FREQUENCY COUNTERS

STARTEK ATH SERIES
User's Manual

This Manual has been edited for web viewing.

Photo shows model ATH-15, front & side view, with #CC-90 Case, #TA-90 Telescoping Antenna and AC Adapter / Charger.

Information and specifications in this document are subject to change without notice or obligation.

User's Manual

STARTEK ATH SERIES
FREQUENCY COUNTERS

ATH-10 ATH-15 ATH-30 ATH-50

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1. INTRODUCTION

The ***STARTEK ATH SERIES*** frequency counters are sub-compact, pocket size units, designed for ease of use and dependable performance. Utilizing computer aided design and built with top shelf, commercial grade components, the low cost of these instruments belies the quality construction and useful, innovative features found throughout the product line.

ATH refers to the High Speed, ***Auto Trigger & Hold*** circuitry that is standard on all *ATH series* frequency counters. This highly significant feature enables reading of very short signals (80 ms or longer) and also includes an ***automatic clean dropout*** function that prevents a false display when a signal stops amid a sample count or gate time.

The *Response Time* or time from the start of an input signal until the frequency is displayed, has been dramatically speeded up over previous models, about 10 times faster.

The *Auto Trigger & Hold* feature and *Fast Response Time* dramatically change the way these instruments can be used. They offer enjoyment and convenience never before experienced with inexpensive instruments of this type.

The ***STARTEK*** *shirt pocket* frequency counters are used by professionals and amateurs alike for finding and identifying frequencies, counter surveillance functions, repair and adjustment of equipment, monitoring RF output from transmitters and signal generators, tuning antennas with antenna analyzers, field strength measurement and much, much more.

STARTEK frequency counters are designed and assembled at our own facility in Ft. Lauderdale, Florida, USA.

2. FEATURES

Below are some of the features common to all *ATH SERIES* frequency counters.

ATH -- AUTO TRIGGER & HOLD

ULTRA FAST RESPONSE TIME

MAXIMIZED SENSITIVITY

DISPLAY HOLD SWITCH

HIGH EFFICIENCY, HIGH BRIGHTNESS, RED LED DISPLAY

NI-CAD BATTERY PACK & AC ADAPTER STANDARD

HIGH GAIN MULTI-STAGE INPUT AMPLIFIER CIRCUITS

9-12VDC AUTO-POLARITY INPUT POWER JACK

BLACK ANODIZED ALUMINUM CABINET

SUB-COMPACT SIZE: <14 CUBIC INCHES, 9 OUNCES

ATH SERIES FEATURES by MODEL

FEATURES	*ATH-10*	*ATH-15*	*ATH-30*	*ATH-50*
FREQUENCY RANGE	1 MHz - 1200 MHz	1 MHz - 1500 MHz	1 MHz - 2800 MHz	5 Hz - 2800 MHz
AUTO TRIG & HOLD	yes	yes	yes	yes
SIGNAL BAR GRAPH	**no**	**yes**	**yes**	yes
LOW BATTERY IND	**no**	**yes**	**yes**	yes
ONE-SHOT & RESET	**no**	**optional**	**yes**	yes
HI-Z LOW RANGE	**no**	**no**	**no**	yes

3. SPECIFICATIONS

ATH FREQUENCY COUNTER MODELS:

ATH-10, ATH-15, ATH-30 & ATH-50

FREQUENCY RANGE

MODEL	*LOW RANGE*	*HIGH RANGE*

ATH-10	1 MHz to 400 MHz	25 MHz to 1.2 GHz
ATH-15	1 MHz to 500 MHz	25 MHz to 1.5 GHz
ATH-30	1 MHz to 800 MHz	1 MHz to 2.8 GHz
ATH-50	5 Hz to 50 MHz	10 MHz to 2.8 GHz

ATH RESPONSE TIME / RESOLUTION

Auto Trigger & Hold Response Time is the **Total Time** required from the **start** of a readable signal, to *automatically* **read, compute, display, lock and hold** the frequency data (not just gate time). *Resolution* is shown as the value of the least significant digit.

COUNT	*ATH-50* LOW RANGE	*ATH-10/15/30* LOW RANGE	*ATH-10/15/30/50* HIGH RANGE
FAST	0.12 sec / 100 Hz	<0.2 sec / 1 KHz	<0.08 sec / 10 KHz
MED	0.48 sec / 10 Hz	<0.8 sec / 100 Hz	<0.31 sec / 1 KHz
SLOW	4.08 sec / 1 Hz	<6.6 sec / 10 Hz	<2.62 sec / 100 Hz

SIGNAL BAR GRAPH - *ATH-15/30/50* (not on *ATH-10*)

A two inch, 10 segment, red LED Bar Graph, indicates relative signal strength. Works on all frequency ranges (except the High Impedance-Low Range on the *ATH-50s produced after Jan 1998)*, instant reading, functions independently of counter, works with *Display Hold* on or off.

ACCURACY TO CALIBRATION

STANDARD
TIMEBASE: TCXO, +/- 1PPM typ. at room temp., +/- 1 count.

The *standard timebase* consists of a discrete xtal oscillator circuit with temperature compensating components, aging <0.5 PPM/yr typ. Adjustable through a small hole in the front panel labeled *CAL*.

Option #HST-15
TIMEBASE: TCXO, +/- 0.2PPM, 18-40 deg. C typ., +/- 1 count.

The option #HST-15 provides an upgraded, *ultra high stability TCXO* timebase (sealed module), factory installed in counter and adjusted through small hole in cabinet back. Aging <0.2 PPM/year typ.

SIGNAL INPUT

ATH-10/15/30 **&**
ATH-50 **HI RANGE** 50 ohm impedance, BNC connector, vswr <2:1 typ., MMIC amp stages, max input +15dBm/1.26V RMS.

ATH-50 **LO RANGE** 1 megohm nominal impedance, BNC connector. Diode protected FET input and 3 stage IC amplifier circuit.

Max input +10dBw or 22V RMS.

SENSITIVITY

Typical sensitivity stated in millivolts RMS

FREQUENCY	*ATH-10/15*	*ATH-30*	*ATH-50*
5 Hz - 1 MHz	n/a	n/a	5-10mV (Hi-Z)
10-800 MHz	<1mV	<1mV	<1mV
1 GHz	3mV	1mV	1mV
2 GHz	n/a	10mV	10mV
2.4 GHz	n/a	25mV	25mV

DIGITAL FREQUENCY DISPLAY

Eight Extra Bright, high efficiency, red, .3 inch LED digits. Superb angle visibility, usable in bright light, no back light required for darkness or low light conditions. Automatic decimal placement at MHz position. Lead zeros blank above decimal point.

ATH ONE-SHOT FEATURE & RESET CONTROL

This single reading, capture, lock and display function is not available on the *ATH-10*, optional on the *ATH-15*, standard on the *ATH-30* and *ATH-50*. This feature can be switched on or off and works in conjunction with the *ATH* or Auto Trigger & Hold function. This enables reading of a very short duration signal (80 ms or longer) or can be set to trigger and hold a reading unattended, etc. A RESET Push Button is installed on all models with the ONE-SHOT feature. After the ONE-SHOT triggers, RESET can rearm and clear the display to zero.

CABINET

The cabinet is black anodized aluminum, using 4 machine screws.
SIZE: 4" H x 3.5" W x 1" D, **< 14 cubic inches.**
WEIGHT: 9 oz., with internal batteries.

EXTERNAL POWER REQUIREMENTS

Auto-Polarity external power input: Use 9-12 VDC 300mA AC adapter. When powering an ATH series Frequency Counter from an automobile or other auxiliary power source, input to Counter should be 8.5 to 10.5 VDC. #**APA-9** Vehicle Power Adapter accessory has been designed for for powering a STARTEK ATH series Counter from an automobile. Higher voltages can damage batteries, lower voltages may cause counter to operate incorrectly or not at all.

BATTERY OPERATION

Internal Ni-Cad batteries operate unit 3 to 6 Hours, 18-24 Hours required for full charge. Do not charge batteries (or operate on AC adapter/charger) for more than 30 hours continuously. Charging for days at a time will shorten battery life.

4. SWITCH CONTROLS & INDICATORS

PWR SWITCH

AC-CHG: Use this position to turn unit **OFF** when operating from internal batteries.

When powered by the AC adapter or other external 9-12 VDC power source, via the power jack on side of unit, the counter will be on and usable and internal Ni-Cad batteries will be charging.

BAT: Use this position to power unit **ON** from internal batteries.

COUNT SWITCH

The COUNT switch has three positions labeled FAST, MED and SLOW that determine the COUNT TIME (which may also be referred to as the SAMPLE TIME or GATE TIME) for measurement of the input signal. The green LED COUNT indicator is illuminated while the instrument is actually counting.

The slower COUNT time WILL SHOW more resolution or more digits will be displayed. Frequently the higher resolution is not required and the quick reading obtained using the FAST count selection is convenient and sufficient. If higher resolution is preferred, use the FAST or MED count speed first, to establish a steady, readable signal, then switch to SLOW for maximum resolution.

The response time and resolution for the various COUNT times and ranges for each model are listed in the SPECIFICATIONS section.

RANGE SWITCH

Use to select the appropriate RANGE for frequency being counted. The switch is labeled in MHz.
Ranges overlap and sometimes one range will work better than the other for a specific application.

MODEL	LOW RANGE	HIGH RANGE
ATH-10	1-400 MHz	25-1200 MHz
ATH-15	1-500 MHz	25-1500 MHz
ATH-30	1-800 MHz	1-2800 MHz
ATH-50	5 Hz-50 MHz	10-2800 MHz

The low range (5 Hz to 50 MHz) on the ATH-50 has a 1 megohm, HIGH IMPEDANCE, input.
When counting a signal with a probe, it will place minimal loading on the circuit under test.
All other models and ranges have a 50 ohm, low impedance, RF input.

HOLD SWITCH

The hold switch will stop the counter from counting and keep the current frequency display unchanged.
The red HOLD LED will be lit when the HOLD switch is ON.

If the unit is **initially turned on** with the **HOLD switch in the ON position**, the digital frequency display will be blanked and the COUNT & HOLD LEDs will be on. Although it is not necessary, this can be done to turn unit OFF when charging batteries, if desired. Switching HOLD to OFF will immediately activate the counter.

ATH SWITCH

The *ATH* switch enables the **AUTO TRIGGER & HOLD** function, which can be set to automatically trigger, display and hold a reading when the signal stops - hands free!

With the ***ATH* switch OFF** (and HOLD switch off), the unit will continuously cycle the selected COUNT rate (selected by COUNT switch), updating the display after each count, just as most frequency counters operate.

With the ***ATH* switch ON**, the unit will stay in the HOLD status (red LED on) until or unless the input signal level is strong enough to trigger the automatic count circuitry. When the *ATH* triggers, the red HOLD LED will go off and the green COUNT LED will light. When the input signal drops below the trigger level (or input signal stops), the unit will automatically switch to the HOLD status and maintain the last *complete* reading on the digital frequency display.

Automatic Clean Drop-out: When input signal stops amid the count time, the partial count is ignored and the last *complete* reading is held and displayed.

On the models with a Bar Graph (*ATH-15/30/50*), the *ATH* will trigger with an input signal or noise level strong enough to light one or more segments on the Bar Graph. When using the unit with an antenna, the input level can usually be reduced, if necessary, by altering the antenna (change antenna, reduce length of telescoping antenna, etc.).

The *ATH* trigger level is factory adjusted for what should be the best overall operation, however, the trigger level is user adjustable on models *ATH-10/15/30* via a small access hole in the upper left area of the front panel. **It is normally NOT necessary for a user to alter this adjustment.** If the adjustment is changed, the user is cautioned to alter by small increments. On models *ATH-15/30*, this adjustment will also affect Bar Graph sensitivity.

On the *ATH-15/30*, the trigger level and Bar Graph sensitivity are reduced (requiring a stronger signal) when the adjustment is turned counter-clockwise.

On the *ATH-10*, the trigger sensitivity is reduced (requiring a stronger signal) when the adjustment is turned clockwise.

RESET PUSH BUTTON

The RESET switch is a push button, located on the top, right side of the instrument. The RESET switch will clear the display to zeros and restart the COUNT or GATE period that may be in progress. The RESET switch will function any time the unit is powered ON.

This control is on models that have the ONE-SHOT *ATH*feature.

ONE-SHOT *ATH*

A standard feature on *ATH-30/50*, optional on *ATH-15*, not on *ATH-10.*

The ONE-SHOT *ATH* switch is located on the top of the unit and is labeled with the international symbols,

"0" for OFF, "1" for ON.

When utilized, this function will display and hold the **FIRST** readable signal to trigger the counter, until manually reset; only **ONE** COUNT period or GATE TIME is used to prevent a subsequent signal from altering the display data.

The "ONE-SHOT *ATH*" or "ONE READING, Auto Trigger & Hold" function works in conjunction with the *ATH*.

The ***ATH* switch must be ON** and the **HOLD switch must be OFF, to use the ONE-SHOT**.

Next to the ONE-SHOT *ATH* switch are two LED indicators, **SEL** for ONE-SHOT function **SELECTED** and **RDY** for ONE-SHOT function **READY**. When the *ATH* switch is ON and the ONE-SHOT *ATH* switch is ON, the yellow **SEL** LED will be ON.

When the ONE-SHOT function is selected, use the RESET push button to clear the digital display to zeros and light the **RDY** LED. At this point the first signal to trigger the *ATH* circuitry ***for a full count time*** will turn OFF the RDY indicator, the counter will display the frequency and automatically switch to HOLD status. One push of the RESET push button will clear the display and rearm or make the ONE-SHOT *ATH* function READY again.

If a signal triggers a unit, in the "ONE-SHOT READY" status, for less than the selected COUNT TIME, it returns to HOLD with ONE-SHOT READY and the display will not be updated. This function of the AUTOMATIC CLEAN DROP-OUT circuitry prevents the display of erroneous data from a *partial reading*.

LOW BAT INDICATOR

A Low Battery indicator is standard on the *ATH-15/30/50*, not used on *ATH-10*.

The yellow "LOW BATTERY" LED indicator will light (blink) with the COUNT indicator,

when the internal Ni-Cads need to be recharged.

There are a few minutes of operation remaining after the initial warning. The counter can be used, with no damage to the circuitry, until the batteries will no longer power it.

This indicator may be labeled "BAT CHG" on the *ATH-15*.

5. BAR GRAPH & DIGITAL DISPLAY

SIGNAL STRENGTH BAR GRAPH

A signal strength Bar Graph is standard on the *ATH-15/30/50* (not used on the *ATH-10*). The Bar Graph has a two inch display with 10 red LED segments that illuminate from left to right indicating the relative strength of the input signal.

The Bar Graph is quite useful for many applications from peaking the output of a circuit to locating RF sources to showing the presence and relative strength of a signal you may be trying to count, however, it is a relative indication and can vary with frequency.

The Bar Graph functions independently from the digital counter and will react to the strongest input signal. When using an antenna with the counter, a signal may sometimes light from one to all Bar Graph segments before a stable, usable reading is displayed. This usually depends upon the number and strength of RF signals within the band pass or input frequency range of the counter, at the given location. The use of a Band Pass Filter can reduce the input frequency range and minimize this effect.

When counting a signal directly from a circuit with a probe or cable, you will almost always be able to count a stable signal with as little as one or no Bar Graph segments lit. This is due to the undesired RF being eliminated by the shielded cable, reducing the overall noise level and allowing a weaker signal to be counted.

The Bar Graph will function normally with the HOLD function ON or OFF.

DIGITAL FREQUENCY DISPLAY

The frequency of a readable input signal is displayed by an eight digit, red, .3" character height, high efficiency LED display. The extra bright LED digits take no more power than

standard brightness displays but can be used in very bright light, very low light, have excellent angle visibility and are readable by most people to more than 15 feet away.

A decimal point is automatically placed to display MHz. The display will automatically blank leading zeros above the decimal point. The display can be blanked and counter turned off by switching the HOLD ON before powering unit ON. This is not required but can be done when charging batteries, if desired.

6. BATTERY OPERATION

The counters can operate 3 to 6 hours from full charged, internal Ni-Cad batteries. The batteries consist of two packs each made up of two AA Ni-Cads that are soldered on the PC board for a compact installation and a long term trouble free life.

To full charge a battery pack, power externally from an AC adapter or other 12 VDC source, place the PWR SWITCH in the AC-CHG position for 24 hours.

When powering counter and charging the batteries from an external power source, other than the supplied AC adapter, be certain the voltage, under load, **does not exceed 12 volts DC**. If powering unit from an automotive electrical system, the voltage must be reduced as voltages of 14VDC or more are typical in vehicles.

The counter can be **on and usable,** while being charged, or **can be switched off** by placing the HOLD switch ON prior to applying the external power.(The digital LED display will turn off)

When operating the counter from the internal batteries, use the PWR SWITCH for OFF / ON:

BAT = Battery power **ON** & **AC-CHG** = Battery power **OFF**

To maximize battery life and capacity, do not keep the batteries charging for more than one day at a time and occasionally discharge almost completely. **DO NOT TOTALLY DISCHARGE BATTERIES** (This can cause a cell to reverse polarity and ruin the battery pack), operate unit until display is noticeably dim.

A yellow LED, LOW BATTERY indicator labeled "LOW BAT" or "BAT CHG" will flash with the COUNT indicator when the circuit voltage is low and the Ni-Cad batteries need charged. Unit may be operated with the low battery warning but sensitivity will start degrading.
(Not used on *ATH-10*).

7. TIME BASE & FREQUENCY CALIBRATION

STANDARD TIME BASE

The standard time base is a 15.625 MHz crystal oscillator with temperature compensating components.
Typical accuracy to calibration of 1 PPM at room temperature.

Aging rate <0.5 PPM per year typ.

The standard time base is adjusted by a trimmer capacitor, accessible through a small front panel hole labeled "CAL".

HIGH STABILITY TIME BASE (OPTION #HST-15)

OPTION #HST-15 provides an upgraded, ultra High Stability, 15.625 MHz TCXO* time base (sealed module). This option must be factory installed and may be ordered when the unit is initially purchased or a unit, with a standard time base, may be returned to the factory for upgrade.

The premium time base will increase the accuracy of the counter and maintain the accuracy over a much wider temperature range. Typical accuracy to calibration is +/- <0.2 PPM from 18-40 C.

Aging rate <0.5 PPM per year. (<0.2 PPM per year typ)

The high stability time base is adjusted through a small hole in the cabinet back.

*(TCXO = Temperature Compensated Xtal Oscillator)

MEASUREMENT ACCURACY

For an accurate frequency measurement, you must have a stable, repeatable reading. The instrument accuracy to calibration is the "overall time base accuracy +/- 1 count.

To determine the "overall time base accuracy", the temperature stability rating (at

temperature equilibrium) and aging factor for time base, must be calculated.

The "+/- 1 count" refers to the *least significant digit* displayed. This is called a *quantization error* and is inherent in digital measurements. Clearly at higher resolution (more digits displayed), the quantization error is less significant.

Measurement accuracy is +/- a percentage of the frequency and stated in "PPM" or Parts Per Million.

For example:

1PPM @ 150 MHz = 150 Hz, 0.2PPM @ 150 MHz = 30 Hz.

1PPM @ 850 MHz = 850 Hz, 0.2PPM @ 850 MHz = 170 Hz.

FREQUENCY CALIBRATION

STARTEK counters are calibrated just prior to shipment from the factory.

To calibrate the counter, measure a precise frequency signal. Use the MED then the SLOW count time for maximum resolution and adjust the time base calibration control for the correct frequency display. The highest possible calibration frequency should be used for maximum accuracy.

The user is cautioned about making the calibration adjustment without proper equipment. Consult the factory Customer Service Department if in question.

Factory calibration service is available. Contact factory for details.

8. USAGE INFORMATION

TECHNICAL ASSISTANCE

Technical assistance is available by telephone from the factory. Please review the applicable sections of this manual before calling, as every effort has been made to include information in this manual to answer the majority of questions we receive.

If you wish to call, the customer service number is:

954- 537-5577

Technical assistance is not available on the toll free order line.

SIGNAL INPUT

CAUTION!! DO NOT EXCEED MAXIMUM SIGNAL INPUT LEVEL!!

Maximum safe input signal level is +15 dBm or 1.26V RMS. This limit applies to all *ATH* series models with only one exception, the LOW RANGE on the *ATH-50*, which uses a diode protected input that can safely handle up to +10 dBw or about 22V RMS.

Never key a transmitter coupled directly into the counter input.

Keep a 5 Watt transmitter antenna at least 6 feet away from the frequency counter antenna, higher power further, etc.

FACTORY SERVICE TO REPAIR DAMAGED INPUT AMPLIFIER CIRCUITS, CAUSED BY EXCESSIVE INPUT POWER,
IS NOT COVERED BY WARRANTY!!
PLEASE BE CAREFUL!!

Be careful not to allow a static discharge from a TV screen or low humidity environment to reach the antenna as it can damage the input circuit components.

Input protection circuitry is seldom used in products of this type as it significantly degrades the high sensitivity performance.

RANDOM COUNTING

When using the counter with an antenna for signal pick-up, random counts may appear. This is normal, due to the high gain amplifier circuitry, weak signals and noise are amplified in the absence of a stronger, readable signal. If the frequency display changes each time the display is updated, the reading is **not valid** and is usually caused by mixed signals or signals that are too weak to accurately count.

When the counter is operated with no antenna, the display should read zeros. If a unit is operated by battery, immediately after full charging the batteries, a small random count may sometimes occur for the first few minutes of operation as the battery voltage can be extra high for a short period. **Any readable signal will override a random count**.

A readable signal must be at least 10 dB stronger than the next strongest signal or noise level. If two strong signals have near equal signal strength, neither can be accurately counted. This is analogous to multiple signals of near equal strength on a receiver channel.

DISTANCE FROM TRANSMITTER, ANTENNA RECEPTION

The distance from a transmitter at which a frequency counter can read the frequency depends on many factors, such as type and location of transmitting antenna, transmitter output power, type of antennas, obstacles, other strong RF signals nearby, the sensitivity of the counter, the particular frequency and more.

A frequency counter will simultaneously receive RF signals over a huge frequency spectrum of hundreds of MHz or literally millions of radio communication channels. A counter can not have the sensitivity of a radio receiver tuned to a single channel. This is why you must have a strong signal and be much closer to the transmitting antenna.

Due to the many variables, readability distances from a transmitter can vary greatly, however, some typical situations are as follows:

TRANSMITTING DEVICE	TYPICAL DISTANCE in FEET
Cordless phone - 49 MHz	1
Cellular phone - 840 MHz	10 - 80
VHF 1W HT - 150 MHz	10 - 100
UHF 1W HT - 450 MHz	10 - 100
CB 5W - 27 MHz	5 - 30

Significant improvements in reception distances can be made using Band Pass Filters and antennas made for specific frequency bands.

ANTENNAS

The telescoping antenna is the most useful general purpose antenna. When using a telescoping antenna, it will maximize the counter sensitivity if you collapse it to a minimum length for UHF, 450 and 850 MHz frequencies and above, fully extend it for HF and VHF, 150 MHz and below signals.

Using an antenna cut and tuned for a specific frequency band, such as an 800 MHz rubber duck, has two advantages. First it will maximize the input sensitivity of the counter or receiving device in the desired frequency band and reduce the sensitivity at other frequencies, which can also help reception in the desired band. Finding the best antenna to use in a particular situation is usually best done by trial and error experimentation.

HAM & CB FIXED STATION USE

When monitoring a fixed station transmitter at HF frequencies, the radio shack signal, near the transmitter, may be relatively weak due to distance from the antenna and the increased efficiency of the transmitter shielding at the longer wavelength, lower frequencies.

If you have difficulty reading the signal with a small antenna on the counter, there are other methods that may be tried.

A piece of hook-up wire can be run, from the input connector on the counter, to and along the transmitter output cable. Try 5 to 10 feet along the cable and a turn or two around the cable.
MAKE NO DIRECT CONNECTION to CO-AX CENTER CONDUCTOR.

If an outside antenna is available or can be placed, that may work.

A SIGNAL TAP can be purchased or constructed. This consists of a "T" connector or box in the transmission line, with a pick-up loop or pin of some sort, feeding a small signal to the counter. This can be done with negligible insertion loss in the transmission line.

A Band Pass Filter accessory, such as the LP-60, which passes only frequencies below 60 MHz, can improve the ability to read HF signals as well.

A CW, FM or AM signal can be read but an SSB (single sideband - suppressed carrier) signal can not, unless there is a steady, modulated output. The SSB transmitter can momentarily be switched to the tune or CW position to obtain the frequency reading.

GARAGE DOOR OPENERS

Most garage door openers, auto remote locking devices and alike typically use a pulsed output to save power and extend the battery life. You will not be able to read the frequency from many of these devices without going into the circuit and disabling the timing circuitry to allow a continuous output.

USE WITH ANTENNA ANALYZERS

The counters should work well with antenna analyzers such as the MFJ-207 and other similar models. The frequency counter output from most of these units is unregulated and can vary with the state of the battery. Although the output should not damage a counter, sometimes an erroneous reading of about double the proper frequency may be observed.

This is due to signal overload of the counter input. If this problem is encountered, a series resister of about 150 to 300 Ohms, placed in the input cable, should cure the problem.

A custom interface cable with a built in resistor, a BNC male connector on one end and an RCA phono plug on the other, is available from STARTEK as part number M207-IC. This cable should work with any counter and the MFJ antenna analyzers. See OPTIONAL ACCESSORIES section of this manual for more information.

RESOLUTION

The resolution or number of digits displayed will vary with the RANGE and COUNT switch selections. Sometimes the user may want additional digits displayed, however, the accuracy of the time base and total accuracy of the instrument must be able to support the resolution or the least significant digits become meaningless, virtually a *random number generator.*

For example, if you have 1PPM instrument accuracy, that would be 150 Hz at 150 MHz. If you then had 1 Hz resolution (9 digits -- 150.000 000 MHz), it may appear impressive but the last two digits would be **meaningless;** the 3rd digit would be 2 counts!!

The *ATH series* frequency counters have balanced resolution to support a legitimate display, based on instrument accuracy.

DECIBELS to AC VOLTS RMS CONVERSION CHART

+3 dBw	10.0 V	-13 dBm	50.1 mV
+27 dBm	5.01 V	-27 dBm	10.0 mV
+15 dBm	1.26 V	-33 dBm	5.01 mV
+7 dBm	501 mV	-47 dBm	1.00 mV
0 dBm	224 mV	-53 dBm	501 V
-7 dBm	100 mV	-60 dBm	224 V

9. FACTORY SERVICE

Please contact the factory by phone, prior to returning a unit for service, to receive a **RETURN AUTHORIZATION NUMBER** that must appear on the address label. Unauthorized returns may not be accepted. Frequently, problems can be solved by phone, as well.

FACTORY CUSTOMER SERVICE PHONE

954- 537-5577

Technical help is not available on the "Order Line"

Please be very specific when explaining your frequency counter problem. Always specify the approximate frequency you are trying to count, type of signal being counted, etc., such as: "1 watt FM handy talkie at 147 MHz, 3 feet away from *ATH-15* frequency counter, on low range with a telescoping antenna", etc. The more specific information you give initially, the faster and better we will be able to help without having to ask for each detail.

If it is necessary to return a unit for repair, include a good description of your problem on a note and include a daytime and/or evening phone number if possible.

For warranty repairs, include return shipping charges, a copy of purchase receipt or information about when and where purchased.

For non-warranty repairs, we can usually give you an estimate on the phone and make payment arrangements, such as credit card, COD, prepayment, etc.

ADDRESS SERVICE RETURNS TO:

STARTEK INTERNATIONAL INC
Customer Service Dept.
398 NE 38th Street
Ft. Lauderdale, FL 33334

INCLUDE RETURN AUTHORIZATION NUMBER

We recommend insurance for all items shipped to the factory. Carefully package to prevent damage. Carriers will not pay for damage if an item is not well packaged.

10. LIMITED WARRANTY

STARTEK INTERNATIONAL INC. warrants the *ATH series* frequency counters, to the original purchaser, against defects in material and workmanship for a period of 5 years for parts and one year for repair labor, from date of purchase.

After the first year, the current minimum labor charge will be made for all repairs. All parts required will be provided at no additional charge, for five years from date of purchase, provided repairs are made at the factory.

All parts and labor costs to repair or replace a defective unit are covered for the first year.

This warranty does not cover instruments that have been modified, subjected to unauthorized repairs, misuse or abuse.

This warranty does not cover damage caused by excessive power levels applied to signal input.

This warranty is limited to the value of the instrument and does not cover any incidental or consequential damage or expense.

This warranty does not cover transportation costs; all repairs are FOB our factory.

STARTEK instruments are not warranted as to suitability for any specific application.

STARTEK INTERNATIONAL INC. PROVIDES NO OTHER WARRANTIES THAT EXTEND BEYOND
THE ABOVE DESCRIBED LIMITED WARRANTY.

11. OPTIONAL ACCESSORIES

A	CC-90	Black vinyl zipper case
B	TA-90	Telescoping BNC antenna
C	TA-90-L	Telescoping elbow BNC antenna
D	RD-150	150 MHz Rubber Duck BNC antenna
E	RD-2750	27-50 MHz Rubber Duck BNC antenna
F	RD-800	800-850 MHz Rubber Duck BNC antenna
G	M207-IC	Interface-resistance cable for MFJ-207 & similar antenna analyzers.
H	P-110	200 MHz probe, 1X or 10X switchable Scope or frequency counter usage.
J	LP-22	Lo-pass audio frequency probe. Will attenuate RF noise from audio frequencies.

K	DC-10	Direct, 50 Ohm probe

BAND PASS FILTERS

Can increase readability distance from a transmitter.
< 1 dB pass band insertion loss.

LP-60	DC-60 MHz usage
BP-150	115-800 MHz Usage
HP-400	400-1500 MHz usage
HP-800	800-2000 MHz usage

12. SHIPPING TO FACTORY

If for any reason it is necessary to ship anything to the factory, please call and request a

"**RETURN AUTHORIZATION NUMBER**".

Return authorization numbers are valid for 30 days.

SHIPMENTS WITHOUT AN AUTHORIZATION NUMBER MAY BE REFUSED AND RETURNED TO SENDER.

PLEASE BE CERTAIN TO CLEARLY MARK YOUR RETURN AUTHORIZATION NUMBER ON OR NEAR THE ADDRESS LABEL.

All shipments should use the address below. Pack items carefully and avoid damage & problems. We recommend the sender fully insure shipment.

STARTEK INTERNATIONAL INC. 398 NE 38th Street Ft. Lauderdale, FL 33334 USA

PHONE 954-537-5577