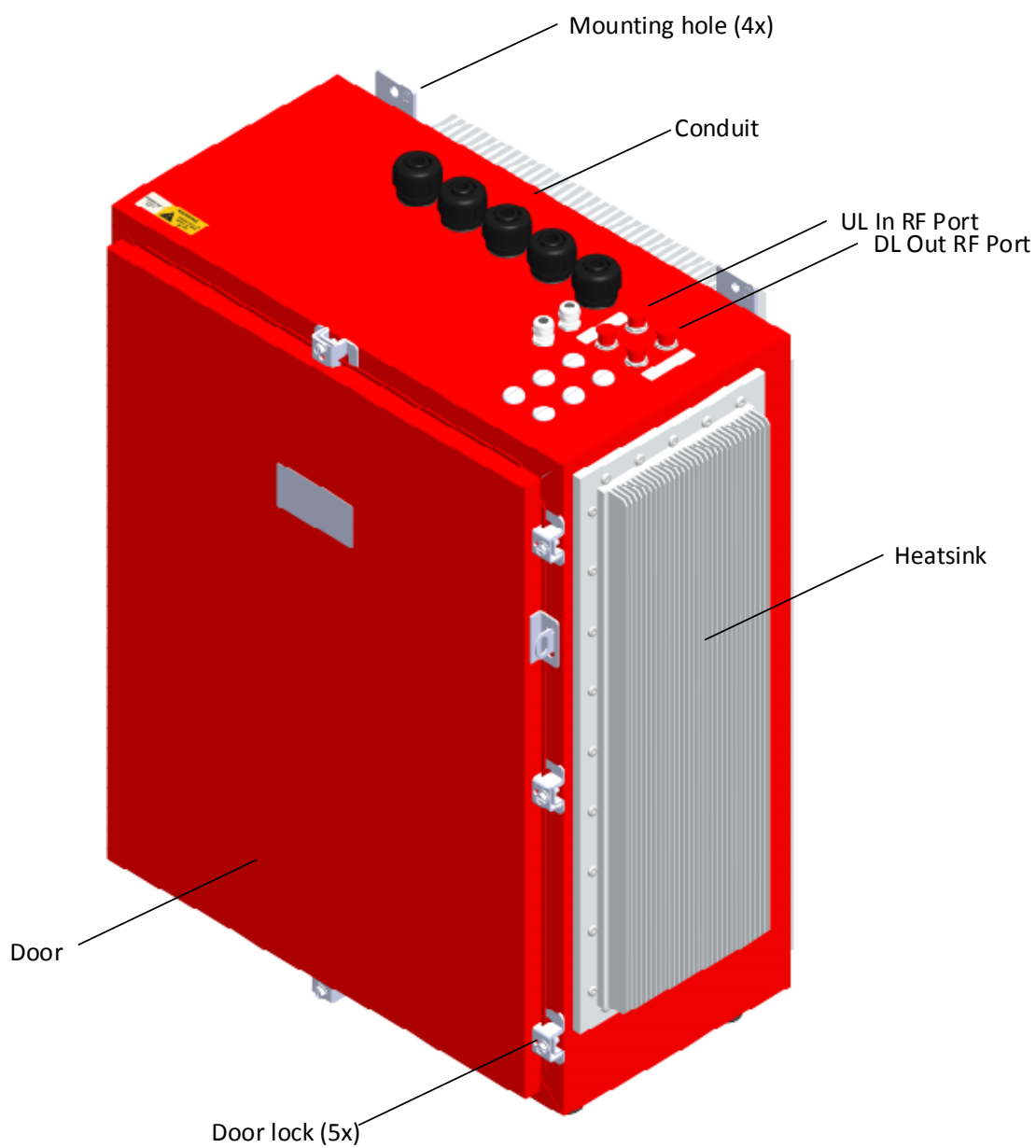


Figure: Product Parts



Product Dimensions

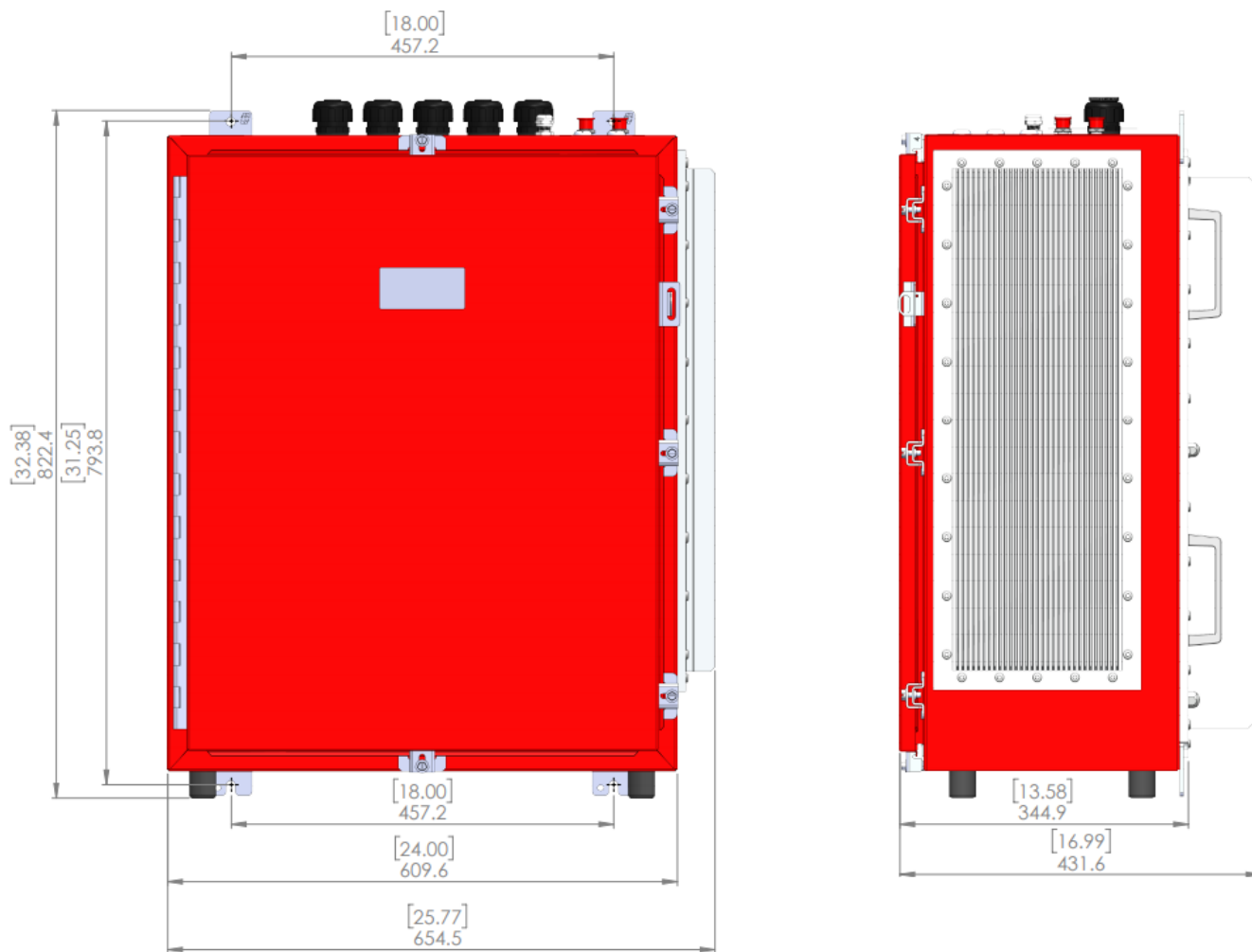


Figure: Dimensions in mm [in]



Installation

The Fiplex HRHU1444S is designed for outdoor usage with a weather proof outdoor NEMA4 cabinet that can be mounted without any kind of shelter from rain, snow or hail.

However, to improve reliability, it is recommended to mount the device on a site with shelter from direct exposure to sun, rain, snow and hailing.

It is not recommended to operate the device under bad weather conditions, such as:

- Intense rainfall, snowfall or hail
- Storm or high wind
- Extremely low or high temperature
- High humidity of the air

Mounting

A. This cabinet can be mounted on a wall.

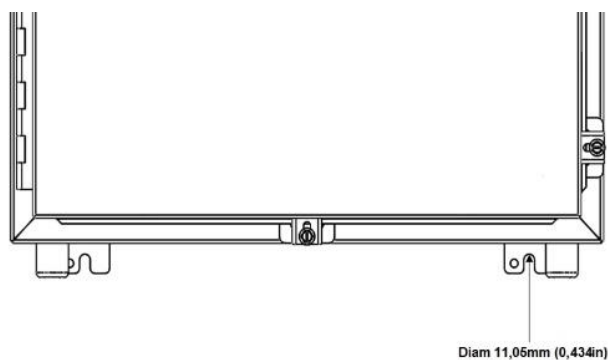


Figure: Secure Signal Booster / Master / Remote cover

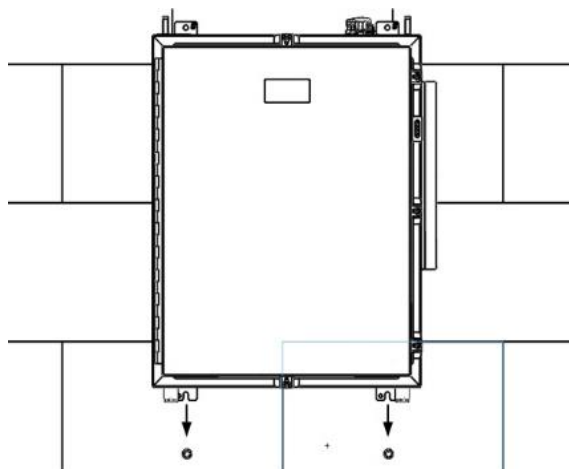


Figure: Hang the Signal Booster / Master / Remote

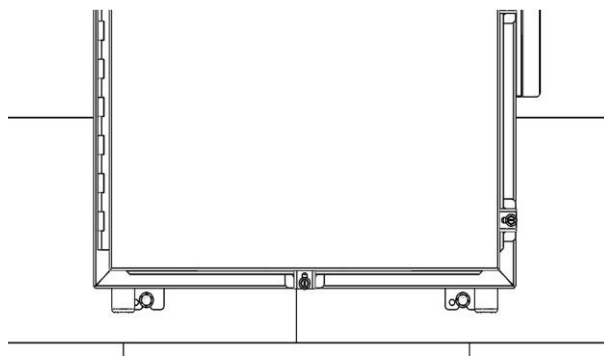


Figure: *Secure Signal Booster / Master / Remote cover*

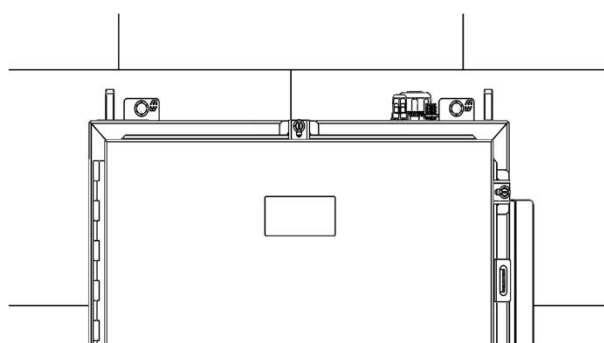


Figure: *Secure Signal Booster / Master / Remote cover*

Note: For 19in Rack mount, additional mounting kit has to be ordered.



FOr

B. To open the cabinet, release the door screws using a flat screw driver.

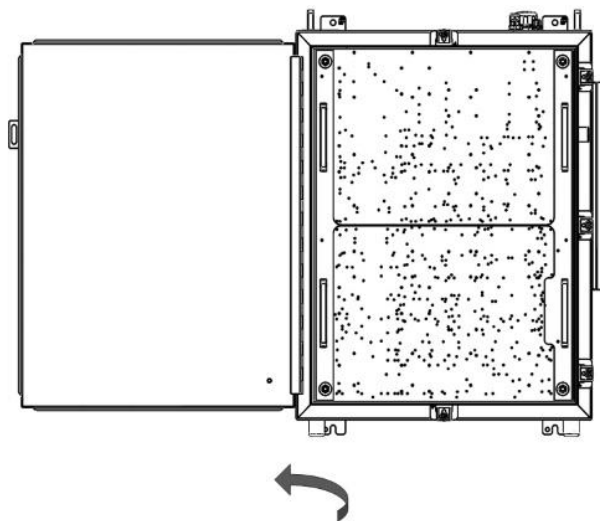


Figure: Open the Signal Booster / Master / Remote cover

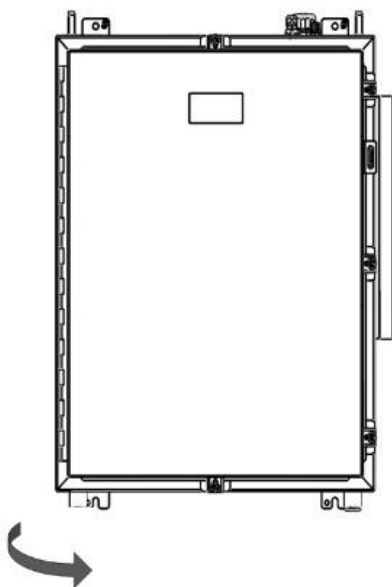


Figure: Close the Signal Booster / Master / Remote cover

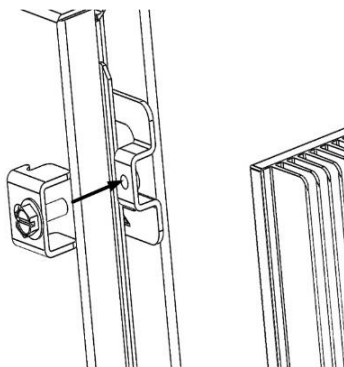


Figure: Secure Signal Booster / Master / Remote cover

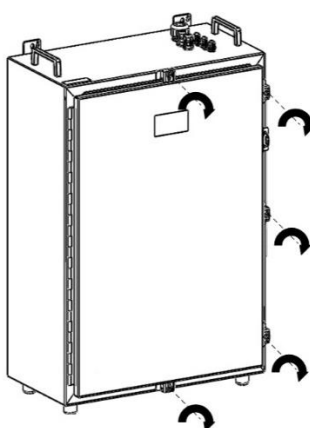


Figure: Secure Signal Booster / Master / Remote cover

Use of Liquid Tight Conduit

The unit has available a Liquid Tight Conduit Fitting connector for $\frac{3}{4}$ " tubes. The unit as standard has the connector installed, so if the user requires to use this connector, if available, the NFPA alarm cables, Ethernet, Fiber, DC or AC cables can be routed through this connector.

If the is not going to use Liquid Tight Conduits, then the connector should be replaced by the provided sealing cup.

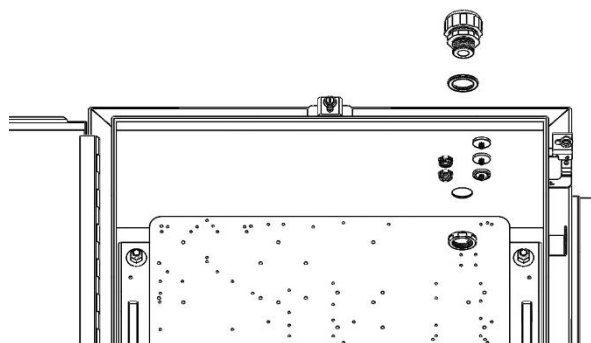




Figure: *Remove the conduit connector*

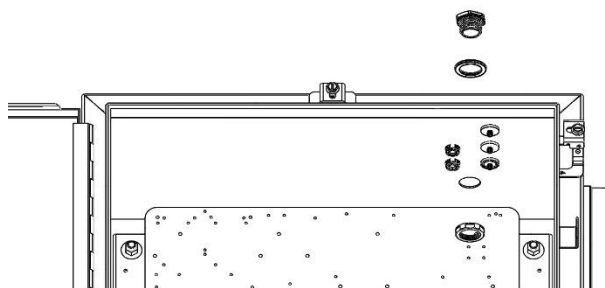


Figure: *Install the sealing cup*

Replacement of Conduit connector to sealing cup

NEMA4 considerations

This device is equipped with a NEMA4 enclosure, however, to ensure the NEMA rating, the user must have the following considerations:

1. Correct use of the Liquid Tight Conduit. In case this interface is not used, it should be replaced with the sealing cup.
2. Sealing cups should be installed in the non-used cable glands.
3. The RF Ports should be perfectly mated.





Commissioning

Connection step by step

Connect the RF ports, Power, Fibers and Ethernet Cable Glands location, for Master and Remote units following the next steps:

1. For Master Unit:

- a. Master Unit with duplexed configuration
 - i. Connect the signal coupled from the base station to the "To Base" RF port. N type female connectors are used in the unit. The coupling to Base station can be done with a Donor antenna or through a POI.
 - ii. Connect fiber cables to internal optical modules. LC-APC connectors are used in the unit. Connect the remote units on the dedicated ports.
 - iii. Connect USB Cable for local management.
- b. Master Unit with non-duplexed configuration
 - i. Connect the signal coming through the external duplexer using the "UL Out" and "DL in" RF ports. N type female connectors are used in the unit.
 - ii. Connect fiber cables to internal optical modules. LC-APC connectors are used in the unit. Connect the remote units on the dedicated ports.
 - iii. Connect USB Cable for local management.

2. For Remote Unit:

- c. Remote Unit with duplexed configuration
 - i. Connect service antenna ("RF To Mobile" port) coaxial cable to remote unit. N type female connectors are used in the unit.
 - ii. Connect fiber cable to internal optical module. LC-APC connector is used in the unit.
- d. Remote Unit with non-duplexed configuration
 - i. Connect the remote unit to the external duplexer using the "DL Out" and "UL In" RF Ports. N type female connectors are used in the unit.
 - ii. Connect fiber cable to internal optical module. LC-APC connector is used in the unit.

3. Once RF ports of the unit are properly loaded connect the Main Power the AC or DC source depending on the model.

If using the AC model, electrical installation must provide differential and thermo-magnetic breaker elements according to electric safety international regulations.

If using the DC model, the Main Power cable provided with the unit has three poles:

- The Green cable is connected to the chassis.
- The Blue cable should be connected to the most positive source tension.
- The Brown cable should be connected to the most negative source tension.

For -48VDC supply voltage, connect the 0V(GND) reference to the Green and Blue cable, and the -48VDC to the Brown cable.

For +48VDC supply voltage, connect the 0V(GND) reference to the Green and Brown cable, and the +48VDC to the Blue cable.

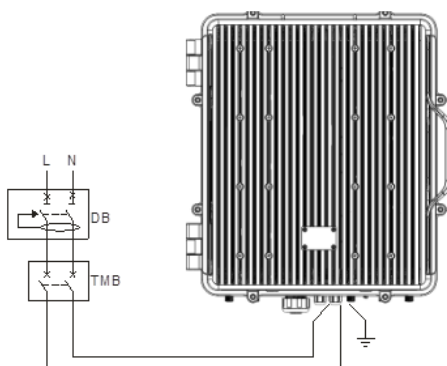


Figure: *Connect the main AC power*

4. Once the unit has been connected to the power source, it takes about 30 seconds to run a booting routine. After that time unit is ready to be connected via USB cable to the Digital Master to a computer running Fiplex Control Software (FCS) in order to be properly configured.



Starting Operation



BE SURE THAT “TO MOBILE” AND “TO BASE” PORTS ARE PROPERLY LOADED EITHER WITH 50 OHMS DUMMY LOADS, OR RADIATING SYSTEM.

The Digital Signal Booster may come in one out of two versions: a 32 narrow-band filters version or an up-to-8 adjustable-bandwidth filters version. It is even possible to have both versions in one device so that the user can choose either of them. Depending on which version is actually running, the main screen of the Fiplex Control Software will have a slightly different look.

1. Turn on the Digital Master Unit, connect computer to repeater through USB cable, and run Fiplex Control Software. Check that all remote units are connected to the master through fiber optic checking link status.

The screenshot displays the Fiplex Control Software interface for a Digital Fiber DAS Master. The interface is divided into several sections:

- Left Sidebar:** Contains navigation options: Content, Status, Tags, IP, Download Spectrum, Date & Time, Configuration, Apply Changes, Reload Settings, and Version.
- Master Fiplex Section:**
 - RF IN from Base Station (DL):** Power: -71.4 dBm, Overflow: No Signal, Attenuator: 0 dB.
 - RF OUT to Base Station (UL):** Power: -44.0 dBm, AGC: 0.0 dB, Attenuator: 0 dB.
 - BOARD STATUS:** Temperature: 42 °C, Signal Processor: RESET.
 - DOWNLINK FILTERING:** Enable: ☒, Squelch: ☒, Threshold: -80 dBm, Show channels: ☒.
 - Channel List:**

Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det	Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det
1	<input checked="" type="checkbox"/>	177.500000	0	90	-71.8	-71.8	2	<input checked="" type="checkbox"/>	176.500000	0	90	-118.9	-118.9		
3	<input checked="" type="checkbox"/>	178.500000	0	90	-117.9	-117.9									
- Link status Section (highlighted with a red box):**
 - EXPANSOR LINK 1: ☒
 - REMOTE LINK 1: ☒
 - REMOTE LINK 2: ☒
 - REMOTE LINK 3: ☒
 - REMOTE LINK 4: ☒
 - REMOTE LINK 5: ☒
 - REMOTE LINK 6: ☒
 - REMOTE LINK 7: ☒
 - REMOTE LINK 8: ☒
 - REMOTE LINK 9: ☒
 - REMOTE LINK 10: ☒
 - REMOTE LINK 11: ☒
 - REMOTE LINK 12: ☒
- Remote FIPLEX7 Section:**
 - RF IN from terminal (UL):** Power: -99.3 dBm, Overflow: ☒, Gain (UL: M ← R): 80 dB.
 - RF OUT to terminal (DL):** Power: 14.4 dBm, Gain (DL: M → R): 80 dB, AGC: 0.0 dB.
 - POWER AMPLIFIER:** Enabled: ☒, RF ON button, Attenuator: 0 dB.
 - BOARD STATUS:** Temperature: 39 °C, Signal Processor: RESET.
 - UPLINK FILTERING:** Enable: ☒, Squelch: ☒, Threshold: -100 dBm.
 - REMOTE LINK 1 REMOTE MASTER:**

Frequency Sync	Status	Rx Detect	Error Count
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8 0



2. Enable channel filtering if needed and setup desired channel frequencies. If Fiplex Digital Fiber DAS is used as channel selective, user has to know what frequencies are used in base station. Each channel can be enabled independently. Channels not used can be showed / hidden using the "Show channels" checkboxes. If remote units are on and connected through optical fiber, the corresponding uplink frequencies will be automatically set, too.

Set number of active channels and frequencies

Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det	Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det
1	<input checked="" type="checkbox"/>	177.500000	0	90	-71.8	-71.8	2	<input checked="" type="checkbox"/>	176.500000	0	90	-118.9	-118.9		
3	<input checked="" type="checkbox"/>	178.500000	0	90	-117.9	-117.9									

3. According to DL RF input levels, program input attenuator to avoid input overflow, and output attenuator for each remote to obtain desired output level in each remote.

Set Input attenuator

Set Output attenuator

POWER AMPLIFIER

Enabled ☒ RF ON

Attenuator 0 dB



4. Reciprocally, set UL band gain adjusting output attenuator of master unit. It is recommended that DL gain and UL gain be equal.

The screenshot shows the Fiplex Control Software interface for a Digital Fiber DAS Master. The Master unit settings are displayed at the top, and the Remote unit settings are shown below. The Master unit settings include RF IN from Base Station (DL), RF OUT to Base Station (UL), and DOWNLINK FILTERING. The Remote unit settings include RF IN from terminal (UL), RF OUT to terminal (DL), and UPLINK FILTERING. The interface also shows a list of Remote Links and a list of Expansor Links.

Master Fiplex

RF IN from Base Station (DL)

Power: -71.4 dBm
Overflow: No Signal
Attenuator: 0 dB

RF OUT to Base Station (UL)

Power: -44.0 dBm
AGC: 0.0 dB
Attenuator: 0 dB

DOWNLINK FILTERING

Enable: ☒ Squelch: ☒ Threshold: -80 dBm

Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det	Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det
1	<input checked="" type="checkbox"/>	177.500000	0	90	-71.8	-71.8		2	<input checked="" type="checkbox"/>	176.500000	0	90	-118.9	-118.9	
3	<input checked="" type="checkbox"/>	178.500000	0	90	-117.9	-117.9									

Remote FIPLEX7

RF IN from terminal (UL)

Power: -99.3 dBm
Overflow: No Signal
Gain (UL: M ← R): 80 dB

RF OUT to terminal (DL)

Power: 14.4 dBm
Overflow: No Signal
Gain (DL: M → R): 80 dB

UPLINK FILTERING

Enable: ☒ Squelch: ☒ Threshold: -100 dBm

5. Set up squelch settings. Controls are independent in UL (for each remote) and DL (master) bands. Typical values for UL are between -110dBm and -100dBm for squelch threshold. For DL, recommended value for squelch threshold is minimum level received in any active channel minus 10dB.

The screenshot shows the Fiplex Control Software interface for a Digital Fiber DAS Master. The Master unit settings are displayed at the top, and the Remote unit settings are shown below. The Master unit settings include RF IN from Base Station (DL), RF OUT to Base Station (UL), and DOWNLINK FILTERING. The Remote unit settings include RF IN from terminal (UL), RF OUT to terminal (DL), and UPLINK FILTERING. The interface also shows a list of Remote Links and a list of Expansor Links.

Master Fiplex

RF IN from Base Station (DL)

Power: -71.4 dBm
Overflow: No Signal
Attenuator: 0 dB

RF OUT to Base Station (UL)

Power: -44.0 dBm
AGC: 0.0 dB
Attenuator: 0 dB

DOWNLINK FILTERING

Enable: ☒ Squelch: ☒ Threshold: -80 dBm

Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det	Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det
1	<input checked="" type="checkbox"/>	177.500000	0	90	-71.8	-71.8		2	<input checked="" type="checkbox"/>	176.500000	0	90	-118.9	-118.9	
3	<input checked="" type="checkbox"/>	178.500000	0	90	-117.9	-117.9									

Remote FIPLEX7

RF IN from terminal (UL)

Power: -99.3 dBm
Overflow: No Signal
Gain (UL: M ← R): 80 dB

RF OUT to terminal (DL)

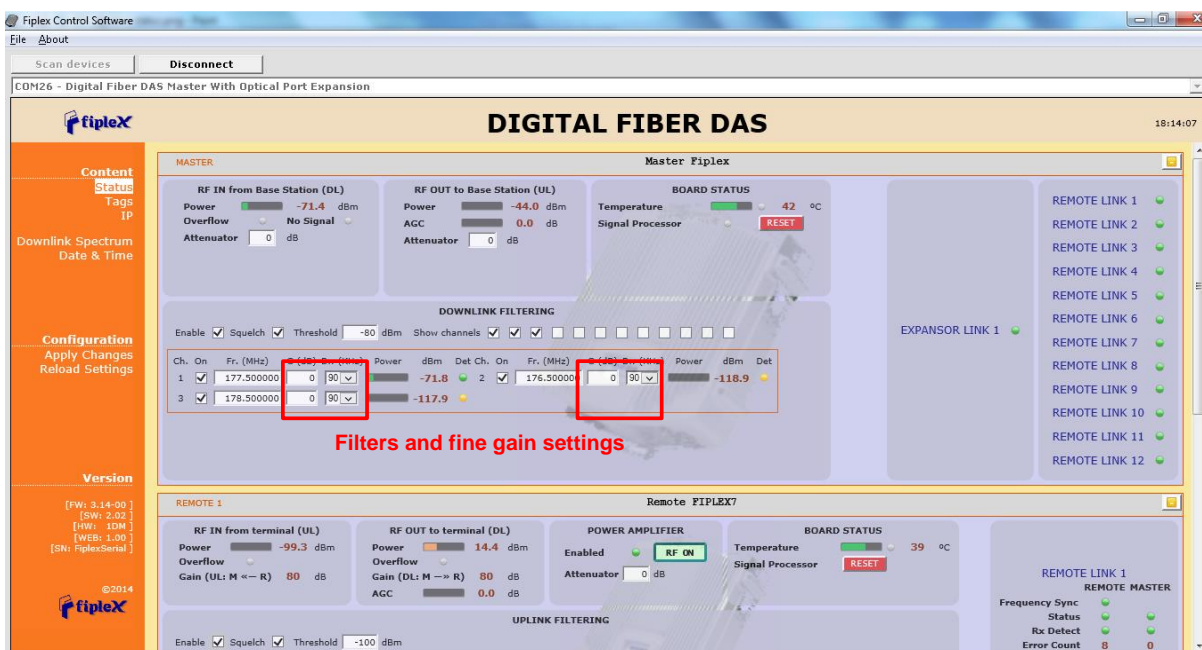
Power: 14.4 dBm
Overflow: No Signal
Gain (DL: M → R): 80 dB

UPLINK FILTERING

Enable: ☒ Squelch: ☒ Threshold: -100 dBm



- Setup desired filter bandwidth, depending on presence of adjacent channels. In principle, recommended bandwidth filter is 90KHz due to its low delay, but if adjacent signal is detected, narrow filters can be used. Fine gain can be set to equalize input signals.



Status Indicators

There is an indicator panel located at the front panel of the repeater. This led panel works as a status monitor, in order indicate warning or alarms of device.

There are four LEDs, first one the power ON indication led, labelled “PWR”.


A Second LED, labelled “STS” summarizes warnings regarding critical operational conditions of the device.

Third and fourth LED summarizes operational conditions for uplink “UL” and downlink “DL” chains.

In general, LEDs has four states: off, slow blinking, fast blinking, on. Table 1 describes alarm and warning conditions for each led state in the Master Unit and Table 2 is for Remote Unit.



Table 1

Indicator Panel	LED indication description
	Unit is not powered or fail in power supply

















	Normal state: Unit is powered on
	Normal state
	HW fail: digital signal processor is not detected Temperature: very high internal unit temperature Optical fiber alarm in at least one link
	TBS Warning: No signal is detected coming from base station
	Normal state
	RF input overflow: maximum level at RF input is exceeded
	Normal state
Where:	
	Led OFF
	Led slow blinking with period of 2 seconds aprox. WARNING
	Led fast blinking with period of 0.5 seconds aprox. ALARM
	Led ON

Table 2

Indicator Panel	LED indication description
	Unit is not powered or fail in power supply
	Normal state: Unit is powered on
	Normal state
	HW fail: digital signal processor is not detected Temperature: very high internal Unit temperature Optical fiber alarm in at least one link



	Normal state
	PA Overflow or excessive temperature alarm.
	PA Underflow: PA output level is lower than +25dBm
	Normal state
Where:	
	Led OFF
	Led slow blinking with period of 2 seconds aprox. WARNING
	Led fast blinking with period of 0.5 seconds aprox. ALARM
	Led ON

Laboratory Measurement

For specific parameters verification and laboratory tests, please contact factory.

Detailed procedures, recommended tests set up, and a knowledge engineering team will bring adequate support to perform this measurements in a comfortable and safely way.



Software

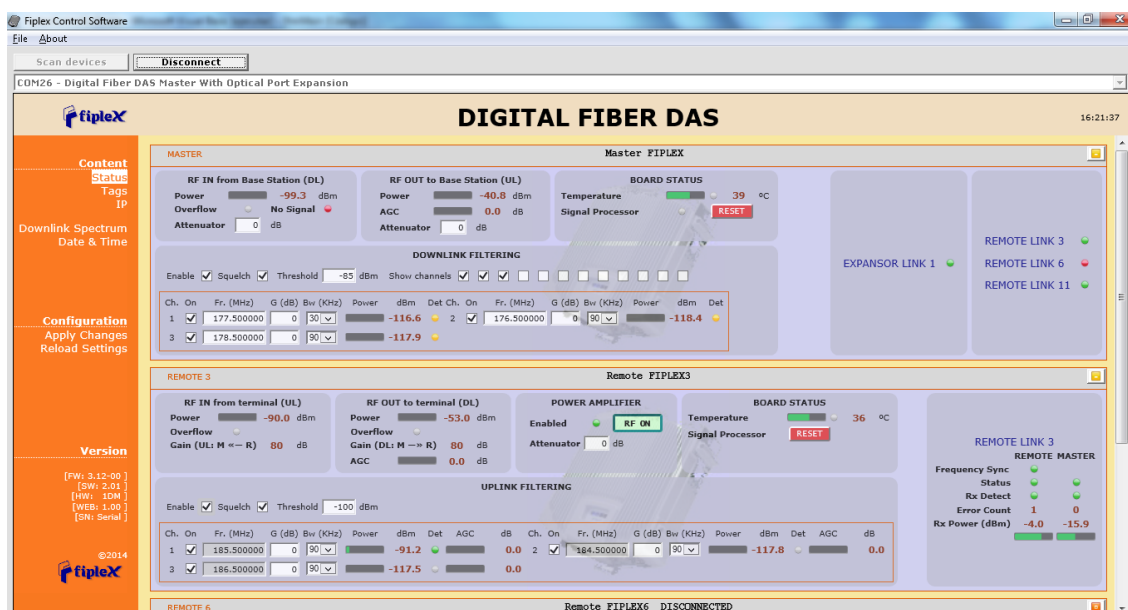
Introduction

Fiplex Fiber DAS can be fully configured and monitored through USB connection. Digital Master unit receives through optical links monitoring and configuration data from remotes units. For this reason, whole system can be fully configured and supervised from digital master unit.

USB Software

Software description (Digital Master)

If software has been successfully installed and connected to Digital Master (see section 0) status screen will appear. In this screen, RF configurations parameters (channel frequencies, bandwidth filter, gains / attenuation) and RF and optical links monitoring (RF input/output levels, AGC status, optical link status) are shown.



At left side of webpage, configuration menus are shown:

- Content
 - Status: whole RF configuration and monitoring parameters are shown. These parameters are described in next section.
 - Tag: user can set a tag to ease repeater identification. For modifying the TAG, write a new value in text field and click over Apply Changes link



fiplexX

Content
Status
Tags
IP
Downlink Spectrum
Date & Time

TAGS

MASTER	Master FIPLEX
EXPANSOR 1	Expansor FIPLEX1
REMOTE 3	Remote FIPLEX3
REMOTE 6	Remote FIPLEX6
REMOTE 11	Remote FIPLEX11

- IP: At this page (for units with Ethernet supervision), IP addresses configuration and addresses of SNMP Managers are shown. User can set addresses of two SNMP Managers (IP where SNMP agent will send TRAP information). To modify, click over Apply Changes link after writing new values on text fields. Also router 3G IP address can be viewed in this screen (if 3G router option is installed)

fiplexX

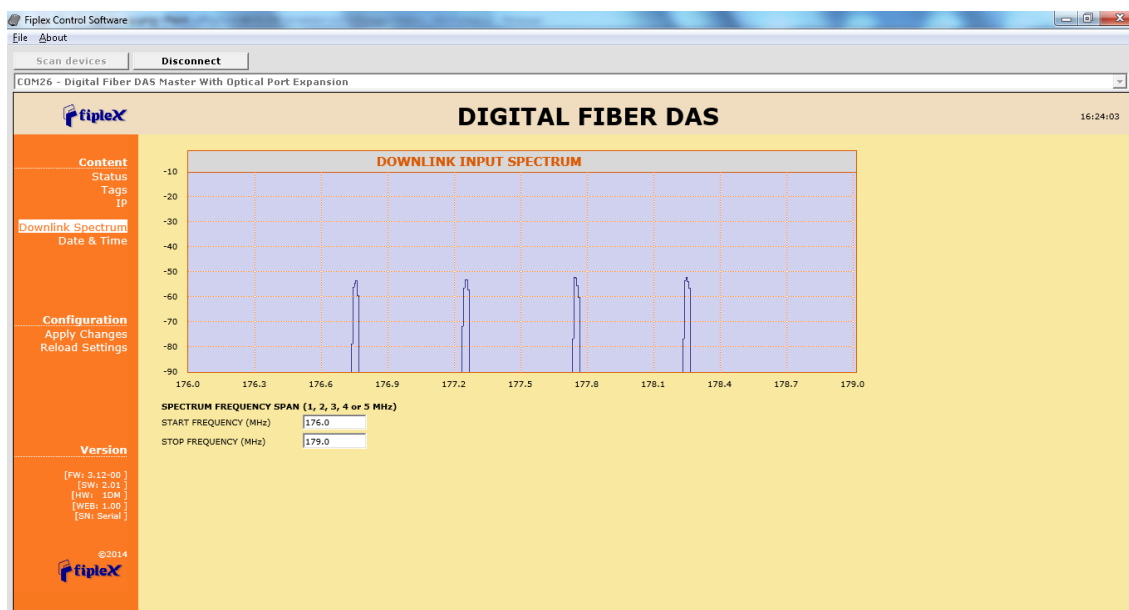
Content
Status
Tags
IP
Date & Time

IP SETTINGS

IP	192	168	1	10
NET MASK	255	255	255	0
GATEWAY	192	168	1	2
SNMP Manager 1	192	168	1	15
SNMP Manager 2	172	18	21	2

Configuration
Apply Changes
Reload Settings

- Downlink Spectrum: in order to know input signal: level of desired channels, unwanted channel levels, Digital Master provides an spectrum analyzer that shows input signal in frequency domain.

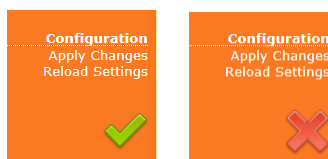




- Date & Time (for units with Ethernet supervision): page to modify real time clock. When the repeater is not powered, this clock runs with a voltage supply provided by a 3V lithium battery, button type of 20mm (CR2032) with 220mA-h. This suffices for at least half year. When the repeater is powered, no current is drained from the battery. So, actual battery life will depend on repeater usage. For battery replacement, please locate battery holder between USB and Ethernet connectors on main board. Battery positive side is UP, i.e. on holder clip.

After clicking on “Apply Changes” link, next message will appear, warning the user that system needs to be rebooted.

- Configuration
 - Apply Changes: as it is said above, this link is used to load changes to the repeater, in configuration, tag, IP, password and date and time menus. After any configuration change, web page will show and icon that allows user to know if configuration has been successfully applied:



- Reload Settings: clicking this link, repeater configuration data is refreshed.
- Version: shows hardware, firmware and software versions of repeater and serial number.

RF parameters description (Digital Master)

“Status” menu shows whole RF configuration and RF and optical links monitoring data that are distributed along the webpage.

The first frame called “MASTER” is placed in top of webpage, showing configuration of digital master unit. Below this, some frames titled “REMOTE 1”, “REMOTE 2”... . There is one for each remote unit connected to the master, and configuration and status information related to each remote can be viewed. Next figures show these frames:



MASTER Master FIPLEX

RF IN from Base Station (DL)
Power -99.3 dBm
Overflow No Signal
Attenuator 0 dB

RF OUT to Base Station (UL)
Power -40.8 dBm
AGC 0.0 dB
Attenuator 0 dB

BOARD STATUS
Temperature 39 °C
Signal Processor
RESET

DOWNLINK FILTERING
Enable ☒ Squelch ☒ Threshold -85 dBm Show channels ☒ ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det	Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det
1	<input checked="" type="checkbox"/>	177.500000	0	30	-116.6			2	<input checked="" type="checkbox"/>	176.500000	0	90	-118.4		
3	<input checked="" type="checkbox"/>	178.500000	0	90	-117.9										

EXPANSOR LINK 1 ☒
REMOTE LINK 3 ☒
REMOTE LINK 6 ☐
REMOTE LINK 11 ☒

- Digital Master frame. There are five sub-sections inside this frame:

DOWNLINK FILTERING

Enable ☒ Squelch ☒ Threshold -85 dBm Show channels ☒ ☒ ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det	Ch.	On	Fr. (MHz)	G (dB)	Bw (KHz)	Power	dBm	Det
1	<input checked="" type="checkbox"/>	177.500000	0	30	-116.6			2	<input checked="" type="checkbox"/>	176.500000	0	90	-118.4		
3	<input checked="" type="checkbox"/>	178.500000	0	90	-117.9										

- Downlink filtering: this section contains fields to modify channel frequencies, squelch options and filtering options. Parameters are described in following table:

Parameter	Range	Description
Frequency	Downlink band	Downlink frequency channels. Frequency resolution is 3.125KHz
Channel enable	Enabled / disabled	Each of 12 channels can be enabled/disabled
Bw Filter	90KHz / 45KHz / 30KHz / 20KHz / 15KHz	Bandwidth of channels filter can be independently adjusted (if filtering is enabled)
Fine Gain Adjust	-5 to +5dB	If filtering is enabled, gain of each channel can be fine adjusted
Power indicator	---	Level of each channel, measured according to its bandwidth filter, is shown in dBm units. Led indicator shows if levels exceeds squelch threshold (green) or not (yellow).
Squelch enable control	Enabled / disabled	Enabling this control, repeater does not transmit in each channel if RF input power do not exceed the threshold level configured according to next row
Squelch threshold control	-90dBm to 40dBm	If squelch is enabled, input levels below this threshold are not transmitted.
Filtering enable	Enabled / disabled	Filtering option can be bypassed. If filtering is disabled, fine gain adjustments and squelch options are ignored

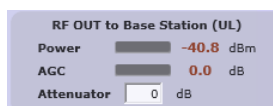
RF IN from Base Station (DL)

Power -99.3 dBm
Overflow No Signal
Attenuator 0 dB



- Master RF Input parameters. Next table describes information of this frame:

Parameter	Range	Description
Broad band level	---	This indicator shows input level measured along DL band
Overflow	Grey: normal state / Red: alarm state	This indicator shows overflow on input circuitry is occurring. This condition can be avoided increasing input attenuator
Input Attenuator - RF IN from TBS (DL)	0dB to 30dB	Input attenuator to accommodate input levels. This value must be set to avoid overflow condition. Together with output attenuator of remotes sets the downlink gain: $G_{DL} (dB) = 80 - AttIN_{master}(dB) - AttOUT_{remote}(dB)$



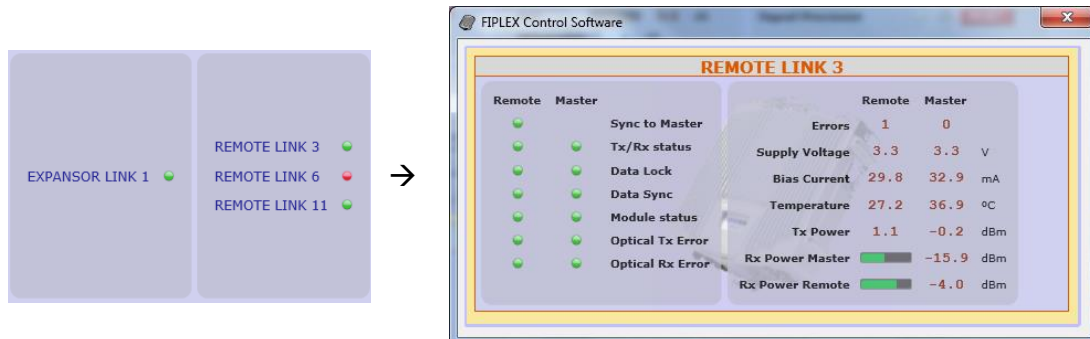
- Master RF Output parameters. Next table describes information of this frame:

Parameter	Range	Description
UL Output power	---	This indicator shows output level in UL band
AGC	Grey: normal state / Red: alarm state	This indicator shows gain reduction that master unit is applying at RF output to prevent PA UL overload
Output Attenuator RF OUT to Base Station (UL)	0dB to 30dB	Output attenuator to adjust UL gain. System UL gain can be computed as: $G_{UL} (dB) = 80 - AttOUT_{master}(dB)$

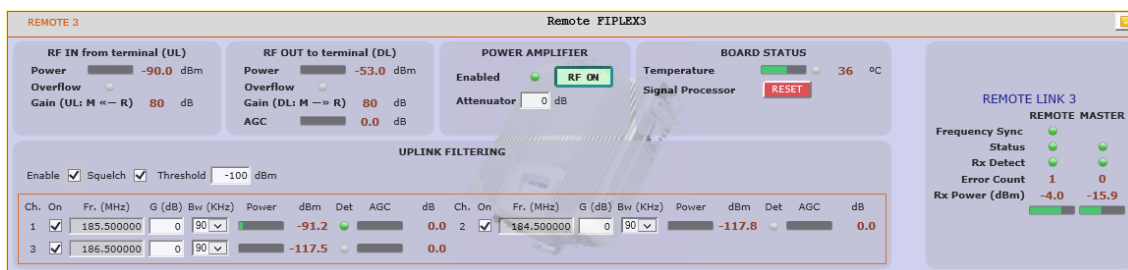


- Master Board status: general parameters of master unit are contained in this frame

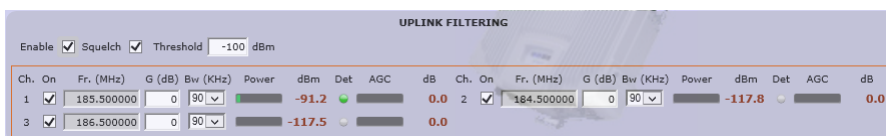
Parameter	Range	Description
Temperature	---	This indicator shows unit temperature
High temperature alarm	Grey: normal state / Red: alarm state	High temperature alarm condition is indicated with this led.
Signal processor alarm	Grey: normal state / Red: alarm state	Alarm indicates that digital signal processor is not working properly.
RESET control	---	With this control, unit can be restarted



- Optical link status: each indicator shows optical link status between digital master and each remote unit. Clicking on “REMOTE LINK n” detailed monitoring data of each optical link can be viewed: voltage, current and temperature of each optical module, transmitted and received optical power, and alarms related to digital data recovery system



- Remote frame: shows configuration and monitoring information of each remote unit. The frame is divided in the following sections:

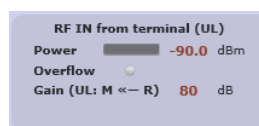


- Uplink filtering: this section shows equivalent parameters of downlink filtering of master unit.

Parameter	Range	Description
Frequency	UL band	Uplink frequency channels. These frequencies are derived automatically from downlink frequencies, taking into account frequency separation between DL and UL bands
Channel enable	Enabled / disabled	Each of 12 channels can be enabled/disabled
Bw Filter	90KHz / 45KHz / 30KHz / 20KHz / 15KHz	Bandwidth of channels filter can be independently adjusted (if filtering is enabled)

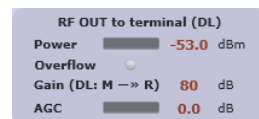


Fine Gain Adjust	-5 to +5dB	If filtering is enabled, gain of each channel can be fine adjusted
Power indicator	---	Level of each channel, measured according to its bandwidth filter, is shown in dBm units. Led indicator shows if levels exceeds squelch threshold (green) or not (yellow).
AGC	---	Show gain reduction to prevent overloading in AGC per channel
Squelch enable control	Enabled / disabled	Enabling this control, repeater does not transmit in each channel if RF input power do not exceed the threshold level configured according to next row
Squelch threshold control	-110dBm to -70dBm	If squelch is enabled, input levels below this threshold are not transmitted.
Filtering enable	Enabled / disabled	Filtering option can be bypassed. If filtering is disabled, fine gain adjustments and squelch options are ignored



- Remote RF Input parameters. Next table describes information of this frame:

<i>Parameter</i>	<i>Range</i>	<i>Description</i>
Broad band level	---	This indicator shows input level measured in UL band
Overflow	Grey: normal state / Red: alarm state	This indicator shows overflow on input circuitry is occurring.
Uplink gain from remote to master	--	Shows system uplink gain for each remote. Can be calculated as: $G_{UL} (dB) = 80 - AttOutMaster(dB)$



- Remote RF Output parameters. Next table describes information of this frame:

<i>Parameter</i>	<i>Range</i>	<i>Description</i>
Output power level	---	This indicator shows the PA output power

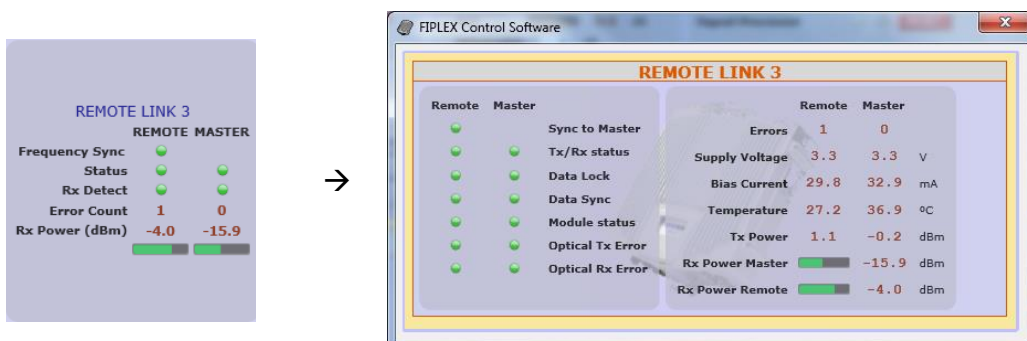


PA Overflow	Grey: normal state / Red: alarm state	Indicates that PA is overloaded. Condition is output power higher than +43dBm
Downlink gain from master to remote	---	Shows downlink gain for each remote. Can be calculated as: $G_{DL} (dB) = 80 - AttInMaster(dB) - AttOutRemote(dB)$
AGC	---	Shows gain reduction applied in DL band signal to prevent PA overload



- RF on/off control and Board Status:

Parameter	Range	Description
RF on/off Indicator	Green: RF Enabled / Red: RF Disabled	This indicator shows PA status. Power amplifier can be automatically disabled if other alarm conditions occurs: a) Fail in optical link b) PA Overflow
RF Enable Control	On / Off	With this control RF DL and UL chains can be disabled
Output attenuator	0 to 40dB	This control sets the output attenuation used to set DL gain together with Master Input Attenuator
Temperature	---	This indicator shows unit temperature
High temperature alarm	Grey: normal state / Red: alarm state	High temperature alarm condition is indicated with this led.
RESET control	---	With this control, unit can be restarted





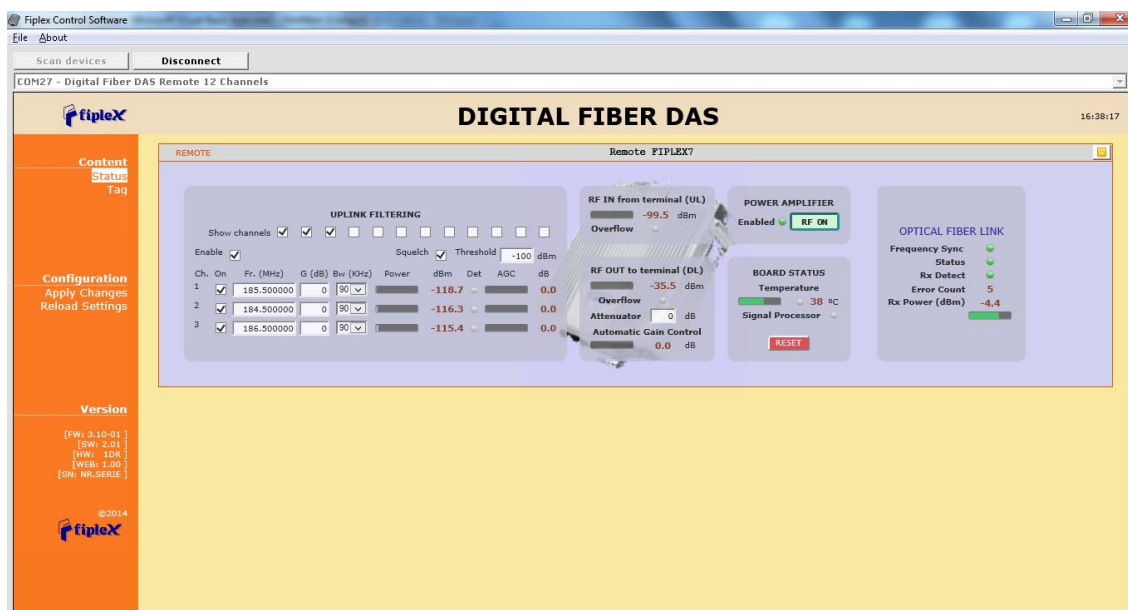
- Optical link status: shows optical link status between master and each remote unit. Moreover, clicking on “REMOTE LINK n” detailed monitoring data of each optical link can be viewed: voltage, current and temperature of each optical module, transmitted and received optical power, and alarms related to digital data recovery system. The main window shows only general parameters:

Parameter	Range	Description
Frequency Sync	Green: Normal state / Red: Alarm state	This indicator shows frequency synchronization status between master and remote unit
Status	Green: Normal state Yellow: Warning state Red: Alarm state	This indicator summarizes the status of optical module based in voltage, current, temperature and optical transmitted power
Rx Detect	Green: Normal state Yellow: Warning state Red: Alarm state	This indicator summarizes the status of optical reception based in received optical power and digital data recovery system
Error Count	---	Counter that it is incremented when optical link fails.
Rx Power	---	Shows optical received power. For reliable optical link, RX power must be higher than -25dBm

Software description (Remote Unit)

While software connected to digital master allows configuration and monitoring of whole system, if software is connected to remote unit, only parameters of this unit can be viewed / modified.

Then, status screen of remote unit only shows information regarding this unit:





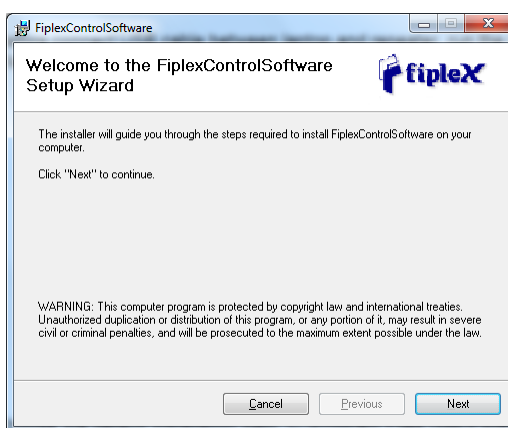
Distribution and meaning of the controls contained in status page are very similar to single remote frame of master status page, only optical frame is different due to only remote side of optical link is monitored.

Local Software. Installation and troubleshooting

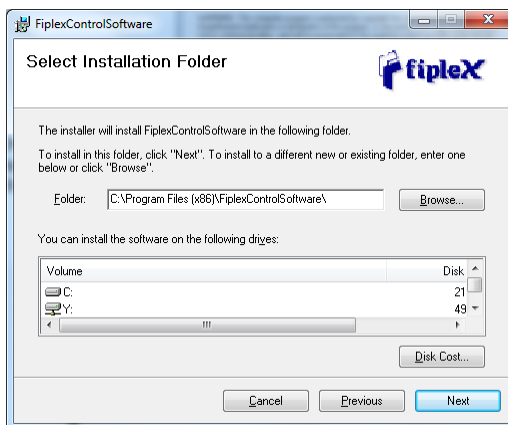
Installation

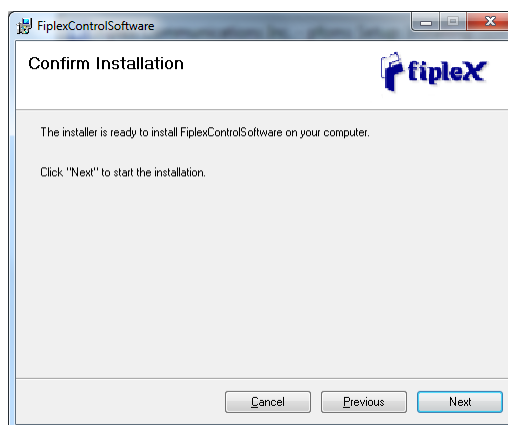
The following section will describe the steps to be followed in order to install and use the Fiplex Control software with your Fiplex repeater.

1. Before connect USB cable between computer and repeater, run the FiplexControlSoftware.msi File. Next screen will appear...

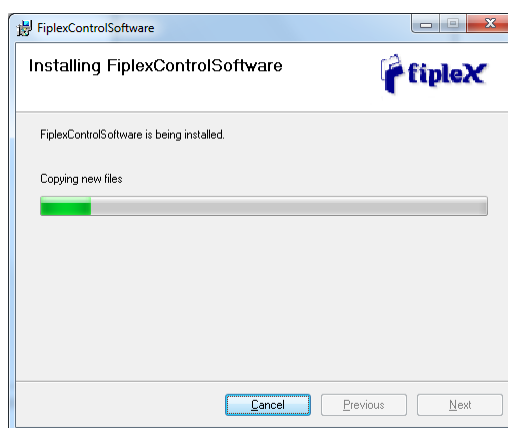


2. Choose the default installation path "C:\Program Files (x86)\FiplexControlSoftware". Note that this can change according to your system configuration (32bits or 64bits), language and Windows Version.

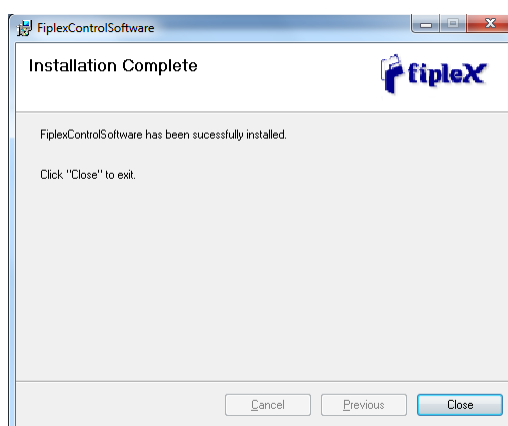




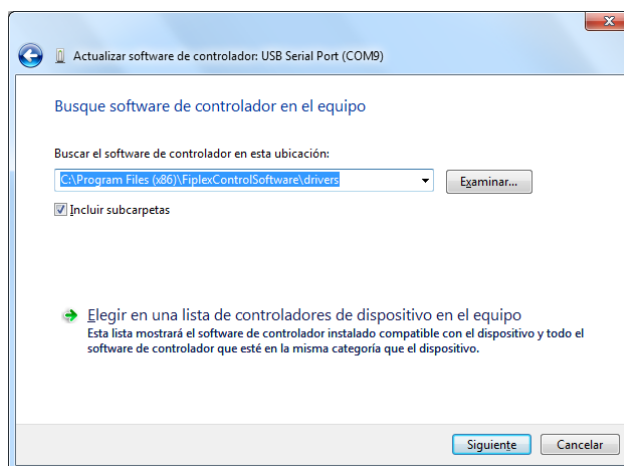
3. The installer will start to copy the necessary files.



4. After installation has completed, a shortcut in user desktop will appear.



5. Connect USB cable between computer and repeater, keeping the repeater powered off. Usually, drivers will be automatically installed, but depending on Windows version, screen asking for drivers of new device can appear. Drivers can be found in application folder: C:\Program Files (x86)\FiplexControlSoftware\drivers".



6. Turn on the Repeater



BE SURE THAT “TO MOBILE” AND “TO BASE” PORTS ARE PROPERLY LOADED EITHER WITH 50 OHMS DUMMY LOADS, OR RADIATING SYSTEM.

7. Execute the Fiplex Control Software. Next window will appear:



User interface has the following controls:

- Scan Devices Button: refresh the available COM ports and identify Fiplex devices
- Connection Button: connect / disconnect software from repeater



- List of available devices: below two buttons, is placed a dropdown list that shows all available COM ports. Available COM ports not related to Fiplex devices will be shown with its number and “Unknown device” label. COM ports related to Fiplex devices will show a device description.
- Embedded Web browser: graphical area where configuration and monitoring parameters will be shown.
- File menu: contains menus to save repeater configuration to a file and load configuration from file to repeater.

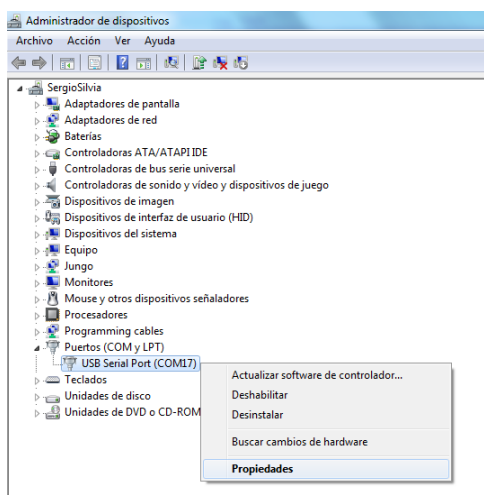
NOTE: if Fiplex Repeater is not turned on, related COM port will appear as “Unknown device”

8. Click “Scan Devices”

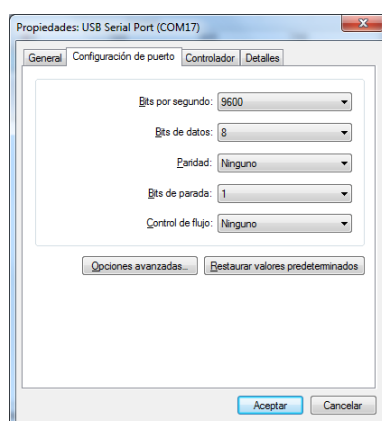


Now, the Fiplex unit is shown in the list of available devices, and connection button is enabled.

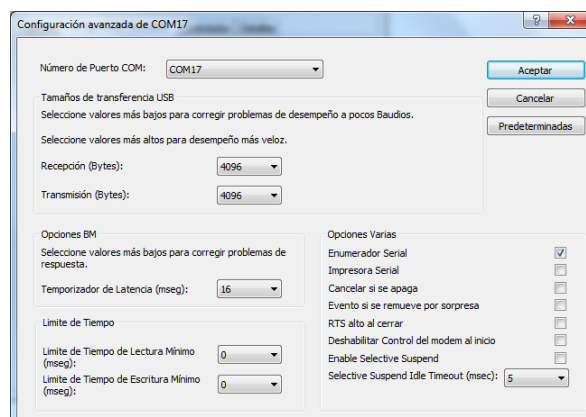
NOTE: Fiplex repeater could not appear in list, if COM port number is higher than COM16, depending on Windows version. COM port number can be forced to arbitrary number (below COM16) through Device Administrator. In order to change COM number, click “Properties” pop-up menu:



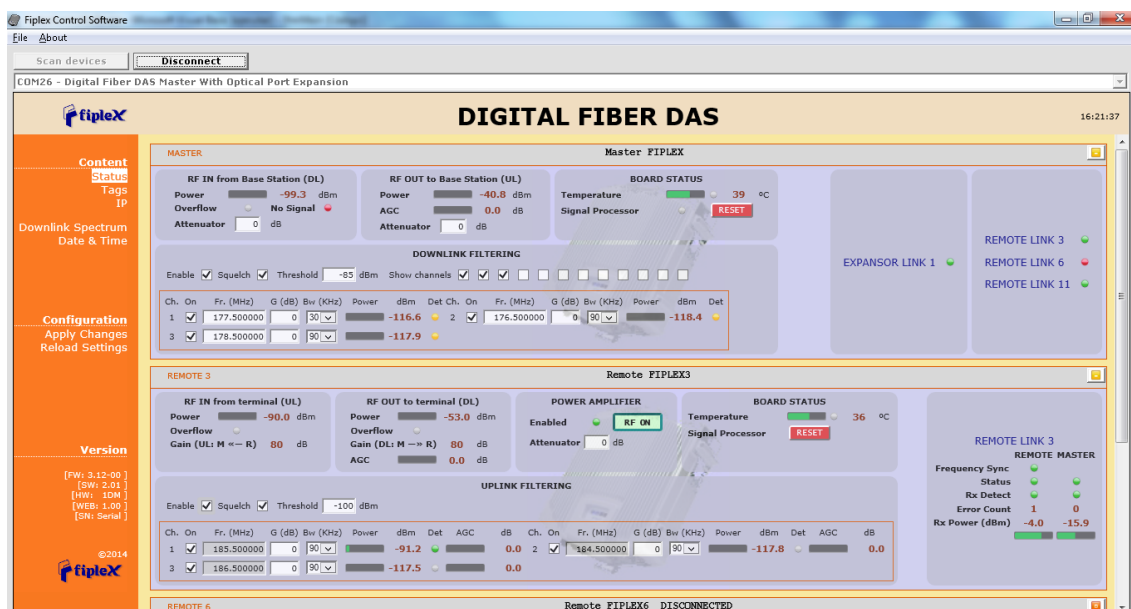
Click “Advanced Options”



Change COM port number



9. Click “Connect”. Fiplex Control Software window will be automatically maximized, and it will show the configuration screen described in previous sections.



10. Once system is configured, user can disconnect software using connection button, now labelled “Disconnect”. Initial window will be shown.

If repeater is disconnected or turned off, while Fiplex Control Software is connected to device, software will go back to initial window. Moreover, if some communication problem occurs while device is monitored, the software will go back to initial state as well.

11. Remote unit can be controlled through USB port. In this case, Fiplex Control Software will show that connected device is a remote unit.



After click on “Connect” button, program will show only remote configuration and monitoring parameters, with same graphical interface described in previous sections:

