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## **1. GENERAL INFORMATION**

### **1-1. Introduction and Description**

This manual explains the installation, operation and maintenance of the ACOM2000S automatic antenna selector.

The ACOM2000S is an automatic 1 out of 10 antennas selector especially designed for use with the ACOM2000A automatic linear amplifier and the ACOM2000SW remote antenna switch. In addition it can be directly used with the ACOM's DOS application for tuning via PC and/or to work in a local network. Nevertheless, the ACOM2000S can be manually controlled by the UP/DOWN buttons, and also used in other automatic antenna systems thanks to the standard RS232 serial input and 4-bit inverted BCD parallel output control signals for antenna number selected.

## 1-2. Owner Assistance

If assistance is needed, you should contact your local dealer first. If you still have an issue you need to discuss with one of ACOM's specialists. The contact information is as follows: fax +359 2 276 190, e-mail [acom@aster.net](mailto:acom@aster.net) or by mail: ul.3011-9, complex Lyulin, 1324 Sofia, Bulgaria.

## 1-3. Equipment Supplied and Options

The ACOM2000S automatic antenna selector plus a mating cable connector for the output control and this manual are shipped in one cardboard carton. The remote antenna switch ACOM2000SW is a separably-purchasable option. If you have purchased it, the same carton will contain both units.

## 1-4. Features

- Easy to operate: tactile + sound feedback, up/down manual selection of 1 out of 10 antennas. No operator intervention is required at all when used with the ACOM2000A automatic HF linear amplifier. Thus the risk of inadvertent errors, such as incorrect antenna selection is eliminated.
- Antenna number 7-segment LED indicator plus sound alarm provided.
- Monitors "ready to transmit" parallel input signal from antenna switch and generates "transmit inhibit" output signal to the transceiver for maximum operating flexibility and anti-hot switching protection.
- Two nominal line voltages: 120 and 240VAC (50 or 60Hz).
- All functions are accessible from a PC via serial port connection. Also, local networking capability exists for more than one set of amplifier / antenna units working in a system. Compatible with ACOM DOS application for antenna tuning preparation.

## 1-5. Safety Considerations, Explicit Definitions

The ACOM2000S automatic antenna selector is designed to meet international safety standards. It is a Safety Class I unit, i.e. the third grounding lead of its mains cord (which is colored yellow with two green stripes) and the ground stud on the rear panel of the selector, marked GND, both must be connected to the station's grounding system for safe operation.

This operating manual contains information, precautions, indications for cautions and warnings which must be followed by the user to ensure safe operation and to keep the ACOM2000S in safe operating condition.

### PRECAUTIONS:

The EXPLICIT DEFINITIONS described below apply to this operating manual:

**WARNING** notes call attention to a procedure which, if not correctly performed, could result in personal injury, fire hazard or electric shock.

**CAUTION** notes call attention to a procedure which, if not correctly performed, could result in equipment damage, not only in the selector.

**NOTE** notes call attention to a procedure which, if not correctly performed, could result in inconvenience only.

**WARNING HIGH VOLTAGE!**

The selector works with mains AC voltage, which is dangerous for life! For your safety, pull the selector power plug out of the mains wall outlet EACH TIME BEFORE you remove the cover of the selector.

**WARNING**

NEVER EXPOSE the selector to rain, snow or any liquids. AVOID placing the selector in direct sunlight.

**WARNING**

Do not undertake on your own repairs or changes in hardware or software of the selector in order not to endanger your or other's health and life and not to damage the selector and the equipment connected with it, not covered by warranty. The manufacturer is not liable for another's actions and responsibility shall be assumed by the doer.

**CAUTION**

To avoid damage (not covered under warranty) read the Installation - S.2 of this operating manual carefully. If you have any doubts about the installation, operation or safety of the selector, please consult your dealer.

**2. INSTALLATION**

**2-1. Unpacking and Initial Inspection**

**NOTE**

Before you start any action on installing the selector, thoroughly read through this manual. First carefully inspect the cardboard carton and its contents for physical damage. If damage is noticed, notify your dealer immediately. Delay may infringe carrier's warranty conditions. Keep all packing for possible future transportation!

Check carefully the serial number of the selector with the Table of Individual Data (Table 2-1). If you find any discrepancies notify your dealer immediately to have your warranty information corrected.

Selector s/n .....  
Local network self number: .....  
Voltage Selector Position: ..... VAC

Table 2-1. ACOM2000S Individual Data

**2-2. Line Voltage Selection**

**CAUTION**

To avoid damage (not covered under warranty), check carefully if the voltage for which the unit is set corresponds to your mains nominal voltage.

Normally the unit is supplied with Voltage Selector set for a nominal mains voltage of 240V. There might be exceptions in cases of special delivery and then the voltage set is noted in the Table of Individual Data (Table 2-1). If your mains has a different nominal voltage, it will be necessary for you to contact your dealer for details.

## 2-3. Connections

Connections must be accomplished in the order described below, before you apply mains voltage to the selector.

Fig.2-2 ACOM2000S rear panel

a) First connect the ground stud of the selector (on the rear panel, marked GND) to the station's grounding system (Fig.2-2). Length should be as short as practical.

b) If you will use only one control source, for instance ACOM2000A automatic linear amplifier or only a PC or so, you will need a "null modem" type serial interface cable with at least one DB9F connector. Connect it from the 9-pin connector on the rear panel, marked "AMP", to the identical control unit connector (marked "RS232 INTERFACE" on the amplifier rear panel). Up to 5m (16 feet) length is acceptable.

Select the second cable connector upon the control unit. If a 25 pin serial port connector is available, a DB9F connector plus a 9 to 25 contact adapter or simply a DB25F connector may be used.

Check the cable you intend to use or prepare it by yourself using the following contact information:

### CAUTION

Null modem cables have RxD-TxD cross connected. Do not use a "standard" cable (with RxD-TxD directly connected) because this may result in damage in both - selector or connected equipment. Cut all extra connections (if any).

c) The connector on the rear panel, marked PC, remains free if only one control source is used (be it amplifier, PC or other - see S.3-note). Use this connector when you use the selector with ACOM2000A plus a personal computer or in a local network as described in S.3 and S.4. You will need another "null modem" cable as described in (b) above.

d) Preparation of output control cable.

A 6-wire shielded cable should be used for the output control. The minimum wire cross-section depends on the distance from the antenna selector to the antenna switch in your station. You can determine cable specifications proportionally from the following table:

When you use the ACOM2000SW remote antenna switch, solder all 6 wires and the shield to mate by numbers. Use the 8-contact connector for the selector side and the 7-contact connector for the switch as follows:

ACOM2000S	ACOM2000SW
NC514 - female	PC7 - female
soldering view:	soldering view:

When not ACOM2000SW but another switch is used, the following information may be needed to prepare the output control cable:

Contact:    Signal name:    Functional description:

nr. 1	+27V	Power supply output, 200mA maximum
nr. 2	RDY	Input from selector; "high" when ready to transmit
nr. 3	GND	Common ground, shield
nr. 4	*A1	Output: BCD bit 0; "low" when A0 selected
nr. 5	*A2	Output: BCD bit 1; "low" when A2 selected
nr. 6	*A4	Output: BCD bit 2; "low" when A4 selected
nr. 7	*A8	Output: BCD bit 3; "low" when A8 selected
nr. 8		not connected (spare for nr.3 - GND)

You can draw up to 200mA from the +27V unregulated output (contact nr.1) to supply your own switch (when ACOM2000SW not used). See S.5-3 for details on how the input and output signals are to be used.

e) The KEY-IN and KEY-OUT sockets on the rear panel provide extra control signals. They could be used to improve the switching safety.

If your transceiver has a suitable input which disables transmission, we recommend that you connect it with a cable terminated in a Phono connector to the KEY-OUT socket of the selector. Up to 5m (16 feet) length is acceptable.

Transceiver producers give different names to this input and they are for instance TX-INHIBIT, MUTE, LINEAR, etc. An external "pull up" resistor or software command may be needed to implement this function of the transceiver. Check your transceiver's manual or consult your dealer for details.

If your transceiver has not such an input, don't worry - the selector will function normally as well and then this and the next (KEY-IN) connectors may remain unused, so skip (f) and (g).

f) If KEY-OUT is used - see (e) above - and you use the ACOM2000A automatic linear amplifier, connect with a shielded cable, terminated in a Phono connector, the "ground on transmit" signal from the transceiver to the "KEY-IN" of the amplifier.

Transceiver producers give different names to this output and they are for instance TX-GND, SEND, T/R-LINE, etc. Some transceivers require that "ground on transmit" is implemented via a software command, or by changing the setting of a switch on the rear panel, or interior of the transceiver. Check your transceiver's manual or consult your dealer for details.

Then connect with a shielded cable, terminated in two Phono connectors, the "KEY-OUT" from the amplifier to the "KEY-IN" of the selector. Up to 5m (16 feet) total length is acceptable.

g) If KEY-OUT is used - see (e) above - but you don't use an amplifier, or

your amplifier has not suitable keying signals, run a cable terminated in a Phono connector from the transceiver socket providing "ground on transmit" directly to the selector rear panel KEY-IN socket. Up to 5m (16 feet) length is acceptable.

#### **NOTE**

If KEY-IN/OUT signals are not properly cabled, the anti-hot protection may not work or the transmitting may be impossible.

To insure proper cabling, check the following (when KEY-IN/OUT used):

- your transceiver must not transmit until you power on the antenna selector (all antennas are grounded).
- transmitting will also be inhibited shortly after every antenna change (for 0.2 seconds) while the antenna contacts are "flying".

h) Mains plug.

Due to the different standards in different countries, the mains plug is supplied and mounted by the dealer. He connects to the mains cord end a standard mains plug which meets the Safety Class I units standard in your country. The ground lead of the selector's mains cord is colored yellow with two green stripes and the blue and brown leads are active. When the selector is to be used with only one mains fuse, it is connected in series with the brown lead which must be the active. If you have any doubts about the correct way of connecting the wires, consult your dealer.

Make sure the main Power Switch on the front panel is in OFF position and insert selector's mains plug into the wall outlet. The selector remains switched off.

### **3. POWER ON, CONTROLS AND INDICATORS**

#### **CAUTION**

To avoid damage (not covered under warranty), carefully check that the voltage for which the selector is set corresponds to your mains nominal voltage (see S.2-2 and table 2-1).

#### **NOTE**

Set the slide switch on the rear panel properly. If both amplifier and PC are used, connect the units to the AMP and PC connectors respectively and re-select the active unit when needed. If only one control source is used (be it amplifier, PC or any other), connect it to the AMP connector and set the slide switch to AMP too. Otherwise antennas may not be automatically changed.

#### **NOTE**

We recommend that you turn on the transceiver (and amplifier if any) after the antenna selector. Turn off the selector the last. All antennas will be automatically grounded always when the selector is not powered.

After following all instructions in S.2, you can turn ON the Main power switch on the rear panel. The green LED indicator must indicate antenna number 1 blinking to remind that no command has been received yet. In this position you may control antenna numbers UP and DOWN via the respective push buttons.

**The dot next to the figure will glow always when the last command is executed and you are ready to transmit. It will go out when a new command is accepted but not yet executed (for 0.2s minimum or longer if you transmit and change antennas simultaneously). If so, warning will BEEP for 10 seconds. The command is memorized and executed automatically after the next pause in transmitting. If 10 seconds are exceeded, the command is rejected and**

the LED number remains blinking until a next command is issued. After it has been executed, the antenna number will constantly glow.

## **4. OPERATION**

### **4-1. OPERATION IN THE ACOM SYSTEM**

Operation using ACOM2000A HF linear amplifier, ACOM2000SW antenna selector and/or the ACOM DOS application for PC is automatic. No operator intervention is needed to change antennas.

Anyway you may still change antennas manually from the selector UP/DOWN buttons or amplifier's RCU as well. The results will be indicated on both the selector and the RCU.

When the amplifier's auto antenna change function is set to "ON", the antenna control from the RCU and/or the selector is equivalent. With the function set to "OFF" use the selector's buttons when a temporary antenna change is needed. Only the frequency segment currently used would be affected. It will be valid until next change from RCU. Changes from RCU have a general function in this mode, i.e. the antennas for all frequency segments are equalized to the last number selected.

### **4-2. USER SYSTEMS OPERATION**

When used in another system, the ACOM2000S selector can be controlled in two ways: manually via its UP/DOWN buttons and also via the RS232 serial interface commands, issued from a PC or some kind of other control unit.

RS232 standard and a relatively low speed of 1200bit/s are used for maximum information reliability. This permits involving inexpensive low-pass filters with cutoff frequencies substantially below the lowest operating frequency (for instance 50-100kHz) in severe EMC conditions. See S.5-3 to get an idea.

Use the list of rules and serial interface commands below to control the ACOM2000S automatic antenna selector properly.

ACOM2000S automatic antenna selector properly.

### ***RULES FOR ACOM2000S LOCAL NETWORK CONTROL***

a) Protocol: 1200,N,8,1 (1200bit/s, no parity check, 8 information bits, 1 stop bit).

b) Local network addresses are coded via ASCII symbols with codes equal to the needed address. For instance, address number 81dec (51hex) is sent via the ASCII symbol "Q".

Addresses 40 to 4F (hex) are reserved for amplifiers.

Addresses 50 to 5F (hex) are reserved for antenna control units (selectors and/or tuners).

Addresses 60 to 6F (hex) are reserved for transceivers.

Addresses 70 to 7F (hex) are reserved for PC controllers.

The selector network self address (1-15) is to be coded in hexadecimal by means of 4 jumpers inside the selector box. They are located on the PCB, just near the quartz crystal and are marked "NETWORK ADDRESS".

c) Numbers are coded in hexadecimal or decimal, by figures. Every figure is sent via one own ASCII symbol. Symbols codes begin with 3 (the most significant half-byte) and end on the coded figure itself in the least significant half-byte as follows:

Figure (dec)	Figure (hex)	ASCII code (hex)	ASCII symbol
0	0	30	0
1	1	31	1
2	2	32	2
3	3	33	3
4	4	34	4
5	5	35	5
6	6	36	6
7	7	37	7
8	8	38	8
9	9	39	9
-	A	3A	:
-	B	3B	;
-	C	3C	<
-	D	3D	=
-	E	3E	>
-	F	3F	?

d) Messages format:

**RX\_addr. TX\_addr. Comm. data\_1 data\_2 ... .. NULL**

where:

RX\_addr. - destination address (hex), sent first;

TX\_addr. - sender address (hex);

Comm. - command or message code;

data\_1 - first data byte (command or message parameters);

data\_2 - second data byte (command or message parameters);

... - more data (parameters), if any.

NULL (00hex) - end of message, sent the last.

Rem. address 255 (FFhex) is reserved for broadcast addressed messages;

Example: "QAW34" shall mean: to selector 1 (Q) from amp. 1 (A), change antenna (W3) to nr.4 (4);

The similar command from a PC would be: "QqW34"

e) Rules in the local network:

- maximum symbols number in one message - 255 (including service symbols as addresses, NULL, etc.);
- every unit in the network passes to his output another's messages without changes and stops the addressed to (and also from) its own address;
- every unit sends periodically its own local address, addressed to FFhex or the mating unit address in order to inform others it is on;
- selectors and amplifiers have to mate by address suffix (for instance: amplifier 41hex with selector 51hex, or amplifier 42hex with selector 52hex etc.) in order they collaborate as a pair;
- selectors execute W1 and W3 commands if addressed to them and also to their mated amplifier;
- selectors filter the not-addressed single byte messages (beginning with 8x and higher). If this info is needed, the selector must be connected in the chain before the amplifier in order not to stop them.

f) Commands list:

\* The command is executed also if addressed to the mating amplifier and

then is passed to it. If not executed in a 10 seconds period, the command will not be passed. Broadcasting addressed commands are also executed.

\*\* Message generated without a command.

#### **NOTE**

Antenna data is checked for permissible values from 0 to 9. If the antenna number included in the command is outside this range, the command is ignored.

### **4-3. LOCAL NETWORK OPERATION**

You may control via a single port several units thanks to their local network capabilities. For this purpose every one unit is addressed in order to be identified in the local network. Addresses are reserved by groups. All units in the network are divided in separate virtual local area networks. All units addressed "Xn" are in group "n". For instance, every one pair "selector + amplifier" is to be mated by their address suffixes in order to collaborate in a system. Addressing of the selector is done via the four jumpers on the PCB in HEX code. Addressing of the amplifier is done via its RCU. Address numbers 1 to 15 are selectable. See the previous S.4-2b for details.

The TX-D and RX-D serial port signals of all units are to be connected in a closed loop chain. Every unit receives messages via its RX-D input and repeats them to its TX-D output (if not addressed to it). In this way the messages propagate from the sender through the chain until they meet their destination address and stop there. If any message is occasionally returned to its sender, the sender would stop it.

In order to minimize repetitions in the local network, respectively to increase the propagation velocity, it is preferable that the most loaded information links be direct. For this reason it is best that the mating unit pairs be adjacent, although this is not mandatory.

The preferable information direction is: from the PC to the antenna selector and then to the amplifier, when only one pair "selector + amplifier" is to be controlled. In this way the "fast" single byte messages, generated by the amplifier about the forward and reflected power (8x...Ax), will directly come into the PC (and stop there).

Increasing pairs number, the information flow volume will increase and the propagation velocity will respectively decrease. For this reason, the possibility for controlling more than two pairs "selector + amplifier" via one single serial port may practically depend on their activity. In such cases the opposite direction may be used in order to decrease the flow volume as the selector will filter the "fast" messages generated by the amplifier. Of course, now the forward and

reflected power could not be frequently monitored via the PC. Anyway, you can still measure them via the "M(uv)" command of the amplifier.

## 5. MAINTENANCE

### **WARNING HIGH VOLTAGE!**

**The selector works with mains AC voltage, which is dangerous for life! For your safety, pull the selector power plug out of the mains wall outlet EACH TIME BEFORE you remove the cover of the selector.**

#### 5-1. Cleaning

### **WARNING**

**Do not use solvents for cleaning - they may be dangerous both for you and for the selector paint.**

Do not open the selector. Cleaning of the outer surfaces can be done with a piece of soft cotton cloth lightly moistened with clean water.

#### 5-2. Fuses Replacement

If occasion should require replacement of the mains fuses, use only standard ones. The two Primary Mains Fuses of the selector are located inside the box. They are glass body 0.1A/250V slow blow, 5mm diam., 20mm

ong.Contact your dealer for details.

#### 5-3. The ACOM2000S Schematic Diagram

See Fig.5-1. The automatic antenna selector ACOM2000S is based on the single chip microprocessor AT89C2051 (U3) of Atmel. It receives antenna change commands from two sources: serial RS232 interface (RxD, pin2) and UP/DOWN buttons (B1, B2, pins 11 & 13). Then the microprocessor generates parallel output code in BCD (A1, A2, A4, A8, pins 16-19) to control the remote antenna switch.

Besides this basic function, the microprocessor serves the RS232 RxD and TxD (pin 3) signals and network self address inputs (SW1, pins 6-9) in order to comply the selected data protocol and local network rules (see S.4-2 and S.4-3). An additional microprocessor job is to scan the RDY (ready) signal from the remote antenna switch (pin 12) in order to realize the anti-hot switching protection. Blinking the 7-segment LED indicator is done by BI output (pin 14) and the alarm buzzer is controlled via the \*BUZ (pin 15).

The quartz crystal X1 (9MHz) stabilizes the main clock frequency in order to maintain the serial port speed within close tolerances (abt. +/- 0.1%) in the temperature range from 0 to +50 °C. The R-C pair R29 and C17 (pin 1) assure the delayed power-on reset of the microprocessor.

The RS232 serial interface input (RxD) from JP5:2 or JP6:2, as selected with "AMP-PC" slide switch (SW4), is fed to the MC1489 receiver / level converter (U6) and adapted from +/-12V to 0/+5V levels. The opposite operation is done by MC1489 (U7) for the TxD signal which is fed to JP6:3.

The output BCD code is inverted and fed to the output control connector JP1 via the open-collector buffer ULN2003A (U1A-U1D). It is also fed through the BCD to the 7-segment decoder/LED driver 7447 (U2) to the 7-segment LED indicator A-361G (U4). The decimal point is controlled by the RDY signal from another buffer ULN2003A (U1E).

The KEY-IN signal is buffered via Q2 and Q3 to the KEY-OUT output. The transistors Q1 & Q2 realize an “AND” logic in order to inhibit transmission when the remote antenna switch is not ready. Then Q1 is saturated, so Q3

cannot be controlled by the KEY-IN and is always in off state until RDY signal goes in logical high.

The power supply comprises TV1 mains transformer 2x9V, D4...D11 bridge rectifiers, 7805 (U5) +5V regulator and D12, D13 parametric voltage regulators for +/-12V supplies. The +27V supply is not regulated. Maximum of 200mA current could be consumed in any external unit from +27V.

## 5-4. Troubleshooting

If the selector indicator does not glow maybe the mains fuses have blown. Check the line voltage selection first (see S.2-2) and then see S.5-2.

If any function is not properly executed check slide switch position (see S.3) and then the external cabling (S.2-3). Check all cables for continuity and short circuits. If the problem persists, contact your dealer first or ACOM directly - see S.1-2.

## 6. SPECIFICATIONS

### 6-1. Parameters

a) Serial control input/output: +/-12V, levels, impedances, and timing comply the RS232 standard protocol 1200, N ,8 ,1.

b) Parallel input/output control:

- logical low input: -1...+1.25V, 1.2kOhm input resistance.

- logical high input: +7.5...+18V, 1.2kOhm input resistance;

- logical low output: 0...+1V, 15mA drive, 60mA sink;

- logical high output: +20...+30V, 1.2kOhm output resistance;

c) KEY-IN:

- open KEY voltage (drive): +10...+12V;

- closed KEY current (drive): 10...12mA;

- input voltage (resistance) @ 12mA: -1...+2V (0...160 Ohm) to consider the KEY is “closed”.

d) KEY-OUT:

- switching voltage (open circuit): -0.5...+40V;

- switching current (closed circuit): 0...20mA sink;

- output resistance @ 20mA sink current (closed circuit): 100...120 Ohm.

e) Output power supply voltage for external devices: +20...+30V unregulated, 0...200mA.

f) Primary Power: 100-132V (120V tap) and 200-264V (240V tap), 50-60Hz, 10VA.

g) Size & Weight (operating): W131mm x D162mm x H41mm, 1.3kg.

h) Operating temperature range: 0...+50 degs. Celsius;

### 6-2. Functions

- a) Conversion of serial RS232 port commands to 4-bit parallel BCD inverted output code. Manual up/down antenna number control.
- b) Directly compatible with ACOM2000SW remote antenna switch, ACOM2000A automatic HF linear amplifier, and ACOM DOS application for tunings via PC.
- c) All functions accessible from PC via serial port, local network functions for more than one sets of amplifier / antenna units, working in a system.
- d) Anti-hot switching protection for the external antenna switch.

### **6-3. Storage and Shipment**

#### **CAUTION**

Should you need to transport the selector, use the original packing as described below.

First pull the mains plug out of the mains outlet, afterwards disconnect all cables from the rear panel of the selector (remove the ground connection the last). Finally pack the selector in the original carton. Fill in the empty space if the ACOM2000SW antenna switch will not be transported.

a) Storage environments: the selector must be kept packed in dry and ventilated unheated premises without chemically active substances (acids, alkalies etc.) in the following climatic environment:

- temperature range: -40 to +70 °C;

- humidity: up to 75% @ +35 °C.

b) Shipping Size and Weight W178mm x D194mm x H182mm, 2kg (4kg when purchased with remote antenna switch ACOM2000SW).

c) Shipping environments: all types of transportation, including aircraft baggage section.