HAL ID-1A REPEATER IDENTIFIER

INSTRUCTION MANUAL

HAL COMMUNICATIONS CORP.
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QUALITY COMMUNICATIONS EQUIPMENT

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WARRANTY

HAL Communications Corp. warrants that the HAL ID-1A Repeater Identifier shall be free of defects in materials and workmanship under normal use and service for a period of one year from the date of the original invoice. Should such defects occur within the warranty period, the identifier will be repaired at no charge except for transportation costs upon return of the unit to the factory. Units returned for warranty service must be postmarked within one year from the beginning of the warranty period.

This warranty is and shall be in lieu of all other warranties, whether expressed or implied, and of all other obligations or liabilities on the part of HAL Communications Corp. resulting from the installation or use of this identifier.

The foregoing warranty is completely void on all units which have been repaired by individuals other than HAL Communications Corp. personnel, those which have been damaged, abused, modified, improperly installed, or tampered with, and those which have been subjected to improper voltages or currents.

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TABLES AND ILLUSTRATIONS

I. DESCRIPTION

The HAL Communications Corp. ID-1A repeater identifier is designed to help owners of repeater stations meet FCC requirements for periodic station identification. It automatically transmits the station call sign at the required intervals whenever the repeater is in use. The ID-1A offers these advanced features:

- TTL integrated circuits for high noise immunity and wide operating temperature range
- Reprogrammable diode-matrix read-only memory for storage of the station call sign
- Accurate interval timing derived from the AC power line
- Interval timing source for emergency or portable operation from DC power
- Transistor switch for direct control of the repeater keying relay
- Page control input to inhibit identification during paging tones
- Adjustable code speed
- Low-impedance audio output with adjustments for pitch and volume
- Regulated 5 volt DC power supply
- Rugged G-10 epoxy-glass circuit board

Operation

The ID-1A identifier is completely automatic. It senses when the repeater has been actuated and immediately transmits the station call sign by feeding a keyed audio tone to the repeater transmitter.

After this initial identification has been sent, a short "guard" period commences. At the same time, a three-minute timing interval starts.[1] If the repeater is again keyed up during the guard period, but remains inactive during the nominal three-minute timing interval, only the initial identification is transmitted. This feature prevents the unnecessary repetition of the call sign if the repeater is triggered briefly by a noise burst or by a short call to which there is no response.

If, however, the repeater is reactivated after the guard period but before the end of the timing interval, the identifier will repeat the call sign at the end of the longer interval. The identification will be transmitted approximately every three minutes as long as the repeater is activated once during each interval. If the repeater is held continuously activated, the ID-1A will identify at three minute intervals. If the repeater happens to be off the air at the moment the identification is to be transmitted, a keying transistor in the ID-1A actuates the repeater keying relay, returning the transmitter to the air while the call sign is being sent.

Identification may be inhibited by grounding the page control input. If this line is grounded when the timing interval ends, identification will be delayed until the control line is released.

Circuit Description

The identification message is stored in a diode-matrix read-only memory (ROM). This memory has been specially designed to store code characters (dots, dashes, or spaces) using a minimum number of diodes. The memory capacity is sufficient to store the letters "DE" plus any amateur call sign.

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[1] Timing intervals of approximately 6, 12, or 24 minutes may also be selected by changing the position of a jumper on the circuit board, as shown in the schematic diagram. The guard period remains the same.

On the average, the number of diodes needed to store a given message is equal to about two thirds of the number of characters the message contains.

Unlike many commercially available ROM's, the memory used in the ID-1A may be reprogrammed by the user. The stored message can be changed by rearranging the diodes in the matrix. Complete instructions for reprogramming the memory are given in section IV of this manual.

Timing for the identifier is derived from the AC power line frequency and is therefore very stable and needs no adjustment. A series of integrated-circuit flip-flops divide the power frequency by a factor of 10,240 to provide a basic timing interval of 2 minutes, 50.7, sufficiently close to the desired three-minute timing interval. As described on page 12, the timing interval may be changed to 2, 4 or 8 times the basic timing interval if desired. A 60 Hz unijunction oscillator is also provided to supply a time source during D.C. operation.

Each time the identification message is transmitted, the memory is read out, one character at a time. The memory output is supplied to a character generator, which reconstructs the code characters with precise weight and spacing. The code speed may be adjusted by a potentiometer mounted on the circuit board.

The character generator keys the audio oscillator, which supplies the audio signal to the repeater's microphone line and to an internal monitor speaker.

A rugged transistor switch is built into the ID-1A to activate the transmitter control relay. The transistor is rated to handle ±25 volts at 500 ma. A high-voltage transistor switch, rated to carry 150 ma. at +250 volts or -150 volts is available as an option. The normal high-current switch is recommended if you plan to control the repeater's push-to-talk relay.

All ID-1A circuitry, including the regulated 5 volt power supply, is contained on a 3 x 6" circuit board. The power transformer, fuseholder, test switches, connectors and bypass capacitors are mounted external to the board.

The ID-1 is available assembled in 1½" high by 4" deep rack-mounted (19" wide) cabinet, or is available as an assembled, tested circuit board ready for mounting and shielding.

II. INSTALLATION OF ASSEMBLED CIRCUIT BOARD

Mounting and Wiring

Since the ID-1A circuit board is supplied wired and tested, it is necessary only to mount the board and the external components in a suitable enclosure, such as a HAL cabinet or a Bud Minibox, and to connect the identifier to the repeater transmitter.

Figure 1 shows the circuit board and the terminals to which the following external components are connected:

1. Power transformer (including primary circuit wiring)
2. Fuseholder
3. Speaker
4. Audio output connector (phono jack)
5. Keyed output jack (¼" phone jack)
6. Keyed input jack (phono jack)
7. Page control jack (phono jack)
8. DC voltage input (phono jack)
9. Test switches A and B

The power transformer secondaries should be wired in parallel to provide 6.3 volts. The two primaries should be connected in parallel for 115 VAC operation, or in series for 230 VAC operation. Be certain to observe the polarity of the leads when connecting the windings in series or parallel. A terminal strip is provided for the wiring of the transformer primary circuit, which includes the transformer leads, the fuseholder, the power cord, and the line bypass capacitors. Bypass each side of the power line to the cabinet with the .001 ufd capacitors provided. Connect the power cord ground conductor securely to the cabinet.

The two-inch speaker provided for monitoring and testing the ID-1 can be mounted most conveniently by simply gluing it to one side of the cabinet. Scotch spray adhesive, Elmer's white glue, or some similar cement is adequate.

The input and output jacks, as well as the test switches, may be mounted at any convenient location on the cabinet and connected to the circuit board as shown in Figure 1. The keyed input jack (a phono connector) carries the signal which triggers the ID-1A whenever the repeater goes on the air. Grounding the center contact of this jack activates the identifier. The jack may be connected to any unused contacts which close when the repeater is keyed up. Connect a 0.1 ufd capacitor across the jack terminals to prevent noise pulses from activating the ID-1A.

Test switch B is also connected across the keyed input jack. Depressing this switch has the same effect as keying up the repeater. It is therefore useful in testing the identifier. Permenantly closing this switch (grounding the keyed input jack) will cause the ID-1A to identify at the end of each timing interval.

The keyed output jack is used to connect an external transmitter control relay to the transistor switch in the ID-1A, allowing the identifier to activate the transmitter when an identification is to be sent. When the switching transistor conducts, it grounds the center conductor of the jack. The transistor can switch either positive or negative voltages, depending on the way the output jack is wired to the circuit board (see Figure 1). Bypass the jack terminals with the .01 ufd capacitor supplied.

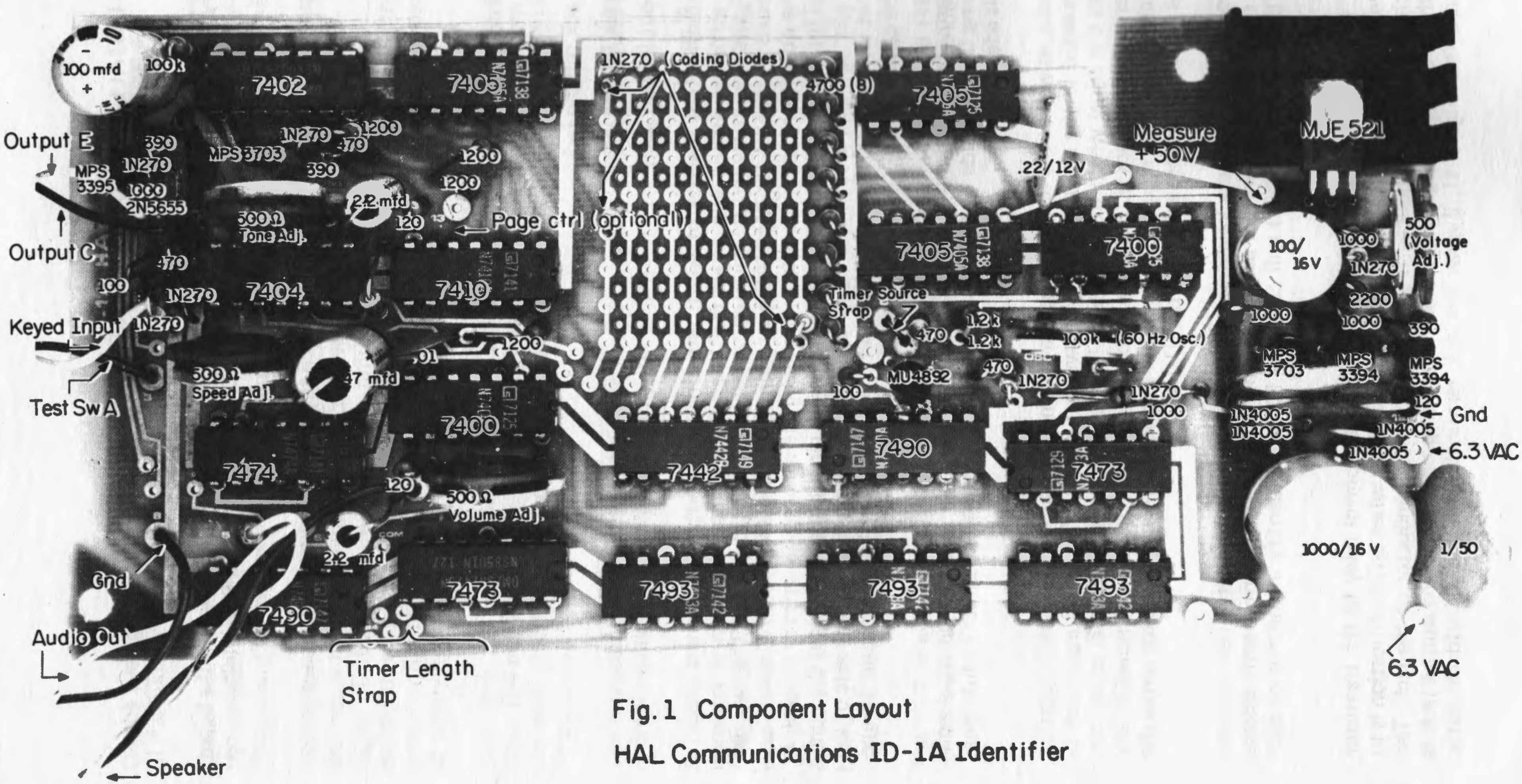

Fig. 1 Component Layout
HAL Communications ID-1A Identifier

The transistor switch is rated at ±25 volts and 500 ma., which is adequate to switch push-to-talk relays operating from a 12 volt DC source. If your repeater uses a 6 volt relay, be sure that it draws less than 500 ma. before connecting it to the ID-1A.

Connect the clamping diode provided across the terminals of any relay switched by the ID-1A. This diode eliminates the switching spike generated when the relay current is interrupted. Without the diode the spike voltage may damage the switching transistor. The diode should be connected with its cathode toward the positive end of the relay coil so that it is normally nonconducting.

The keyed audio output is fed to the transmitter through a phono connector. The relatively low impedance of the output terminals permits driving the microphone lines of most transmitters directly. Bypass the audio output terminals at the jack with a .01 ufd capacitor.

Test switch A is provided for bench testing of the ID-1A. It causes the coded message to be generated each time it is pushed, whether or not a complete timing interval has passed. Repeated closures of this switch (or contact bounce) may cause errors in the transmitted message. Use the switch for off-the-air testing only; do not make any external connections to the switch contacts.

The page control input can be used to ensure that no identification will be sent during a paging call. If the end of the timing interval is reached when the page control line is grounded, the identification will be delayed until the line is released. The state of this control line does not affect the internal timer. If the line is used, bypass it with a .01 ufd capacitor.

Typical Installations
The ID-1A incorporates many features, not all of which need be used in a particular application. To help in planning an installation, here are two typical examples:

Situation A: An amateur - band repeater is to be identified at the required three-minute intervals. The push-to-talk relay in the transmitter is controlled by an output from the receiver. One end of the relay coil is connected to a +12v DC source capable of supplying the 200 ma needed to activate the relay. The identifier is to be operated from a 12v DC source. The page control feature is not needed.

Procedure:

1. Set the timer for the three-minute interval by connecting the jumper to the three-minute position (3) on the PC board.
2. Strap the timer input to the internal clock (I).
3. Supply 12v DC to the unregulated supply input through a 15 ohm, 5 watt resistor. Leave the power transformer unconnected.
4. Locate an unused contact pair on the receiver relay. Connect the keyed input line to one contact; ground the other contact.
5. Connect the emitter of the transistor switch to ground. Connect the collector to the low side of the push-to-talk relay. Wire the damping diode across the relay coil, with its cathode toward the positive end of the coil.
6. Couple the audio signal to the transmitter audio input circuitry.
7. Connect the speaker and test switches as described in the preceding section.
8. Leave the page control input unconnected.

Situation B: A commercial repeater for handling messages is to be identified every 24 minutes regardless of how often the repeater is activated. However, if the receiver is active and a message is being sent, transmission of the call sign is to be delayed until the message has been completed. The identifier is to operate from a 120v AC power source. The transmitter is controlled by a 12v DC, 200 ma relay.

Procedure:

1. Use the normal 120v Ac connections to supply power to the ID-1A.
2. To provide continuous operation, ground the key line.
3. Set the timer for a 24-minute interval by inserting the jumper wire in the proper hole (24) on the PC board.
4. Strap the timer input to use the AC line (L) as its timing source.
5. Connect the transmitter relay as described in step 5 of the previous example.
6. In the receiver, locate the relay which closes when messages are being received. Connect the page control line to an unused contact; ground the other contact of the pair so that the page control line will be grounded when the relay is closed.
7. Connect the speaker, audio output, and test switches as described previously.

Adjustments
The ID-1A requires only three simple adjustments before it is put into operation.

The code speed is adjusted by the speed control. For checking the speed, press switch A to start the coded message.

The audio level is controlled by the volume adjust pot. The tone control adjusts the oscillator pitch. Again, test switch A is convenient for checking the settings.

The power supply voltage and the internal timing oscillator are set prior to shipment, and should not require adjustment. If adjustment becomes necessary, refer to the component layout for the location of the controls and measurement points.

III. TEST PROCEDURE

If you should have difficulty with your ID-1A, you can check its performance by conducting the following tests:

1. Apply AC power to the identifier and check the regulated DC voltage at the emitter of the regulator pass transistor (the MJE521). It should be between +4.7 and +5.1 volts. If it is not, adjust the power supply voltage control. If you cannot bring the voltage within these limits, check for defective components in the power supply.
2. If the power supply voltage is correct, push test switch A. The speaker should emit the coded identification message immediately. It should be possible to adjust the code speed, the audio tone, and the volume with the appropriate controls. If the identifier emits a very short, fast burst of code characters, check the 47 ufd capacitor in the master clock circuit.
3. If the above steps have not isolated the problem, press test switch A again. After the coded message has been emitted, wait until about half of the time interval has elapsed. Then push test switch B. After the timing interval has been completed, the identifier should repeat the coded message.
4. If the identifier has performed properly in step 3, wait until one more timer interval has elapsed. The identifier should *not* repeat the coded message.
5. After step 4 has been completed, push test switch B again. The identifier should emit the coded message immediately.

If the identifier has successfully passed these five tests it is working properly. Check all connections between the ID-1A and the repeater transmitter for loose joints and wiring errors during final installation.

IV. PROGRAMMING THE MEMORY

The ID-1A read-only memory (ROM), which stores the identification message to be transmitted, is of the diode matrix type. It is designed so that a minimum number of diodes is required to store a given message.

Although the ID-1A is normally supplied with the desired message precoded into the memory, the user can change the stored message by altering the arrangement of the diodes in the matrices. The process, a relatively simple one, will be explained in the following paragraphs.

Memory Format

The memory is capable of storing forty code "characters" (dots, dashes, or spaces). Each character is composed of two logic "bits". The memory is made up of two separate matrices, one called the "dash" matrix and the other the "space" matrix. Each stores one of the two bits that make up a given character.

As the message is transmitted, the contents of the memory are read out sequentially, one character (two bits) at a time. The output signals are fed to the keyer circuitry, where they cause the keyer to reproduce the stored character.

Since each character consists of two bits, any one of four possible combinations (and therefore any of four different characters) may be stored at each memory location:

TABLE 1: Character Codes

Character	Space Matrix	Dash Matrix	
Dot	0	0	(1 indicates the
Dash	0	1	presence of a diode,
Space	1	0	0 indicates the
End	1	1	absence of a diode)

Note that the keyer automatically produces a short space, equal in length to a dot, after each dot or dash. No separate code character is needed to generate this intercharacter space. The "space" character therefore is used only to generate the longer spaces required between complete letters or between words. It is equal in length to two dots. The "end" character is always used as the last character in the coded message; it tells the keyer circuitry that the message is completed.

Coding the Memory

To code the memory, all you need to do is connect diodes at the appropriate places in the matrices. For example, if the first character to be transmitted is a dash, a diode is connected at location 1 in the dash matrix, but location 1 of the space matrix is left vacant.

Figure 2 shows the physical arrangement of the matrix circuit board, viewed from the top, with the memory coded to transmit the message "DE WB9XYZ". To illustrate how the coding is done, we will follow the process used to store this message.

The first step is to break the message down into a series of dots, dashes, and spaces, as shown in Table 2 on the following page. The dash and space matrix columns are then filled in by using the code patterns given in Table 1. One space character is used between each letter or number in the message; three are used to form the longer spaces between words. An end character must be included as the last character in the message.

TABLE 2: Coding the Memory for "DE WB9XYZ"

Memory Location	Letter	Character	Space Matrix	Dash Matrix
1		Space	1	0
2		Space	1	0
3		Dash	0	1
4	D	Dot	0	0
5		Dot	0	0
6		Space	1	0
7	E	Dot	0	0
8		Space	1	0
9		Space	1	0
10		Space	1	0
11		Dot	0	0
12	W	Dash	0	1
13		Dash	0	1
14		Space	1	0
15		Dash	0	1
16		Dot	0	0
17	B	Dot	0	0
18		Dot	0	0
19		Space	1	0
20		Dash	0	1
21		Dash	0	1
22	9	Dash	0	1
23		Dash	0	1
24		Dot	0	0
25		Space	1	0
26		Dash	0	1
27		Dot	0	0
28	X	Dot	0	0
29		Dash	0	1
30		Space	1	0
31		Dash	0	1
32		Dot	0	0
33	Y	Dash	0	1
34		Dash	0	1
35		Space	1	0
36		Dash	0	1
37		Dash	0	1
38	Z	Dot	0	0
39		Dot	0	0
40		End	1	1

If the message to be coded (including the end character) does not require the use of all 40 memory locations, it is well to insert extra space characters at the beginning of the message. These will delay the beginning of the message, allowing time for control relays to activate the transmitter before the first character is sent. In our example, the message plus the end character require only 38 memory locations, so we insert two space characters ahead of the first message character.

Once the table has been constructed, we may use the coding chart in Figure 2 to mark the locations in the matrix where diodes must be inserted. In the drawing, the diode locations in both the dash and the space matrices are numbered from one to 40. Starting with the space-matrix column in the table, we mark a diode at locations one and two of the space matrix, since the space-matrix column contains ones for these locations. We leave locations three through five empty, however, since the space-matrix column contains zeroes. The process is continued for all forty locations in the space matrix. The diodes in the dash matrix are then marked in the same way, using the contents in the dash-matrix column in the table.

Figure 3 provides a spare coding chart to use in programming your own message. Once the table of characters has been constructed and the chart properly marked, diodes are inserted in the board at the required locations and are soldered. Be sure that the diode *cathodes* connect to the printed conductors on the *bottom* of the circuit board. It pays to carefully recheck your work at each stage of the process to guard against wiring errors.

When soldering the diodes in place, use a low-voltage, pencil-tip soldering iron. Use only enough heat to obtain a good connection. Overheating the joints may damage the circuit board or the diodes. Use a limited amount of solder and check to make sure that excess solder does not bridge across adjacent conductors.

Changing the Stored Message

If you are *recoding* a memory to change the stored message, it often saves time to construct a table for both the old and new messages. By comparing the tables you may find it is not necessary to remove all of the existing diodes–some may already be in the correct position for the new message.

Remove unneeded diodes from the board by snipping the diode leads with a pair of wire cutters. It is safer to snip the diodes out than to risk damage to the circuit board by trying to unsolder them. Carefully remove the leads from the holes with a soldering iron and needle-nosed pliers. Clean each hole to ease the reassembly process.

Germanium signal diodes such as the 1N270 make suitable replacement diodes. To save the trouble of locating and replacing defective diodes after the board has been completed and tested, check each diode (whether new or used) with an ohmmeter before installing it.

Factory Recoding

HAL Communications Corp. will recode your identifier's memory for a $5.00 service charge plus shipping costs. Please notify the factory before returning your keyer for recoding.

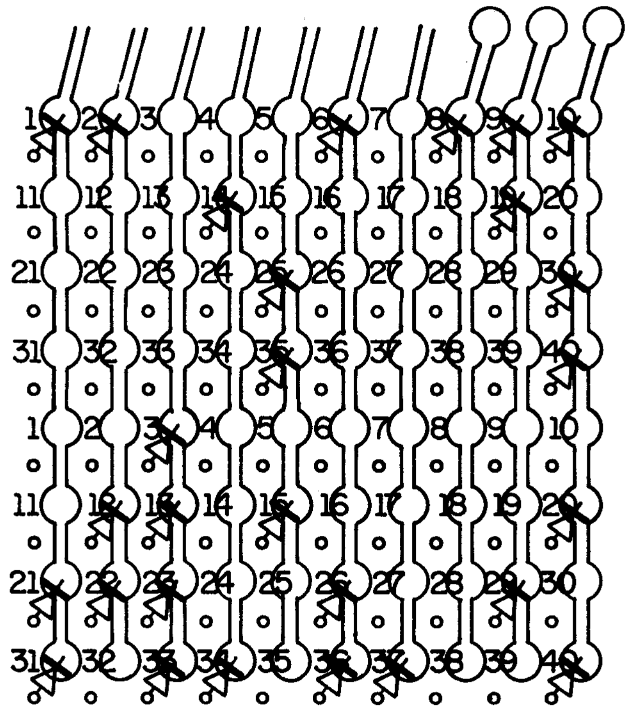

Fig. 2: Coding Chart for DE WB9XYZ

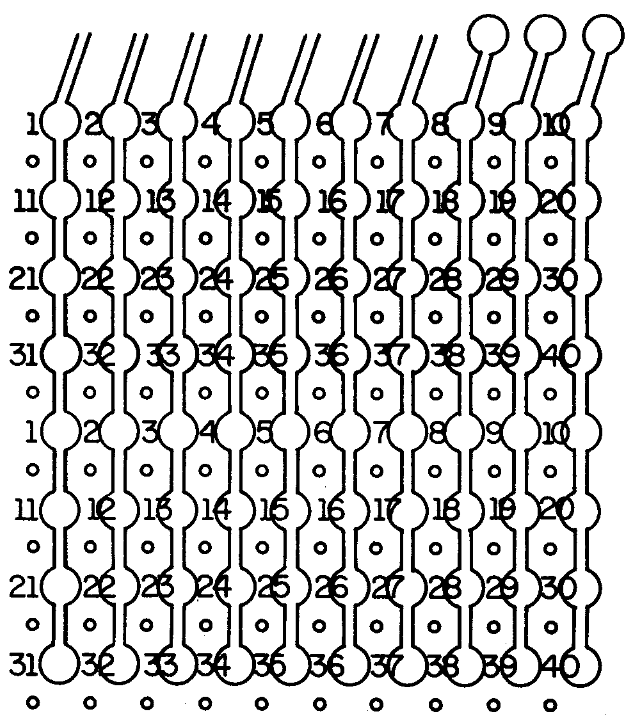

Fig. 3: Blank Coding Chart

V. THEORY OF OPERATION

The ID-1A circuitry is composed of four basic parts: the timing and control circuits, the memory, the character generator, and the power supply. With the exception of the relay drivers and the power supply regulator, all circuits are made up of TTL logic devices.

The following is a detailed explanation of how each portion of the circuitry operates. For a review of the basic circuit functions, refer to Section I of this manual.

Timing and Control Circuitry

The control circuitry in the ID-1A senses when the repeater transmitter goes on the air, triggers the transmission of the coded identification message, starts and stops the timer circuitry at the appropriate moments, and actuates the transistor keying switch. The timer circuits establish the duration of the basic timing intervals and of the guard period.

The identifier control circuits are connected to the repeater via the keyed input jack. Whenever the repeater is activated, the identifier input bus is grounded, setting the INPUT SENSE flip-flop and driving its output high. Assume for the moment that the output of the TIMER END flip-flop is also high. The signals from these latter two flip-flops are fed to a NAND gate along with the page control input. Its output--the START line--then goes low. The START line may also be driven low for test purposes by closing test switch A.

The signal on the START line is inverted, and used to reset the row and column address registers of the memory circuit. The RUN line goes high, allowing the master clock oscillator to start. When the RUN lines goes high, the TIMER END flip flop is reset and the START line allowed to go high. The coded message is then transmitted, as will be described in a later section.

The timer chain, which establishes the time interval between successive transmissions of the coded message, consists of a chain of frequency dividers. The 60 Hz power line waveform, taken from the low-voltage side of the power transformer, is converted to a squarewave by a Schmitt trigger and fed to the first divider in the chain.

The timer chain divides the line frequency by a factor of $10 \cdot 2^{10}$, or 10,240.[1] Thus, with a 60 Hz input frequency the timer emits an output pulse every 2 minutes and 51 seconds, very close to the desired three-minute time interval.

A unijunction oscillator is provided to drive the timer chain when operating from DC voltage. The reset terminal of the first divider in the chain is driven by the output of the TIMER END flip-flop. When the identifier is inactive, this reset terminal is held in the high state, preventing the chain from dividing the line frequency. When the identifier is activated and the initial identification message transmitted, however, the RUN line (the output from pin 6 of IC-1B) goes high resetting the INPUT SENSE and TIMER END flip flops. The timer chain reset terminal goes low, allowing the timer to divide.

After the timer chain reaches its maximum number of counts, its output goes high; this signal is fed to the set terminal of the TIMER END flip-flop, changing the flip-flop back to the set condition. Its output returns to the high state, resetting the first divider in the timer chain and holding the chain inactive. During the time that the RUN line is high, and for a short guard period after it goes low, the INPUT SENSE flip-flop is held cleared and input keying is ignored. For this reason, a noise pulse or short transmission will cause only one identification to occur.

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[1]Timer intervals of approximately 6, 12, or 24 minutes may be selected by changing a jumper wire on the circuit board, as shown in the schematic diagram.

If, however, the repeater is activated after the guard period but before the end of the three-minute timing cycle, the INPUT SENSE flip-flop is driven to the set state again, and its output goes high. When the end of the timing cycle occurs and the TIMER END flip-flop is set, the START line is driven low once more. Another identification message is transmitted, the timer chain is allowed to start dividing, and the entire cycle is repeated.

If the repeater transmitter happens to be off the air at the moment when an identification is to be transmitted, it is keyed up for the duration of the message by the relay driver circuitry, which is connected to the RUN line. The relay driver uses a common-base amplifier stage (an MPS3703), to drive the MJE521 keying transistor. A keying relay in the repeater is grounded through this transistor to put the repeater on the air.

Memory

The identification message is stored in a diode-matrix read-only memory. It can store up to 39 characters (dots, dashes, or spaces) plus an end character which marks the end of the stored message. Each character consists of two "bits"; each bit may have one of two logic states: 0 or 1 (low or high, respectively). The memory is divided into two matrices. One is designated the dash matrix and the other the space matrix. Each stores one of the two bits which make up a given character.

By using all possible combinations of the two bits, we may define any of four different characters, as shown in Table 1 on page 8. When the contents of the memory are read out sequentially, one character (two bits) at a time, the character generator recreates the stored code characters.

Each memory matrix is composed of ten columns and four rows, as shown in the schematic diagram. A bit is stored at each intersection of a row and a column. Thus each matrix contains 40 memory locations. When a diode is connected between the row and column lines at a given location, the bit for that location is read out as a 1. If no diode is present, the bit is read out as a 0.

The memory readout process is controlled by the column and row address registers. These are simply counters which "address" each memory location in sequence, causing its contents to appear at the matrix output. When the START line is activated, the address registers are reset to zero and the contents of the first memory location in each matrix are read out.

The column address register takes its driving pulse from the output of the character generator. Each time a character is completed this register increments by one. Although the register counts in binary-coded-decimal (BCD) code, its outputs are transformed into decimal code by a decoder circuit. As the count progresses the ten memory column lines are driven low, one at a time. The others remain high.

The row address register drives the memory row lines in both matrices through a decoder circuit. After it has been reset, all row lines except the first one in each matrix are held low. Since it takes its driving pulse from the output of the column address register, it increments to the next row only after all ten columns of a given row have been scanned.

At the output of each matrix, the row lines are connected to the four inputs of a NOR gate. If all the row lines in a given matrix are low, the NOR gate output will be high, indicating a 1 bit. If any of the row lines is high, the output will be low, indicating a zero bit.

Suppose that the address registers have just been reset. The first column line in each matrix will be low; the first row line will be high. Memory location 1 is therefore being examined. If a diode is connected at location 1 in the dash matrix, the low voltage on the column line will pull the row line low. Since the other row lines are held low by the row address register, all four row lines will be low. The output of the NOR gate for this matrix will be high, indicating the presence of a diode--a 1 bit.

If no diode were present, the first row line would be high. The output of the NOR gate would be driven low, indicating a 0 bit. Notice that diodes at other columns along the first row do not affect the output, since all of the other column lines are high.

At the same time that location 1 of the dash matrix is being examined, the bit stored at location 1 in the space matrix is read out into a separate NOR gate. The outputs of both NOR gates are decoded and fed to the character generator which then produces the appropriate character.

After the first character has been generated, the column address register increments by one and the contents of the second memory location in both matrices are read out. The process is repeated until all ten columns of the first row have been examined. The column address register returns to zero, the row address register increments, and the memory locations in the second row are examined. The readout continues until an "end" character (two 1 bits) is encountered. The decoding circuits then instruct the character generator to stop, and the RUN line goes low.

Character Generator

The memory outputs are decoded by the character generator circuit, which reproduces the stored code characters. The heart of this circuit is the master clock oscillator. It determines the speed at which the code stream is transmitted. The oscillator frequency, and therefore the code speed, is adjusted by the 500-ohm speed control potentiometer.

The clock's operation is controlled by a NAND gate; when the input of this gate is high, the oscillator is allowed to run. This control gate is driven from the RUN line, which in turn is controlled by the NOR gates at the memory output. When either or both of the NOR gate outputs are low, the output of NAND gate 1B is high and the clock runs. Both memory outputs are high only when an end character is encountered. The clock then stops.

The master clock drives two flip-flops, which divide the clock frequency by two or four, depending on the state of the memory outputs. When both memory bits are zeroes, the second flip-flop is inhibited from toggling by the low input at its clear terminal. Its output remains high. The first flip-flop, however, toggles at half the clock frequency, producing a symmetrical dot and space, as shown in Figure 4. (This intercharacter space is equal in length to a dot. It should not be confused with the longer space generated by coding a space character into the memory). The waveform at the output of the first flip-flop passes through a NAND gate, which inverts it and applies it to the KEYING line.

If the output of the dash matrix is high (a 1 bit) and that from the space matrix low (a 0 bit), indicating a dash, the second flip-flop is no longer inhibited from toggling. It changes state every time the output of the first flip-flop goes high. When the outputs of the two flip-flops are added in the NAND gate the desired dash waveform, shown in Figure 5, is produced.

To produce a space character, equal in length to a dot plus an intercharacter space, the space matrix output must be high and the dash matrix output low. Since the second flip-flop is inhibited, a dot would normally be produced. The output of the space matrix, however, is fed through an inverter to a gate which controls the audio oscillator. When the space matrix is high, the input to the oscillator control gate is held low, preventing the oscillator from running.

As the memory address registers scan the contents of the memory, the character generator produces each character in sequence. When an end character is detected both memory bits are high; the RUN line, driven by the output of a NAND gate goes low, stopping the master clock, resetting the TIMER END and INPUT SENSE flip-flops, and releasing the transmitter keying relay. The timing sequence then begins, as described previously.

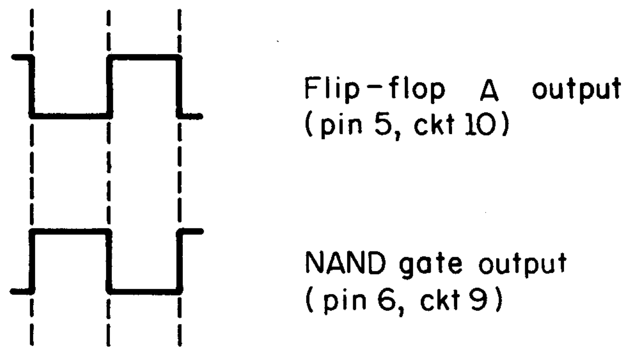


Fig. 4: Generating a Dot

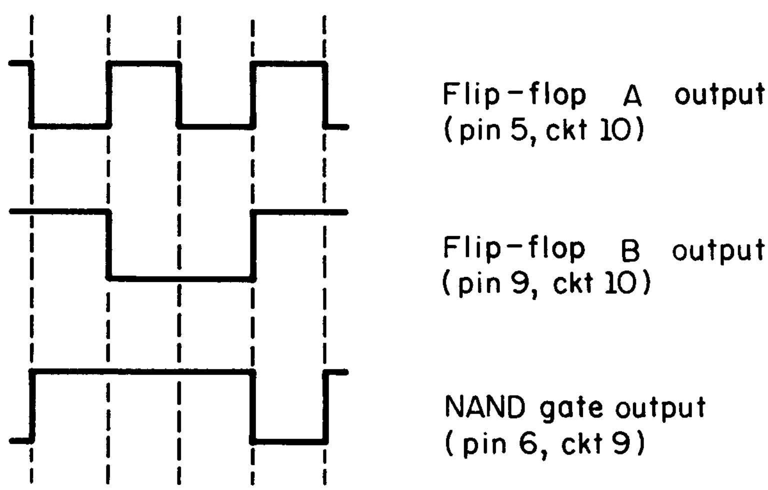


Fig. 5: Generating a Dash

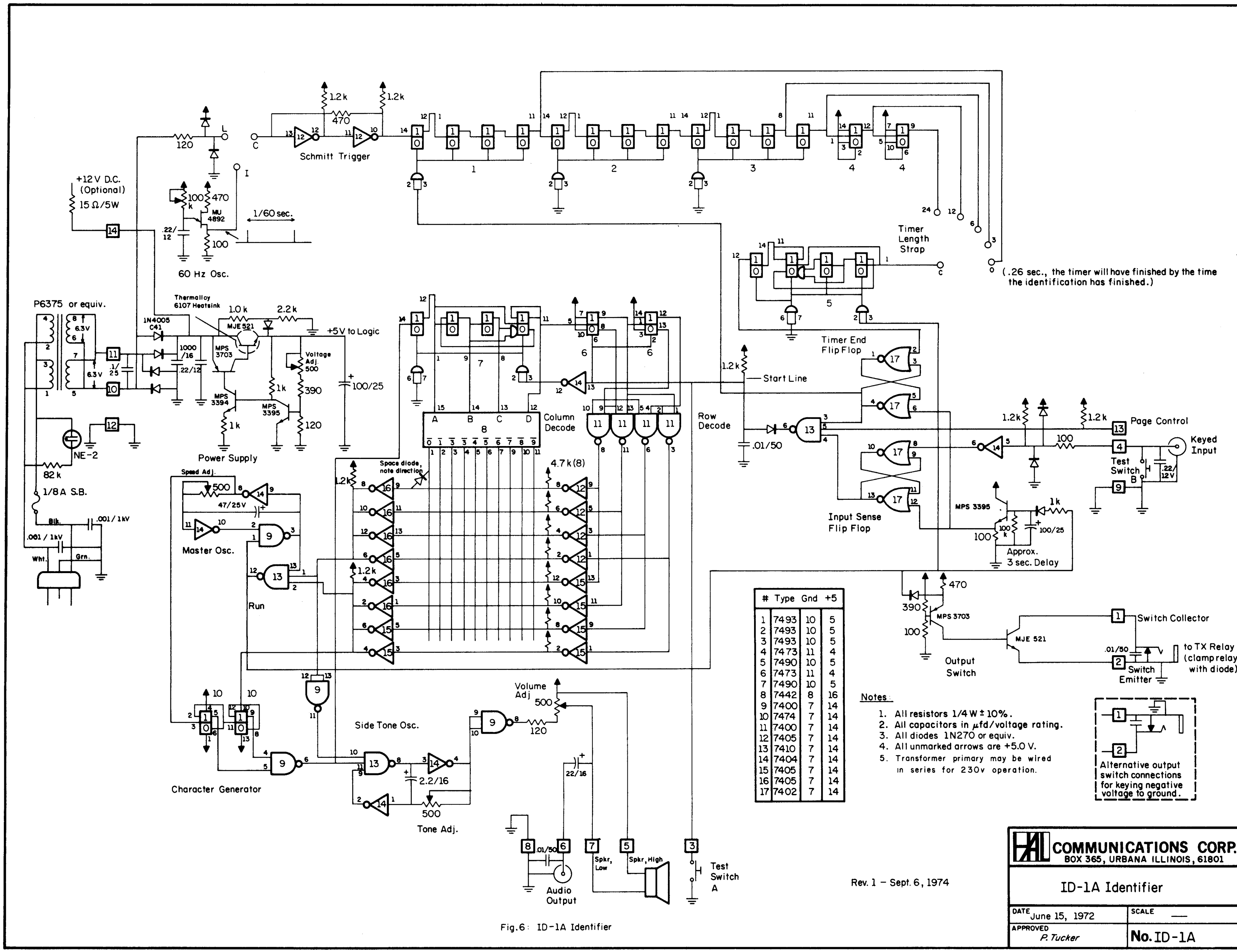
Audio Oscillator

The audio output of the identifier is produced by an integrated circuit oscillator. A NAND gate permits the oscillator to run whenever its inputs are high. One pin is normally held high by the output of the space matrix (unless a space character is being transmitted). The output of the character generator is supplied to the other input via the KEYING line. Whenever the line goes high the oscillator produces a tone. The pitch may be adjusted by the 500-ohm tone potentiometer.

An inverting amplifier is used to isolate the oscillator from its load. The amplifier drives the speaker and, via the audio output jack, the transmitter audio circuits. The audio output level is adjusted by the volume control.

Power Supply

DC power for the identifier circuitry is provided by a power transformer and full-wave rectifier circuit. The power supply output is regulated at +5.0 volts by a conventional series regulator circuit. The supply voltage is adjusted by the 500-ohm sampling potentiometer. A 0.1 amp time-delay fuse in the transformer primary lead protects the power supply from overloads.



#	Type	Gnd	+5
1	7493	10	5
2	7493	10	5
3	7493	10	5
4	7473	11	4
5	7490	10	5
6	7473	11	4
7	7490	10	5
8	7442	8	16
9	7400	7	14
10	7474	7	14
11	7400	7	14
12	7405	7	14
13	7410	7	14
14	7404	7	14
15	7405	7	14
16	7405	7	14
17	7402	7	14

Notes:

1. All resistors 1/4 W ± 10%.
2. All capacitors in μfd/voltage rating.
3. All diodes 1N270 or equiv.
4. All unmarked arrows are +5.0 V.
5. Transformer primary may be wired in series for 230v operation.

Rev. 1 – Sept. 6, 1974

Fig. 6: ID-1A Identifier

HAL COMMUNICATIONS CORP.
BOX 365, URBANA ILLINOIS, 61801

ID-1A Identifier

DATE June 15, 1972	SCALE —
APPROVED P. Tucker	No. ID-1A

VI. PARTS LIST

Resistor (¼ watt, 10%)
2 - 100 ohms
4 - 120
3 - 390
3 - 470
4 - 1000
7 - 1200
1 - 2200
8 - 4700
1 - 100 K
4 - 500 ohm trimpot
1 - 100 K ohm trimpot

Semiconductors
8 - 1N270 Ge Signal Diode
4 - 1N4005 600 PIV/1A
2 - MJE521
2 - MPS3394
1 - MPS3395
1 - MPS3703
1 - MU4892

Capacitors (μfd's)

1 - .01/50V	disc ceramic
1 - .1/25V	disc ceramic
2 - .22/12V	disc ceramic
2 - 2.2/16V	electrolytic
1 - 47/16V	electrolytic
2 - 100/25V	electrolytic
1 - 1000/16V	electrolytic

Integrated Circuits
2 - 7400
1 - 7402
1 - 7404
3 - 7405
1 - 7410
1 - 7442
2 - 7473
1 - 7474
2 - 7490
3 - 7493

Other Parts
1 - heat sink (for MJE521)
1 - 4-4 x 3/8" machine screw and nut

Miscellaneous parts external to the circuit board
2 - 12.6V transformer or eq.
1 - 3 conductor line cord
1 - fuseholder
1 - .1 amp SB fuse
1 - 6 terminal tie strip
4 - phono jack
4 - phono plug
1 - ¼" phone jack
1 - ¼" phone plug
2 - .001ufd/1KV disc ceramic
4 - .01ufd/50V disc ceramic
1 - .1ufd/50V disc ceramic
1 - speaker
1 - 1N4005 600 PIV clamping diode
2 - SPST NO pushbutton switch
1 - 15 ohm/5W resistor
1 - Instruction Manual