Power Sensor

sat-nms PS2

User Manual

Version 3.0.007

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Abstract

> The ***sat-nms*** PowerSensor manufactured by SatService GmbH is a measurement tool which measures the RF output power of 6, 8 or 14GHz satellite communications signals and provides this information both on a web page via an internal web server or as M&C output information for control systems.
>
> This document describes how to install, setup and operate this antenna controller.

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1 Introduction

The ***sat-nms*** PowerSensor enables the ***sat-nms*** software to perform a precise power measurement even if the monitored and controlled SATCOM equipment like TWT or SSPA amplifiers or converters do not provide the necessary capabilities or don't have the accuracy. Applications which include a transmit power control loop need to measure the transmit amplifier output power. While many amplifiers provide a built in power sensor with adequate accuracy and resolution, some low-cost models do not. This power sensor is intended to be a supplement to such equipment.

This user manual contains all necessary information how to install, setup and operate the ***sat-nms*** PowerSensor. The user manual is available as a printed document and for on-line reading on the power sensor itself as well.

The paragraphs below give a short overview to the contents of this manual.

- Installation : The installation chapter guides through the installation and setup of the power sensor. It describes the mechanical concept of the power sensor box and the assignment of the power sensor's connectors. Finally you learn in this chapter how to set the power sensor's IP address, which is a essential precondition to operate the power sensor by means of a web browser.
- Operation : The ***sat-nms*** power sensor is operated using a standard web browser like the Internet-Explorer on MS Windows based computers. The user interface design is straight forward and clearly structured. Operating the power sensor is mostly self-explanatory. Nevertheless, the 'Operation' chapter outlines the map of web pages which make up the user interface and elaborately describes the meaning of each alterable parameter.
- Remote Control : The power sensor provides a versatile remote control interface. A monitoring & control software may fully operate the power sensor through a TCP/IP network connection. This chapter describes the communication protocol used for remote control and lists all parameters accessible through the remote interface.
- Theory of Operation : This chapter gives a short overview how the power sensor works. This includes a description of the power sensor's electronic concept and the methods of linearizion and temperature / frequency response compensation implemented in it.
- Specifications : At the end of the document, the specifications applicable to the ***sat-nms*** power sensor are summarized in this chapter.

Support and Assistance

If you need any assistance regarding our power sensor, don't hesitate to contact us. We would be pleased to help you by

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2 Installation

This chapter describes how to install the ***sat-nms*** power sensor. You find a guide how to connect, configure and mechanically mount the power sensor below.

Before you start, please first read the Safety Instructions chapter below. It contains some important recommendations to prevent damage from the power sensor.

Then, we strongly recommend to do a first setup of the power sensor on a lab desk before installing it at it's final location. This is mainly for the following reason:

To setup the power sensor's IP parameters, the PC used for configuring and the power sensor must either be connected to the same Ethernet hub or must be connected directly with a crossover cable. The initialization program does not work through routers intelligent network switches.

Hence, the typical sequence of tasks when putting an ***sat-nms*** power sensor into operation is as follows:

1. Read the chapter Safety Instructions
2. Set the power sensor's IP address
3. Mechanically mount the power sensor
4. Connect the power sensor to it's signal source, the power supply and the Ethernet network.

2.1 Safety Instructions

Failure to observe all Warnings and Cautions listed below may result in personnel injury and/or equipment damage not covered by the warranty.

- Follow standard Electrostatic Discharge (ESD) procedures when handling an Power Sensor Unit.
- Select and apply the appropriate 24V DC voltage according to the data sheet and documentation **before** connecting power.
- The PowerSensor will be damaged if the total RF input power is higher then +20dBm. Do not connect the RF input of the Power Sensor to interfaces where the total output power is higher than the specified value of the data sheet or indicated on the PowerSensor.
- In case of an failure don't open the Power Sensor, call SatService GmbH for an RMA number.
- Observe normal safety precautions when operating, servicing, and troubleshooting this equipment.
- Take standard safety precautions with hand and/or power tools.
- When connecting the PowerSensor's fault relay circuit, observe the maximum ratings: 120V D/C, 100 mA. The fault circuit is a Photo MOS semiconductor relay which will immediately damaged when connected to higher voltages than specified.

2.2 Setting the IP Address

Before you can operate the power sensor, you need to set the power sensor's IP address. There is a special configuration program on the documentation CD shipping with the power sensor for this purpose. We recommend to configure the power sensor's TCP/IP settings before you install the power sensor at it's final place. To configure the power sensor, the following equipment is required:

- The ***sat-nms*** power sensor itself
- A 24V DC power supply
- A Computer running a Microsoft Windows operating system equipped with CD-ROM drive and Ethernet network card.
- A CAT5 crossover network cable or a Ethernet hub and standard network cables to connect the power sensor and the computer.
- The CD-ROM shipping with the ***sat-nms*** power sensor.

Setting the power sensor's IP parameters now is easily done within a few minutes.

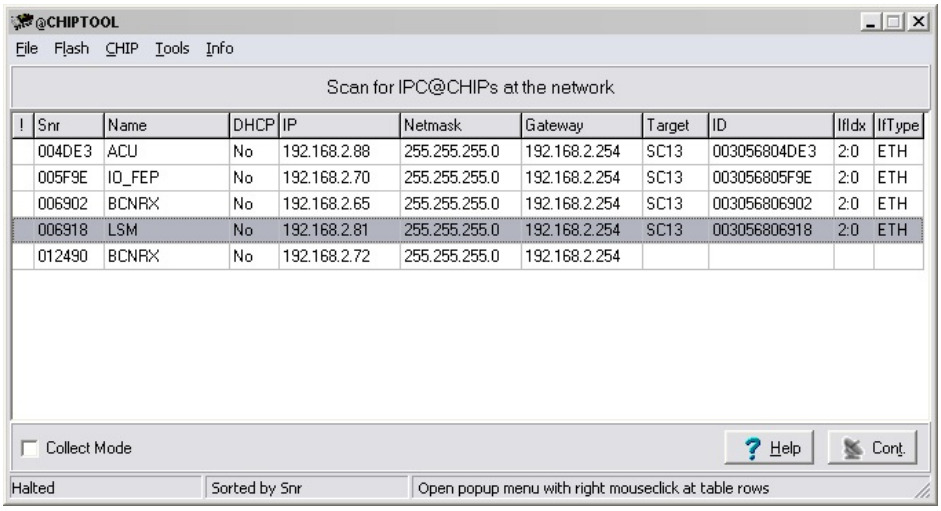
1. First install a network cable between the power sensor and your computer. If you have a

crossover cable available, this is very easy: simply put the cable into the network connectors of computer and power sensor. Without a crossover cable, you need to connect both, the computer and the power sensor to the same network hub using two standard network cables. It is essential, that the computer and the power sensor are connected to the same network segment, the configuration program is not able to find the power sensor through routers or network switches.

2. Now power on your computer and connect the power sensor to the 24V DC supply.

3. Insert the CD-ROM into the computer's drive and inspect it's contents through the 'My Computer' icon on your desktop. Double-click to the 'ChipTool.exe' program in the 'ChipTool' directory.

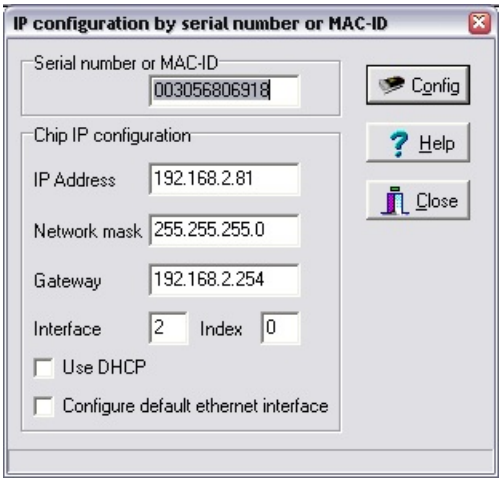
4. When the ChipTool program is running, type CTRL+F to make the program search the power sensor. The program shows a list containing at least one entry describing the actual network parameters of the power sensor.



!	Snr	Name	DHCP	IP	Netmask	Gateway	Target	ID	IfIdx	IfType
	004DE3	ACU	No	192.168.2.88	255.255.255.0	192.168.2.254	SC13	003056804DE3	2:0	ETH
	005F9E	IO_FEP	No	192.168.2.70	255.255.255.0	192.168.2.254	SC13	003056805F9E	2:0	ETH
	006902	BCNRX	No	192.168.2.65	255.255.255.0	192.168.2.254	SC13	003056806902	2:0	ETH
	006918	LSM	No	192.168.2.81	255.255.255.0	192.168.2.254	SC13	003056806918	2:0	ETH
	012490	BCNRX	No	192.168.2.72	255.255.255.0	192.168.2.254				

5. The serial number shown in the first column of the list, must match the serial number printed on the power sensor's enclosure. If the list stays empty, the power sensor is not connected properly. If there are more entries in the list, the configuration program has found other devices in this network segment which use the same technology.

6. Now type CTRL+I to open the IP configuration window of the program. In this form enter the power sensor's serial number, it's new IP address and network mask. If the power sensor later shall be operated through a router, enter the address of the router on the gateway field, otherwise leave this field blanc. Be sure, that the 'DHCP' mark is unchecked. Finally click to the 'Yes' button to set the new parameters at the power sensor!

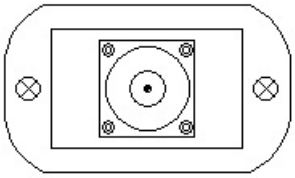


Now the IP configuration of the power sensor is completed. You may finally want to test if the power sensor is reachable now. Start your web browser and type the power sensor's IP address into the URL field of the browser. The power sensor should reply with it's main page, provided that the power sensor and your computer are configured for the same subnet.

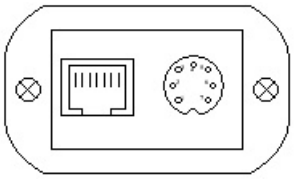
2.3 Connecting the Power Sensor

The connectors of the power sensor are placed on both sides. One side contains the RF input connector, the other side the D/C and Data connectors.

RF connectors:

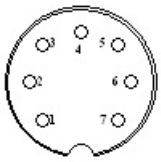


D/C and data connectors:



The RF input connector is a make N-type connector, mounted at one front panel of the power sensor enclosure. At the other side, the Ethernet and power supply connectors are mounted. The Ethernet connector is a standard 10 Base-T / RJ45 connector. Use a standard network cable to connect the power sensor to an Ethernet hub. If you want to connect your computer and the power sensor directly without using a hub, you need a crossover cable for this with swapped RX/TX lines.

The power supply connector also contains the fault relay contact. The latter is a floating Photo MOS solid state circuit. In fault state (level below an adjustable threshold) or while the unit is powered off it is in hi-Z state (several MOhms). A resistance below 10 Ohms indicates that the function is OK. The diagram below shows the pin out of this connector (front view).



Connector type: Binder series 712, subminiature circular, connector (socket), front view

pin no.	*description*
1	n.c.
2	Fault relay circuit (max. ratings: 120V D/C, 100 mA)
3	Fault relay circuit (max. ratings: 120V D/C, 100 mA)
4	Ground
5	Ground
6	n.c
7	+24V Power Supply

Internally the power sensor interconnects RF ground and D/C ground. In order to avoid ground loops, it is recommended not to connect RF ground and D/C ground at a second point.

2.4 Mechanical installation

The ***sat-nms*** PowerSensor is designed to be mechanically mounted with it's RF input connector. For most setups this will be the most convenient method. However, there are some cases where it is recommended to fix the PowerSensor with a break at a solid surface:

- When operated in an vibrating environment, the sensor may resonate when fixed only with the input connector. This may result in a inadmissible severe vibration at the power sensor itself.
- When the sensor is connected to a SMA connector through an adapter, this connection easily may break as it is mechanically to strong enough not fix the sensor in safe manner.

3 Operation

The ***sat-nms*** power sensor is designed to be controlled over a network link using a standard web browser. This means in practice, that the user interface to the power sensor appears in your browser window after you type in the power sensor's IP address in the address field of the browser program.

Operating the power sensor is mostly self-explanatory.

3.1 The Web-based User Interface

After having connected the to a power supply and set the power sensors IP address, you can access the power sensor's user interface. To do this, start your favorite web browser program (Internet Explorer, Netscape Navigator, Opera or what else Program you prefer). At the address

field, where you normally enter the URL of a web page you want to see, type in the IP address of the ***sat-nms*** power sensor you want to control.

The power sensor shows a web page consisting of a navigation bar at the left side of the browser window and the actual readings of the power sensor in the main part of the window. The readings automatically refresh once a second.

The navigation bar at the left contains five buttons which build the power sensor's main menu:

- State --- This button switches back to the power sensor's main page you already see when you connect to the power sensor. This page displays the actual readings of the power sensor.
- Settings --- By clicking to this button you switch to the 'Operational Settings' page where you can view and change the operational settings of the power sensor.
- Setup --- By clicking to this button you switch to the 'Installation Settings' page where you can view and change the basic settings of the power sensor.
- Event Log --- By clicking to this button you switch to the 'Event Log' page where you can view the events of the power sensor.
- Info --- After a mouse click to this button, the power sensor shows a table with information like the serial number of the device or the revision ID and compilation date of the software.
- Help --- Clicking to this button shows the on-line version of this user manual

3.2 Power Reading "State"

The 'Power Reading' page is the main page of the power sensor which shows the actual measurement value and some important settings. Parameter settings reported here, are for information only. To change a setting switch to the Settings page. The 'Power Reading' page automatically refreshes once a second. The table below describes the information shown by this page:

Parameter Name	***Description***
power reading	Shows the actually measured power. The displayed value is the calibrated power at the power sensor's input with the frequency compensation values and an optional level offset added.
frequency	If you have set the frequency value at the Setting page to a non-zero value, the power sensor interpolates this frequency in the frequency response calibration table and includes this value into the displayed power value.
cal offset freq	The amount of frequency response compensation applied is displayed in this field (see description above).
Display Offset	At the Setting page, you may enter an additional level offset which also is included into the displayed value. The value actually used by the power sensor is displayed here.
temperature	Shows the temperature inside the power sensor's enclosure.
average filter	Shows the averaging mode actually used by the power sensor.
Sensitivity	Shows the input amplifier range actually used.

alarm threshold	Shows the alarm threshold actually set at the Setting page. If the **displayed power reading** falls below this limit, an alarm is reported and the normally closed alarm contact is opened.
Raw adc value	Shows the actual measurment value as raw ADC-value (0..65535)
Time	Shows the actual time.
Last time sync	Shows the last synchronization of the time and the source (RTC, NTP)
level alarm	Shows the actual alarm threshold state (OK /FAULT)
NTP time sync alarm	Shows the actual alarm state of the NTP time server

3.3 Operational Settings "Settings"

The page 'Settings' contains the power sensor's operational parameters. Operational parameters are those which are assumed to be changed more frequently than the installation parameters on the Setup page.

The page displays a table with the parameters actually set. Each parameter value is a hyper-link to a separate page which lets you change this parameter. This parameter change page shows the actual parameter setting either in an entry field or in a drop down box. You may change the parameter to the desired value and then click to the 'Submit' button to pass the changed value to the power sensor. The power sensor automatically returns to the settings page when the parameter has been changed. To cancel a parameter modification you already started, either use the 'Back' button of you web browser or click to the 'Settings' button on navigation bar. Both returns to the settings page without changing the parameter you edited.

Parameter Name	***Description***
Sensor Sensitivity	Sets the sensivity range, the power sensor uses. **AUTO** --- makes the power sensor select the appropriate range automatically. **LOW** --- selects the low sensivity range (for high levels). **HIGH** --- selects the high sensivity range. It is strongly recommended to operate the power sensor with in **AUTO** mode.
Average Filter	Sets the filter, the power sensor applies to the measured values. Valid choices are **OFF** --- no averaging. **FAST** --- the sensor displays the average of 8 readings. **SLOW** --- the sensor displays the average of 48 readings.
RF frequency	Here you may enter the frequency of the measured signal in MHz. If this parameter is not zero, the power sensor looks up the frequency response calibration offset for the given frequency and adds this offset to each measured value before it is displayed. The power sensor accepts integer numbers in the range of the calibration table (see info page) and 0 for no offsets.

Display Offset	The value [dB] specified with this parameter is added to the measured power before it is displayed and compared to the fault threshold value. If value is set to zero, the power sensor shows the power which is measured at it's input connector. The valid range is -99.99 to 99.99.
Alarm threshold	alarm threshold --- Defines the alarm threshold value. If the displayed power value (with any user defines offset and frequency response calibration already applied) drops below this limit, the power sensor reports a 'low signal' alarm and opens the fault relay contact. To disable the threshold, set it to -99.99.

3.4 Setup Parameter "Setup"

The page 'Setup' contains the power sensor's installation parameters. Installation parameters are those which are assumed to be changed less frequently than the operational parameters on the Settings page.

The page displays a table with the parameters actually set. Each parameter value is a hyper-link to a separate page which lets you change this parameter. This parameter change page shows the actual parameter setting either in an entry field or in a drop down box. You may change the parameter to the desired value and then click to the 'Submit' button to pass the changed value to the power sensor. The power sensor automatically returns to the settings page when the parameter has been changed. To cancel a parameter modification you already started, either use the 'Back' button of you web browser or click to the 'Settings' button on navigation bar. Both returns to the settings page without changing the parameter you edited.

- **Note** --- You may enter a note / comment here which is displayed by the power sensor as the heading of the 'Readings' page.
- **Display refresh** --- With this parameter you control the display refresh rate of the standard reading / status web-page. The default setting is 1 second. You may slow down the page refresh down to once every 30 second with this setting. Setting the refresh rate to 0 disables the page refresh completely, you may use your browser's 'reload' button to trigger a page refresh manually in this case.
- **User password** --- Here you can define the password for the 'user' login. Default password is 'user'. When you are logged in as 'user' you can control the operating parameters at the 'Settings' page and the fine tuning buttons at the navigation bar. You can't modify the setup parameters while logged in as 'user'.
- **Admin password** --- Here you can define the password for the 'admin' login. Default password is 'admin'. When you are logged in as "admin" you have full access to all parameters of the power sensor.
- **UDP destination address** --- This parameter defines the IP address to which the power sensor sends UDP datagrams with the actual measurement value. Enter the destination IP address in 'dotted quad' notation or the keyword 'none' to prevent the power sensor from sending UDP datagrams. Chapter UDP level distribution explains this communication feature more detailed.
- **SNMP system contact** --- The power sensor replies to MIB-II sysContact requests with the text entered at this place.SNMP read community** --- Sets the SNMP community string expected for read access. The default is 'public'.
- **SNMP system name** --- The power sensor replies to MIB-II sysName requests with the text entered at this place.
- **SNMP system location** --- The power sensor replies to MIB-II sysLocation requests with the

text entered at this place

- **MIB File** --- click here to download the MIB file
- **SNMP write community** --- Sets the SNMP community string expected for write access. The default is 'public'.
- **SNMP trap community** --- Sets the SNMP community string sent with traps. The default is 'public'.
- **SNMP traps** --- This parameter decides if the SNMP traps are enabled or disable
- **SNMP trap IP 1-4** --- Enter up to 4 trap destination IP addresses (dotted quad notation) to make the power sensor sending traps by UDP to these hosts. Setting the parameter to 0.0.0.0 disables the trap generation.
- **Time** --- This parameter allows the time setting if a NTP server is not available.
- **NTP server 1 and 2 IP address** --- This parameter defines the IP address of an NTP server which provides the time stamp for the unit.

4 Remote Control

The ***sat-nms*** power sensor may be controlled remotely by a monitoring and control application through the TCP/IP interface. All communication with the power sensor is made with HTTP get requests. This section gives a detailed description how to read out the power sensor's measurement values and how to set it's operational parameters.

4.1 General command syntax

The power sensor knows a number of parameters, each identified by a parameter name. To set a certain parameter to a new value, a message:

name=value

has to be sent to the power sensor. The power sensor interprets this command, checks the range of *value* , sets the internal parameter and then answers:

name=value

The *value* in the reply is the value actually recognized by the power sensor. For instance, if the requested value was out of range, the replied (and internally used) value is limited to the applicable minimum or maximum.

To read a parameter from the power sensor, instead of a new parameter value a question mark is sent:

name=?

The power sensor replies the actual value in a complete message:

name=value

A complete list of the parameter the power sensor knows is shown later in this document in chapter Parameter list . Below, some common rules applying to the remote control message syntax are summarized.

- Parameter names always are of lower case letters, most of them are four characters long.
- Non-numeric parameter values always are written in upper case.
- Numeric (floating point) values may be specified with an arbitrary precision, however the

device will reply only a fixed number of places. The power sensor recognizes a decimal point ('.'), numbers must not contain any commas.
- There must not be any whitespace in front or after the '=' in a message.
- If the command/query is not of the form **name=value** or **name=?** , the power sensor replies the message **?SYNTAX** .
- If the message syntax is OK, but contains an unknown parameter name is used, the reply is **?UNKNOWN**
- Numeric parameters are cut to the limits defined for this particular parameter.
- Misspelled choice values cause the power sensor to set the first value of the choice list.
- Assigning a value to a read-only parameter will cause no fault, however the power sensor will overwrite this parameter immediately or some seconds later with the actual value.

4.2 TCP/IP remote control interface

Controlling the power sensor through the network is done by means of HTTP GET requests. Setting parameter values or querying readings or settings, all is done by requesting HTTP documents from the power sensor. The message *to* the power sensor thereby is coded into the URL as a CGI form parameter. The power sensor replies a one line document of the MIME type 'text/plain'.

The document name for remote control is **/rmt** , hence (assuming the power sensor is listening to the IP address 10.0.0.1), requesting a document with the URL

```
http://10.0.0.1/rmt?dbms=?
```

will let the power sensor reply the actual power level in a one line text document:

dbms=-22.31

This way all parameters may be queried or set, you may use your favorite web browser to try out the remote control of the power sensor manually.

4.3 Parameter list

The table below shows the complete list of M&C parameters the power sensor knows. For each parameter the data type and a short description is given.

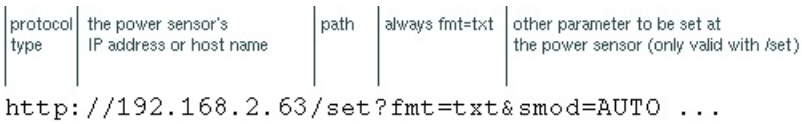
name		type	unit	description
dbms	r/o	float	dBm	The calibrated / temperature compensated power reading in dBm. See chapter Power Reading power reading for a detailed description.
adcv	r/o	int		The raw ADC value without any calibration or compensation applied. The value is in the range 0 .. 65535.
temp	r/o	float	°C	The temperature measured inside the power sensor enclosure. The value is in degree Celsius.
sens	r/o	LOW HIGH		The actual input amplifier sensivity. **sens** is either **HIGH** or **LOW**

tflt	r/o	FAULT OK		The threshold fault state. if the power reading is below the threshold the value is **FAULT** else **OK**
tsya	r/o			NTP time sync alarm
smod		AUTO LOW HIGH		Sets the sensivity range, the power sensor uses. See chapter Operational Settings Sensor Sensitivity for a detailed description.
fltr		OFF FAST SLOW		Sets the filter, the power sensor applies to the measured values. See chapter Operational Settings Average Filter for a detailed description.
thrh		float	dBm	Defines the alarm threshold value. See chapter Operational Settings Alarm threshold for a detailed description.
freq		int	MHz	Defines the frequency of the measured signal in MHz. See chapter Operational Settings RF frequency for a detailed description.
fcor	r/o	float	dB	The calibration offset, the power sensor actually adds to each measured value due to the frequency response calibration. See chapter Power Reading cal offest freq for a detailed description.
offs		float	dB	The value [dB] specified with this parameter is added to the measured power before it is displayed and compared to the fault threshold value. See chapter Operational Settings Display Offset for a detailed description.
srno	r/o	character string		The power sensor's serial number. This is a five digit hexadecimal number which uniquely identifies each individual unit. For the one line command use ' snr' instead 'srno'.
note		character string		The Power Sensor Note / comment, which is displayed by the power sensor as the heading of the 'Readings' page.
udpa		character string		UDP destination address
sver	r/o	character string		Software version
scon		character string		SNMP system contact
snam		character string		SNMP system name

sloc		character string		SNMP system location
rcom		character string		SNMP read community
wcom		character string		SNMP write community
tcom		character string		SNMP trap community
autr		DISABLED,ENABLED		SNMP traps enabled, disabled
ipt1..4		character string		SNMP Trap destination address
stim		character string		Set the actual time in the following format 'yyyy-mm-dd hh:mm:ss'
time	r/o	character string		Get the actual time in the following format 'yyyy-mm-dd hh:mm:ss'
lsyn	r/o	character string		Last time synchronization
ntp1..2		character string		NTP server IP address
ivpr	r/o	character string		Invalid parameter value, set only if the entered value out of range

4.4 One line 'read' via Command TCP/IP

Command parameters to the power sensor are appended as CGI form parameters to the URL (see RFC-1738). The first parameter always is 'fmt=txt' which tells the unit to reply a one line text document instead of a voluminous HTML page.



To read the measurement value from the power sensor, request the 'read' document with a HTTP GET command. The path which must be sent with the GET request is

/read?fmt=txt

Assuming the power sensor listens to the IP address 10.0.0.1, the complete URL for the request is:

```
http://10.0.0.1/read?fmt=txt
```

The 'fmt=txt' parameter forces the power sensor to reply a one line text document rather than the HTML coded page which is normally displayed by the web browser.

The power sensor answers a 'text/plain' type document which consist of one line. As shown in the example below, the line consists of a set of keyword - value pairs, separated by '&' characters. Within each pair, keyword and value are separated by the '=' character.

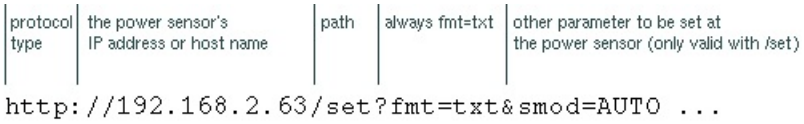
dbms=-12.34&adcv=12345&temp=22.5&sens=LOW&tflt=OK

The format does not use fixed column widths for the values, however the precision of floating

point values is always as shown in the example. An application which parses this string should not rely on the order of the values in the line. Future version of the power sensor may provide additional values which not necessarily will appear at the end of the line. A description of the parameters is given in the chapter Parameter list above.

4.5 One line 'set' via Command TCP/IP

Command parameters to the power sensor are appended as CGI form parameters to the URL (see RFC-1738). The first parameter always is 'fmt=txt' which tells the unit to reply a one line text document instead of a voluminous HTML page.



To set the operational parameters the power sensor, request the 'set' document with a HTTP GET command and append the parameters which shall be set to the URL. The path which must be sent with the GET request is

/set?fmt=txt&...

where ... stands for an arbitrary number of parameter definitions, each consisting of a key word and the associated parameter value, separated by a '=' character. Assuming the power sensor listens to the IP address 10.0.0.1, an example URL for this request is:

```
http://10.0.0.1/set?fmt=txt&smod=AUTO&offs=0
```

The 'fmt=txt' parameter forces the power sensor to reply a one line text document rather than the HTML coded page which is normally displayed by the web browser. The parameter definitions 'smod=AUTO' and 'offs=0' shown in the above example make the power sensor to select it's sensivity range automatically and to clear any user defined offset to the measurement value. For a complete list of keywords see the table below.

The power sensor replies to every 'set' request with a complete list of parameters in one line. Like with the 'read' command, the line consists of a set of keyword - value pairs, separated by '&' characters. Within each pair, keyword and value are separated by the '=' character.

smod=AUTO&fltr=OFF&thrh=-99.99&freq=0&fcor=0.00&offs=0.00&snr=0D8F9

The values contained in this list are the values which actually are applying, including the new values read from the 'set' URL. The power sensor does not give a fault message if it receives an invalid parameter definition. It limits parameter values to a valid range or selections instead. If a keyword is not known, it ignores this parameter completely. To read the parameters actually set with changing a value, send a HTTP GET request with 'fmt=txt' as the only parameter. A description of the parameters is given in the chapter Parameter list above.

4.6 UDP level distribution

Polling the power sensor by means of HTTP GET requests via the network interfaces is limited in speed. The power sensor may be polled about three times a second this way.

To overcome this limitation, the power sensor provides the capability to distribute the measured level as UDP datagrams. It does this in real time as the values are sampled by the power sensor

(20 samples per second).

Protocol Definition

The UDP datagrams are sent to a configurable IP address at port 2000. Each datagram carries the actual measurement value as a zero-terminated string. Hence, if the power sensor is configured to make plain level measurements, the UDP datagrams contain something like '-25.33' which represents the measured level in dBm.

UDP datagrams are sent each time the power sensor measures the input level.

Configuration

To use the UDP feature, enter a valid IP address to the "UDP destination address" field at the Setup page or set this parameter from remore with the ' udpa ' remote parameter.

The power sensor starts to send UDP datagrams as soon as it receives a valid destination IP address. To stop the UDP distribution, set the destination address value to 'none'.

Beside definite IP addresses, the power sensor also accepts UDP broadcast masks for the "UDP destination address" parameter. In this case, the power sensor sends the datagrams as UPD broadcasts, multiple clients may receive the measurement value in this mode. When using UDP broadcasts you should consider the following:

- Other computers in the same network which listen to UDP datagrams at port 2000 may be disturbed by the data send by the power sensor.
- You must not enable UDP broadcasts for more than one power sensor in a network. Receivers of the UPD messages might fail to distinguish the messages coming from different power sensors.
- IP routers, also some sorts of switches deny to forward UPD broadcasts unless they are explicitly configured to do so.

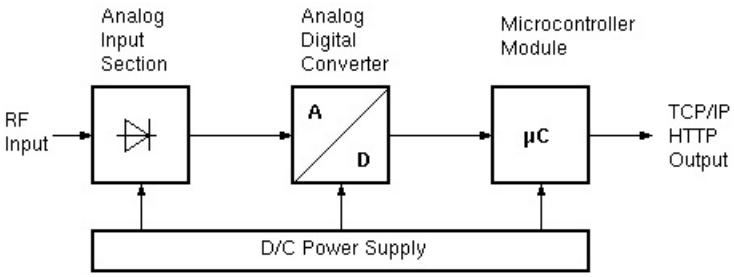
4.7 SNMP Control

The ***sat-nms*** power sensor contains an SNMP agent listening at UDP port 161. The SNMP agent provides a common subset of the MIB-II system / interface parameters and gives full access to the remote control capabilities of the power sensor with a number of MIB objects placed in the private.enterprises tree.

The actual MIB file defining the ***sat-nms*** power sensor private MIB may be downloaded from the unit itself by FTP (user 'service', password 'service'). The file 'P-SENS.MIB' contains all necessary information. A link to this MIB file is also included in the web interface on the 'setup page'.

5 Theory of Operation

The ***sat-nms*** Power Sensor consists of the following four major parts:



In the analog input section a microwave detector provides a DC voltage which is depending on the input power range either proportional to the input power or proportional to the input voltage of the input power at the power sensor. The relationship between input power level and the DC voltage to be measured in the last instance by the analog to digital converter is not necessarily to be known exactly, as this is measured and calibrated during the in-factory calibration of each individual sensor.

The DC voltage coming from microwave power detector gets amplified in an operational amplifier. Via a switchable resistor network the gain of the amplifier is controlled by the micro controller, which allows a so called high and low sensitivity mode. The power sensor software will control this switch and either set the gain to a fixed high or low-sensitivity value or in 'auto' mode take full control about the sensitivity control and depending on the analog to digital converter (ADC) output value switch the sensitivity automatically.

At the output of the operational amplifier the DC voltage which is a measure of the RF input power is provided as input value to the analog to digital converter. The ***sat-nms*** Power Sensor uses a 16 bit ADC, this provides enough resolution to always guarantee the 0,01dB resolution in power level output via the web server.

The complete power sensor is operated by a 24V DC voltage source. This has the advantage that the already existing 24V supplies in a satellite ground station or an M&C System can be used to provide the supply voltage of the power sensor. The 24V supply voltage is routed via a EMV coupled inductor and a transsorber diode which switches off at voltages greater than 36V. This together with a fuse protects the power sensor from to high input voltages or EMV disturbances introduced via the 24V supply line.

After this input and safety section a DC/DC converter provides the 5V/3.3V DC voltage necessary for the microprocessor and digital part of the power sensor. Parallel to this a linear voltage regulator provides a so called analogue +/-3.3V which is independent from the microprocessors digital 3.3V supply and therefore more stable and less noise which is better for the analog to digital converter and its analog input section.

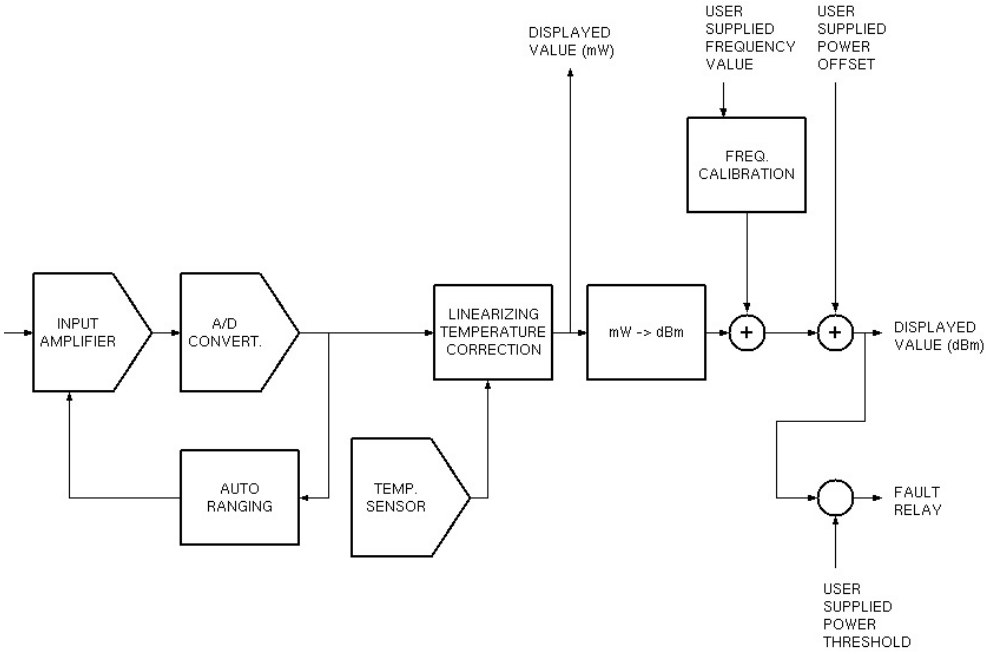
Beside the detector diode and the RF matching circuitry the RF sensor module contains a temperature sensor. The temperature registered by this sensor is used by software in the M&C module to perform the temperature compensation of the measured power.

5.1 Linearity and Temperature Compensation

The microprocessor module measures the RF power by means of the A/D converter, measures the temperature and controls the input amplifier sensitivity. Using this data, the software calculates the true RF input power by interpolating in calibration tables.

During the in house commissioning each power sensor individually gets calibrated at several temperatures over the whole dynamic range. The calibration tables derived from this are stored

on the power sensor. During operation, the power sensor interpolates in these tables to evaluate the true measured power from the raw ADC value and the temperature reading.



5.2 Frequency Response Calibration

The power sensor has a frequency response calibration table built in, which lets the power sensor compensate the influence of the signal frequency to the power reading. This calibration has been made at SatService GmbH, the power sensor shows the power value at it's input connector with this calibration.

If you are going to use the power sensor mounted at a fixed location in an earth station, you might want to include your coupler calibration to make the power sensor show the real amplifier output power. For this reason it is possible to replace the calibration table in the power sensor.

The calibration table is a plain text file called FCORR.TXT. It contains a table where each line consists of a frequency value (MHz) and the correction value (dB), separated by a semicolon. The file should not contain any other information, no space characters and no empty lines. You may prepare this table with a spread sheet program like Microsoft Excel and export the table as a semicolon separated 'csv' table.

To upload your own FCORR.TXT file to the power sensor, use a standard FTP client program at the command line. Replace the default IP address from the example below with the address the power sensor is actually listening to

```
ftp 192.168.2.62
user name: service
password: service
ren FCORR.TXT FCORR.BAK
put FCORR.TXT
bye
```

The suggested command sequence in the example above contains the line **ren FCORR.TXT FCORR.BAK** . You should do this once the before you upload a FCORR.TXT file the first time.

This saves the original calibration table into the FCORR.BAK file and lets you restore the factory calibration at a later time.

Never change or delete the 'H*.TXT' / 'L*.TXT' calibration files on the power sensor. If these files are damaged, the sensor must be returned to SatService GmbH and calibrated again. There is no way to calibrate the power sensor on-site!

6 Specifications

RF Specification

Input frequency range (to be defined at order) PSMC	5.8 to 6.6 GHz
Input frequency range (to be defined at order) PSMX	7.9 to 8.4 GHz
Input frequency range (to be defined at order) PSMKu	13.75 to 14.5 GHz
Input Connector	N male 50 Ohm
Input Return Loss	> 16 dB
Input Power Measurement Range	-15 to -15 dBm
Input Power damage Level	+20 dBm
Resolution of power level	0.01 dB
Linearity failure	+/-0.1 dB
Absolute Accuracy	1 dB
Averaging function selectable	High, Low, Auto

M&C Interface Specification

Ethernet interface for M&C and user interface	10-Base-T
User Interface	Via any Web Browser
M&C Interface for remote monitoring & control	Via http GET requests
Summary fault / level alarm indication	Photo MOS Relay contact (120 V D/C, 100 mA)

Electrical and Mechanical Specification, Environmental conditions

Supply Voltage, all stabilization necessary should be performed on the board	22V to 28V unregulated DC
Connector for 24V Supply and Alarm contact	Binder Series 712 7PIN
Temperature range	5° to 50° C
Humidity	up to 90% non condensing .ts Compact Module