



GPSR116

Quick Start Guide

Introduction

Microlab's digital GPS repeater system can be used for cellular communications UTC synchronization for locations where the GPS signals are not readily available. The system is built with Microlab's patent-pending Digital SkyTiming Technology™ offering industry-first GPS signal transmission via CPRI for highly accurate timing and location. The system offers several configurations for indoor and outdoor applications.

The GPS timing system is configured with indoor unit and outdoor unit. Both models sold separately. Model **GPSR116** is meant to work with outdoor remote unit model **GPSR400**.

GPS Repeater Models

Model	Description
GPSR116	Indoor head-end receiver, 16 RF output, 1RU
GPSR400	Outdoor GPS signal transmitter, 4 antenna inputs, US version

Unpacking and Inspection

Carefully unpack the **GPSR116** remote unit and check for damaged or missing parts. The remote unit ships with the following:

- **GPSR116** Head-End Unit (1RU EIA Rack)
- One (1) **72" DC Power cables**
(Part#: PSM-129)
- Quick Start Guide

GPSR116 - Front and Rear Panels

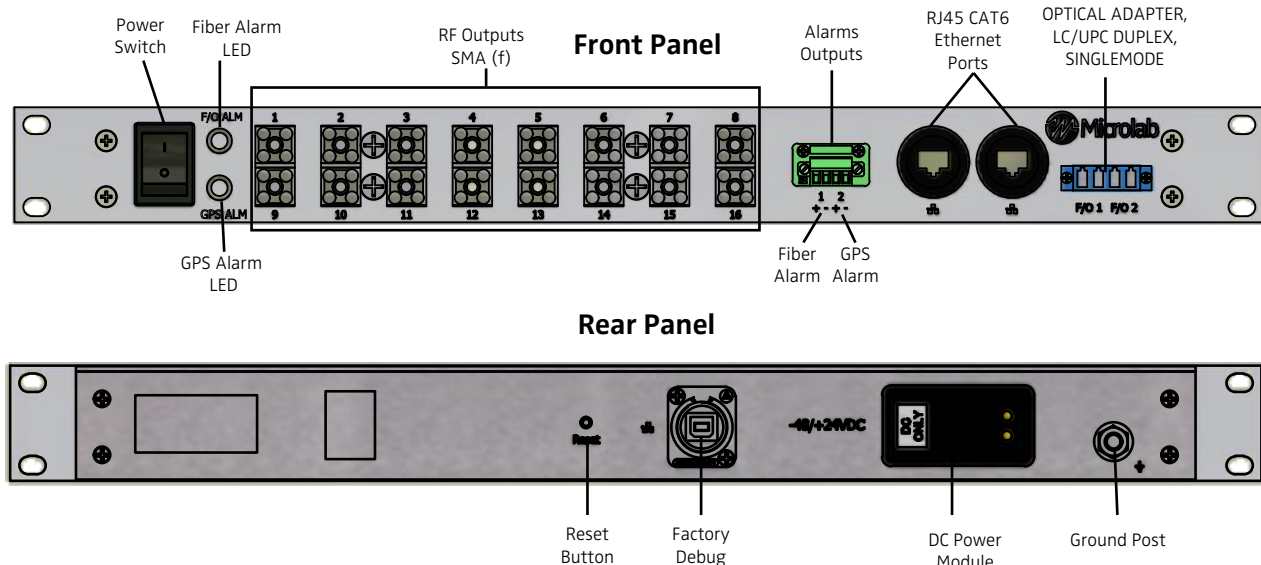
Note: Product appearance varies by model

Hardware Needed

The following items are recommended for Setup and operation:

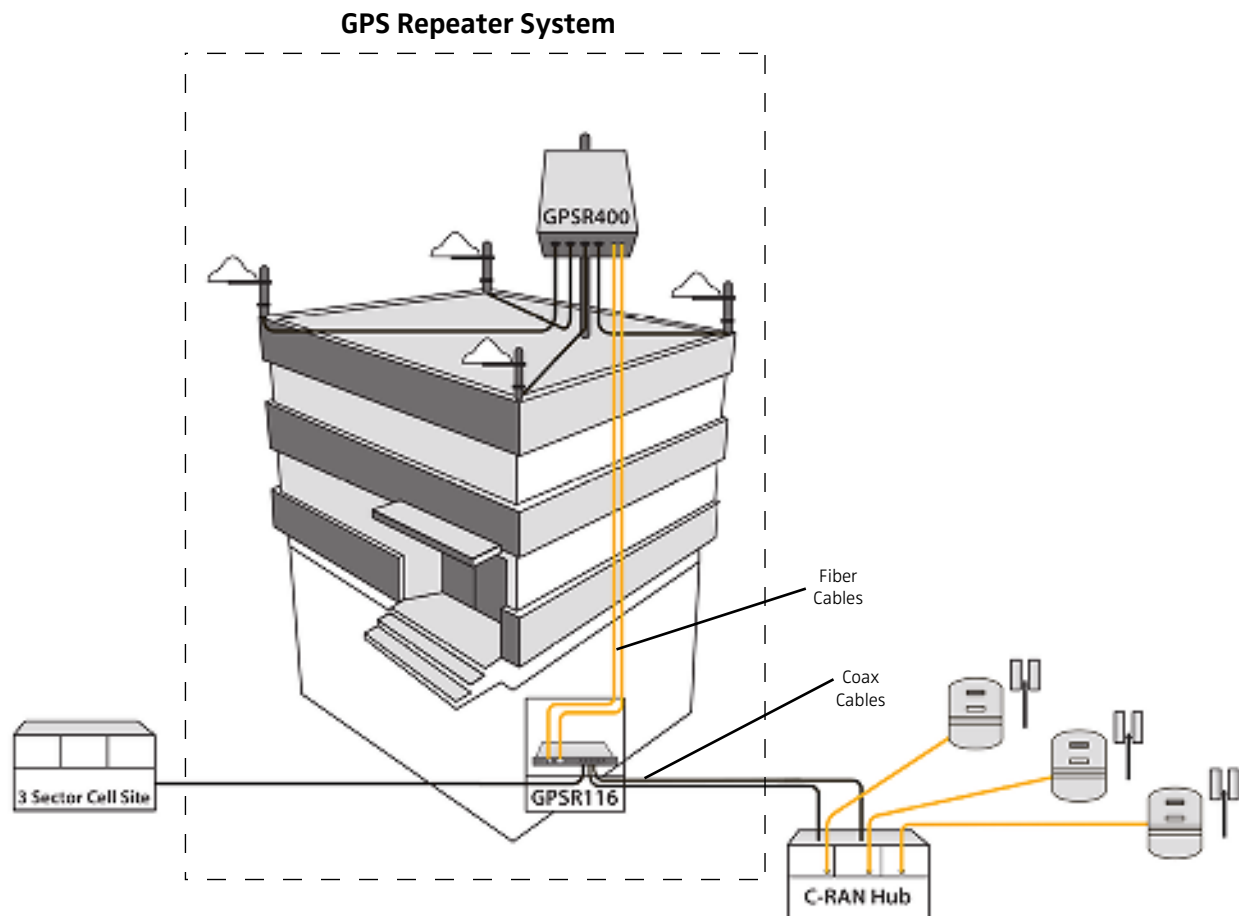
- Four (4) screws/washers (consult your rack requirements)
- Screwdriver
- Included DC Power Cables OR use a Power Supply:
Microlab **GPSA001** AC/DC Adapter (not included)
Microlab **GPSA002** PoE DC/DC Adapter (not included)
- **TA-1MF** SMA(m) terminations for each unsued port
- One ethernet cable (RJ45 connectors)
- One PC or Laptop with an ethernet port or ethernet USB adapter
- Singlemode duplex fiber < 2km in length
(with Duplex LC/UPC Interfaces)

Please contact Sales for other fiber length requirements



System Connection Diagram

The following diagram illustrates how the GPS repeater system is utilized



Mounting Installation

This GPS signal transmission system is designed to be setup by professional communications systems installers.

The **GPSR116** requires DC Power (-48/+24VDC). The DC interface mates with DC Power Cable **PSM-129**. Mount the **GPSR116** Head-End Unit in close proximity to the eNode B or BBU to minimize cable lengths.

Install the rack-mount **GPSR116** on an EIA standard 19" rack using standard hardware and practices

Connections RF, Optical, and Ethernet

Follow these steps for connecting and disconnecting RF and optical fiber cables to the unit. Ground the unit, make all RF connections and terminate all unused RF connections before applying DC Power.

Connect fiber optic and RF cables as shown in the *System Connection Diagram*.

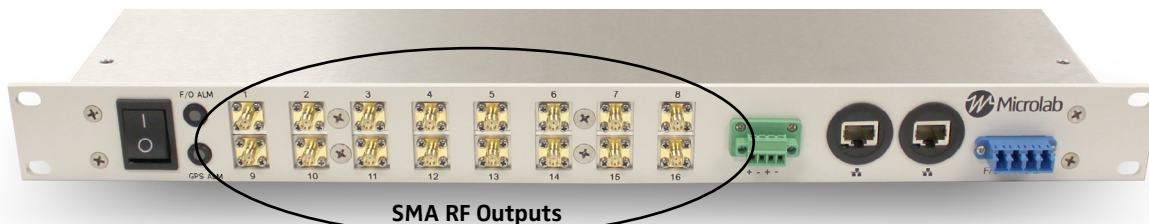
It is recommended that the Head End Unit has been properly installed, Fiber-Fed, and Powered ON before Installing the Remote unit. Skip the "LED/System Verification" section until the remote unit has been properly installed and connected to the Head-End unit. Please refer to GPSR400 Remote Unit "Quick Start Guide".

Sequence to connect:

1. Connect System Ground.
 - The remote unit comes with a .25-20FLANGENUT grounding lug. A grounding wire of suitable gauge must be used to ground to a common bus bar in the Telecom room according to local and building regulations.



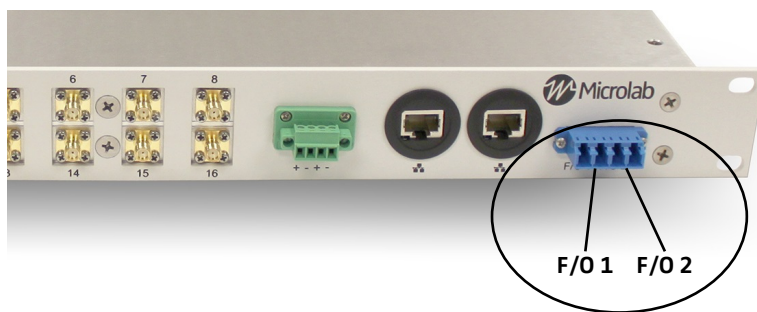
2. Connect each RF Output (**Ports 1 through 16**) to each eNode B or BBU GPS inputs
 - One (1) RF Output port connected to one (1) enB GPS input required for operation.
 - Apply appropriate torque to SMA connectors
 - Terminate ALL SMA RF Output ports not used. See Microlab **TA-1MF** terminations



Connections RF, Optical, and Ethernet (Continued)

3. Connect singlemode duplex fiber with Duplex LC/UPC Interfaces to optical port **F/O 1** (*Other Interfaces available*)

- Fiber length must be shorter than 2km **Please contact Sales for other fiber length requirements**
- *Clean optical connectors prior to installation*
- *Optical ports can be connected in any manner*
- *Only one optical fiber connection needed for operation.*
- *Recommended second fiber connected to optical port **F/O 2** for redundancy.*

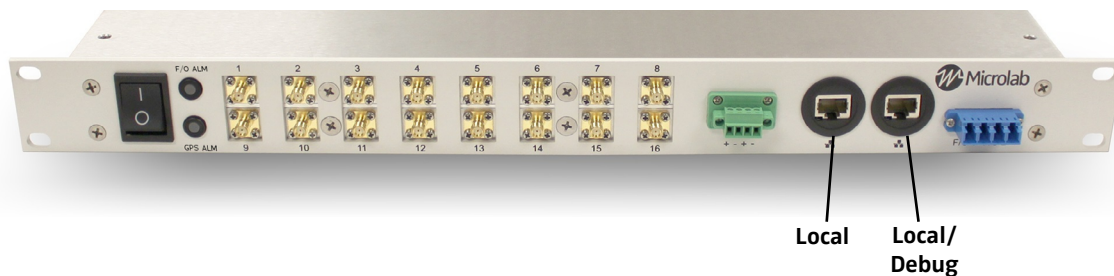


LC/UPC Duplex
Interface

4. **(Optional)** Connect Ethernet Cable to the unit's Ethernet **Local** port

Local/Debug port used for on-site debugging while maintaining connection to the NOC (Network operations center)

*Note: Both Ethernet ports on the **GPSR116** are a transparent bridge. Both Remote Unit and Head-End supports Ethernet over CPRI. Either unit can provide a local network connection to the other. See section "System Configuration and Operation"*



DO NOT CONNECT THE HEAD-END AND REMOTE UNIT TO THE SAME SWITCH. CONNECTING BOTH UNITS ON THE SAME LAN WILL CREATE A BRIDGE LOOP

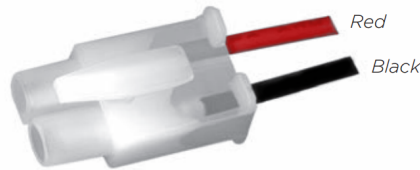
Connecting Power

Power up Sequence:

Required:

- -48/+24VDC power source (**Model PSM-129**) with the included power cable. Follow wiring diagram shown

Power Cable



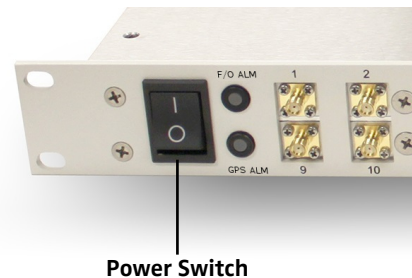
Connect DC Positive and Negative terminals as follow:

1. **Red** (Positive (+))/**Required**
2. **Black** (Negative (-))/**Required**

1. Carefully align and mate the power cable DC connector to the Head-End unit's primary **Power 1** DC Only Receptacle
 - A second power supply can be connected to **Power 2** for continuous operation in case primary power supply fails.



2. Turn on DC power source and **Switch On** the unit
 - If the unit is deployed with at least one power supply, both LEDs will illuminate.
 - Off Status LEDs indicate that power supply is not functioning or not connected.

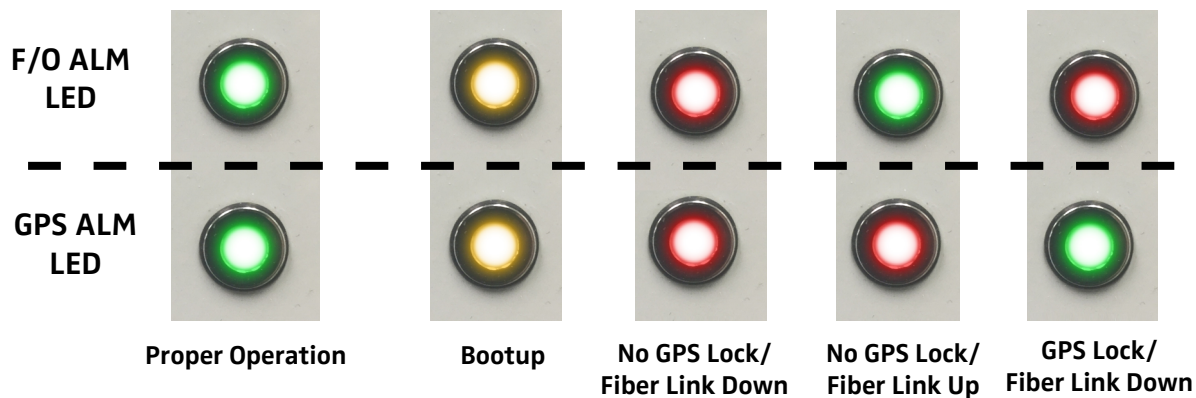


Note: Bootup time is approximately 60 seconds. During this time both front panel LEDs will be **Yellow**. After system bootup, LEDs will illuminate **RED** while waiting for GPS signal lock and Fiber Link connection.

LED/System Verification

1. Verify GPS and Fiber Link status LEDs turn **GREEN** to ensure proper GPS repeater operation

- Fiber Status:
 - Allow up to 5 seconds for fiber/CIPRI connection between Head End and Remote unit to be established and illuminate LED **GREEN**.
- GPS Status:
 - Allow up to 5 minutes for GPS signal acquisition.
 - If GPS signal is locked, LED will illuminate **GREEN**.

**LED Indicators**

- Fiber Status:
 - Illuminates **Yellow** during bootup
 - Illuminates **RED** while waiting for link with the head-end
 - Illuminates **GREEN** when link is established with Head-End Unit connected to fiber ports **F/O 1** OR **F/O 2**
- GPS Status:
 - Illuminates **Yellow** during bootup
 - Illuminates **RED** while waiting for GPS signal acquisition
 - Illuminates **GREEN** when GPS signal has been locked on any antenna

Note: If there is an error during bootup. Both LED's will remain **Yellow**. Press the Reset Button in the rear panel of the unit. If problem persists, please contact Customer Service for troubleshooting assistance.

System Configuration and Operation

The web interface is accessed as described in the following sections. First, the unit must be connected to a router or directly to a computer or laptop via an ethernet cable (Use designated **Local/Debug** port on the **GPSR116**).

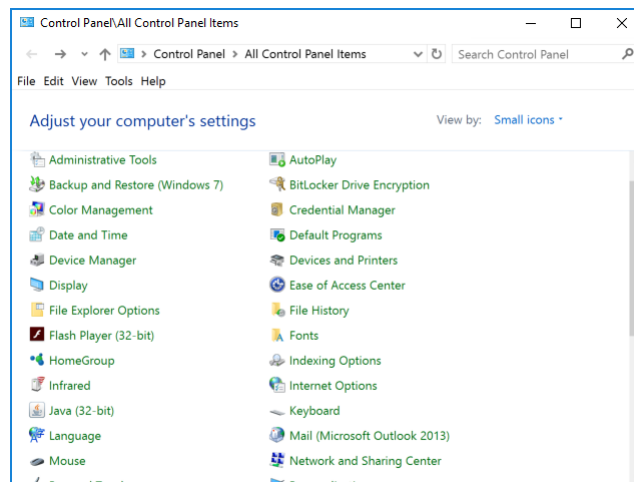
System Access

Default TCP/IP: 192.168.1.201 (**GPSR116**)

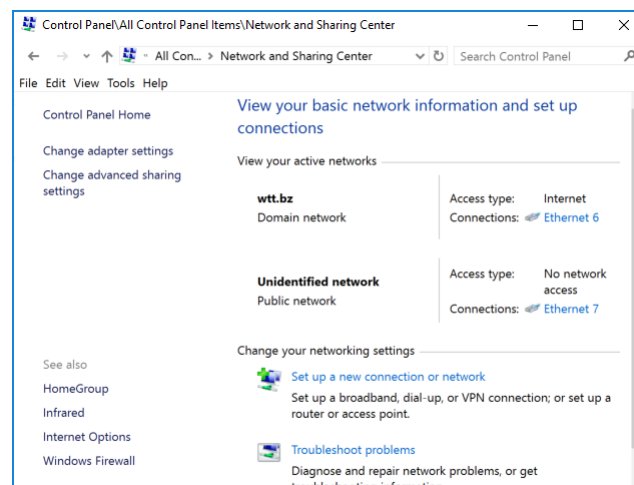
Default TCP/IP: 192.168.1.200 (**GPSR400**)

If the unit is connected directly to a PC/laptop (Windows 10 Recommended)

1. Open the start menu and click on Control Panel.

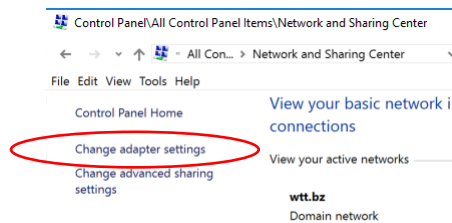


2. Open "Network and Sharing Center"

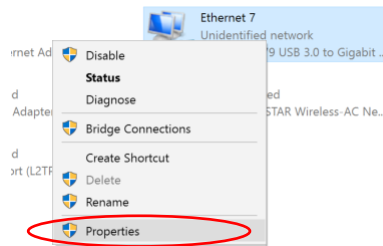


System Configuration and Operation (Continued)

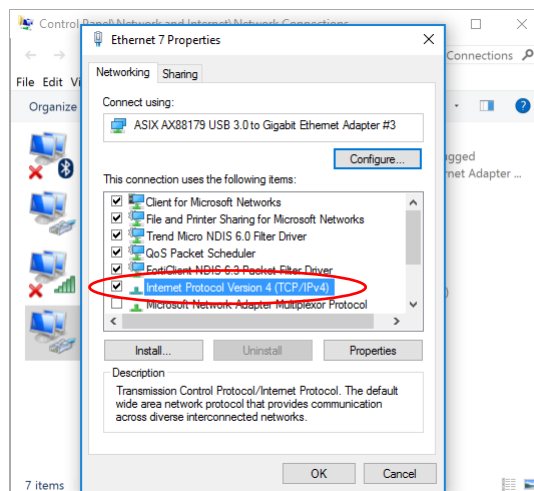
3. Click “Change adapter settings”



4. Right click the Network Adapter and open its Properties

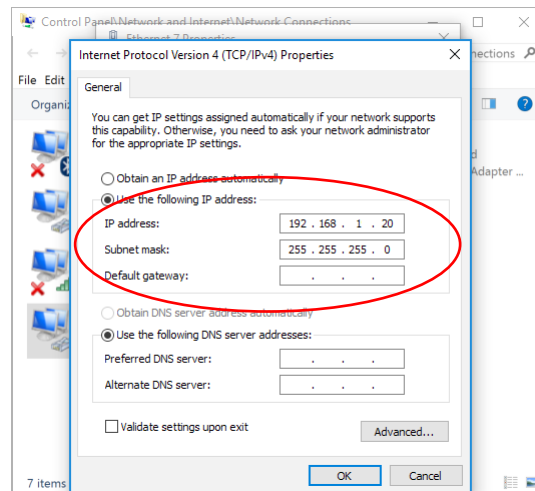


5. Double click “Internet Protocol Version 4 (TCP/IPv4)”



System Configuration and Operation (Continued)

6. Check "Use the following IP address" and enter the following settings. Press "OK" to save the settings
- IP address: 192.168.1.20 (address must be within the range of the **GPSR116** subnet)
Range: 192.168.1.1 - 192.168.1.254
Subnet mask: 255.255.255.0
Default gateway: 0.0.0.0



Web Console

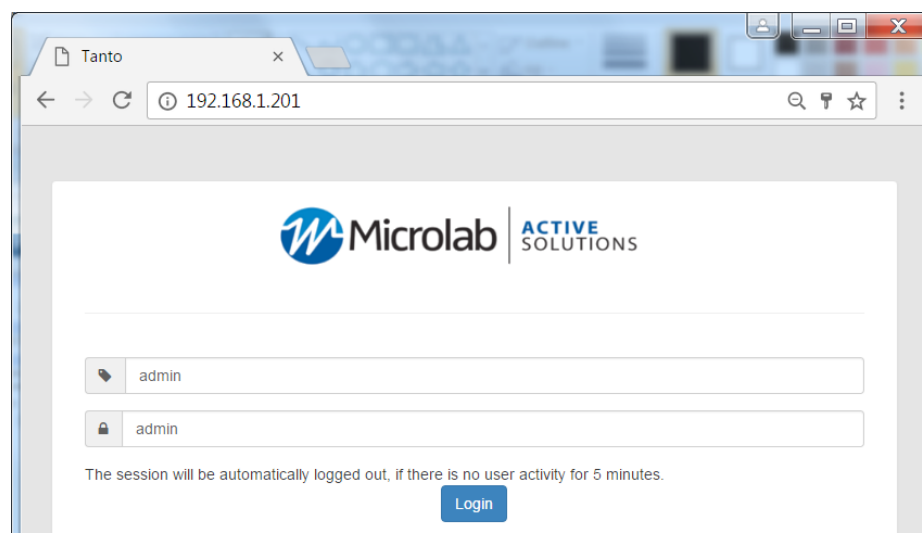
After following the steps in the previous section. Open an internet browser and type the address <http://192.168.1.201>. The system log-in page should appear. Type in the default admin username and password.

Username and Password

Username: admin

Password: admin

Note the password is case sensitive

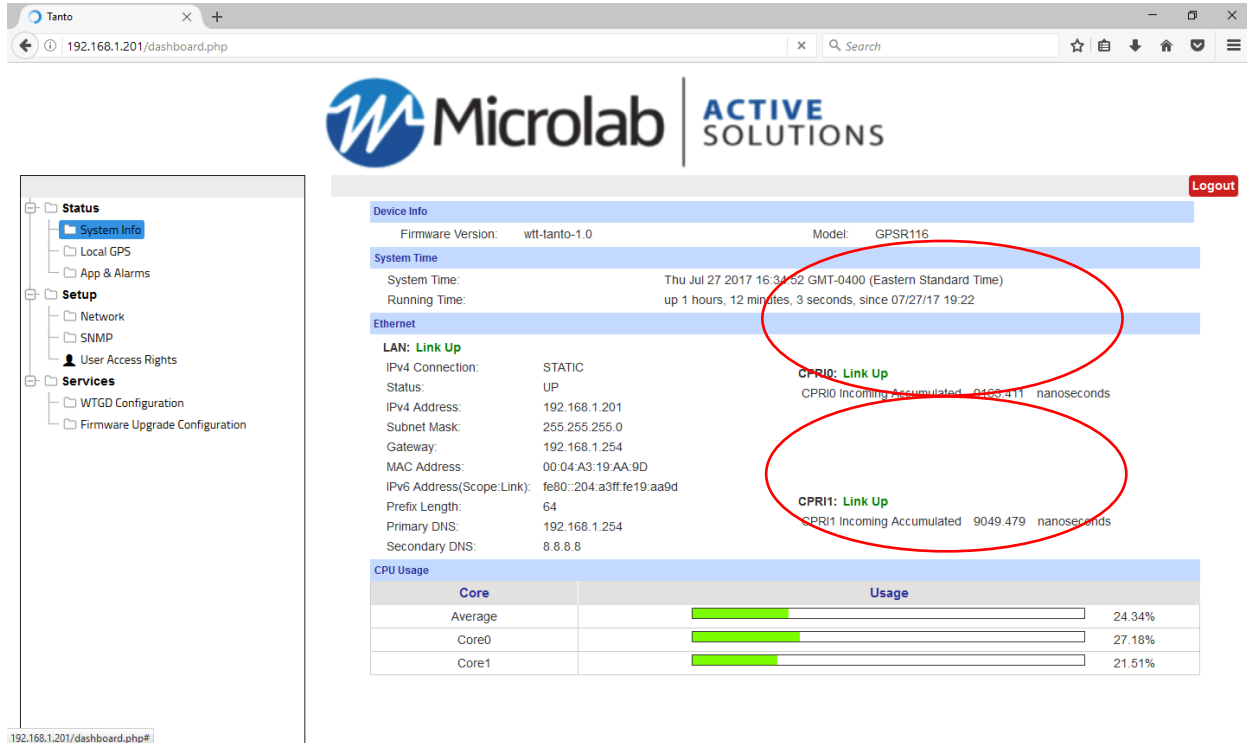


Web Console (System Info)

Viewing System Info:

1. Click "System Info" in the menu tree on the left.
2. View the status of each fiber connection to the head-unit under the "Ethernet" section
 - Working Interfaces **CPRI0** and **CPRI1** will display **Link Up**
 - CPRI0/CPRI1** Delay should be greater than 0 nanoseconds
 - Otherwise, they will display **Link Down**
 - CPRI0/CPRI1** Delay will be 0 nanoseconds

CPRI incoming Accumulated is the time delay from GPSR400 to GPSR116.



The screenshot shows the web console interface for the GPSR116 device. The left sidebar contains a menu tree with the following items: Status (selected), System Info, Local GPS, App & Alarms, Setup, Network, SNMP, User Access Rights, Services, WTGD Configuration, and Firmware Upgrade Configuration. The main content area displays the following information:

- Device Info:** Firmware Version: wtt-tanto-1.0, Model: GPSR116
- System Time:** System Time: Thu Jul 27 2017 16:31:52 GMT-0400 (Eastern Standard Time), Running Time: up 1 hours, 12 minutes, 3 seconds, since 07/27/17 19:22
- Ethernet:**
 - LAN: Link Up**
 - IPv4 Connection: STATIC
 - Status: UP
 - IPv4 Address: 192.168.1.201
 - Subnet Mask: 255.255.255.0
 - Gateway: 192.168.1.254
 - MAC Address: 00:04:A3:19:AA:9D
 - IPv6 Address(Scope:Link): fe80::204:a3ff:fe19:aa9d
 - Prefix Length: 64
 - Primary DNS: 192.168.1.254
 - Secondary DNS: 8.8.8.8
 - CPRI0: Link Up**
 - CPRI0 Incoming Accumulated: 8488.411 nanoseconds
 - CPRI1: Link Up**
 - CPRI1 Incoming Accumulated: 9049.479 nanoseconds
- CPU Usage:**

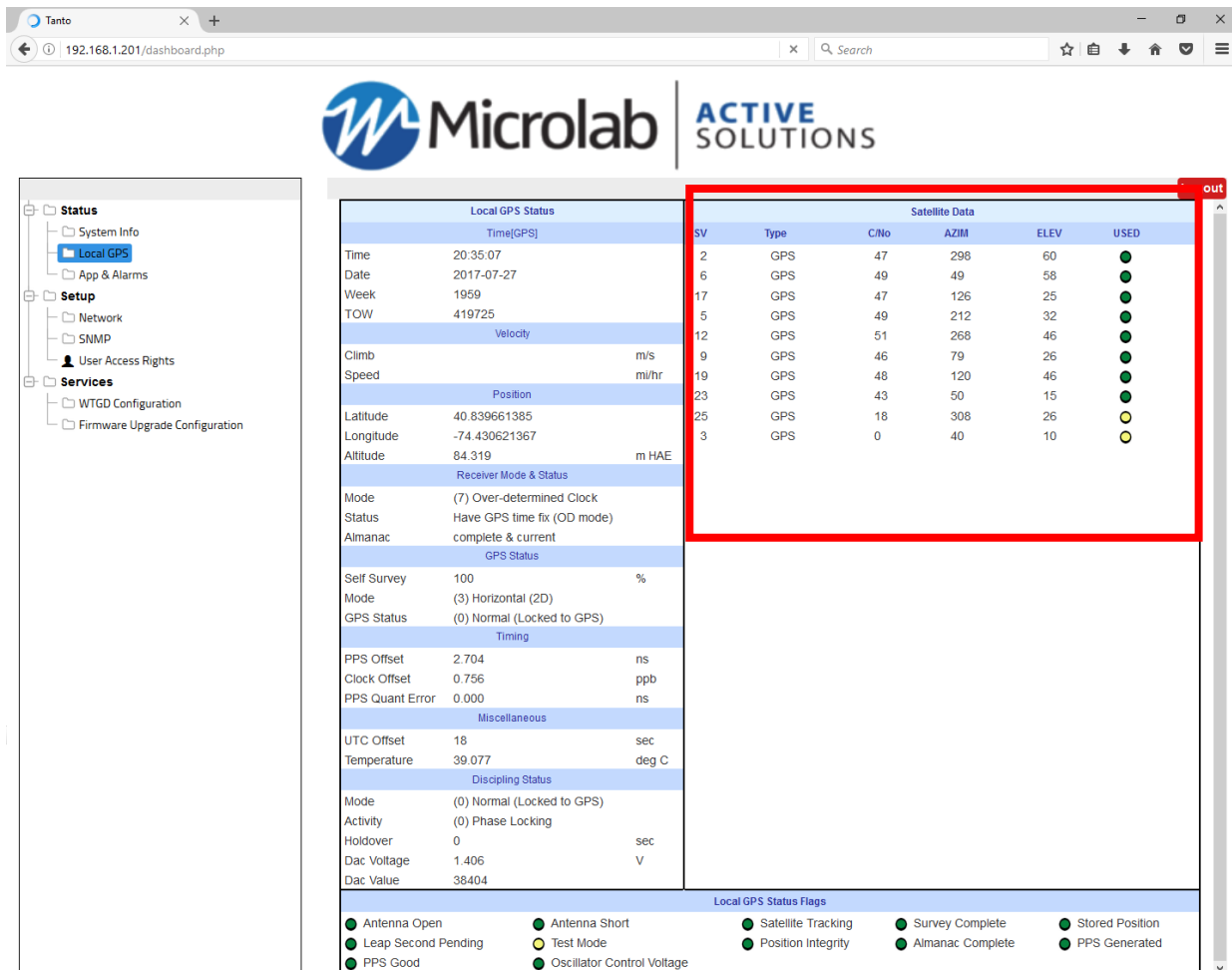
Core	Usage
Average	24.34%
Core0	27.18%
Core1	21.51%

Web Console (Local GPS)

View Satellite Data:

1. Click "Local GPS" in the menu tree on the left.
2. Satellite information will be displayed under "Satellite Data" if the **GPSR116** Remote unit has successfully locked to a GPS signal on one of the GPS Antennas
Otherwise, no data will be displayed

- Satellite Indicators:
 - Good/Used Satellites **WILL** be shown in **GREEN**
 - Satellites **NOT** used will be shown in **Yellow**



The screenshot shows the Microlab Web Console interface. On the left is a menu tree with sections: Status (System Info, Local GPS, App & Alarms), Setup (Network, SNMP, User Access Rights), and Services (WTGD Configuration, Firmware Upgrade Configuration). The 'Local GPS' option is selected. The main content area is divided into two panels. The left panel, 'Local GPS Status', displays various GPS parameters including Time, Date, Week, TOW, Velocity, Position, Receiver Mode & Status, GPS Status, Timing, Miscellaneous, and Discipling Status. The right panel, 'Satellite Data', is highlighted with a red box and contains a table of satellite information.

SV	Type	C/No	AZIM	ELEV	USED
2	GPS	47	298	60	●
6	GPS	49	49	58	●
17	GPS	47	126	25	●
5	GPS	49	212	32	●
12	GPS	51	268	46	●
9	GPS	46	79	26	●
19	GPS	48	120	46	●
23	GPS	43	50	15	●
25	GPS	18	308	26	●
3	GPS	0	40	10	●

Below the 'Satellite Data' table is a section for 'Local GPS Status Flags' with various indicators: Antenna Open, Antenna Short, Satellite Tracking, Survey Complete, Stored Position, Leap Second Pending, Test Mode, Position Integrity, Almanac Complete, PPS Generated, PPS Good, and Oscillator Control Voltage.

Web Console (App & Alarms)

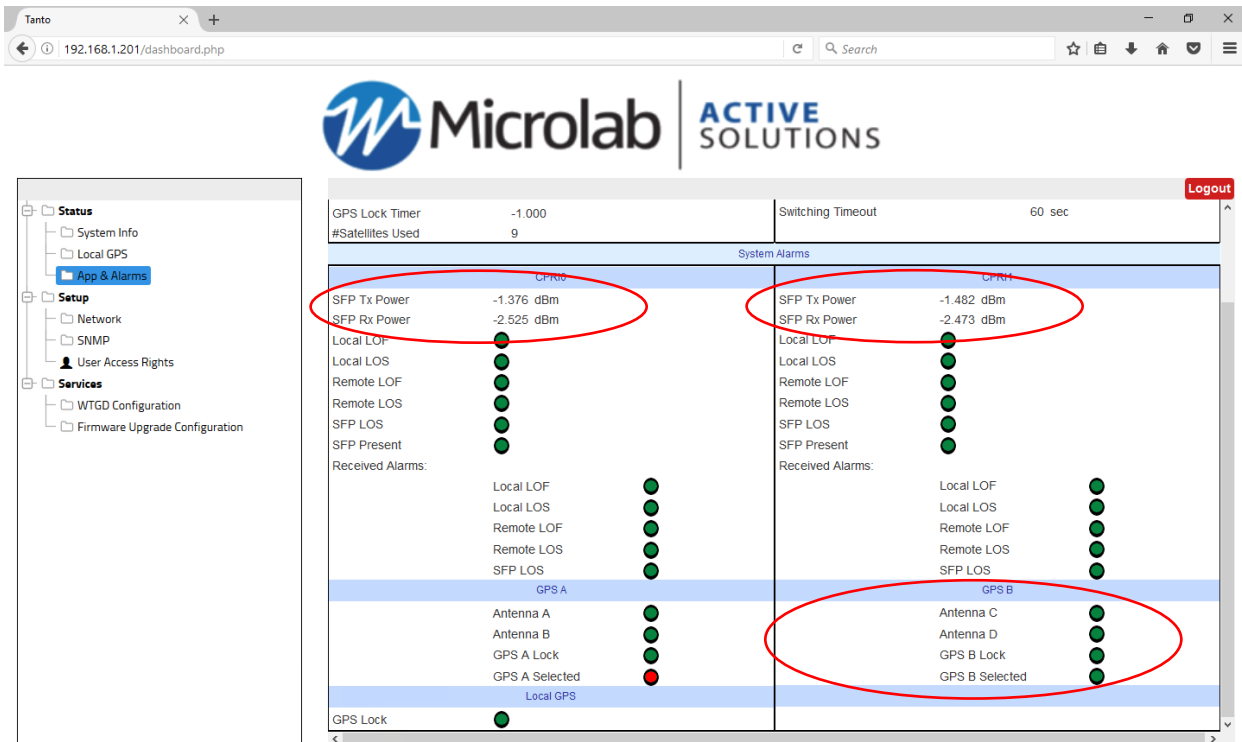
View Fiber loss

1. Click "Apps & Alarms" in the menu tree on the left.
2. Scroll down to "System Alarms"
3. Verify fiber loss for each **CPRI** interfaces (**SFP Rx Power / SFP Tx Power**)
If **SFP Rx Power** is less than -10 dBm, verify all fiber connections

View Antenna Alarms

Any system Alarms triggered will display **RED**

1. Under "Apps & Alarms"
2. Scroll down to "System Alarms"
3. Verify that the connected antenna(s) are working properly
Alarms will be **GREEN** if antennas are working properly
Alarms will be **RED** if antennas are failing, disconnected or shorted



The screenshot shows the Microlab Active Solutions Web Console interface. The left sidebar contains a menu tree with sections: Status (System Info, Local GPS), Setup (Network, SNMP, User Access Rights), and Services (WTGD Configuration, Firmware Upgrade Configuration). The 'App & Alarms' section is selected. The main content area displays 'System Alarms' for two CPRI interfaces. Red circles highlight specific alarm details: SFP Tx Power and SFP Rx Power for both CPRI interfaces, and the GPS B section (Antenna C, Antenna D, GPS B Lock, GPS B Selected) for the second interface. The status of each alarm is indicated by a green dot (OK) or a red dot (Error).

Interface	Alarm Type	Status
CPRI 1	SFP Tx Power	OK
	SFP Rx Power	OK
	Local LOF	OK
	Local LOS	OK
	Remote LOF	OK
	Remote LOS	OK
	SFP LOS	OK
	SFP Present	OK
	Received Alarms:	None
	GPS A Selected	OK
CPRI 2	SFP Tx Power	OK
	SFP Rx Power	OK
	Local LOF	OK
	Local LOS	OK
	Remote LOF	OK
	Remote LOS	OK
	SFP LOS	OK
	SFP Present	OK
	Received Alarms:	None
	GPS B Selected	OK

Web Console (App & Alarms)

The table below shows the list of alarm causes and resolutions. All alarms listed are available on the web interface of **GPSR400** and **GPSR116**. All alarms are also reportable via SNMP.

Alarms:	Cause	Resolution
Local LOF	loss of CPRI frame including frame synchronization	check optical fiber cable, connection and optical power on both ends
Local LOS	loss of CPRI signal	
Remote LOF	remote loss of CPRI frame including frame synchronization	
Remote LOS	remote loss of CPRI signal	
SFP LOS	loss of SFP signal	
SFP Present	SFP module not present	call tech support to replace the SFP module
GPS A:		
Antenna A	Antenna port A not connected (open or short)	check antenna A, cable, connection and +5VDC at "GPS In 1" port of GPSR400
Antenna B	Antenna port B not connected (open or short)	check antenna B, cable, connection and +5VDC at "GPS In 2" port of GPSR400
GPS A Lock	GPS receiver A not locked to GPS satellite signals	check antenna A, Antenna B, cable, connection and +5VDC as above
GPS A Selected	GPS receiver A is not selected as signal source	OK if the other GPS is selected, otherwise check GPS A Lock as above
GPS B:		
Antenna C	Antenna port C not connected (open or short)	check antenna C, cable, connection and +5VDC at "GPS In 3" port of GPSR400
Antenna D	Antenna port D not connected (open or short)	check antenna D, cable, connection and +5VDC at "GPS In 4" port of GPSR400
GPS B Lock	GPS receiver B not locked to GPS satellite signals	check antenna C, antenna D, cable, connection and +5VDC as above
GPS B Selected	GPS receiver B is not selected as signal source	OK if the other GPS is selected, otherwise check GPS B Lock as above
Local GPS:		
GPS Lock	local GPS receiver is not locked	check CPRI, SFP and antennas as above

Notes

CPRI : Common Public Radio Interface

SFP: (Small Form-factor Pluggable) A transceiver for optical fiber cable

GPS A is connected to either Antenna A ("GPS In 1") or Antenna B ("GPS In 2")

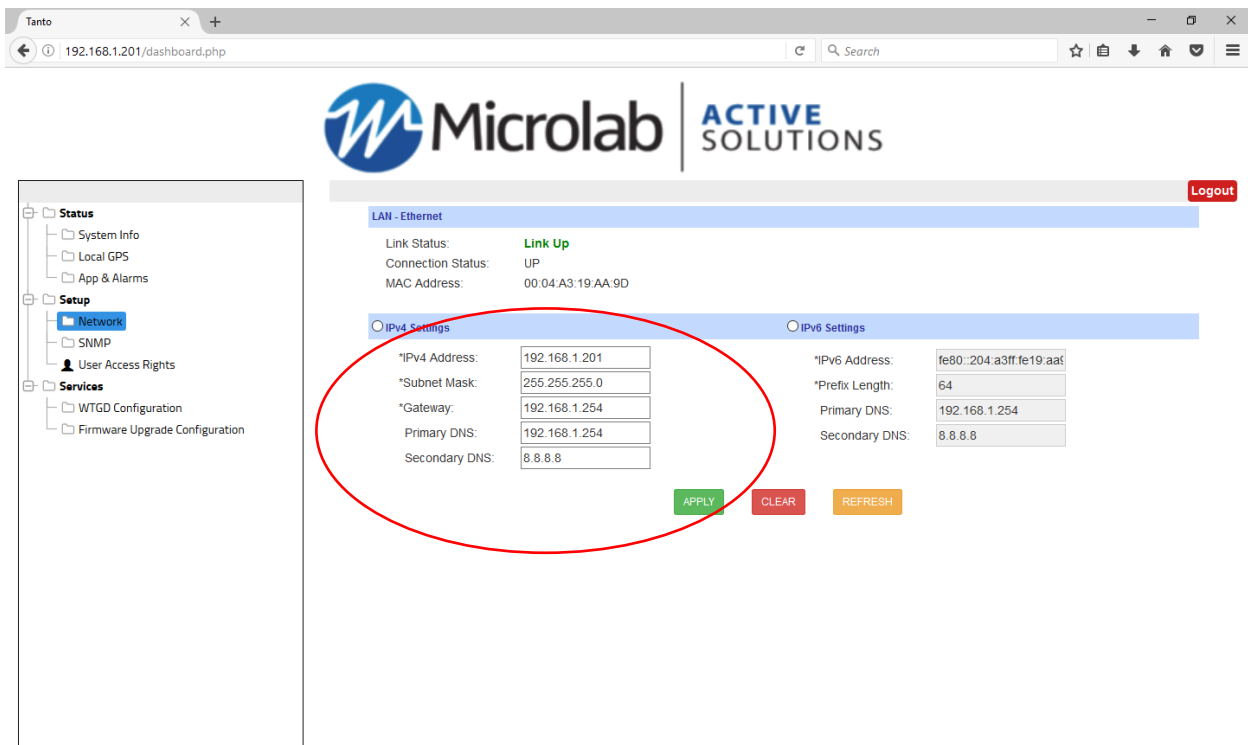
GPS B is connected to either Antenna C ("GPS In 3") or Antenna D ("GPS In 4")

Either RF path of GPS A or RF path of GPS B is selected as input to Local GPS and BS

Web Console (Network)

Change Default IPv4 Network Settings

1. Click "Network" under "Setup" in the menu tree on the left.
2. Select the IP version to be configured (**IPv4**)
 - 2.1 Set the desired IP address of the **GPSR116**. It should be within the range of the gateway.
 - 2.1.1 Default IP Address: 192.168.1.201
 - 2.2 Set the subnet mask of the router
 - 2.2.1 Default Subnet Mask: 255.255.255.0
 - 2.3 Set the gateway of the router (the router's IP address)
 - 2.3.1 Default Gateway: 192.168.1.254
 - 2.4 Set Primary and Secondary DNS addresses
 - 2.4.1 Default Primary DNS: 192.168.1.254
 - 2.4.2 Default Secondary DNS: 8.8.8.8
3. Click the Apply button (Current page will not refresh)
4. Reopen internet browser and type the newly configured IP address
 - 4.1 Popup will appear confirming "Successfully configure the Network". Press "OK" to continue
 - 4.2 The system log-in page should appear.
 - 4.3 Type in the admin username and password.



The screenshot shows the Microlab Active Solutions web console. The left sidebar contains a menu tree with 'Setup' > 'Network' selected. The main content area shows the 'LAN - Ethernet' status as 'Link Up'. Below this, the 'IPv4 Settings' section is highlighted with a red circle. It contains the following fields:

Field	Value
*IPv4 Address:	192.168.1.201
*Subnet Mask:	255.255.255.0
*Gateway:	192.168.1.254
Primary DNS:	192.168.1.254
Secondary DNS:	8.8.8.8

Below the IPv4 settings are three buttons: 'APPLY' (green), 'CLEAR' (red), and 'REFRESH' (orange). To the right, the 'IPv6 Settings' section is visible but not selected.

Disconnecting/Uninstalling

Sequence to Disconnect:

1. **Switch OFF** the unit
2. Remove/Disconnect DC power to the device
3. Disconnect the RF Output connections of the unit.
4. Disconnect optical input of the unit.
5. Disconnect Ethernet connection of the unit (if ethernet-fed).
5. Disconnect Ground
6. Unmount Unit

Disclaimer

GPS and GNSS re-transmission to an antenna requires regulatory approval. These approvals are granted on an individual basis by regulating bodies. Microlab cannot grant these approvals, and cannot be held responsible for violating these regulations using the system.

The FCC requires commercial users within the US to acquire and maintain a Part 5 experimental license to re-broadcast GPS signals. Licenses are not required if they are inside an RF shielded environment. European regulations vary by country. Consult local authorities for additional details.

Contact Microlab - Active Solutions

To contact Microlab, visit our website at www.microlabtech.com or send email to sales@microlabtech.com. For operating assistance in the USA, call (973) 386-9696.

Safety Information

To avoid possible electric shock or personal injury, the following general safety precautions must be observed during all phases of operation, service, or repair of the Microlab Unit. Failure to comply with these precautions or with specific warnings in this guide violates the safety standards of design, manufacture, and intended use of the Microlab Unit. Microlab assumes no liability for the customer's failure to comply with these requirements.