

STARTEK INTERNATIONAL INC

Ft. Lauderdale, Florida

MODELS

1350 15-UHS

15-BG 35-BG

FREQUENCY COUNTER

USER MANUAL



STARTEK INTERNATIONAL, INC.

398 NE 38TH ST., FORT LAUDERDALE, FL 33334

PHONE: (305) 561-2211 FAX: (305) 561-9133

STARTEK FREQUENCY COUNTER USER MANUAL

FOR MODELS: 1350 15-UHS 15-BG 35-BG

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CAUTION: DO NOT EXCEED MAXIMUM INPUT SIGNAL LEVEL

Maximum safe input signal level is +15 dBm or about 2V peak (1.26V RMS), however, below 30 MHZ up to 5V peak will not damage the input circuitry.

Never key a transmitter directly into the counter input.

Be careful not to allow a static discharge from a TV screen or low humidity environment to reach the antenna as it would very likely damage the input circuitry of the counter.

USE WITH ANTENNA ANALYZERS (MFJ-207)

The counters should work well with an antenna analyzer such as the MFJ-207. The MFJ-207 has a frequency counter output which is unregulated and its output signal will vary with the state of the battery. The output level of the 207 may in some cases exceed the maximum input voltage rating for our counters but does not harm them as we are dealing with HF frequencies (below 30 MHZ). Although the output does not damage the counters, sometimes an erroneous reading of about double the proper frequency may be observed due to this signal overload. A 200 to 500 Ohm resistor in series with the input signal will cure the problem, should you experience it.

A custom interface cable for the MFJ-207 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 M207IC for \$10.00. This cable should work with any counter and the MFJ-207 analyzer.

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(305) 537-5577
FAX: (305) 561-9133

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. The more closely you approximate the frequency wavelength, the better your antenna will work at that frequency.

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.

HAM & CB FIXED STATION USE

For monitoring a fixed station transmitter output for CB or HAM HF frequencies, the signal in the shack, near the transmitter, may be very weak due to efficient shielding of the transmitter and distance from the outside antenna. This can be particularly noticeable at 40 meters and below due to the longer wavelength. If the signal can not be picked up by using an antenna, try a piece of hook-up wire from the input connector on the counter to the output coax and run it a few feet along the coax or try a turn or two around the cable, NO DIRECT CONNECTION to a transmitter output should ever be used or required.

A CW, AM or FM signal can be read but a SSB-suppressed carrier signal can not unless there is a steady output. An SSB transmitter can usually be switched into the TUNE position momentarily 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 most of these devices without going into the circuit and defeating the timing circuitry to allow a continuous output.

MODEL BOAT & PLANE REMOTE CONTROL TRANSMITTERS

Most FM transmitters such as ACE, JR and AIRTRONICS, 72 and 53 MHZ, can be read but most AM transmitters can not.

STARTEK RF COUNTERS *** USER INFORMATION

MODELS:	1350	15-UHS	15-BG	35-BG
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The STARTEK model 1350 replaces the 1500A, the model 15 replaces the 1500HS. These updated models have numerous improvements including: a BATTERY CHARGE INDICATOR, AUTO POLARITY power input, 3 GATE TIMES, a HOLD SWITCH with INDICATOR, provisions to accept future options and upgradeability.

The STARTEK models 15-BG and 35-BG are all NEW, top quality sub-compact RF Counters with an integrated signal strength Graph.

STARTEK was the first company to offer "shirt pocket" size counters ranging over 3 GHZ; now STARTEK is first again with the RF signal Bar Graph feature to the sub-compact counter.

Other "STANDARD" features and innovations not found in comparable equipment include: auto-polarity power input HOLD switch and indicator, 3 gate times, CAD circuit with high capacity NI-CADS, low power design-longer battery operation, Key ICs socketed for serviceability, top quality components, a StarCab anodized aluminum cabinet with machine screw hardware, glass-epoxy UL/FR4 PC boards, TCXO time base.

These counters utilize LSI and surface mount technology with experienced RF layout, packaging and low power design result is unbeatable sensitivity, frequency range and performance in a sub-compact size with 3-5 hours portable operation from the standard internal Ni-Cad batteries.

Used by professionals and amateurs alike, STARTEK "SHIRT POCKET" RF COUNTERS are ideally suited for finding or identifying frequencies, counter surveillance, repair and adjustment of equipment, monitoring RF output from transmitters and signal generators, use with antenna tuners, field strength measurement applications and much, much more.

STARTEK FREQUENCY COUNTERS are designed and 100% assembled in Ft. Lauderdale, Florida - USA

SPECIFICATIONS for MODELS 1350 & 15-UHS FREQUENCY COUNTERS

FREQUENCY RANGE	#15-UHS = 1 MHZ to 1500 MHZ (1.5 GHZ) #1350 = 1 MHZ to 1300 MHZ (1.3 GHZ)		
DISPLAY	8 RED LED DIGITS, .3" HT.		
DISPLAY HOLD	HAS DISPLAY "HOLD" SWITCH & INDICATOR		
3 GATE TIMES & RESOLUTION (FULL RANGE)	10 HZ = SLOW GATE = 25 SECOND 100 HZ = MED GATE = 2.5 SECOND 1 KHZ = FAST GATE = .25 SECOND		
ACCURACY TO CALIBRATION	+/-1PPM, +1 COUNT LSD, 25-35 DEG C TYP. <1PPM/YR TYPICAL AGING, TCXO TIMEBASE		
SIGNAL INPUT	50 OHM, FEMALE BNC CONNECTOR. MAX SAFE INPUT = +15 dBm (1.26V RMS)		
POWER INPUT	9-12 VDC, 2.1mm CO-AXIAL DC POWER JACK, AUTO POLARITY, FULL WAVE BRIDGE INPUT.		
BATTERY OPERATION	3 to 5 HRS USAGE, 16 HRS TO FULL CHARGE, CUSTOM NI-CAD PACK, INTERNAL FACTORY INST.		
CONSTRUCTION	STAR-CABTM ANODIZED ALUMINUM CABINET, SIZE: 3.4"W x 3.8"H x 1"D WEIGHT: 5 oz., 9 oz. with batteries		
SENSITIVITY (TYPICAL) IN mV RMS	FREQUENCY	#1350	#15-UHS
	1-10 MHZ	20-150 mV	.5-10 mV
	10-500	5-35	.1-1
	500-1300	35-250	.5-10

The 15-UHS has MMIC (Monolithic Microwave Integrated Circuit) amplifiers the 1350 does not have, which provide the "UHS" (Ultra High Sensitivity) performance. This is the "sensitivity" or minimum signal level that can be detected and counted. This will directly affect the distance from a transmitter at which a counter can make an "off-the-air" reading, etc. The 1350 has "good" or "normal" frequency counter sensitivity in the HF, VHF and UHF ranges, where the 15-UHS has "ULTRA HIGH SENSITIVITY".

The 1350 replaces the 1500A, the 15-UHS replaces the 1500HS. NUMEROUS IMPROVEMENTS include a BATTERY CHARGE INDICATOR, AUTO-POLARITY POWER INPUT, 3 GATE TIMES, HOLD SWITCH WITH INDICATOR, provisions for FUTURE OPTIONS and UPGRADEABILITY.

USAGE TIPS & INFORMATION

RANDOM COUNTING

When using the counters with an antenna for signal pick-up, random COUNTS or FREQUENCY DISPLAYS often appear. This is normal, due to the high sensitivity amplifier circuitry. If a digital reading changes each time the display is updated or each gate time, it is invalid and usually caused by amplifier oscillations and/or RF signals too weak to obtain a stable, accurate count. A readable signal will override the random count and produce a stable, unchanging indication.

DISTANCE FROM TRANSMITTER, OFF-THE-AIR RECEPTION

The distance from a transmitter at which a counter can read the frequency depends on many factors, such as the type and location of the transmitting antenna, transmitter output power, type of receiving antenna on the counter, obstacles, other strong RF signals nearby, the sensitivity of the counter and more. A frequency counter can simultaneously receive rf signals over a huge spectrum of several hundred MHZ to several GHZ and can not have the sensitivity of a radio receiver which is tuned to a single channel of a few KHZ of bandwidth, therefore you must have a stronger signal and be much closer to the transmitter.

For the above reasons, the off-the-air readable distances will vary greatly, however some typical situations are as follows:

TRANSMITTER	DISTANCE IN FT.
Cordless Phone 49 MHZ	1-3
Cellular Phone 850 MHZ	10-100
VHF 1W HT 150 MHZ	25-150
UHF 1W HT 460 MHZ	25-50
CB 5W 27 MHZ	15-50

NOTE:
The model 1350 does not have the UHS-MMIC amplifier circuits contained in the other models and will not have the off-the-air readability range of the other models.

TIME BASE and CALIBRATION ADJUSTMENT

The counters use a 3.906250 MHZ clock time base which may be adjusted by a trimmer capacitor accessible from a small front panel access hole labeled "CAL". The counters are factory calibrated just prior to shipment.

A TCXO or Temperature Compensated Xtal Oscillator with typical accuracy to calibration of better than ± 1 PPM at room temperatures is standard. Typical aging factor is < 1 PPM/year.

An optional High Stability TCXO is available for some models.

To calibrate the counter, measure a very stable signal of known frequency, use the MED or SLOW GATE TIME for maximum resolution and adjust at the "CAL" location for the proper frequency display. The higher the frequency used for calibration, the more accurate the adjustment.

SIZE and CABINET

All models are enclosed in the high quality StarCab aluminum cases using 4-40 machine screws and press nuts. Cabinets measure approximately: 3.4"W x 3.8"H x 1"D. Weight is about 9 ounces including the internal batteries.

LIMITED WARRANTY

STARTEK INTERNATIONAL INC. warrants this hardware product, to the original purchaser, against defects in material or workmanship for a period of one year from date of purchase. All parts and labor costs to repair or replace a defective unit are covered, provided the instrument was not modified and was not subjected to unauthorized repairs, misuse or abuse. 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.

THERE ARE NO OTHER WARRANTIES THAT EXTEND BEYOND THE ABOVE DESCRIBED LIMITED WARRANTY.

SPECIFICATIONS MODELS 35-BG & 15-BG BAR GRAPH - COUNTERS

FREQUENCY RANGE	#15-BG = 1 MHZ to 1500 MHZ (1.5 GHZ) #35-BG = 1 MHZ to 3200 MHZ (3.2 GHZ)				
SENSITIVITY in mV RMS (typical)	#15-BG	1-500 MHZ .1-2	.5-1.5 GHZ 1-20	1.5-2 GHZ N/A	2-3 GHZ N/A
	#35-BG	.1-2	.2-3	2-10	8-50
DIGITAL DISPLAY	8 x .3" high RED LED DIGITS, AUTO DECIMAL PLACEMENT AT MHZ.				
DISPLAY HOLD	HAS DISPLAY "HOLD" SWITCH & INDICATOR				
BAR GRAPH DISPLAY	10 SEGMENT RED LED, 2 INCH HORIZONTAL DISP. INDICATES RELATIVE SIGNAL STRENGTH OF INPUT SIGNAL. BAR EXTENDS FROM LEFT TO RIGHT.				
BAR/DOT SWITCH	SELECTS "BAR GRAPH" OR "DOT GRAPH" DISPLAY.				
3 GATE TIMES & RESOLUTION (FULL RANGE)	FAST = .25 second, RES = 1 KHZ MED = 2.5 seconds, RES = 100 HZ SLOW = 25 seconds, RES = 10 HZ				
TIMEBASE	TCXO, 3.90625 MHZ.				
ACCURACY TO CALIBRATION	+/-1PPM, +1 COUNT LSD, 25-35 DEG C TYP. <1PPM/YEAR TYPICAL AGING.				
SIGNAL INPUT	50 OHM, FEMALE BNC CONNECTOR, MAX SAFE INPUT = +15 dBm (1.26V RMS).				
POWER INPUT	9 - 12 VDC, CO-AXIAL TYPE DC POWER JACK, AUTO POLARITY, FULL WAVE BRIDGE INPUT.				
CABINET SIZE & WEIGHT	ANODIZED ALUMINUM, 3.4"W x 3.8"H x 1"D, ABOUT 9 ONCES (INCLUDING BATTERIES).				
CONSTRUCTION	MADE IN USA, FIRST QUALITY ASSEMBLY SOCKETED IC'S, DS/PTH/UL-FR4 PC BOARD.				
BATTERY OPERATION	3-5 HOURS OPERATION, 14-16 HOURS CHARGE. CUSTOM NI-CAD PACK, INTERNAL INSTALLATION. USE COUNTER OR TURN OFF DURING CHARGE.				
BATTERY CONFIGURATION	4.8 V CUSTOM NI-CAD PACK, 600 MA-HR, INTERNAL FIT, SOLDERED INSTALLATION.				

CONTROLS & DISPLAYS

DIGITAL DISPLAY

8 red 7 segment LED digits, .3" ht., with automatic decimal point placement at MHZ and lead zero blanking above the decimal point. Overflow indication giving effectively 9 digit resolution above 1 GHZ on the slow (or long) gate time. A display overflow will turn on the decimal point between digits D7 and D8 (leftmost digits).

PWR SWITCH

BATT: Counter is powered ON by internal Ni-Cad batteries.

AC-CHG: When powered by AC adaptor or 9-12 VDC via the POWER INPUT JACK, the counter is operable and will charge Ni-Cad batteries simultaneously.

Counter may be switched off while charging batteries by switching HOLD switch ON before placing DC POWER PLUG into POWER INPUT JACK.

GATE SELECTION SWITCH

The GATE switch has three positions to select the "GATE TIME" or "SAMPLE TIME" for the measurement of the input signal. FAST = .25 sec, MED = 2.5 sec, SLOW = 25 sec. The GATE indicator LED is illuminated during the SAMPLE or GATE TIME.

The slower the gate time, the more resolution or more digits will be displayed. Frequently the higher resolution is not required and the fast reading obtained using the FAST gate time is convenient and sufficient. If higher resolution is preferred, use the fast gate time first, to establish a readable signal, then switch to the slower gate time.

A signal must be very stable to accurately read it on the SLOW gate time. The following examples show the difference in the display with different gate times reading 800 MHZ.

NI-CAD BATTERY OPERATION

The counters can operate 3 to 5 hours from full charged internal NI-CAD batteries. The batteries consist of two custom packs each made up of two AA, 600 MA/HR, leak proof NI-CADS which are soldered on the PC board for a compact installation and a long term trouble free life of typically several years, depending on type of usage, etc.

When the counters are powered externally from an AC adaptor or other 9-12 VDC source, place the PWR SWITCH in the AC-CHG position for 14-16 hours to full charge a completely discharged battery pack. The counter can be on and useable while the batteries are being charged or may be switched off by placing the HOLD SWITCH ON before placing the DC POWER PLUG into the POWER INPUT JACK.

During portable operation, the PWR SWITCH will function as BATT = POWER ON and AC-CHG = POWER OFF.

The battery charge circuit is regulated and continuous charging should not damage the batteries. However, to maximize battery life and capacity, we recommend NOT keeping the batteries on charge for weeks at a time and occasionally discharging the batteries completely.

"BATT CHG" INDICATOR

Some models have a "BATTERY CHARGE" indicator which indicates a regulated charge current is applied to the internal NI-CAD batteries when the indicator is illuminated.

INPUT POWER

The counters require 9 to 12 VDC to power the instrument and charge the internal NI-CAD batteries. The display may be switched off or the unit may be used while the batteries are being charged.

The Bar Graph is quite useful for many applications from peaking the output of a circuit to locating RF sources to simply showing the presence and approximate strength of the signal you are trying to count, however, it is a relative indication and will vary in calibration with frequency and AC to battery operation. When used at a specific frequency for a power measurement, the Bar Graph can be calibrated for a specific reading or power level.

Some Bar Graph models have a small hole on the front panel labeled "BG" which allows access, with a small screw driver, to a Bar Graph sensitivity adjustment.

BAR/DOT SWITCH (Bar Graph Counters)

The "BAR GRAPH" display may be switched to a "DOT GRAPH". The DOT GRAPH uses less power and increases battery operation.

HOLD SWITCH

The HOLD SWITCH can be used for THREE different functions.

- 1) It can "HOLD" the currently displayed FREQUENCY.

When the HOLD SWITCH is in the "1" or ON position the HOLD LED indicator is illuminated and signal gating is suspended allowing the digital frequency display to remain unchanged until the HOLD SWITCH is moved to the "0" or OFF position.

- 2) BAR GRAPH can be turned ON and FREQUENCY DISPLAY OFF.
(Bar Graph Counters)

By switching the HOLD SWITCH "ON" FIRST and then switching ON the counter (battery or external power), the BAR GRAPH will be turned ON and the digital frequency display will remain switched OFF.

If unit is being used as an RF signal strength meter under portable operation, battery life can be extended by switching off the frequency display.

- 3) Frequency display can be switched OFF during BATTERY CHARGING, if desired, by switching HOLD "ON" before inserting DC POWER PLUG into POWER JACK.

GATE	TIME	DISPLAY	RESOLUTION
FAST	.25 second	_ _ 8 0 0.0 0 0 0	1 KHZ
MED	2.5 seconds	_ 8 0 0.0 0 0 0	100 HZ
SLOW	25 seconds	8 0 0.0 0 0 0 0	10 HZ

DISPLAY OVERFLOW INDICATOR

A DISPLAY OVERFLOW will occur when reading a signal of 1 GH higher using the SLOW GATE TIME. When this happens, the dec point between D7 and D8 (the leftmost digits) will light.

RANGE SELECT SWITCH

LO RANGE:

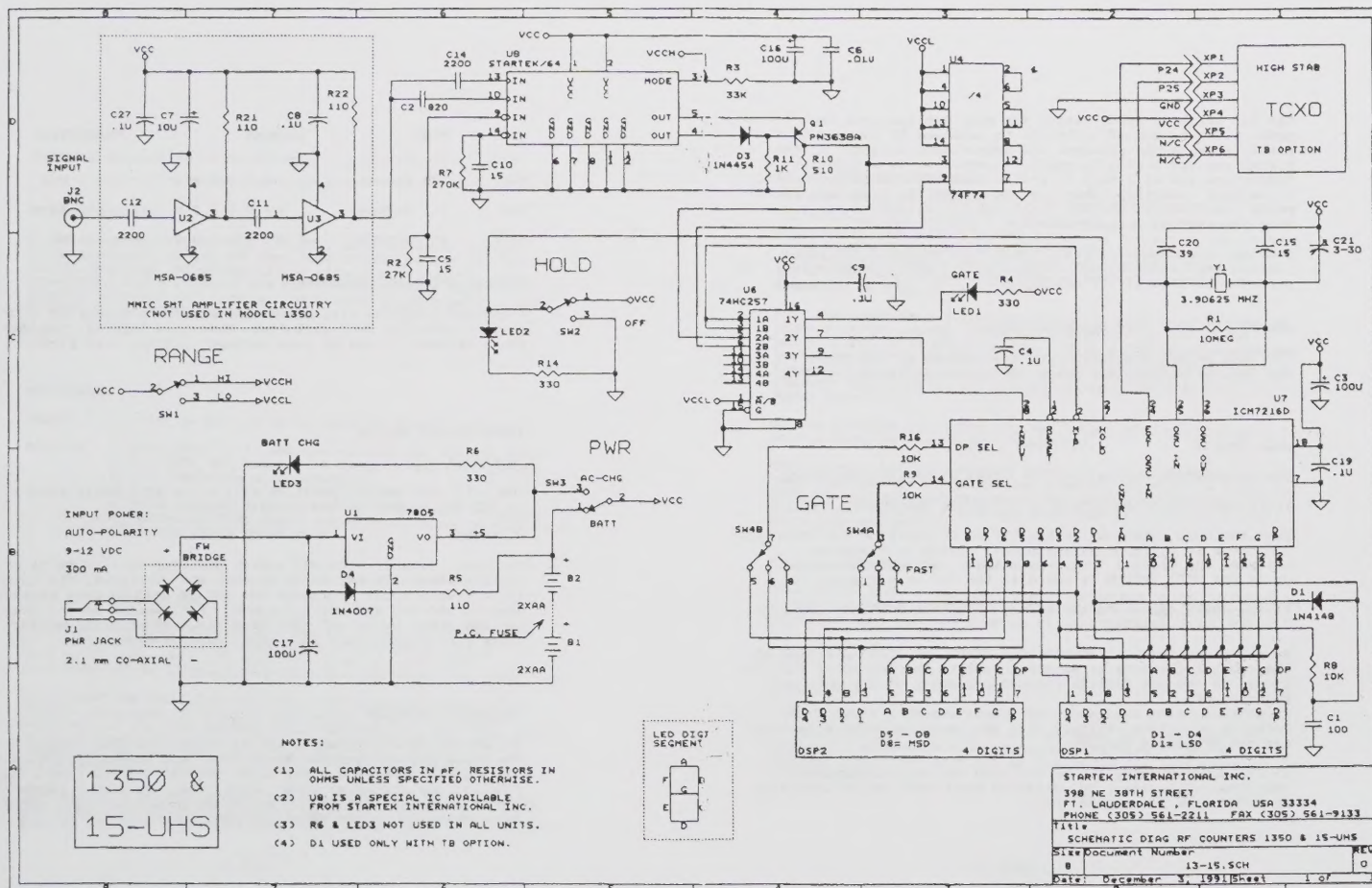
The 1-500 MHZ switch position will allow RF signals from 1 to 500 MHZ to be counted and displayed.

HI RANGE:

The 1300, 1500 or 3200 MHZ switch position will allow RF signals above 500 MHZ to be counted and displayed. The high range overlaps the low range and can be used to read signal: down to 100 MHZ and below, however, for maximum sensitivity the low range below 400 MHZ. From about 400-500 MHZ either range can be used with near equal sensitivity.

BAR GRAPH COUNTERS

The Bar Graph will display the RELATIVE RF SIGNAL STRENGTH of the input signal. The Bar Graph functions independently from the digital counter and the range switch. The Bar Graph will react to the strongest input signal over the entire range of the instrument, in fact the Bar Graph reacts to input signal from about 100 KHZ to about 3.5 GHZ.



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MED	2.5 seconds	__ 8 0 0.0
SLOW	25 seconds	8 0 0.0 0

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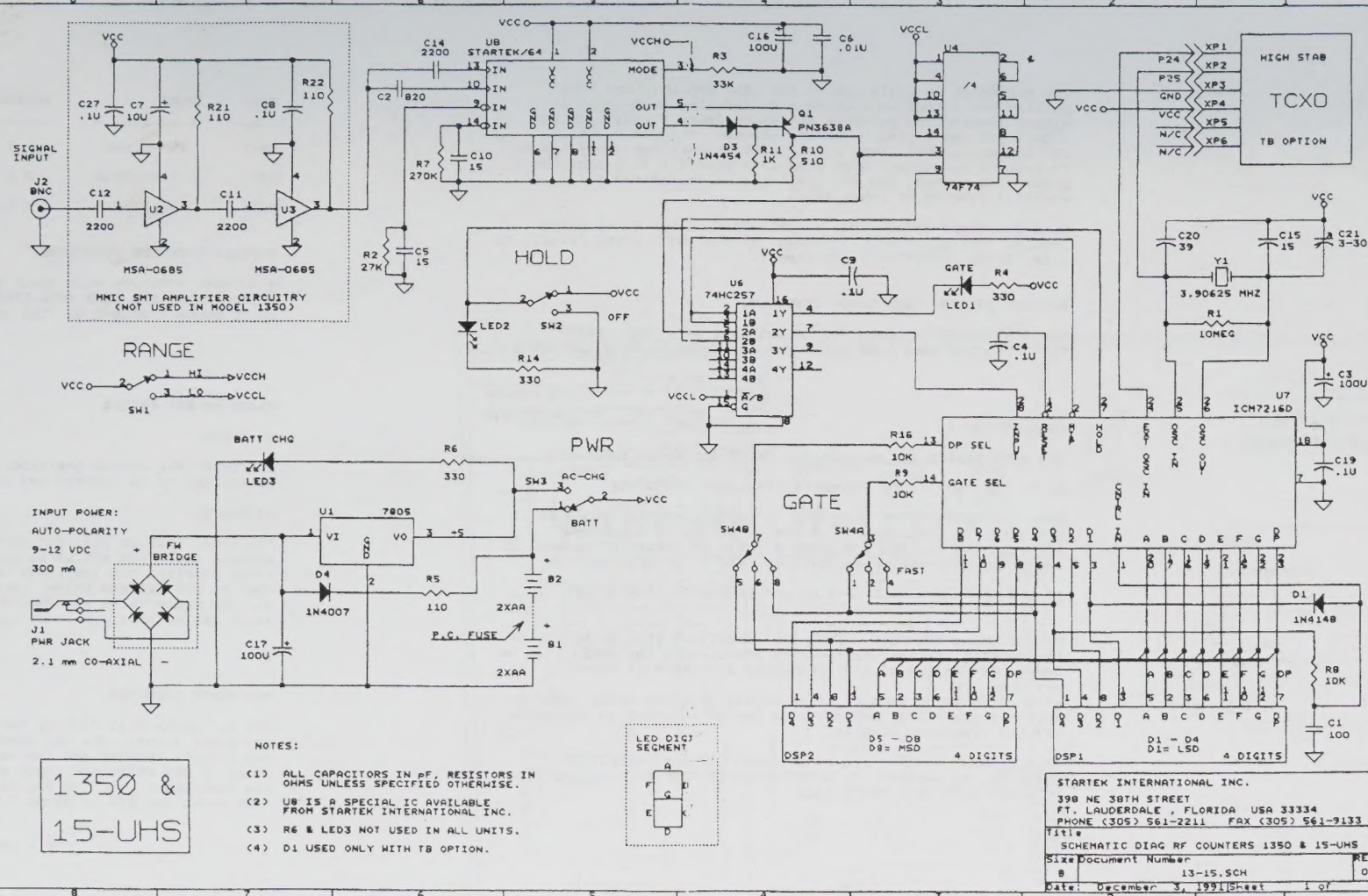
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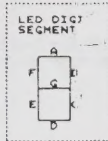
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1350 &
15-UHS

- NOTES:
- (1) ALL CAPACITORS IN pF, RESISTORS IN OHMS UNLESS SPECIFIED OTHERWISE.
 - (2) U8 IS A SPECIAL IC AVAILABLE FROM STARTERK INTERNATIONAL INC.
 - (3) R6 & LED3 NOT USED IN ALL UNITS.
 - (4) D1 USED ONLY WITH TB OPTION.



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PHONE (305) 561-2211 FAX (305) 561-9133

Title
SCHEMATIC DIAG RF COUNTERS 1350 & 15-UMS

Size Document Number

B 13-15.SCH

Date: December 3, 1991 Sheet 1 of 1