



Palstar products are designed by Hams for Hams carrying on the Palstar tradition for high-quality products designed and manufactured in Ohio, USA.

HF-AUTO Automatic Antenna Tuner

Specifications Summary

- 2 watts to 1800 watts PEP
- 160 m to 6m
- Tuning time 10 secs or less
- Large 4 line display
- 12.5" x 6.5" x 16.5"

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HF-AUTO RF NETWORK Technical Manual

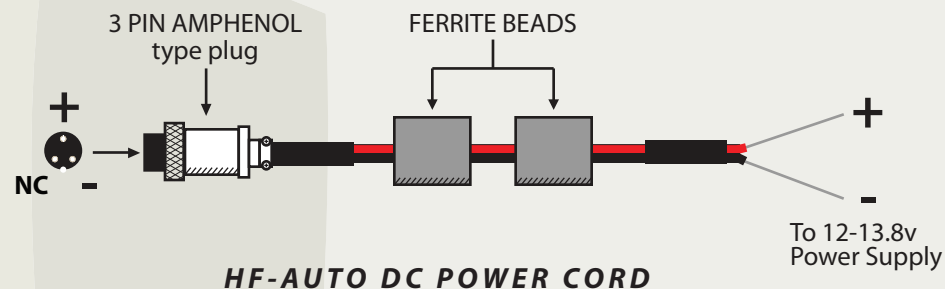


Designed and Manufactured in the USA
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HF-AUTO SPECIFICATIONS

- **NETWORK CONFIGURATION:** High-Pass network, shunt variable
16 μH inductor, series fixed 10 μH inductor
- **DIFFERENTIAL CAPACITOR:** 470 pF - 10 pF - 470 pF;
Voltage rating 5.5 kV
- **LANDC:** Stepper motor-controlled
- **FREQUENCY RANGE:** 1.8 MHz to 54 MHz
- **MATCHING RANGE:** 8:1
- **POWER RANGE:** 1800 watts PEP/CW 1.8-29.9 MHz;
800 watts PEP 50-54 MHz
- **TUNING LEVEL:** Minimum level 2 watts,
single tone carrier up to 200 watts
- **TUNING ACCESS TIME:** Typically <10 secs 80m to 6m;
3-5 secs 80m to 160m
- **DUTY CYCLE:** 100% SSB AND CW
- **DIGITAL DISPLAY:** RF Power, SWR, Frequency, Antenna
selection, Position of L and C;
Modes: Auto, Manual, Bypass, Setup
- **OUTPUT:** 3 Output connectors S0-239
- **CHASSIS & COVER:** 11 ga. .090 gold Iridite Treated Aluminium,
Powder-coated top cover and front panel
- **DC POWER:** 12 - 13.8 VDC at 4 Amps Peak, 3 Pin
Amphenol Type connector cord supplied
- **DIMENSIONS:** 12.5" W x 6.75" H x 14" D
- **WEIGHT:** 20 LBS, 9 Kg

HF-AUTO POWER CABLE



MAINTENANCE REQUIREMENTS

IF THERE IS MAINTENANCE REQUIRED IT WILL MOST LIKELY BE RELATED TO MECHANICAL ISSUES:

- **ROLLER SHAFT:** the wheel rides should be lubricated with our factory-made conductive grease.

This grease is available from Palstar at NO CHARGE.

- **DIOXIT-D5** spray is always very useful for cleaning the wire on the roller coil. Do not use the spray directly. Put a small amount on a cotton cloth and hand wipe the roller once a year while turning the roller crank.
- All set screws are the CAP POINT type and take care to carefully tighten these screws with a 5/16" allen key wrench, which is available from any hardware outlet.

REPAIR OR REPLACEMENT MODULES

- All PC Boards are removeable with standard American tools in case of failure.
- The rear panel (relay PCB) has custom S0-239 connectors that can be loosened with a 3/4" socket and 4 x 6-32 keps nuts. Remove these nuts and two connections from the variable and the entire relay PC Board is removable without a soldering iron.
- Both the front and rear panels can be lowered by removing the 3 countersink screws from the bottom edge of each panel.

THEORY OF OPERATION

The HF-AUTO is a matching system that is a complete stand-alone RF Tuneable Auto T Network tuner.

It is completely independent of data from an external source to determine frequency of tracking from Band to Band. As a result of this feature, the HF-AUTO will function with any transmitting device without interconnecting data cable attachments.

The HF-AUTO uses an RF Coupler that provides voltage and current information from 1.8 MHZ to 54 MHZ.

This information is then processed by a pair of processing devices that provide accurate phase oriented forward and reflected values that are used in two TI processors to calculate SWR.

This allows for detection of frequency and SWR at very low levels, typically 2 watts, and is scaled to read these levels up to 1800 watts.

The processors establish the threshold for tuning and uses this information to see if a tuning sequence is required.

A preset voltage for all the frequencies are used to determine the positions of the variable differential capacitor and the roller inductor by a precise mechanical sprocket and kevlar belt system.

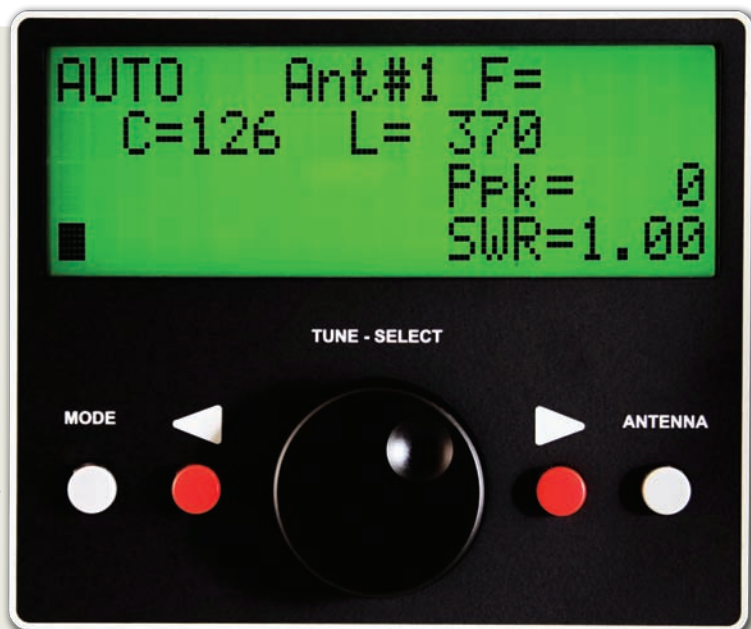
This determines with great accuracy and repeatability the exact location of L&C needed to execute a tune sequence. This system samples DC voltage and compares this to the intended frequency band and sees that if the SWR is more than the preset tuning set by the user then the steppers for L & C will adjust to that voltage which will represent the minimum SWR.

This will be better than 1.2:1, typically 1.05.

SCREEN DISPLAY ON POWER-UP

ON INITIAL POWER-UP

Display will indicate rev level of software and Palstar copyright information.



PRESS
MODE

AUTO

MANUAL

BYPASS

SETUP

PRESS
TUNE KNOB

TO SELECT
C AND L

TO SELECT
SETUP ITEM

PRESS
ANTENNA

ANT #1

ANT #2

ANT #3

HOW-TO UPDATE SOFTWARE

DOWNLOADING HF-AUTO FIRMWARE

- CREATE a folder on your computer's hard drive (but not desktop)
- NAME the folder HF_AUTOUPGRADE
- DOWNLOAD the Firmware file (Zip format) from the Palstar website - <http://www.palstar.com/en/hf-auto/> - it is near the bottom of the page . The link to the file is named "HF-AUTO Firmware 1.x"
- SAVE the file to the folder you created in Step 1
- OPEN the folder by right-clicking on the Zip file and select "Extract All" - follow the steps in the Extraction wizard

INSTALLING THE FIRMWARE UPGRADE

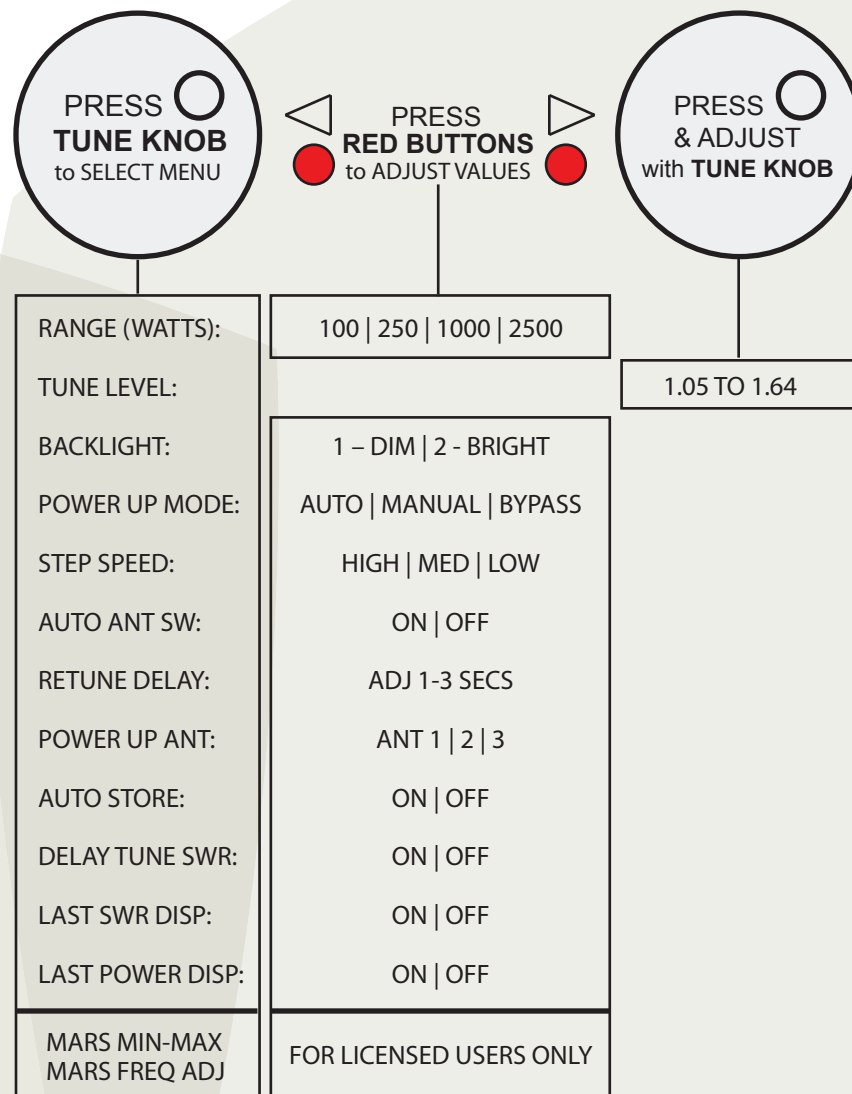
- TURN-OFF the HF-AUTO
- CONNECT the RS-232 cable to the rear panel
- CONNECT the other end of the RS-232 cable to Com 1 or your computer
- TURN-ON the HF-AUTO
- SET Switch at rear of the HF-AUTO to "PROGRAM"
- Note: LED (PROGRAM MODE) on Front Panel is illuminated
- DOUBLE-CLICK "LOAD_HF_9600" from your HF_AUTOUPGRADE folder that you created in Step 2
- DOS Window appears - wait until DOS Window closes (approx. 1 min)
- TURN "PROGRAM" Switch to "NORMAL"
- REMOVE the RS-232 cable
- TURN HF-AUTO OFF and then ON again
- LOOK at HF-AUTO display to see new REV level at top-right corner when you first turn it on
- COMPLETE - you have now completed the update of the firmware

NOTE: The HF-AUTO ships with a DB9 serial cable. You can order a USB to DB9 serial cable from Palstar for use with computers with no DB9 serial port to update the firmware.

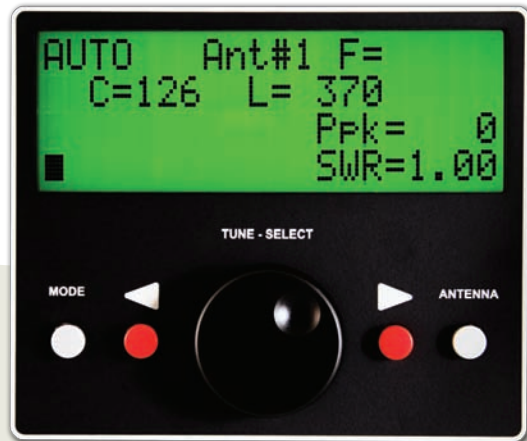
HF-AUTO Firmware Summary

- v1.18:
 - new default position settings made for the positioning of the C and L with a given frequency range;
 - added menu option to clear out the memory offset positions for the C and L with a given frequency range;
 - removed limits on the C and L offset position values;
 - added menu selection of the Amp-Key relay state when no RF power is detected;
 - added ability in manual mode to store a memory position using the Right Arrow button;
- v1.19:
 - changes regarding operation with the MARS frequencies.
- v1.20:
 - allowed for the use of the new relay board with the proper jumper selection;
 - added additional memory presets between 7.0 MHz and 14.0 MHz;
 - manual mode now allowed the Left Arrow Button to return to Auto mode.
- v1.21:
 - corrected problem where the display was not being updated after pressing left arrow button and would make the unit go from Manual Mode to Auto Mode.
- v1.22:
 - minor display corrections: UNABLE TO TUNE message remained on display in error after a new tune operation started.
- v1.23:
 - added Setup Menu item to select AUTO STORE to be ON or OFF;
 - added Setup Menu item to select DELAY TUNE SWR to be ON or OFF;
 - provided for using Ant 3 selection with dummy load by changing to AUTO ANT SWITCH MODE state by pressing and holding of the ANTENNA button;
 - added memory locations to have memory settings every 50 kHz from 28 MHz to 29.7 MHz.
- v1.24:
 - removed Amp Key Relay Menu items;
 - corrected problem where the display could be blanked out after the unit remained in the Setup Menu for an extended time.
- v1.25:
 - corrected an occasional problem in Auto Tune Mode if the unit has AUTO ANT SWITCH set to ON;
 - made improvements in the Auto Tune operation to reduce the time needed to find the C and L tune positions when a given frequency is first applied.
- v1.26:
 - corrected a problem where some units were incorrectly reading EEPROM calibration and setting values.
- v1.27:
 - removed restrictions in manual mode that prevent storing of new C and L positions when those changes are only of a minimal number of steps. The restriction is there to prevent the auto tune mode causing excessive writes to the EEPROM;
 - corrected occasional problems in finding the absolute best match when v1.25 changes were made;
 - added to the operation when holding the ANTENNA button to select BYPASS MODE when AUTO ANT SWITCH is turned OFF and select AUTO MODE when AUTO ANT SWITCH is turned ON.
- v1.28
- v1.29:
 - The selection of the antenna port in an auto frequency selection mode now is programmable for each of the ten different HF bands;
 - The INITIALIZE PRESETS menu option has been removed;
 - The QUICK TUNE menu option has been removed;
 - The last frequency of transmission is saved on power down and the inductor and antenna relay settings are restored for that same frequency at power up in auto antenna mode;
 - The power reading no longer has an option to be average power. Only peak power is displayed;
 - The accuracy of the peak power has been improved;
 - Added menu option to have last SWR reading remain on the display after power is removed;
 - Added menu option to have last Power reading remain on the display after power is removed.

SETUP MODE



TUNER OPERATION



PLACE TUNER IN AUTO MODE WITH GREY MODE BUTTON

1. CONNECT the transceiver to the RF INPUT chassis connector at the rear of the back panel
2. CONNECT a dummy load to one of the coax outputs or your desired antenna
3. APPLY a single tone level greater than 5 watts (use FM MODE) typically 5 to 50 watts
4. DISPLAY will indicate Frequency, Power Level, SWR, and Numerical value for C and L

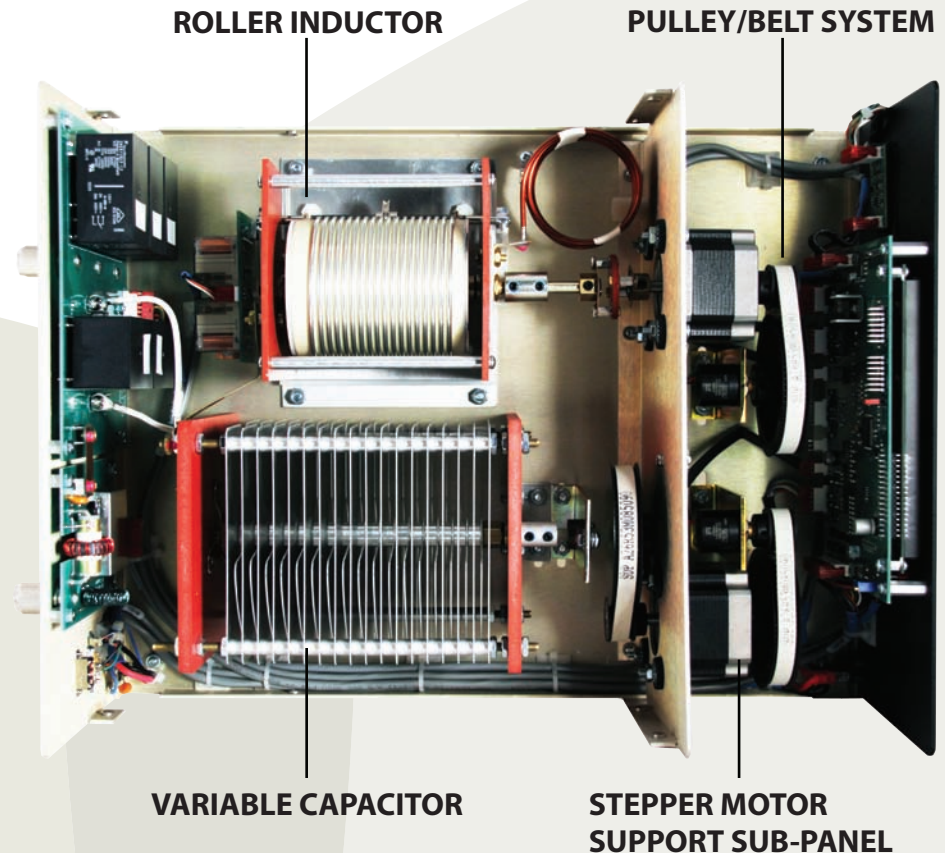


NOTE: To execute a tune sequence at another band or frequency lower the power of the transceiver or any other transmitting device to low power and change frequency and the tuner will immediately follow to the new location. You can also click the PTT button on your microphone in FM MODE and accomplish the same at the lowest power level

TUNING THE HF-AUTO

Applying only a short burst of single tone power to the HF-AUTO will allow the tuner to pretune to a memory segment containing the desired frequency. **ANOTHER** application of RF Power must be applied to complete the final tune condition where high power may be applied. You can also apply single tone power continuously until the final tune cycle has completed and get the same result. Trying to tune at high power without executing the final tune condition could damage the tuner.

INSIDE VIEW



REMOTE OPERATION

PALSTAR will offer a fully remote version of the base version in the near future. However, in certain cases where there is DC power available at a reasonable distance you can operate this base version in the AUTO MODE. Other functions would of course not be available.

The base version is frequency sensing you need only to insert a metering device that could monitor reflected power in the transmitting location.

SAVING MEMORY LOCATIONS

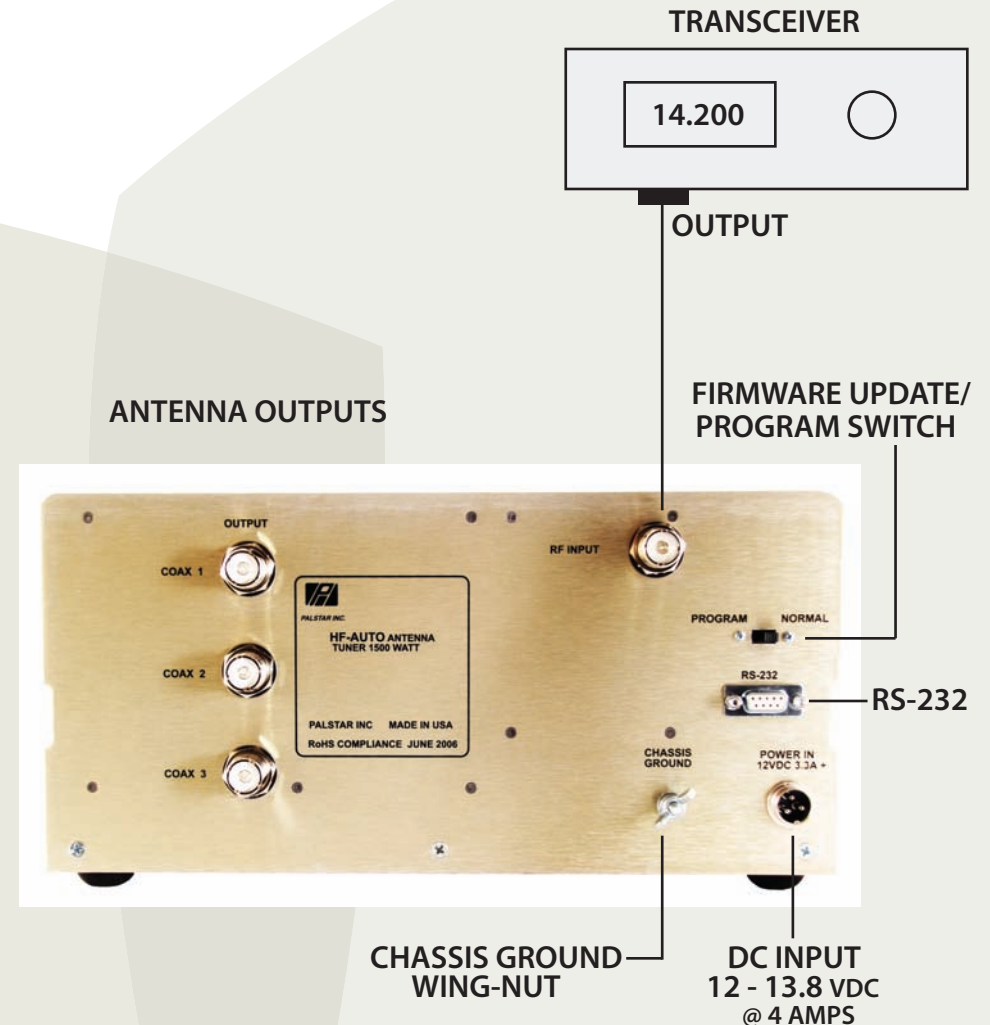
- TUNE the HF-AUTO using a low power FM or CW signal
- **MANUALLY** tune L&C for best SWR while power applied
- While power is still applied push red button to the right of the tuning knob and hold for 2 seconds or more until the display says **"SETTINGS CHANGED"**
- Remove power and release the red button
- The frequency is now saved
- To return to **AUTO MODE** push left red button

DIVISIONS IN THE FREQUENCY BANDS FOR SETTINGS

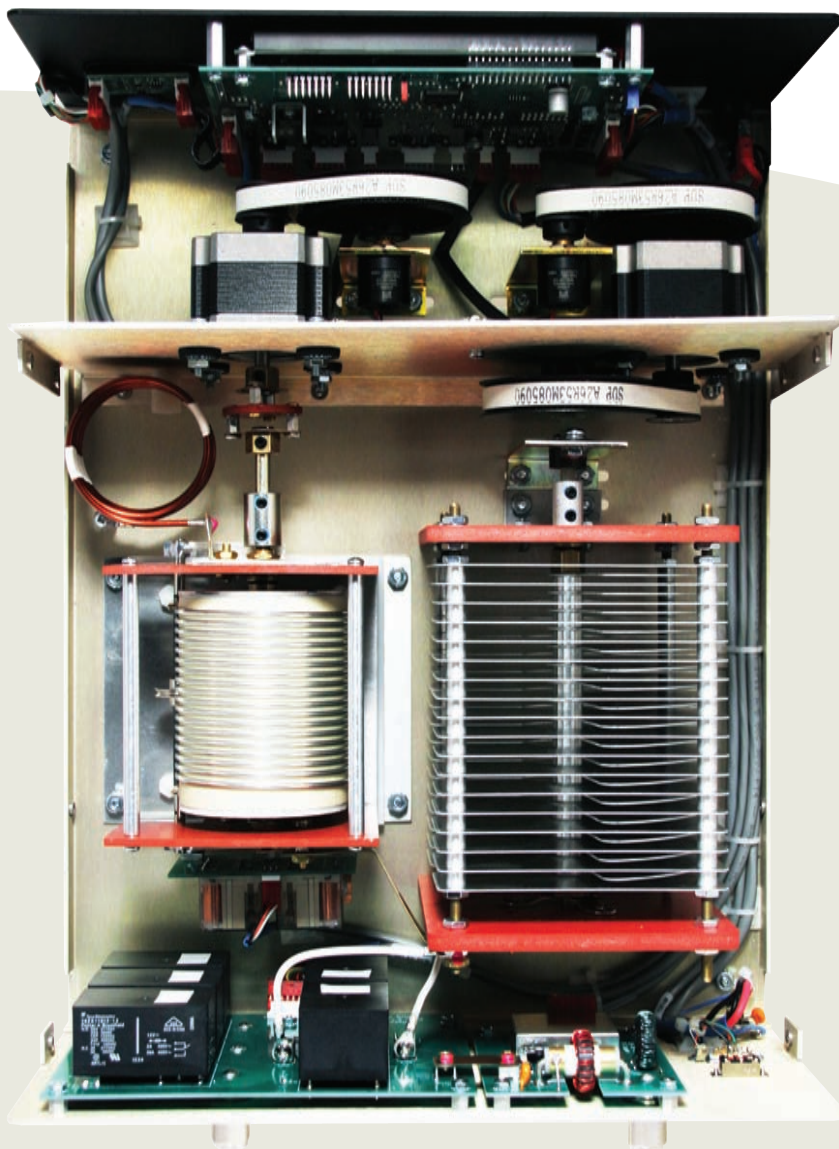
FREQUENCY IN MHZ	# OF SETTINGS	SPACED
1.8 MHZ to 20 MHZ	51	4 Khz
3.5 MHZ to 4.0 MHZ	51	10 Khz
7.0 MHZ to 7.3 MHZ	36	50 Khz
10.1 MHZ to 10.150 MHZ	2	50 Khz
14.0 MHZ to 14.350 MHZ	18	40 Khz
18.068 MHZ to 18.168 MHZ	3	50 Khz
21.0 MHZ to 21.450 MHZ	5	100 Khz
24.890 MHZ to 24.990 MHZ	1	500 Khz
28.0 MHZ to 29.70 MHZ	51	500 Khz
50.0 MHZ to 54.0 MHZ	101	40 Khz
MARS FREQUENCY	707	4 Khz to 500 Khz

FOR ALL TUNABLE FREQUENCIES FROM 1.8 - 30 MHZ, 40 MHZ THROUGH 41 MHZ AND 50 MHZ TO 54 MHZ THERE ARE 1193 SUBDIVISIONS OR MEMORY POSITIONS.

REAR PANEL OF HF-AUTO



INSIDE VIEW OF HF-AUTO



HF-AUTO SCHEMATIC

