



Trinity-316TDD PLUS

## Installation and Operational Guide

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# Quick start

**Warning :** This product transmits information using microwave radio signals. Installation of fixed outdoor radio links should only be performed by a qualified and trained technician familiar with local radio, electric and safety regulations.

Before proceeding with the installation verify that the equipment works on the ground. Power up both units and put them between your computer and network access, you should have full communication within a few minutes of powering up the units. (If the units have no internal antenna make sure you place the antenna connectors directly opposite each other.) The units are pre-configured and paired from factory with the following parameters.

Master	Client
<b>IP address</b> 10.0.0.1	10.0.0.2
<b>Username</b> admin	admin
<b>Password</b> public	public

## Installing the link

- Mount the first unit, point it towards the site of the second unit. Power it up and make sure the Power LED is lit and the status LED blinks slowly.
- Mount the second unit. Power it up and adjust it for best signal using the status LED see section 1.9 for details .
- Adjust the first unit for best signal using the Status LED.
- Make sure all cables are secured and connect the link to the network.
- Configure the distance parameters at the master unit to reflect the correct distance between the units.

**Note** Make sure that the polarization on both units are in the same direction. Unaligned polarization will significantly reduce the signal strength.

# Installation Guide

## 1.1 Who should use this guide

Installing fixed outdoor radio links requires technical expertise and should only be carried out by a technician. You should only attempt to install and configure the Trinity link if you have

- Experience with mounting outdoor radio equipment and antenna installation.
- An understanding, or common knowledge, of network equipment.
- Made sure that the installation site is suitable and complies with local radio, electrical and safety regulations.

**Warning** *Radio regulations differs between countries and all options and/or combinations in this manual might not be allowed in your current region. Local radio regulations or legislation may impose restriction on allowed usage such as*

- *Allowed radio channel frequencies for outdoor usage.*
- *Maximum allowed EIRP.*

*You are responsible for that your installation complies with local radio, electrical and safety regulations.*

## 1.2 Additional tools required

Depending on the conditions at the installation site other tools might be needed, including, but not limited to

- Cat5E Ethernet cable
- RJ-45 crimp tool and RJ-45 connectors if not using a pre-assembled Ethernet cable
- An adjustable wrench
- Drill for wall mounting
- Ground cables
- Cable ties to secure cabling

## 1.3 Unit description

There are three LEDs, power, status and Ethernet link/activity.

LED	Colour	Status	
Power (P)	Green	On	Power on
Status (S)	Green	Flashing	Signal strength pattern
		Blinking	Firmware upgrade in progress
Ethernet (E)	Green	On/blingking	Reflects Ethernet traffic and link status
		Off	No Ethernet link

## 1.4 Installation

Installing Trinity-316TDD PLUS system consists of the steps outlined below, each step is explained more thoroughly in the following sections. The Trinity link system consists of two separate Trinity units, one master unit and one slave unit, the installation steps needs to be carried out for both units.

1. Mount the Trinity unit and antenna (if applicable) at site A.
2. Install the PoE at an indoor location where power and network equipment is available.
3. Run Ethernet cable from the PoE to the mounted Trinity unit.
4. Repeat the above steps for the unit at site B.
5. Align antennas for best signal reception.
6. For optimal link throughput the following parameters must be updated in the web interface
  - Distance - should accurately reflect the distance in kilometers between the units.

## 1.5 Ethernet cabling

Run Cat5E Ethernet cable from the location where the PoE is to be installed to the location of the Trinity unit, allow for some slack on the wire to avoid putting extra strain on the Ethernet connectors. Make sure the Ethernet cable you are using is rated for outdoor use to avoid decreased cable life time.

### RJ-45 pin-out

If you are not using a pre-assembled Ethernet cable, apply the RJ-45 connectors on to the both ends of the cable using the pin-out table and diagram below.

PoE	Wire	Colour	Function	RJ-45
1	Twisted pair	White/Green	Ethernet (RxN)	1
2	Twisted pair	Green	RxT	2
3	Twisted pair	White/Orange	Ethernet (TxT)	3
4	Twisted pair	Orange	Ethernet (TxN)	6
5	Twisted pair	Blue	Power (+)	4
6	Twisted pair	White/Blue	Power (+)	5
7	Twisted pair	White/Brown	Power (-)	7
8	Twisted pair	Brown	Power (-)	8

## 1.8 Installing the power supply

Install the supplied PoE indoor where power and other network equipment is available. The PoE can be located at most 100 meters from the unit.

**Note** The supplied PoE-adapter (Power-over-Ethernet) is strictly for indoor use only!

**Tip** Make a loop on the Ethernet cable indoors near the PoE to allow water to drain more easily from the cable, before reaching the PoEs unprotected Ethernet connector!

Connect the PoE port marked "P+DATA OUT" to the Trinity-316TDD PLUS system unit using an outdoor-rated Cat5E Ethernet cable. The PoE port marked "DATA IN" should be connected to user supplied network equipment such as a switch or router.

**Note** The Trinity-316TDD PLUS system will boot as soon as the Ethernet cable from the PoE is connected!

## 1.9 Finalizing the installation

Once both units are mounted they need to be aligned for proper operation. Trinity-316TDD PLUS system assists you in doing this using external visual signals and a web interface that shows detailed information about the link status and its signal strength.

### Configuration

The Trinity-316TDD PLUS system come pre-configured and should connect to each other automatically. For optimal throughput you are recommended to accurately configure the distance between the unit using the web interface on the master unit. You should also modify the IP-configuration on both units to reflect your network setup.

### Securing the installation

When the Trinity link is running and the antennas have been properly aligned the units must be secured in place to avoid the units moving due to strong winds. If the units become misaligned the link might be lost. Tightly fasten the mounting brackets to secure the unit in place, make sure the brackets and chassis are connected to ground. Secure Ethernet and antenna cabling using cable ties to avoid unnecessary wear on the cabling material and connectors.

# Configuration

The Trinity-316TDD PLUS system can be configured via a web interface built-in into the unit or using the Repeatit network management system RCS.

## 2.1 Trinity-316TDD PLUS system Configuration concepts

The Trinity-316TDD PLUS system features an advanced configuration management system with the ability to roll back to previously working settings, even with automatic rollback in case of link loss. This helps you to try out different settings to optimize your link throughput while minimizing the risk of a disconnected link.

### Configuration areas

A Trinity-316TDD PLUS system has several what is called "configuration areas", these areas hold configuration data and each area contains one unique configuration instance. Some areas contain different data depending on the unit status whilst some only contain static configuration data that never change. The following different areas exists with in a Trinity-316TDD PLUS system

#### In-active

When you modify the configuration via the web interface all changes end up in this area. This is only a place holder until you choose to apply the new configuration, until that time you can rollback and/or keep modifying any setting without disrupting the unit or link status.

#### Active

This area always contains the current settings in use by the unit.

#### Stored

Contains the configuration currently written to flash, this might differ from both the in-active and active configuration.

### Factory defaults

Static bare basic configuration.

**Note** The factory default IP address is 10.0.0.1, the default username is "admin" and default password is "public".

## 2.2 Configuring using the Trinity-316TDD PLUS system web interface

Both units in your Trinity-316TDD PLUS system link can be fully configured using the built-in web interface. The following section will guide you through how to use the interface to modify the link configuration, please refer to section 2.3 for details on the available configuration parameters. All configuration options in the Trinity-100 series can be found under the tab marked "Configuration" in the web interface.

### Modifying the configuration

To modify a configuration parameter, change its value and press the button labeled "Set".

This will save your changes to the "inactive" configuration area, but will *not* modify the running configuration of the unit. This means that the unit will continue to operate while you are modifying your configuration.

**Tip** Clicking the question mark next to an option will bring up an instant help dialog with a brief description of the parameter. After modifying a setting the current value in use by the unit will be shown to the right of the option. Attempting to set an invalid value, such as a too large distance value or an invalid IP address, the configuration modification will fail and the field containing invalid data will be highlighted in red.

### Applying a new configuration

When you have performed your required modifications you need to "apply" the new settings for the unit to use them. This is accomplished by clicking the "Apply" button in the status pane to the left of the settings. When you click the "Apply" button the unit will attempt to reconfigure itself with the new settings. If the apply operation is successful the unit will be running with your new settings, if the apply fails the unit will automatically revert back to the previous working settings.

If you happen to make a configuration mistake you are able to manually roll back to a previous working configuration by using the "Load configuration" functionality.

**Note** Apply does not permanently save settings to flash!

## 2.3 Configuration parameters

Numerous configuration parameters can be set, some are only available on "master" units. The following section describes the available configuration parameters in more detail.

### Radio settings

The radio settings control parameters related to the radio interface.

#### Mode

A unit can operate in two different modes, master or slave. A master is passive while the client is the active participant.

**Master** Defines the channel to operate on and the distance to its slave. Which slave that is allowed to connect is determined by the remote MAC address setting.

**Client** The slave will attempt to connect to any master that matches its configured remote MAC address.

#### Remote MAC

Radio device MAC address of the remote peer. Setting this will ensure that your unit only connects to a specific peer. If left blank (00:00:00:00:00) the Trinity will use the Link ID and RSSI values of surrounding units to select which peer to connect to.

**Note** If left blank it is recommended to use a unique Link ID

#### Channel

Specifies which radio channel that should be used. Only required on the "master" side.

**Note** For European ETSI domains the frequency range 5.15-

5.35 GHz is solely for indoor use. It is not allowed to use channels within this band in an outdoor installation.

### **Transmit rate**

Controls the radio modulation used for transmission, which affects the transmission rate. If "Channel bandwidth" is changed the same modulation will be used but the display will be updated to show the actual data rate. Only required on the "master" side.

### **Link ID**

An arbitrary, 32 character long, identifier that allows you to differentiate between multiple Trinity-100 links.

**Note** *The Link ID Must be equal on both units*

### **Encryption key**

Specifies an encryption key phrase used for the AES-128 bit encryption of the radio traffic.

**Note** *It is not possible to disable encryption and the key must be equal on both units*

### **Regulatory domain**

The frequency band is divided up into channels, with each local regulatory agency defining what is permitted for use in its area. This affects which channels that are available and the max TX power.

**Warning** *While it is possible to choose a different regulatory domain that enables the use of other frequencies, it is at all times the customers responsibility to ensure that the correct regulatory domain is selected for the country of operation.*

- *The installation must comply with local radio regulations regarding allowed frequencies.*
- *Repeatit AB and its resellers or distributors are not liable for any damage or violation of government regulations that may arise from failing to comply with these guidelines.*

### **Channel bandwidth**

How much of the frequency band should be used for a single channel. Setting this to 40MHz (on units supporting 40MHz) will increase the available transmit rate, but each channel will require twice the spectrum width.

### **Transmit power**

Effect in dBm of the signal transmitted from the radio device. Most regulatory domains have a limit on how high the transmit effect plus antenna gain may be (EIRP). The EIRP is calculated by adding the antenna gain to the configured transmit power. Example, Trinity 216 with 16 dBm antenna and 14 dBm TX power results in a  $14 + 16 = 30$  dBm EIRP.

**Warning** *The user must assure that the maximum local EIRP limits are not exceeded, to achieve this the output power may have to be reduced. The device is by default configured to with a transmit power setting to meet a EIRP limit of 30 dBm. Please consult your local regulatory agency or a Repeatit sales partner for information on power limits in your area.*

- *The installation must comply with local radio regulations regarding maximum allowed EIRP.*
- *Repeatit AB and its resellers or distributors are not liable for any damage or violation of government regulations that may arise from failing to comply with these guidelines.*

### **Antenna gain**

This should be set to the gain in dBm of the connected antenna. Only applicable for units with external antenna.

### **Distance**

For best throughput this should be set to the physical distance in kilometers between the Trinity-300 series units. Only required on the "master" side.

### **CAC Policy**

This will allow you to control the DFS CAC (Channel Availability Check, i.e the amount of time to listen for radar before using a channel) policy. Selecting "Regulatory" will follow the rules according to the selected regulatory domain, this is the recommended setting.

Selecting "Custom" will allow you to enter a custom DFS CAC time.

**Note** *Note that in Europe, according to the ETSI EN 301 893 regulation, there is a 10 minute CAC time on the 5.6GHz band due to weather radars.*

**Warning** *Overriding this might violate the regulations in your area! You are required to consult with your local regulatory agency before modifying this setting!*

## **Network settings**

### **IP**

IP-address on this Trinity-316TDD PLUS system.

### **Netmask**

IP-netmask to use.

### **Gateway**

Specifies the default gateway for this unit.

### **VLAN**

VLAN (IEEE 802.1Q) ID, range 1-4094.

**Note** *Configuring an invalid VLAN ID might result in the loss of Ethernet connectivity if the there is a mismatch with your switch configuration.*

### **DNS**

Specifies one or more nameservers. The default configuration contains two working servers.

### **STP (IEEE 802.1D)**

Enable/disable the usage of Spanning Tree Protocol (IEEE 802.1D) on the bridge.

### **Enable SNMP**

Enable SNMP version 2c for monitoring.

### **Read-only community**

Specify the SNMPv2c read-only community name.

### **Read-write community**

Specify the SNMPv2c read/write community name.

## **System settings**

### **Unit name**

Allows you to specify a custom unit name for easier identification.

### **Location**

Allows you to specify a descriptive name for the units geographical location.

**Status LED**

Visual signal level/link status indicator. Can be set to pulse mode or disabled. If set to "pulse mode" the LEDs will blink according to the current signal strength.

**Use RCS**

Enable/Disable the use of Repeatis network management system RCS.

**RCS IP**

The IP address of your RCS server.

**RCS SSL Port**

SSL port number your RCS is using. The default port number is 9998.

**NTP**

Enable/disable the usage of NTP (Network Time Protocol) and which NTP servers to use.

**Password**

Controls the password for the web interface.

# Support

Support as well as firmware updates for the Trinity product series can be obtained from Repeatits web site at <http://www.repeatit.se>, there you will also find product news, FAQ and other information related to our products.



## Trinity-316TDD PLUS



### A preconfigured link kit that is ready to bridge traffic out of the box.

Operating in the 5 GHz unlicensed band with a throughput up to 100 Mbps the Trinity-316TDD PLUS is designed to reliably transport your data, voice and video communication.

### Advanced Spectrum Analyser with Intelligent Frequency Selection.

The frequency interference graph provides the network operator an efficient tool to help analyze the spectrum.

#### Product Highlight

- 50 or 100 Mbps throughput
- 17 dBi Dual Polarized 5 GHz antenna
- Build-in RF ESD/Surge protection up to 15 kV
- Repeatit Cloud Network Management
- Speed test
- Advanced spectrum analyser
- QoS: Four traffic classes prioritise traffic

Distance	Trinity-116M	Trinity-116M Plus
< 2 km	50 Mbit	100 Mbit
3 km	50 Mbit	100 Mbit
4 km	40 Mbit	100 Mbit
5 km	35 Mbit	100 Mbit
6 km	30 Mbit	90 Mbit
7 km	28 Mbit	85 Mbit
8 km	25 Mbit	75 Mbit
9 km	23 Mbit	60 Mbit
10 km	15 Mbit	60 Mbit

Throughput UDP, 30dB max ETSI EIRP, 6dB margin

General	Trinity-316TDD PLUS
<b>Radio</b>	
Frequency Bands	5.725 – 5.850 GHz
Channel bandwidth	20 MHz; 20/40 MHz (Plus)
Capacity	50 Mbps; 100 Mbps (Plus)
Modulation	OFDM, BPSK, QPSK, 16QAM, 64QAM
Max Tx power	23 dBm
Max Rx sensitivity	-97 dBm
Error Correction	FEC; k=1/2, 2/3, 3/4, 5/6
Encryption	128 bit AES & MAC level Authentication
Surge Protection	15kV
DFS	Yes
QoS	Four Access Categories (AC) Voice, Video, Best Effort, and Background. Traffic classification according to WMM
<b>Ethernet Interface</b>	
Type	10/100/1000BaseT Interface with Auto-negotiation (IEEE 802.3)
Number of Ethernet Ports	1
Framing/Coding	IEEE 802.3u
Traffic Handling	MAC layer bridging, self learning, 802.1q transparent
Data Latency	< 2ms (typical)
VLAN ID for Management	Supported
Power over Ethernet	48V DC, 802.3af, < 6W typical
Connector	RJ-45
<b>Management</b>	
Link Management	Web interface
NMS Application	Repeatit Cloud Network
Tools in web interface	RCS Management Server Spectrum Analyser, Speed Test

Specific	Trinity-316TDD PLUS
<b>Antenna</b>	
Gain	typ. 17dBi
VSWR	max. 1.5:1
3 dB Beam-Width, H-Plane	typ. 20°
3 dB Beam-Width, V-Plane	typ. 20°
Polarization	Horizontal and Vertical
Antenna protection	Internal DC Grounding
<b>Environment</b>	
IP Code	IP63
Temperature	-40° / +55° C
Size	250 x 210 x 80 mm
Weight per unit	1.1 Kg



# USA regulatory compliance

## FCC Part 15

### US Federal Communications Commission (FCC) Compliance

The product complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

This device has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to radio/television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

### RF Requirements

#### 1. RF exposure Hazard Warning

This device generates and radiates radio-frequency energy. In order to comply with FCC radio-frequency exposure guidelines for an uncontrolled environment, this equipment must be installed and operated while maintaining a minimum body to antenna distance of 20 cm

#### 2. RF Frequency Requirements

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This device and its antenna must not be co-located or operating in conjunction with any other unauthorized antenna or transmitter.

## EU Regulatory Conformance

This device is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

CE0678!

# Usage restrictions and legal information

This product contains radio equipment for which the use in several countries is subject to restriction, license or government authorization.



## European Union Notices

This product may be used in all EU countries (and other countries following the EU directive 1999/5/EC) without any limitation except for the countries mentioned below:

In the EU and other European countries, the 5-GHz bands have been made available for the use of wireless local area networks (LANs).

The Overview of Regulatory Requirements for Wireless LANs table provides an overview of the regulatory requirements applicable for the 5-GHz bands. Requirements for individual countries may change, Repeatit recommends that you check with your local regulatory agency for the latest status on regulations for 5 GHz fixed radio links.

### Overview of Regulatory Requirements

Frequency band	Max power level mW (EIRP)	Usage
5150-5350	200 (23 dBm)	Indoor ONLY
5470-5725	1000 (30 dBm)	Indoor and outdoor

The regulatory limits for maximum output power are specified in EIRP. The EIRP level of a device can be calculated by adding the gain of the antenna used (specified in dBi) to the output power available at the connector (specified in dBm). The usage of a power level above the maximum is illegal.



**Denmark**

In Denmark, the band 5150 - 5350 MHz is also allowed for outdoor usage.

**Italy**

The use of 5.8GHz (5725-5850 MHz) is forbidden in Italy.

**United Kingdom**

A license from *Ofcom* ([ofcom.org.uk](http://ofcom.org.uk)) is required for use of the 5.8GHz (5725-5850 MHz) band in the United Kingdom.



## **Warranty**

Repeatit AB, Hamngatan 33, S-172 66 Sundbyberg, Sweden, guarantee that our products do not have any defects regarding material or function upon delivery. All of Repeatits products are covered by a 12 month international warranty.

If during the time of warranty the product displays any defects regarding material or function, the products should be returned to your reseller, who will, according to their own judgment, either repair or replace the product according to the following conditions:

### **Conditions**

1. The warranty is only valid in combination with an original receipt issued by the reseller at the date of delivery or sale. The receipt needs to contain the products serial number or similar identification.
2. If Repeatit repairs or replaces the product, the repaired or replaced product will be covered by the original warranty during the remainder of the guarantee period. During repair, some parts might be replaced. These parts are then the property of Repeatit AB.
3. The warranty does not cover normal wear and tear, faulty usage or handling, or other usage other than the one described by Repeatit AB. The warranty does not cover defects caused by accidents.
4. The warranty is not valid if service is performed on the product by a, by Repeatit non-unauthorized person or company.
5. The warranty is not valid if any products that are not Repeatit original accessories are used with the product.
6. There are no warranty, written or oral, other than this printed warranty.

