

## UHF COMM Controls

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More info at <https://www.vintageavionics.nl/index.htm>

From the beginning, UHF command radios were equipped with a separate guard receiver (usually at 243 MHz), and a main receiver that operates at the same frequency as the transmitter. This frequency is remote selected between 225MHz and 400MHz in 100kHz or- after 1960- in 50 kHz increments, thus with 1750 or 3500 channels.

Frequency selection, volume and mode ( off- without /with guard receiver, using the standard stub antenna or the optional ADF antenna) is done on a remote control panel in the cockpit. A selection from 20 or 26 preset channels can be made. Illumination is with GE327 bulbs (28V-40mA)

The main UHF transceivers used in the fifties were :

RT-178 / ARC-27 ( RT- / ARC-55)

RT-263 / ARC 34 ( RT-423/ARC-66; RT-463/ARC34B; RT 750/ ARC 34C,)

RT-742 / ARC 51 (RT-767A/ARC-51B,

RT-332 / ARC-52 ( RT-424/ARC52X)

Each radio has its own code to transfer frequency from a dozen different control panels. They differ in the voltage for the lamps, impedance of the volume control, ability to store 20 preset channels, ability to create a relay station with two radios, or the presence of an output to drive a channel indicator in front of the pilot instead of under his elbow.



### The ARC 27

All these radios use an auto positioner to set the various tuned circuits and to select crystals inside the radio unit. The motor rotates in just one direction, usually the “decrease frequency” direction. So, increase one channel takes 7 seconds, decrease takes half a second.

In the first years of the ARC27, the remote control consisted of **two** boxes, one stores the 20 preset frequencies, and the other selects one of them.

The C-626 **stores** the 20 presets on 3 drums . for tens MHz, unit MHz and 100kHz digits. These drums are rotated by an auto-positioner. Channels can be programmed on this unit, and non-programmed channels can be selected here.

The selected preset was chosen on the C-628 , shown left.

Typical control panels are

C-911 , C-868 C-905 C-906, C-912, C-853, C-913, C-914, C-1015.

For the ARC27A

C-1024 relay-1 C-1025 relay 2 ,

C-1702 quick preset C-1703 C-1704 C-1705,

C-1904 with manual preset inside box and C-2459 with a remote ch indicator output

Special versions existed for **two ARC27 as relay station.**

Both had a preset memory box like the C-626. The cockpit had two slightly different control panels to select the presets and the mode of operation

The control panels are the C-1024 and C-1025, see ->

### Control panels for the ARC27

C-626/ARC-27 stores presets  
C-627/ARC-27  
C-628(\*)/ARC-27 presets selector

C-911/ARC-27  
C-868/ARC-27  
C-905/ARC-27  
C-906/ARC-27  
C-912/ARC-27  
C-853/ARC-27  
C-913/ARC-27  
C-914/ARC-27  
C-1015/ARC-27

#### For the ARC27A

C-1024/ARC-27A relay-1  
C-1025/ARC-27A relay 2  
C-1702/ARC-27A quick preset  
C-1703/ARC-27A  
C-1704/ARC-27A  
C-1705/ARC-27A  
C-1904 manual preset inside box  
C-2459/ARC remote ch ind output

Two Radio Set Control Systems (AN/ARC-27A and AN/ARC-51A) were developed:

Frequency-Ch Indicator ID-1471(XN-1)/**ARC-27A** with Control, Radio Set C-7306(XN-1)/ARC-27A, and Frequency-Ch Indicator ID-1472(XN-1)/**ARC-51A** with Control, Radio Set C-7307 (XN-1)/ARC-51A. Both control systems met all design objectives. Particularly significant is the packaging of both Indicators in identical MS33639 2-inch instrument cases, thus providing mounting interchangeability. This feature has also been provided in both Controls, where identical front panel heights of 4-1/8 inches with identical mounting centers exist. Finally, the basic design concepts of the Indicators and Controls have been proven through successful completion of all required operational, environmental and reliability tests.

Remote channel indicator ID-572/ARC ( see next page, ARC34)

#### C-1024/ARC-27A and C-1025/ARC-27A RELAY CONTROL PANELS

The C-1024 and C-1025 Control Units are used for the controlling of two RT-178 transceivers connected for automatic relay operation. These units are both installed in the right hand console. The T/R, T/R&G, and ADF functions for both ARC-27 transceivers are controlled by a three-position switch on the C-1024 control box. The C-1024 controls the frequency selection of unit No. 1 and C-1025 controls the frequency selection of unit No. 2. The C-1024 control unit also contains a volume control which simultaneously controls the volume levels of both receivers and a sensitivity control for each receiver. A six position switch controls functions of both transceivers in the following manner.

OFF	Pwr removed from both units
1 T/R	Receive & transmit on Unit No. 1
1 T/R 2 R	Receive & transmit on Unit No. 1, receive only on Unit No. 2
RELAY	Automatic relaying of signals. An automatic relay disabling feature permits the operator to transmit simultaneously on both units by keying mike button. A signal received on UHF No. 1 will be automatically transmitted on UHF No. 2 or vice versa.
2 T/R 1 R	Receive & transmit on unit No. 2, receive only on unit No. 1.
2 T/R	Receive and transmit on Unit No. 2

#### NAVIGATION EQUIPMENT

##### RADIO MAGNETIC INDICATOR

An ID-250/ARN course indicator is installed in the pilot's instrument panel (figure 1-5) and is identified as the radio magnetic indicator. This system combines a magnetic direction compass card with two

## The single ARC 27 control panels

Later came the all-in-one control panels like the C-1015. They had a single drum with pegs that operate a line of 16 microswitches to drive the 16 frequency control lines of the ARC27.

These are 6 contacts for the 10MHz digits, 5 contacts for the 1MHz digit, and 4 contacts for the 0.1MHz digit, in total 16 contacts. One microswitch inverts the 1MHz code when the 100kHz digit is more than 5 (> 500kHz)

On the control panel (as shown below) there is the CHAN knob, which directly rotates the drum over 22 positions of each 16 pegs. These pegs operate 16 microswitches. Programming the pegs is done with the concentric dials next to the CHAN knob.

On the CHAN knob are 20 positions for programmed channels, one for the Guard channel (fixed preprogrammed), and one for manual selection, where the dials are linked directly to the microswitches.



**C-1015, C-1702 / ARC-27**  
( and C-1703, C-1704 and C-1705)

Manual selection and 20 presets.

Preset setup copies the manual selected channel.



**C-1904 / ARC-27**

Compact version. Presets can be set only when the control box is opened.

**C-2459/ARC** has outputs to drive a remote channel indicator ID-572



**C-1827/ ARC-55** is a simple control without preset channels.

It was designed for the ARC55, the non-pressurized version of the ARC27.

# RT-178 /ARC27 Frequency coding

## 10Mc coding

	20 38	21 39	22 -	23 -	24 -	25 -	26 -	27 -	28 -	29 -	30 -	31 -	32 -	33 -	34 -	35 -	36 -	37 -	pin
a	X			X					X	X	X	X		X	X		X		A
b		X			X					X	X	X	X		X			X	B
c	X		X			X					X	X	X	X		X	X		C
d		X		X			X					X	X	X	X		X	X	D
e	X		X		X			X					X	X	X				X
f	*	*	X	X		X	X		X		X		X	X	X	X			H

An "X" indicates that the line connects to ground in the control panel

The remaining lines except line f are interconnected in the control panel

\* grounded for 20 and 21, but open for 38 and 39 times 10 Mc

The open circuit seeking switch in the RT-178/ARC27 has 18 positions and makes 2 cycles. The 16 unused positions of the second cycle are skipped automatically

## 1 Mc coding

	0	1	2	3	4	5	6	7	8	9	-	-	-	-	pin
g			X			X	X		X		X		X		J
h				X			X	X		X			X		P
i	X				X			X	X		X		X		C
j		X				X			X	X		X			A
k	X		X				X		X	X	X		X		M

The meaning of X in the 1Mc coding depends on the 0.1Mc selection.

At xxx.0 thru xxx.4, the "X" lines **connect to ground** in the control panel

The remaining lines are interconnected in the control panel

At xxx.5 thru xxx.9, the "X" lines are **interconnected** in the control panel

The remaining lines **connect to ground** in the control panel

The inverted codes cause the 1Mc positioner to make a "half" step to tune the 20-30Mc first IF amplifier which has 500kc bandwidth

The 4 unused positions of the 14-position switch are skipped automatically

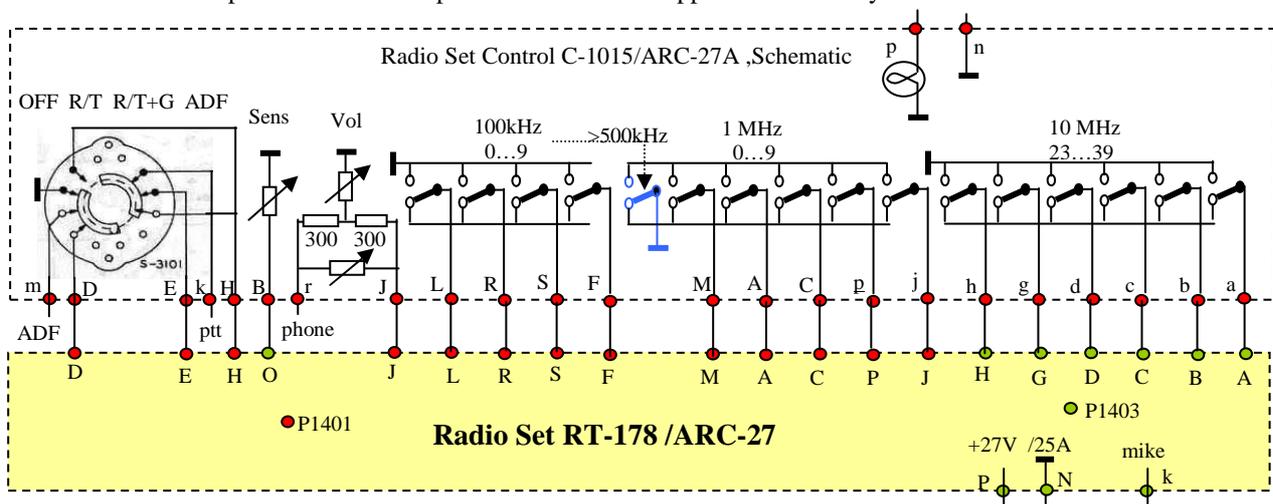
## 0.1 Mc coding

	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	-	-	-	-	pin
l	X		X				X		X	X			X	X	F
m	X	X		X				X		X	X			X	S
n	X	X	X		X				X	X	X	X			R
o		X	X	X		X			X	X		X	X		L

An "X" indicates that the line connects to ground in the control panel

The remaining lines are interconnected in the control panel.

The 4 unused positions of the 14-position switch are skipped automatically



## The ARC 34

RCA designed this system, and they had a different approach than the digital coding of the frequency digits in Collins radio's.

The transercode for the ARC-34 is a potmeter per digit, producing 2V per step. The auto positioner in the radio has a potmeter per digit as well, and stepper motor running until the bridge formed by the remote and local potmeters is balanced.

Typical control panels are C-1057 ( standard, and the C-1057B with channel indicator output



### C-1057 / ARC-34

Any frequency can be selected from 200 to 399.9 MHz.

The channel motor from the ARC-34 will run forever when a frequency is selected below 225MHz.

The C-1057B has separate contact outputs ( 2 for the 200/300MHz, and 4 contacts per digit = 14 contacts) to drive the remote channel indicator ID-572/ARC ( see next page)

The ARC34C had 50kHz channel spacing. The rightmost rotary switch on the control panel had 20 positions, and the tiny window above that knob showed .00 .05 .10 .15 etc. There was no remote indicator for the ARC34C as far as I know.



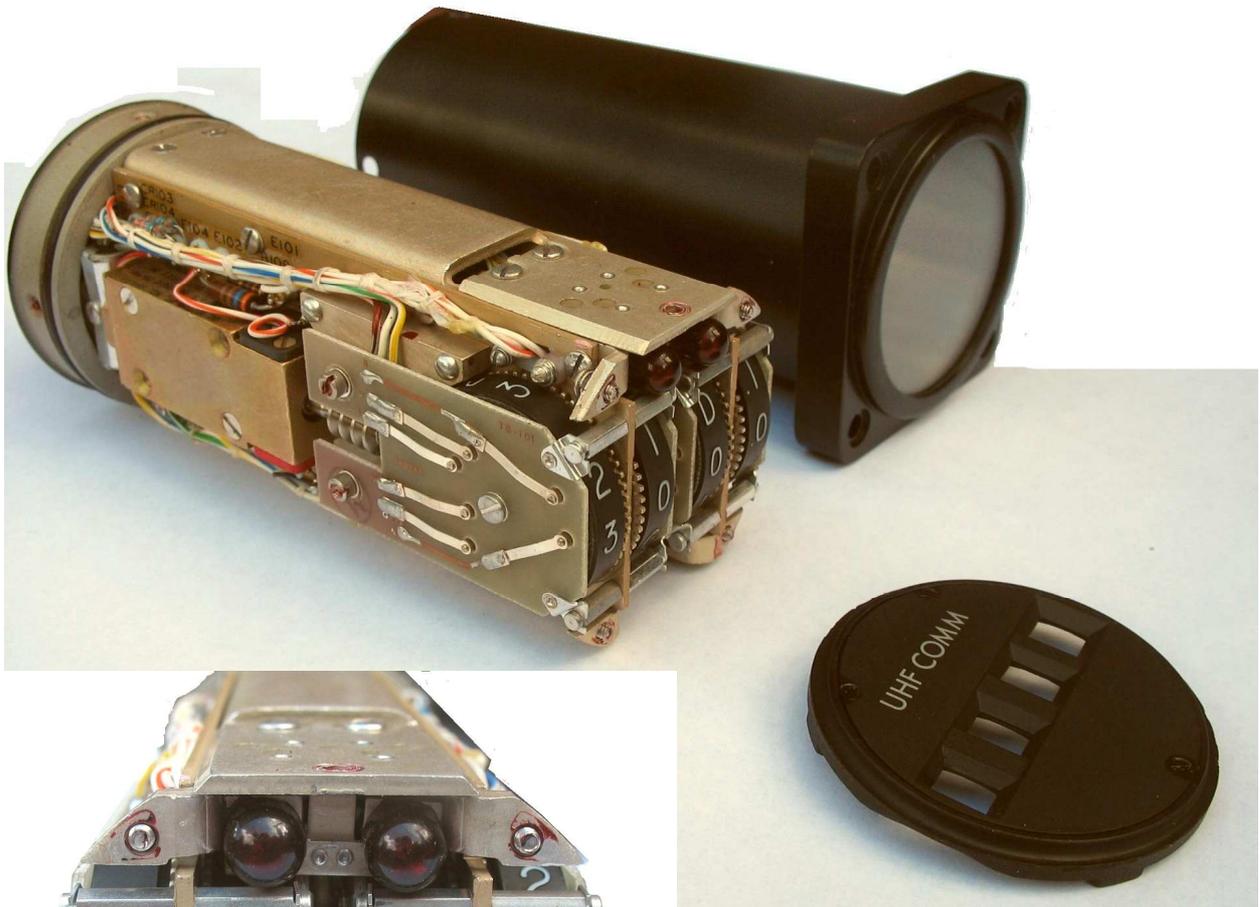
Maybe this control was also used for the ARC34C. It has a fifth knob for the 50kHz channel separation.

(used in ARC150 ? )

## ID-573/ARC Remote Frequency Indicator

The frequency indicator ID-573/ARC is actuated by the control box type C-1057B/(ARC-34). This type indicator is constructed so that additional indicators may be slaved, in series relationship, from previous indicators. Normally, all track the tuning and indicate the tuned frequency. However, when the +27V for a slave is interrupted, the slave "stores" the last displayed frequency to "remember" temporary used frequencies during flight. (Patent US3775690 )

The electromechanical indicator ID-573/ARC requires slightly less than 1.2 seconds to completely change indication from 225.0 to 399.9, thus for this type indicator, the 27.5V must be maintained for approximately this length of time so that the recall indicator can change to the tuned indication.



All four discs rotate in 30 deg steps  
over 12 positions marked:

Disc 1: 2 3 \* 2 3 \* 2 3 \* 2 3 \*

Disc 2: G 0 1 2 3 4 5 6 7 8 9 \*

Disc 3: D 0 1 2 3 4 5 6 7 8 9 \*

Disc 4: \* 0 1 2 3 4 5 6 7 8 9 \*

\* no character

Illumination by 6 (red) lamps 4.5V/65mA,  
1 inside each disc, and two on top to  
illuminate "UHF COMM"

### Motor

The indicator has 4 independent motors, each driving one display wheel. When the right position is reached, a quick stop is made by shorting the motor using a point contact germanium transistor RCA3593. The unloaded motor current is 50mA, regardless of the voltage. Loaded with the transmission and code wheels, the current per motor is approx. 100mA ( 2.5W).

When the motor is removed and replaced, take care that the spindle is not too close to the nylon gear. Otherwise the motor might get stuck. Never apply 27V directly to a motor.

## ARC-45 UHF



### SB328 / ARC45

The ARC45 is a low power UHF transceiver with just 12 preset channels for use in helicopters.

Size and cableloom are identical to the ARC44 FM radio.

The 12 channel frequencies are set in the RT unit, the whole MHz by placing

the appropriate crystals in a rotating drum, the fractional MHz by shifting a peg over 10 positions. The *position* of the drum, the channel, is chosen on the control panel.

### Channel selection mechanism.

On the SB328 control, *Channel* is a 4-wire code:

Pin/ CH	1	2	3	4	5	6	7	8	9	10	11	12
DD	x	x	x				x			x	x	
EE		x	x	x				x			x	x
FF	x		x	x	x				x			x
HH	x	x		x	x	x						x

x= connected to ground, blank=interconnected. For instance channel 5 is selected when DD and EE are interconnected, and FF and HH are tied to ground.

The **ARC-51** frequency is set with 18 contacts, 2 for the 200/300MHz selection, 5 for each of the 10MHz, 1MHz and 0.1MHz digits in a **2-out-of-5 code**, and a single contact for the 50kHz if present. The presets drum has 8 pegs that can be shifted over  $2 + 3 \times 5 + 2 = 19$  positions.



Compared to the ARC34 control, a squelch disable was added, and readout of the manual frequency is far better.

There is a version to drive an external channel display via a second plug, like in the C1057B



The ARC51 was also used on airports, either static or mobile.

Here are some examples of the mobile version, used in Jeep (left)



Some control heads were purpose-made from standard components like the 3C-27 for ground use ( shown right) with Preset drum 5128CP

The preset drum was also used to tune the second set in a 2xARC51 relay system.

Many control heads exist for the ARC51, differing in the telephone impedance (150 / 600Ω), lamp voltage, and presence of a relay function with tel/mike impedance conversion. The latest version had digital display with incandescent 7-segment displays, white or red.

C-4677/ARC51X Manual frequency setting, no presets.

C-6476/ARC-51A	600Ω	28 V lamps
C-6555/ARC-51A	600	5
C-6556/ARC-51B	150	5
C-6287/ARC-51BX	150	28

C-6300/ARC-51A	600	5/28	rel/P + Rel/C * ( includes 600/100Ω -1V conversions)
C-6528/ARC-51B	150	5/28	rel/P + Rel/C
C-7307/ARC-51A	600	5/28	digital display + output remote channel indicator
C-8616/ARC	150	5/28	digital display + output remote channel indicator

ID-1472 /ARC-51A ( red light, 5 or 28V) remote channel indicator

ID-1752 /ARC ( white light, 5 or 28V) remote channel indicator

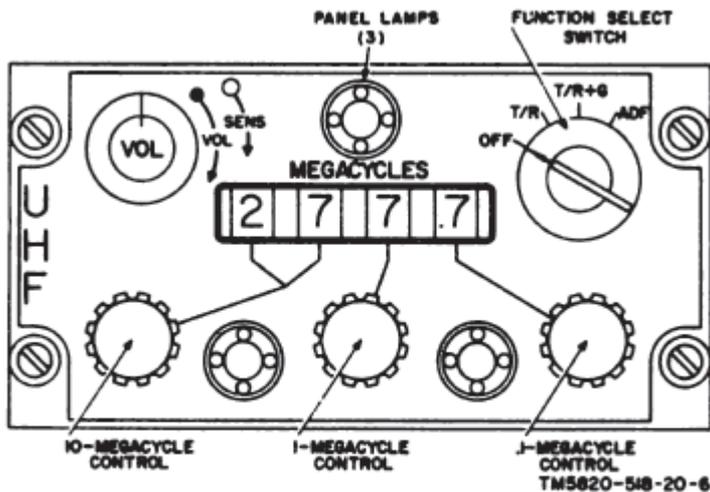
\* rel/P relay/plain rel/C= relay/ciphony by external unit AN/ KY-28

### ARC51 Versies

RT-742 /ARC51BX	RT-742B/ARC51BX	RT-742C/ARC51BX
RT-743 /ARC-51A	RT-743A/ARC-51A	RT-743B/ARC-51A
RT-767 /ARC-51B	RT-767A/ARC-51B	RT-767B/ARC-51B
RT-780 /ARC-51AX	RT-780A/ARC-51AX	RT-780B/ARC-51AX



C-6287/ARC-51BX with front cover removed. The lamps are in two strings of 6 each.



**Figure 2-1. Radio Set Control C-4077/ARC-51X, front panel controls.**

Engineering report. 7 Jun 66-26 Dec 67.  
 ADMIRAL CORP CHICAGO IL  
 ( 108 pages )

**Abstract :** Two Radio Set Control Systems (AN/ARC-27A and AN/ARC-51A) were developed: Frequency-Channel Indicator ID-1471(XN-1)/ARC-27A with companion Control, Radio Set C-7306(XN-1)/ARC-27A, and Frequency-Channel Indicator ID-1472(XN-1)/ARC-51A with companion Control, Radio Set C-7307 (XN-1)/ARC-51A. Both control systems met all design objectives. Particularly significant is the packaging of both Indicators in identical MS33639 2-inch instrument cases, thus providing mounting interchange ability. This feature has also been provided in both Controls, where identical front panel heights of 4-1/8 inches with identical mounting centers exist. Finally, the basic design concepts of the Indicators and Controls have been proven through successful completion of all required operational, environmental and reliability tests.



## Later versions based on the ARC-51

**ASQ-19** Comm/Nav combination has a slightly modified ARC51. The frequency is BCD coded and the power supply is 400Hz 3-phase rather than 28Vdc. Contents:  
 RT-793 /ASQ = ARC51 *plus* bcd->2-out-of-5 re-coder and *without* inverter;  
 C-6684/ASQ fancy panel with digital display and thumbwheels  
 ID-1311 /ASQ remote channel indicator  
 ID-1972 /ASQ remote channel indicator



**ARC-109** has AM en DSB, 30W RF, in about the same box as the ARC51.  
 Components shown below C-6364/ARC109 en RT-749/ ARC109



Note the different 2-out-of-5 code !

## ARC52 family

The ARC52 was a Collins design. Originally, it had 1750 channels on a 100kHz grid. The frequency is coded with one contact for the 200/300MHz choice, and 6 contacts for the three remaining digits. The presets drum had 7 pegs shift able over 23 positions. The link from control panel to transceiver had 19 wires for the frequency setting.



### C-1607 / ARC-52

The original control panel with 1750 channels in a 100kHz grid.

The ARC-552 or 618W-2 had 3500 channels in a 50kHz grid.

The rightmost knob got 20 positions instead of 10, and the control panel got a tiny window which showed either 00 or 50. This can be seen in this picture :



### C1607-4 / PTR175, made by Plessey.

They added 350 VHF channels to the ARC52. Consequently, the 100MHz knob in the control panel can be set to 1, 2 or 3, not only 2 or 3.

Further, a veeder type display is used for the manual frequency like in the ARC52.

All C1607 panels have the same drum to store the preset frequencies. However, the peg on the drum for the hundreds MHz can be shifted over 3 positions ( 1-3-2) and there is an extra peg for the 50 kHz step.

In total there are 8 pegs in 26 positions. The mode switch has 3 extra positions, that are only used when the (fsk) data

module was present in the transceiver.

The positions are DL= Data link reception ( transmitter inoperative)

DL/T = Data link test; T/R on-D/L off same as normal T/R mode.

More info on my vintage avionics site: <http://members.home.nl/a.k.bouwknegt/>