MFJ

CW-Elmer

Model MFJ-419

INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

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VERSION 1A

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Latest Firmware version at the time of writing is 5.02 with loudness control and Iambic Paddle capability.

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Introduction

Morse Code has been used from the wire telegraph days and from the very beginning of radio. For many amateur radio operators it is a relaxing mode of communication even though it is no longer required for an amateur radio license. There are many advantages to using CW once you learn the code.

The MFJ-419 CW-Elmer is a multi-function training tool for learning the International Morse Code. It is both a Receiving and Sending trainer to help you to both learn the code and teach you how to send clean code on one little box.

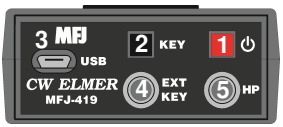
The Send mode the MFJ-419 will act like a code practice oscillator allowing you to practice sending Morse code and will display the characters both in code and in text. The Analyze setting will display your speed and timing to help you to send better code. The Send mode can use either a Straight Key or Iambic Paddle to allow training with either key.

The Receive mode of the MFJ-419 will send you code to help you to learn the characters. The MFJ-419 includes the Koch Method (new) of character selection and sending. The MFJ-419 can also send Random Characters in normal spacing or two Farnsworth speed modes sending the characters faster but spacing to the programmed speed. There is also a USB Text mode where you can use a terminal program to send text either from a keyboard or a text file to the MFJ-419 CW-Elmer so you can listen to real text.

There is also an Exercise mode that will help you with training to make correct length dits and dahs and also the proper spacing between the dits and dahs and between characters and words.

Front Panel Controls

1 Power Button - Push in for ON
2 Internal Key – Press to key
3 Micro USB Connector – USB port for power and data
4 External Key Jack – for external straight key
5 Head Phone Jack
6 Display
7 Battery Cover
8 Internal Speaker



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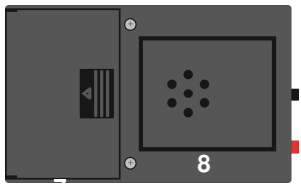

Basic Operation

1. Connect a battery or a USB power source with a Micro USB-B connector to the MFJ-419. When using a battery use a high quality 9 volt NEDA1604A alkaline battery. When storing the MFJ-419 for long periods it is recommended to remove the battery to prevent damage from battery leakage. See the section on the battery installation.
2. Turn on the MFJ-419 by pressing the Power button in.
3. The MFJ-419 will power up and send CQ DE CW-ELMER and the display will display the model number and software version then the MAIN MENU screen.
4. Plug in a straight key into the EXT KEY jack and if desired a set of head phones into the HP jack for private listening. The volume can be adjusted in the SETTINGS menu under Set Loudness. See below.
5. The KEY button can be used for slow practice but is most convenient for selecting modes and settings when a hand key is not available or inconvenient.

Follow the instructions in the MAIN MENU section for complete operational instructions.

Normal Operation

1. Turn on the MFJ-419 and let it boot up.
2. Set the desired code speed by pressing the KEY when it says Settings, press the key when it says Set WPM, then press the key to select the desired speed. See the Settings Menu for complete instructions of all of the features.

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3. For Sending practice press the KEY or the Dit paddle on the Iambic Key when the display says “Send” then press on “Key Code”. The CW-Elmer will now be waiting for you to send code around the speed you selected. The display will now show the sent code on the top line and the character sent on the bottom line. To end press the key for 5 seconds. See the Send Menu for complete instructions of all of the features.
4. For Receiving Practice press the KEY or the Dit paddle when the display says “Receive” then press at “Random”. The CW-Elmer will send random length groups of random characters at the selected speed. To exit press the key when it says KEY to EXIT. For more setting and feature instructions see the Receive Menu and the Settings Menu sections.

Note any time you exit out of a function the MFJ-419 CW-Elmer returns to the Main Menu.

The MFJ-419 CW-Elmer will run on either USB Power or Battery power. The battery will take precedence over the USB source. When battery powered the CW-ELMER will operate till the battery runs down to about 6 volts which is well below what a 9 volt battery is considered to be dead. Periodically check the battery and replace when low. Replace the battery if the CW-ELMER starts malfunctioning on battery power. It is suggested to remove the battery if you primarily run the CW-ELMER on USB Power.

Learning Morse Code

Learning Morse code is a matter of practice, practice and more practice. Whether you're just starting to learn the characters or working on high-speed "head copying," you'll succeed through regular, frequent practice. That is why the MFJ-419 CW-ELMER is the ideal tool for learning the code. It provides a wide variety of practice sessions, all sent in truly random fashion and with high-quality.

Unlike tapes, which you quickly can memorize and thus defeat the purpose of the practice, the CW-Elmer sends a new practice session every time to hone your skills. With speeds from 5 to 40 wpm and sets of characters to the entire character set, this unit can take you from no code skills at all up to the ranks of high-speed CW contesters.

Over the years, many different programs for building code proficiency have been developed, but the common element to all these programs is regular practice. With the MFJ-419, you may follow any training program you desire. This unit is extremely versatile and allows you to tailor its functions to provide the type of code practice you desire. It also allows

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you to customize your practice sessions to focus on any particular trouble spots that may arise during your training.

A traditional method of gaining code proficiency has been to learn all the characters, then slowly build speed. While this succeeds for many people, it proves frustrating for others. A common complaint is that, at about 10 wpm, students hit a "plateau," where they see no increase in their copying speed for some time.

An alternative method, is the Koch Method which sends small groups of characters till you can memorize the sound of each of the characters and differentiate between them.

A third method is the Farnsworth Method, starts students at full speed, say 15 or 20 wpm. The Farnsworth method helps you to recognize the characters at a higher speed but gives you time to think about which character is sent then as the reading skill grows the spacing between characters can be reduced.

Learning to send good code also requires practice. The transmission requires recognition of the characters but the skill of sending the characters with the proper lengths of dots and dashes and the proper spacing of the intra-character spacing and inter-character spacing. Using the SEND mode of the MFJ-419 the proper spacing can be learned.

MAIN MENU

When you turn on the MFJ-419 CW-ELMER it will initialize and enter into the MAIN MENU. Items in all of the CW-ELMER's menus are presented sequentially, first to last, pausing for 2 seconds on each item, then loops back to first and repeats. To make a selection, press the KEY or the Dit paddle on the Iambic key while the desired item is displayed. Note when exiting out of any of the functions you return to this MAIN MENU.

- Send
- Receive
- Exercises
- Settings

SEND MENU

Send mode is the most like a conventional Code Practice Oscillator. Press the key and CW-ELMER sounds a tone, release the key and the tone stops. But CW-ELMER is more than just a simple Code Practice Oscillator.

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In SEND mode, CW-ELMER expects you to key something more-or-less resembling Morse code (you will get better with practice), so it attempts to interpret what you keyed and displays what it thinks the character is.

How this works is: a value called MidTime is set equal to 2 DITs at the selected WPM rate. CW-ELMER measures each key press and compares that to MidTime. If the key is pressed for less than MidTime, it's seen as a DIT; otherwise if longer than MidTime, it considers a DAH was intended.

The MFJ-419 CW-ELMER also measures the pause time between key presses, and when a pause of longer than 3 DITs is detected (end of character), CW-ELMER calculates a numeric value based on the presence and order of the DITs and DAHs, and using that calculation looks up the character for display on the lower row.

Keyed characters are also displayed on the upper row in classic DOT/DASH ("·−·· −−−−") form. This may help you see where your keying was off (QSD) if the interpreted character appears incorrect.

SEND will read and display as long as characters are keyed in, however if the key is held down for more than 5 seconds, SEND terminates and returns control to the MAIN MENU.

The SEND Sub Menus are:

- CPO
- IAMBIC
- Analyzer
- Cancel – exit to the MAIN MENU

CPO

This is the normal Code Practice Oscillator mode using a straight key or the KEY button. In this mode any character (alpha, number, or prosign) can be keyed. The MFJ-419 then interprets the keying and displays the characters with correct timing and pauses. If a character is not recognized the display will say *undefined* on the bottom line. The top line displays the character in Morse code DOT/DASH form and in the bottom line the character received.

- Clear Now? Press the KEY to clear the analysis logs for a fresh analysis.
- KEY for 2 seconds to exit to the MAIN MENU

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IAMBIC

This is the CPO mode using an Iambic Paddle instead of a straight key.

- Change? Sets the Iambic mode and paddle characteristics.
  - Mode selects either Iambic A or Iambic B modes.
  - Polarity selects either Normal or Reversed paddles.
- Clear Now? Press the KEY or Dit paddle to clear the analysis logs for a fresh analysis.
- Hold Dit 2 seconds to exit to the MAIN MENU.

ANALYZE

While keying characters in "Key Code" mode, CW-Elmer records various characteristics about keying and pauses, including the shortest DIT (or DAH) measured, the longest DIT (or DAH), the average duration of all DITs (or DAHs), the duration of pauses between DITs and DAHs within a character. The CW-Elmer records the last 100 key presses and pauses for analysis.

Selecting "Analyzer" presents this information in a sequence of screens for evaluation. Each screen remains displayed for 2 seconds, or if the key is pressed, then proceeds to the next screen.

Values *xxx* is the measured value number.

Analysis DIT Keys

Screen 1:	Analyze DIT keys	
	Tone < *xxx*mS	(DIT is less than this time)
Screen 2:	DIT Time *xxxx*	(total DIT time)
	DIT Count *xx*	(number of DITs analyzed)
Screen 3:	DIT Target *xxx*	(target length)
	DIT Avrage *xxx*	(average DIT length)
Screen 4:	DIT Max *xxx*	(maximum DIT length measured)
	DIT Min *xxx*	(minimum DIT length measured)

Analyse DAH Keys

Screen 5:	Analyze DAH keys	
	Tone > *xxx*mS	(DAH is less than this time)
Screen 6:	DAH Time *xxxx*	(total DHA time)
	DAH Count *xx*	(number of DAHs analyzed)
Screen 7:	DAH Target *xxx*	(target length)
	DAH Avrage *xxx*	(average DAH length)

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Screen 8: DAH Max *xxx* (maximum DAH length measured)
DAH Min *xxx* (minimum DAH length measured)

Analyse Pause Elements

Screen 9: Analyze ELE paus
KeyUP < *xxx*mS (ELE is less than this time)

Screen 10: ELE Time *xxxx* (total ELE time)
ELE Count *xx* (number of ELEs analyzed)

Screen 11: ELE Target *xxx* (target length)
ELE Avrage *xxx* (average ELE length)

Screen 12: ELE Max *xxx* (maximum ELE length measured)
ELE Min *xxx* (minimum ELE length measured)

Analyse Character Pauses

Screen 13: Analyze EOC paus
KeyUP *xxx*mS (EOC is less than this time)

Screen 14: EOC Time *xxxx* (total EOC time)
EOC Count *xx* (number of EOCs analyzed)

Screen 15: EOC Target *xxx* (target length)
EOC Avrage *xxx* (average EOC length)

Screen 16: EOC Max *xxx* (maximum EOC length measured)
EOC Min *xxx* (minimum EOC length measured)

Analyse Word Pauses

Screen 17: Analyze EOW paus
KeyUP *xxx*mS (EOW is less than this time)

Screen 18: EOW Time *xxxx* (total EOW time)
EOW Count *xx* (number of EOWs analyzed)

Screen 19: EOW Target *xxx* (target length)
EOW Avrage *xxx* (average EOW length)

Screen 20: EOW Max *xxx* (maximum EOW length measured)
EOW Min *xxx* (minimum EOW length measured)

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Screen 21: DN ERRORS *xxx* (key press time is too long error)
UP ERRORS *xxx* (space or no key press time is too long)

Screen 22: WPM SET *xxx*
MEASURED *xxx*

CLEAR DATA?

Following the report screens, CW-Elmer asks to clear the statistical data from memory. Press the key within 2 seconds of this message to clear the accumulated data, otherwise timing statistics will continue to accrue. After viewing the list the MFJ-419 will return to the MAIN MENU.

RECEIVE MENU

The functions of the RECEIVE mode are:

- Koch Sequence
- Random Sequence
- USB Reader
- Cancel

KOCH SEQUENCE

The KOCH method of learning Morse code sounds 5 characters only, each selected at random from a group of 2 to 52 (the full character set, including all letters, numbers, and punctuation marks) character pool, itself selected following a pre-defined sequence of available characters. The number of characters available from the pool is determined by the “Koch Level”, beginning at 2 for starters, and increasing to add an additional character in the sequence for each increment, until the full set is utilized. The KOCH character pool is:

KMRSUAPTLOWI.NJEF0YV,G5/Q9ZH38B?427C1D6X(=:)!;-'@_$+"

The book “Morse Code: Breaking the Barrier” by David Finley details the Koch Method and is available from MFJ Enterprises item number MFJ-3400.

- Cancel KEY to EXIT

RANDOM SEQUENCE

This mode generates random length, random character groups. You first should select the character set you want to focus on in

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the SETUP Menu; alphabet only, alphabet plus numbers, or alphabet, numbers and punctuation. MFJ-419 CW-ELMER in the Random mode sounds groups of 3 to 7 characters selected at random at the current WPM rate. You have 5 seconds in which to copy the characters heard before they are revealed. After another five seconds to compare your copy, a prompt is displayed to exit. When finished press the key when it says KEY to EXIT otherwise it will send another random group of code..

- Cancel KEY to EXIT

USB READER

- Text via USB
- Key to clear and EXIT USB Reader

Practice listening for more real-life words and sentences is available using the USB Reader function. This function allows you to send text files to the CW-Elmer. With the text files you can listen to short messages to long books if you desire.

To send files and text MFJ-419 must be connected to a PC or tablet computer through a USB cable with a Micro USB-B connector. An ASCII terminal program such as “Tera Term” or similar must be connected to the appropriate serial port given to the MFJ-419. The terminal settings are:

9600 Baud
8 data bits
NO parity
1 stop bit
XON/XOFF handshaking

Follow your terminal program instructions to set the serial port up. Note when the terminal program is connected to your MFJ-419 the program may reset your MFJ-419. This is normal as one of the serial control lines is also used for reset when using the Arduino IDE. Note you must use XON/XOFF handshaking to prevent the character buffer from overflowing and quitting.

Once connected, simply type text (alpha, numbers, and punctuations) on the terminal SEND screen. The MFJ-419 CW-Elmer will read the received text message and translate each character to Morse code, sounded at the set WPM rate. The text is also displayed in a scrolling mode on the LCD display, going right to left, lower to upper line.

To send text files first the file format is a standard text format normally ending in .TXT. Note ODT or Windows DOC, DOCX and other similar formats or PDF formats will not print correctly.

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You can many times copy and save these sort of files to text format and then send them.

To send a file use the SEND function in the terminal program which sends straight text. Do not use a transfer method that uses something like XMODEM or Kermit. These compress the files and are not ASCII text. Follow the instructions for your terminal program and select the text file to send then send it. The text should start to send as it fills up the buffer.

Pressing the KEY button for about 1 second will pause the sending and pressing the KEY button for 2 seconds will exit the USB Sending mode to the MAIN MENU. The terminal will also display the text that is displayed on the MFJ-419 screen.

WARNING: Serial connections using the USB port must be USB levels only; DO NOT use RS232 level connections that operate at positive and negative 7-10 volts, you could damage the MFJ-419.

Some USB cables intended for phone charging may not pass data. Those cables will not let the computer recognize the MFJ-419 or send the text to the CW-Elmer.

Cancel

Cancel returns you to the MAIN MENU.

EXERCISE MENU

The MFJ-419 CW-ELMER employs the “Paris” timing scheme, where the basic unit of time is the DIT, and a DAH is 3 DITs in length. Intra-character pauses (between DITs and DAHs) are 1 DIT long, pauses between letters in a word are equal to 3 DITs, and a 7-DIT pause marks the end of each word. It’s called the “Paris” scheme because properly keying the word “PARIS”, plus the end-of-word pause, is exactly 50 DITs duration, and is a standard for determining WPM rates (the number of times “PARIS “ can be keyed in one minute, or equivalent).

. DIT Keypress time

_ DAH Keypress time

The object of these exercises is to practice pressing the key for as close to ideal DIT or DAH times as possible at the current selected WPM rate, and be able to do so repeatedly with minimal variance. For a given WPM rate, DIT and DAH are assigned an ideal duration, calculated by DIT(mS) = 1200/WPM. For

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example, at 15WPM, the duration for a DIT is 80mS, while a DAH will be 240mS in duration.

The top line of the display shows the target (ideal) time in mS for a DIT or DAH, depending on selected exercise. This is followed on the same line by the measured time the key was pressed.

The lower line displays this information graphically, with a target shown as " - < > + ". In this line, the brackets " < > " represent the target time for DITs or DAHs, with shorter times are to the right (+), and longer times to the left (-).

A marker " * " indicates the measured time of key press. The objective is to time your key press so the marker falls inside the brackets, as " <*> ". If the marker is to the right, hold the key longer; if on the left, shorten the hold time. Holding the key down longer than 2 seconds will exit the exercise and return control to the MAIN MENU.

Element Pause (ELE) (Intra-Character Pause)

Character Pause (EOC) (Between Character Pause)

Word Pause (EOW) (Between Word Pause)

Just as important, and perhaps more difficult to master, are the pauses that occur between DITs and DAHs within a character, between characters in a word, and between words. Proper timing of these pauses could be the difference between "Y" and "TAT", or between "A NICE HOUSE" and "AN ICE HOUSE", each with totally different meanings, the first being a pleasant dwelling, the second an igloo! To practice these exercises, the key must be pressed two times. CW-ELMER measures the pause, or key UP, time between presses. The first press will make a low tone and the second press will make a high tone.

The duration of each key press is not relevant; I suggest practicing with letters "I" (..), "M" (--), "A" (.-), and "N" (-.) to develop a real-world feel.

The top line of the display shows the target (ideal) time in mS for an IntraChar Pause, Character Pause, or Word Pause, depending on selected exercise. This is followed on the same line by the measured time the key was released between presses.

The lower line displays this information graphically, with a target shown as " - < > + ". In this line, the brackets " < > " represent the target time for the desired pause, with shorter times are to the right (+), and longer times to the left (-).

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A marker " * " indicates the measured time of pause between key presses. The objective is to time your key release so the marker falls inside the brackets, as " <*> ". If the marker is to the right, extend the pause; if on the left, shorten it. Extending the pause longer than 2 seconds between the first and second presses will exit the exercise and return control to the MAIN MENU.

Cancel

Cancel returns you to the MAIN MENU.

SETTING MENU

The SETTING menu is a group of settings that may be altered to make CW-ELMER operate according to your level of skill, or personalized as you wish. All options are saved to the internal EEPROM, to be restored when next powered on.

- Set Volume
- Set Tone
- Set WPM Rate
- Set Koch Level
- Set Farnsworth
- Select Charset
- Set Iambic Keyer
- About
- Cancel

VOLUME

The Volume of the speaker or headphones can be adjusted for a comfortable listening level. The adjustment range is between 0 and 255 with a suggested level around 50 to 80 for headphones or earbuds. A short press will increment or decrement by 1. A press longer than a second or more than one press in a second will increment or decrement by 10.

- Increase +
- Decrease –
- Save?
- Cancel

TONE

CW Pitch is an audio tone used to hear CW signals. The pitch (audio frequency) is useful as an aid for "zero-beating" or "spotting" your transmitter to a received station for optimum communication. Default tone is 600 Hz. A short press will increment or decrement by 1. A press longer than a second or more than one press in a second will increment or decrement by

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10. The maximum frequency is 1KHz and the minimum frequency is 100Hz.

- Increase +
- Decrease –
- Save
- Cancel

WPM RATE

This menu enables you to select the WPM rate that characters are sounded in RECEIVE mode, with corresponding time values used to interpret your keying in SEND, ANALYZE and in EXERCISE functions. To select a lower speed press the KEY when the display says "Decrease –" and to select a higher speed press the KEY when the display says "Increase +". Press the KEY when the display says "Save" to save the new speed or "Cancel" to exit the mode without saving. Available speeds are:

- 5 wpm
- 10 wpm
- 15 wpm (default)
- 20 wpm
- 25 wpm
- 30 wpm
- 35 wpm
- 40 wpm

SET KOCH LEVEL

The level is between 2 characters and 52 characters (all characters). To reduce the LEVEL press the KEY when the display says "Decrease –" and to increase the level press the KEY when the display says "Increase +". Press the KEY when the display says "Save" to save the new LEVEL or "Cancel" to exit the mode without saving.

FARNSWORTH

In RECEIVE the TIMING mode allows you to select Normal character spacing, or Farnsworth mode where the characters are sent at either 18WPM or 25WPM and the character spacing is adjusted to the set WPM.

- NORMAL (default)
- FARNSWORTH 18
- FARNSWORTH 25

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- Cancel

SELECT CHARSET

In RECEIVING mode, characters sounded in Morse are selected at random from select groups of letters, numbers, and punctuation. This menu offers you that choice of character group.

- Alphabet (Alphabet only) (default)
- Alpha+Numbers (Alphabet and Numbers)
- Alpha+Num+Mark (Alpha, Numbers, and Punctuation)
- Cancel

ABOUT

Displays and sends Model and Version

Resetting the EEPROM

To reset the CW-Elmer EEPROM to default settings turn off the CW-Elmer, hold in the KEY button or hold down the straight key, then turn on the CW-Elmer. Hold the KEY till the message “EEPROM Ready” is displayed then release and it will boot up.

Battery Installation and Replacement

To insert or replace the battery:

1. Slide the bottom battery cover off.
2. Connect a high quality standard 9 volt NEDA1604A alkaline battery to the battery snap in the case.
3. Place the battery in the cavity and slide the cover back on.

When the MFJ-419 is not to be used for some time, remove the battery to prevent damage from leaking batteries.

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Firmware Updates

1. Download and install the Arduino IDE from the Arduino web site: https://www.arduino.cc/en/software Choose the correct version for your computer. The software version should be greater than 1.8.16.
2. Download the firmware update from MFJ.
3. Plug a USB cable into your computer and the MFJ-419. The Computer should find the drivers automatically but if not they can be obtained from the FTDI web site: https://ftdichip.com/drivers/vcp-drivers/ and choose the drivers appropriate for your computer and operating system. Install the drivers according to the FTDI and operating system instructions.
4. Open the Arduino IDE. Click on the Tools button at the top.
    a. Highlight Board: and to the right dropdown box choose Arduino Nano.
    b. Highlight Processor: and to the right choose ATmega328P.
    c. Highlight Port: and Choose the COM port that the MFJ-419 was given. Unless you have multiple serial devices plugged you should have only COM1 and COMxx which would be the MFJ-419.
    d. Highlight Programmer: and to the right choose USBasp.
5. Click on File the Open and browse for the new firmware. It should be something like “CWE501.ino”. Click to load it into the IDE.
6. Click on Sketch and select Upload. The message box at the bottom should say “Compiling Sketch” then “Uploading”. When it is finished it will display “Done Uploading” in the IDE. While it is uploading the MFJ-419 will stop the display then when finished start up and run as when powered on. There may be a message indicating low memory available which is normal.

Note Minor updates to the program does not erase the EEPROM settings selected in the Settings Menu. Major updates may reformat the EEPROM settings restoring the default values.

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Morse Characters

Letters

A	·–	H	····	O	–––	V	···–
B	–···	I	··	P	·––·	W	·––
C	–·–·	J	·–––	Q	––·–	X	–··–
D	–··	K	–·–	R	·–·	Y	–·––
E	·	L	·–··	S	···	Z	––··
F	··–·	M	––	T	–		
G	––·	N	–·	U	··–		

Numbers

0	–––––	3	···––	6	–····	9	––––·
1	·––––	4	····–	7	––···		
2	··–––	5	·····	8	–––··		

Punctuation

. Period or Stop	·–·–·–	, Comma	––··––
! Exclamation Pt.	–·–·––	= Double Dash	–···–
(Left Parenthesis	–·––·	) Right Parenthesis	–·––·–
- Dash	–····–	: Colon	———···
? Question Mark	··––··	' Apostrophe	·––––·
/ Slash	–··–·	; Semicolon	–·–·–·
_ Underline	··––·–	“ Quotation Mark	·–··–·
$ Dollar Sign	···–··–	@ Commercial At	·––·–·
+ Cross or Plus	·–·–·		

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Prosigns

KN	Go Only	(	-.--.	HH	Error	....
AR	End of Message	+	.-.-.	SK	End of Work	...-.-
BT	Break	=	-...-	SN	Understood	...-.
AS	Wait		.-...	AL	Paragraph	.-.-..
CT	New Transmission		-.-.-	SOS	Distress	...---...

Some Common CW Abbreviations

73	Best regards	NW	Now
88	Love and kisses	OM	Old man
ABT	About	OP	Operator
AGN	Again	R	Are; received; roger
ANT	Antenna	RCVR	Receiver
BK	Back; break	RIG	Station equipment
CPY	Copy	RITE	Right
CQ	Calling any station	RST	Readability, strength, tone rpt
CUL	See you later	SIGS	Signals
CU	See you	SKED	Schedule
DE	From	STN	Station
DEG	Degree	TEMP	Temperature
DX	Distance; rare station	TKS	Thanks
ES	And; "&"	TNK	Thank
FB	Fine business; excellent	TNX	Thanks
FER	For	TU	Thank You
FREQ	Frequency	UR	Your; you're; you are
GA	Good afternoon	U	You
GE	Good evening	WL	Well; will
GM	Good morning	WTS	Watts
GN	Good night	WX	Weather
HR	Hear; here	XCVR	Transceiver
HW	How	XMTR	Transmitter
K	Go ahead	XYL	Wife (ex-young-lady)
MSG	Message	YL	Young lady
NR	Number; near		

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Some Common Q Signals

QRA	The name of my station is
QRH	Your frequency varies
QRL	Do not interfere, Frequency busy
QRM	Being interfered with
QRN	Troubled by static
QRO	Increase power, High power
QRP	Decrease power, Low power
QRQ	Send faster
QRR	I am ready for automatic operation
QRS	Send more slowly
QRT	Stop sending
QRU	I have nothing for you
QRV	I am ready
QRX	I will call again at ..., wait
QRZ	Who is calling me, I am
QSA	The strength of your signal is
QSB	Your signal is fading
QSD	Your keying is defective
QSK	I can hear you between my signals
QSL	I am acknowledging receipt
QSO	I can communicate with
QST	General call to all stations
QSU	Reply on this frequency or mode
QSX	I am listening to ... on ... kHz
QSY	Change frequency, change to xmit on ... kHz
QTH	My location (home) is
QTR	The correct time is
QTS	I will send so my frequency can be measured
QUB	Here is the info you requested
QUM	The distress traffic has ended

Send a "?" after a Q signal to ask for information or an action. Example: QRZ: station (call) is ... and QRZ?: what is your station (call)?

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Hardware

The original project was designed around an Arduino Nano. The MFJ-419 is set up to emulate an Arduino Nano with the functions and data lines needed to replicate the functions of the CW-Elmer originally developed by David Duncan K7DUN. With that in mind the firmware can be updated or modified the same way as an Arduino Nano and programmed through the USB port using the standard Arduino IDE.

The hardware uses an Atmel ATmega328P processor and an FTDI FT232RL USB IC. A standard LCD display is used in 4 bit parallel mode. No provisions were made for other interfaces such as Bluetooth boards and such due to the limited room in the case.

On the board R1 revision the audio circuit is set up to pad the headphone audio down to a reasonable level and bypasses the pad for use of the internal speaker. Note the R1 board is not compatible with the 4.xx firmware as some wiring and MPU ports have changed between the firmware versions.

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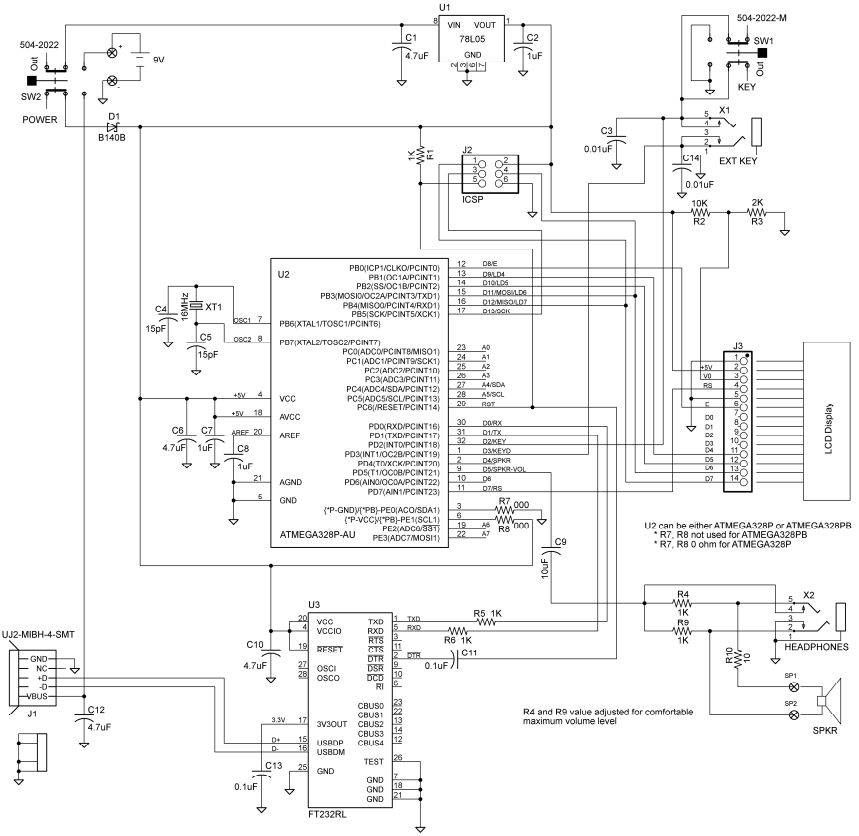
Schematic Diagram



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FULL 12-MONTH WARRANTY

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free from defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original or machine reproduction of such proof of purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, of forgery shall be cause to void any and all warranty terms immediately.

2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order. This is good on all products except antennas and software to cover postage and handling for return from in warranty service. We also take MasterCard, Visa, American Express, and Discover credit cards. Postage and handling may vary according to the weight of the product in question. You should specify what type of delivery service you wish. We can send by UPS, U.S. Postal service or Fedex. MFJ doesn't guarantee delivery by US Postal Service.

3. MFJ Enterprises, Inc. will supply replacement parts free of charge for any MFJ product under warranty upon request, provided the following terms are satisfied. MFJ must receive the original parts you wish to replace, your proof-of-purchase, and a personal check, cashiers check or money order must be provided to cover postage and handling. Postage and handling may vary according to the weight of the product in question. We also take MasterCard, Visa, American Express and Discover credit cards.

4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (662) 323-5869.

5. This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.

6. Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board product is returned.** Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, or cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense un-repaired.

7. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.

8. **Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.

9. This warranty is given in lieu of any other warranty expressed or implied.

10. MFJ Enterprises, Inc. reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.

11. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to **MFJ Enterprises, Inc., 300 Industrial Park Rd, Starkville, Mississippi 39759, USA** and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase and a telephone number.

12. This warranty gives you specific rights, and you may also have other rights, which vary from state to state.

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Starkville, MS 39759

MFJ-419 Manual
Version 1A
Printed In U.S.A.