CTU 2019 Presents

Digital Contesting is Fun!

Ed Muns, W0YK
Digital Contesting is Fun!

- RTTY Contesting → Digital Contesting
- RTTY
  - Operating
  - Setting Up
    - Hardware
    - Software
- Introduction to FT8
  - 2nd session: “Taking Digital Contesting to the Limit”
Three Largest RTTY Contests

- CQ WW CW
- CQ WPX CW
- CQ WPX RTTY
- CQ WW RTTY
- ARRL RTTY Round-Up
- RTTY
- FT8 only

# logs reported

Lots of Digital Contests

> two/month

- **Biglies (7)**
  - CQ WW RTTY (last weekend in Sep)
  - CQ WPX RTTY (2nd weekend in Feb)
  - ARRL RTTY Roundup (1st weekend in Jan) + FT8
  - BARTG (3rd weekend Jan, 3rd weekend Mar)
    - 75 Baud (Apr & Sep)
  - WAE RTTY (2nd weekend in Nov)

- **NCJ contests (4)**
  - NAQP RTTY (3rd Sat. in Feb, 2nd Sat. in Jul)
  - Sprint RTTY (2nd Sat. in Mar & Oct)

- **Other popular RTTY contests (20)**
  - Ten-Meter RTTY (1st Sat. in Dec) FT8 Roundup
  - JARTS, Makrothen, SARTG (2)
  - FT8 DX Contest (Apr), FT8 Makrothen (Jun), SCC FT8

- **CTU**
What Makes a Great RTTY Contester?

1) Contester who happily logs casual callers
2) Uses CW & SSB techniques where useful
3) Strives to exploit RTTY uniqueness
   - Auto-decode frees operator time … use it to do things difficult with CW & SSB, e.g., SO3R!
   - Speed is ~2x CW
4) Applies learning back to CW & SSB
What is RTTY?

compared to CW

**CW**

1) *One* RF carrier

2) Local audio *pitch*

3) On *or* off
   - key up is data 0
   - key down is data 1

4) *Morse* code
   - typically 25-40 wpm

**RTTY**

1) *Two* RF carriers 170 Hz apart *(Space & Mark; Shift)*

2) Local audio *tones*

3) One on *and* other off
   - Space is data 0
   - Mark is data 1

4) *Baudot* code
   - constant 60 wpm *(or 45.45 Baud)*
What is RTTY?

- 5-bit code → 32 chars.
- 2 sets:
  - Letters set & Figures set
  - 6 common control chars.
    - LTRS (unshifted)
    - FIGS (shifted)
  - Null, Space, LF, CR
- LTRS or FIGS toggle set

### Figures Shift

<table>
<thead>
<tr>
<th>Code</th>
<th>Control Characters</th>
</tr>
</thead>
<tbody>
<tr>
<td>11011</td>
<td>LTRS</td>
</tr>
<tr>
<td>11011</td>
<td>FIGS</td>
</tr>
<tr>
<td>00000</td>
<td>Null</td>
</tr>
<tr>
<td>00100</td>
<td>Space</td>
</tr>
<tr>
<td>01000</td>
<td>LF</td>
</tr>
<tr>
<td>00010</td>
<td>CR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Letters</th>
<th>Figures</th>
<th>ITA2</th>
<th>USTTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>00011</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11001</td>
<td>B</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>01110</td>
<td>C</td>
<td>:</td>
<td></td>
</tr>
<tr>
<td>01001</td>
<td>D</td>
<td>ENQ</td>
<td>$</td>
</tr>
<tr>
<td>00001</td>
<td>E</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>01101</td>
<td>F</td>
<td>!</td>
<td></td>
</tr>
<tr>
<td>11010</td>
<td>G</td>
<td>&amp;</td>
<td></td>
</tr>
<tr>
<td>10100</td>
<td>H</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>00110</td>
<td>I</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>01011</td>
<td>J</td>
<td>BELL</td>
<td></td>
</tr>
<tr>
<td>01111</td>
<td>K</td>
<td>(</td>
<td></td>
</tr>
<tr>
<td>10010</td>
<td>L</td>
<td>)</td>
<td></td>
</tr>
<tr>
<td>11100</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01100</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11000</td>
<td>O</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10110</td>
<td>P</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10111</td>
<td>Q</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>01010</td>
<td>R</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>00101</td>
<td>S</td>
<td></td>
<td>BELL</td>
</tr>
<tr>
<td>10000</td>
<td>T</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>00111</td>
<td>U</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>11110</td>
<td>V</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10011</td>
<td>W</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>11101</td>
<td>X</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>10101</td>
<td>Y</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>10001</td>
<td>Z</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What is RTTY?

- Bacon’s cipher (1605)
- Gauss & Weber (1833)
- Baudot code (1870)
  - Manual bit entry
  - 5-bit ITA1 code
  - Two 32-bit character sets
    - letters
    - figures
- Murray code (1901)
  - Teletype character entry
  - Western Union variation
- 5-bit ITA2 code (1930)
  - USTTY variation
- ASCII (1963)
  - 7-bit ITA5 code

### Code History

<table>
<thead>
<tr>
<th>Code</th>
<th>Control Characters</th>
</tr>
</thead>
<tbody>
<tr>
<td>11111</td>
<td>LTRS</td>
</tr>
<tr>
<td>11011</td>
<td>FIGS</td>
</tr>
<tr>
<td>00000</td>
<td>Null</td>
</tr>
<tr>
<td>00100</td>
<td>Space</td>
</tr>
<tr>
<td>01000</td>
<td>LF</td>
</tr>
<tr>
<td>00010</td>
<td>CR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Letters</th>
<th>Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITA2</td>
<td>USTTY</td>
</tr>
<tr>
<td>00011</td>
<td>A</td>
</tr>
<tr>
<td>11001</td>
<td>B</td>
</tr>
<tr>
<td>01110</td>
<td>C</td>
</tr>
<tr>
<td>01001</td>
<td>D</td>
</tr>
<tr>
<td>00001</td>
<td>E</td>
</tr>
<tr>
<td>01101</td>
<td>F</td>
</tr>
<tr>
<td>11010</td>
<td>G</td>
</tr>
<tr>
<td>10100</td>
<td>H</td>
</tr>
<tr>
<td>00110</td>
<td>I</td>
</tr>
<tr>
<td>01011</td>
<td>J</td>
</tr>
<tr>
<td>01111</td>
<td>K</td>
</tr>
<tr>
<td>10101</td>
<td>L</td>
</tr>
<tr>
<td>11100</td>
<td>M</td>
</tr>
<tr>
<td>01100</td>
<td>N</td>
</tr>
<tr>
<td>11000</td>
<td>O</td>
</tr>
<tr>
<td>10110</td>
<td>P</td>
</tr>
<tr>
<td>10111</td>
<td>Q</td>
</tr>
<tr>
<td>01010</td>
<td>R</td>
</tr>
<tr>
<td>00101</td>
<td>S</td>
</tr>
<tr>
<td>10000</td>
<td>T</td>
</tr>
<tr>
<td>00111</td>
<td>U</td>
</tr>
<tr>
<td>11110</td>
<td>V</td>
</tr>
<tr>
<td>10011</td>
<td>W</td>
</tr>
<tr>
<td>11101</td>
<td>X</td>
</tr>
<tr>
<td>10101</td>
<td>Y</td>
</tr>
<tr>
<td>10001</td>
<td>Z</td>
</tr>
</tbody>
</table>
What is RTTY?

- The **LTRS** and **FIGS** characters do not print
  - The code for the characters “Q” and “1” is the same; which one prints depends on if you are in Letters or Figures set
  - Note that the **LTRS**, **FIGS** and **Space** characters appear in both sets
- Example: “**KI7GUO DE K4GMH**” gets sent as:
  - **LTRS K I FIGS 7 LTRS G U O Space D E Space K FIGS 4 LTRS G M H**
- Why do we care to understand this?
  - If a burst of static garbles the **LTRS** or **FIGS** character, then what prints after that is from the wrong set until the next **LTRS** or **FIGS** character appears
What is RTTY?

UnShift on Space

- UnShift On Space (USOS or UOS)
  - Increases noise immunity for alpha text
  - Space character forces a shift to the Letters set
- Contest exchanges are alpha and numeric
  - Should UOS be on or off?
  - Should Space or Hyphen delimit exchange elements?
    - 599 JOHN NY or 599-JOHN-NY
- Recommendation:
  - Turn on both RX & TX UOS and use Space delimiters
What is RTTY?

- Space and Mark audio tones
  - Default: 2295 and 2125 Hz ("high tones")
  - Less fatiguing: 1085 and 915 Hz ("low tones")
- Analogous to CW pitch
  - Operator choice
  - Each operator can use different tone pairs
  - Transmission is two RF carriers 170Hz apart
- Must be same in radio and decoder/encoder
What is RTTY?

AFSK vs. FSK

Two methods of transmission:

- **AFSK (Audio Frequency Shift Keying)**
  - keyed audio tones into SSB transmitter via:
    - Mic input, or
    - Auxiliary audio input. e.g., Line In

- **FSK (Frequency Shift Keying)**
  - on/off keys the transmitter just like CW

*Note: Receiving is the same in either case.*
What is RTTY?

- RTTY RF is independent of local audio tones and whether LSB or USB is used:
  - The higher RF frequency is the Mark (14090.000 kHz)
  - The lower RF frequency is the Space (14089.830 kHz)
  - The difference between the two is the shift (170 Hz)

- FSK displays Mark (14090.000 kHz)

- AFSK displays suppressed carrier which varies with local audio tones and sideband used!
  - For Mark tone of 2125 Hz (Space tone of 2295 Hz):
    - LSB (14092.125 kHz)
    - USB – Mark & Space tones reversed (14087.005 kHz)
What is RTTY?

AFSK vs. FSK

**AFSK**
- Indirect (*tones → Mic input*)
- Any SSB radio (*esp. legacy*)
- SSB (wide) filtering
- Dial = sup. car. frequency
- VOX
- Audio cable (*a'la FT8, JT65/9, PSK31*)
- Must use high tones

**FSK**
- Direct (*like CW keying*)
- “Modern” radios
- RTTY (narrow) filtering
- Dial = Mark frequency
- PTT
- COM FSK keying cable
- Can use low tones

*NET* (*automatic TX tone control*)

*Less bandwidth* (*depends on radio*)

---

**Easier hook-up; NET**

**Less pitfalls**
What is RTTY?

**Summary**

- Uses 5-bit Baudot (actually, USTTY) code with two sets of 32 characters: Letters and Figures
- Space & Mark frequencies separated by 170 Hz “Shift”
- Local Space & Mark tones analogous to pitch in CW
- Constant 45.45 Baud (60 wpm) asynchronous character stream with 5 data bits and 2-3 sync bits
- Figures Shift & Letters UnShift
  - Use optional UnShift-On-Space (UOS), plus space delimiter
- AFSK vs. FSK transmission (receiving is the same)
  - Radio dial frequency differences
  - 100% duty cycle!
The Cynics Say …

- “The RTTY decoder/encoder does everything.”
  
  however, this attribute …
  - frees the operator to improve other skills
  - enables more contest participants
  - provides mode diversity for contest junkies

- “RTTY is a pain to set up and get working.”
  
  … stay tuned, it’s really not that difficult!
RTTY Considerations

Much like CW and SSB, except:

- Non-human decoding implications
  - *serial number repeat, universal “fist” or “voice”*
- Distractions are tempting
  - *watch TV, do email, read, etc.*
- RTTY established practice
  - ‘*CQ*’ at end of *CQ message*
- Whisper-level headphone volume; low tones
  - *just to detect presence & timing*
- Key-down transmission … 100% duty cycle
RTTY Sub-Bands

- 10 meters: 28080-28100, during contests 28080-28200
  - JA: 21070-21150
- 15 meters: 21080-21100, during contests 21080-21150
  - JA: 21070-21150
- 20 meters: 14080-14100, during contests 14080-14150
  - JA: 14070-14150
- 40 meters: 7025-7050 & 7080-7100, during contests 7025-7100
  - JA: 7030-7100
- 80 meters: 3580-3600, during contests 3560-3600
  - JA: 3520-3575 and 3599-3612
- 160 meters: No RTTY contesting
RTTY Sub-Bands

don’t QRM!

- Avoid audio-digital operations near:
  - e.g., 14070-14080

- Avoid the NCDXF beacons:
  - e.g., 21150 and 14100

- More details:
  www.aa5au.com/rtty/rtty-sub-bands
Receiving

- PC Audio isolation
  - Transformer
  - Commercial interface
  - Some radios (K3, Flex)
- Narrow IF filters (Roofing & DSP)
  - 500 Hz - normal
  - 250 Hz - extreme QRM only
- Tone filters – don’t use!
  - Icom Twin Peak Filter
  - K3 Dual-Tone Filter

radio IF filtering

250 Hz

500 Hz
Set RX audio level for noise 5% of full-scale
  ● Receiver audio out level control, and/or
  ● Windows Recording Volume Control applet
Receiving tuning a RTTY signal

- Use narrow filtering
  - CW filters ~ 500 Hz
- Set RX audio level
  - noise 5% of full-scale
- Learn to tune by ear
  - practice with eyes closed
  - get within 10-20 Hz
Receiving

- Use narrow filtering
  - CW filters ~ 500 Hz
- Set RX audio level
  - noise 5% of full-scale
- Learn to tune by ear
  - practice with eyes closed
  - get within 10-20 Hz
- AFC On or Off
  - ‘On’ may cause TX frequency to be off
Transmitting

AFSK adjustment

Insure SSB processor (compression) is Off.

- Adjust:
  - the Windows Playback Volume control, and
  - the transmitter Mic (or auxiliary audio input)

- Such that:
  - ALC is just backed off to zero, and
  - full power output is attained.
Transmitting

FSK adjustment

- None!

(That’s the whole point of FSK.)
Basic RTTY Contest QSO
CQ WPX RTTY Contest

- WPX K5AM K5AM CQ
- ZC4LI ZC4LI
- ZC4LI 599 1349 1349
- [K5AM] TU 599 985 985
- [ZC4LI] TU K5AM CQ

K5AM: running station
ZC4LI: S&P station
RTTY Messages

CQ WPX RTTY Contest

- Short, as with CW/SSB
- No extraneous info
- 599 (not 5NN) once
- Serial number twice
- Space (not hyphen)
- Omit ‘DE’
- RTTY chars (%R, %E)

www.rttycontesting.com/tutorials/messages
**RTTY Messages**

<table>
<thead>
<tr>
<th>F02:</th>
<th>%R%PX P49X P49X CQ %C%E</th>
</tr>
</thead>
<tbody>
<tr>
<td>F03:</td>
<td>%R P49X %E</td>
</tr>
<tr>
<td>F04:</td>
<td>P49X %E</td>
</tr>
<tr>
<td>F05:</td>
<td>%R%C 599 %N2 %N2 %E</td>
</tr>
<tr>
<td>F06:</td>
<td>%RTU P49X CQ %O%E</td>
</tr>
<tr>
<td>F07:</td>
<td>%RQRV %ZR.1 %E</td>
</tr>
<tr>
<td>F08:</td>
<td>%R %C TU .. NOW%L</td>
</tr>
<tr>
<td>F09:</td>
<td>%RAGN %E</td>
</tr>
<tr>
<td>F10:</td>
<td>%RNR? %E</td>
</tr>
<tr>
<td>F11:</td>
<td>%R%N3 %E</td>
</tr>
</tbody>
</table>

- **CR/LF**
- **Space**
- **Receive**
Super Check Partial

**Call sign selection**

- SCP (Super Check Partial) enables computer to select call signs in receive window
  - Unworked calls (no mult)
  - New mults and double mults
  - Dupes
- Use main SCP from CW/SSB/RTTY contests
  - RTTY SCP is a subset

<table>
<thead>
<tr>
<th>Call Signs</th>
<th>Call Signs</th>
<th>Call Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>XYZAB</td>
<td>AA5AU</td>
<td>XYZAB</td>
</tr>
<tr>
<td>XYZAB</td>
<td>9Y1VC</td>
<td>9N8TT</td>
</tr>
<tr>
<td>XYZAB</td>
<td>W5UKM</td>
<td>XYZAB</td>
</tr>
</tbody>
</table>

**N1MM Logger**
Super Check Partial

logger differences

N1MM Logger

WriteLog

Win-Test

- Background option
- Custom colors
Tips

“All I receive is gibberish!”

- “Upside-down”
  - Reverse Mark & Space
  - LSB vs. USB
- Figures vs. letters
  - TOO=599, WPIR=2084
  - UOS should be on
  - Shift-click to convert, or look at top two rows
- Audio-In level, tones, flutter
- (Other station’s signal)
Tips

“They never answer me!”

- “Upside-down”
  - FSK: polarity switch in radio
  - AFSK: LSB vs. USB; polarity select in software

- Off frequency
  - AFC on with NET (AFSK only) off [recommend RIT instead]
  - AFC & NET are on by default; changes non-sticky
    - Change defaults in USERPARA.INI

- AFSK: Mic & SC levels; speech processor on

- Radio mode, tones, FSK interface
More Tips

- 100% duty cycle … caution!
- Practice
  - During RTTY contests (~ two per month)
  - NCCC Thursday night practices (weekly)
- Multi-Ops
RTTY Operating summary

- Many casual RTTY contest participants
- RTTY sub-bands; 10-80 only; avoid audio-digital & beacons
- 500 Hz receive filtering; USOS on
- Messages ("macros")
  - Short, 5NN, unique exchange twice, Space delimiter
- Common problems
  - "Upside-down" (reversed Space/Mark or LSB vs. USB)
  - Figures vs. Letters
  - Audio:
    - RX audio output level and TX (AFSK only) audio input level
    - Unmuted soundcard inputs and outputs
    - Space and Mark tone consistency between decoder and radio
  - Off-frequency tuning (AFC & NET); band conditions
The Cynics Say …

“"The RTTY decoder/encoder does everything."”

however, this attribute …

● frees the operator to improve other skills
● enables more contest participants
● provides mode diversity for contest junkies

“"RTTY is a pain to set up and get working."”

… stay tuned, it’s really not that difficult!
How Do I Set it Up?

overview

- **Acquire** and set up hardware and/or software to convert between the RTTY signal and text:
  - RTTY *receive* decoder
  - RTTY *transmit* encoder
  - PC-radio interface
- **Configure** decoder/encoder
- **Integrate** decoder/encoder with logger

*The rest of the station setup is the same as for CW and SSB*
How Do I Set it Up?

**RTTY decoder/encoder**

- RTTY *receive* decoder converts printed characters from the two RTTY tones.
  - CW decoders seldom used
  - Ears/brain/hands for CW/SSB

- RTTY *transmit* encoder converts typed characters (or messages) into the two tones (AFSK) or keying (FSK).
  - logger *CW keyers and SSB DVKs are also used, similar to RTTY encoders*
  - Otherwise, brain/hands/mouth for CW/SSB
How Do I Set it Up?

decoder/encoder terminology

- The RTTY *transmit encoder* and *receive decoder* is sometimes referred to as a MODEM or a TNC:
  - MODEM = **MOdulator DEModulator**
  - TNC = **Terminal Node Controller**

- MODEMs can be:
  - a hardware box, or
  - a software application driving a PC soundcard
How Do I Set It Up?

**hardware MODEM**

**AFSK**

Radio

RX  TX

audio out  audio input

Line In  Line Out

MODEM

Computer

Term. Em. or Graphic UI

**FSK**

Radio

RX  TX

audio out  FSK input

Line In  FSK output

MODEM

Computer

Term. Em. or Graphic UI
How Do I Set It Up?

hardware MODEM
How Do I Set It Up?

software application & soundcard

AFSK

Radio
RX TX

Audio out
Audio input

Line In
Line Out

Soundcard

Computer
RTTY decoder/encoder

FSK

Radio
RX TX

Audio out

Line In

Soundcard

Computer
RTTY decoder/encoder

FSK input

Line In

USB/Serial port

FSK & PTT keying cable
How Do I Set it UP?

● Receive:
  ● RX audio out to soundcard
  ● Optional DSP filter

● Transmit:
  ● AFSK: TX audio in from soundcard, or
  ● FSK: FSK/PTT keying

● Receive:
  ● 1:1 isolation transformer
  ● JPS NIR-12, or …

● Transmit:
  ● 1:1 isolation transformer, or
  ● Keying interface
How Do I Set It Up?

Eliminate ground loops between radio and PC

Otherwise insert 1:1 audio isolation transformer on:

- RX output
- TX Mic input *(AFSK only)*

Alternatives:

- Bourns LM-NP-1001-B1L transformer → homebrew cable
- Ground loop isolators
- W2IHY iBox
- Commercial RTTY interfaces
- K3 (uses Bourns LM-NP-1001-B1L on LINE IN & OUT)
How Do I Set It Up?

homebrew audio isolation

**Bourns LM-NP-1001-B1L**

-90 dBC 3rd order IMD

$1.78
How Do I Set It Up?

*ground loop isolators*

Radio Shack $19.49 or eBay $6.99

-64 dBC 3rd order IMD

eBay $3.35

eBay $5.50

eBay $7.45
How Do I Set It Up?

W2IHY iBox audio isolation

$60
How Do I Set It Up?

commercial interface audio isolation

Rascal
How Do I Set It Up?

radio audio isolation

K3 audio isolation  IN – LINE – OUT
How Do I Set It Up?

**SDR digital audio isolation**

digital: soundcard
analog: IN – LINE – OUT
How Do I Set It Up

optional radio AF filtering

- PC Audio isolation
  - Transformer
  - Commercial interface
  - Some radios (K3, Flex)
- Narrow IF filters (Roofing & DSP)
  - 500 Hz - normal
  - 250 Hz – extreme QRM only
- Tone filters – don’t use
  - Icom Twin Peak Filter
  - K3 Dual-Tone Filter
- Audio filtering
  - JPS NIR-10/12
  - Timewave DSP-599zx
  - Modern DSP rigs

CONTEST UNIVERSITY
How Do I Set It Up?

*adjust RX audio*

- Set RX audio level for noise 5% of full-scale
  - Receiver audio out level control, and/or
  - *Windows* Recording Volume Control applet
How Do I Set It Up?

adjust AFSK audio

Insure SSB processor (compression) is Off.

- Adjust:
  - the Windows Playback Volume control, and
  - the transmitter Mic (or auxiliary audio input)

- Such that:
  - ALC is just backed off to zero, and
  - full power output is attained.
How Do I Set It Up?

**PTT vs. VOX**

- AFSK uses VOX or PTT
  - radio Mic input will allow VOX
  - rear panel auxiliary audio input may not; then PTT
  - PTT can usually be keyed via the radio CAT cable
- FSK uses PTT
  - Serial port controls FSK and PTT signals
How Do I Set It Up?

*homebrew FSK & PTT keying cable*

FSK: TXD (3)
PTT: RTS (7)

FSK input
PTT input

(DB9 pin #)

Gnd (5)

NPN General Purpose

1k ohm

on radio
How Do I Set It Up?

W3YY FSK & PTT keying cable
How Do I Set It Up?

commercial interfaces

RASCAL

SignaLink™ USB

MFI Deluxe Sound Card Radio Interface

RIGblasters

data jack
plug & play

pro

nomic

plus

iCOM
How Do I Set It Up?

RigExpert Interfaces
# How Do I Set It Up?

*commercial interfaces*

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Model</th>
<th>Price</th>
<th>PC In'tc</th>
<th>PTT</th>
<th>Soundcard</th>
<th>Level ctrl</th>
<th>FSK</th>
<th>CW</th>
<th>WinKey</th>
<th>Voice</th>
<th>Radio In'tc</th>
</tr>
</thead>
<tbody>
<tr>
<td>generic (with K3)</td>
<td>(2) 3.5mm M-M audio cables</td>
<td>$ 10</td>
<td>-</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buxcomm</td>
<td>Rascal-IIIB or -IIIA</td>
<td>$ 69</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buxcomm</td>
<td>Rascal GLX</td>
<td>$ 79</td>
<td>Serial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tigertronics</td>
<td>SL-1+</td>
<td>$ 80</td>
<td>-</td>
<td></td>
<td></td>
<td>auto</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tigertronics</td>
<td>USB</td>
<td>$ 110</td>
<td>USB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFJ</td>
<td>1273B</td>
<td>$ 60</td>
<td>Serial</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFJ</td>
<td>1275</td>
<td>$ 110</td>
<td>Serial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFJ</td>
<td>1279</td>
<td>$ 140</td>
<td>Serial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mountain Radio</td>
<td>RIGblaster Nomic</td>
<td>$ 60</td>
<td>Serial/USB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mountain Radio</td>
<td>RIGblaster Plug &amp; Play</td>
<td>$ 120</td>
<td>USB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mountain Radio</td>
<td>RIGblaster Plus II</td>
<td>$ 160</td>
<td>USB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mountain Radio</td>
<td>RIGblaster Advantage</td>
<td>$ 200</td>
<td>USB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mountain Radio</td>
<td>RIGblaster Pro</td>
<td>$ 300</td>
<td>Serial/USB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navigator</td>
<td>Navigator</td>
<td>$ 417</td>
<td>USB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*See May-June 2012 NCJ, “RTTY Contesting” column*
How Do I Set It Up?

microHAM interfaces

One Radio

SO2R
How Do I Set It Up?

*RigExpert & microHAM interfaces*

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Model</th>
<th>Price</th>
<th>PC In/fc</th>
<th>PTT</th>
<th>Soundcard</th>
<th>Level ctrl</th>
<th>FSK</th>
<th>CW</th>
<th>WinKey</th>
<th>Voice</th>
<th>Radio In/fc</th>
<th>SO2R</th>
</tr>
</thead>
<tbody>
<tr>
<td>RigExpert</td>
<td>Tiny</td>
<td>$120</td>
<td>USB</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RigExpert</td>
<td>Standard</td>
<td>$265</td>
<td>USB</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RigExpert</td>
<td>TI-5</td>
<td>$365</td>
<td>USB</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>microHAM</td>
<td>USB Interface II</td>
<td>$179</td>
<td>USB</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>microHAM</td>
<td>USB Interface III</td>
<td>$225</td>
<td>USB</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>microHAM</td>
<td>Digil KEYER II</td>
<td>$369</td>
<td>USB</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>microHAM</td>
<td>microKEYER II</td>
<td>$479</td>
<td>USB</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>microHAM</td>
<td>micro2R</td>
<td>$369</td>
<td>USB</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>microHAM</td>
<td>MK2R</td>
<td>$899</td>
<td>USB</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>microHAM</td>
<td>MK2R+</td>
<td>$999</td>
<td>USB</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See May-June 2012 NCJ, “RTTY Contesting” column
How Do I Set It Up?

**summary - receive**

1. Connect receiver audio output, via isolation, to …
   - MODEM Audio In,
   - or
   - MMTTY via Soundcard Line In (or Mic In with pad):
     - Enable/adjust soundcard Line In (or Mic) input, disable/mute other inputs

2. Optional receive audio filtering
How Do I Set It Up?

summary - AFSK

1. Connect radio’s Line In (or, Mic In with pad), via isolation, from:
   - MODEM Audio Out
   - Soundcard Line Out
2. Speech processor off
3. Enable/adjust SC audio level
   - Disable or mute all other SC outputs
How Do I Set It Up?

**summary - FSK**

1. Connect the radio FSK and PTT inputs to:
   - the MODEM FSK and PTT outputs and connect the MODEM Serial port to the PC (USB adapter)
     or, if MMTTY …
   - the RTTY interface FSK and PTT outputs and connect the interface Serial port to PC (USB adapter)

2. If no PC Serial port, then use a USB-Serial adapter.
   - Beware that some won’t key FSK properly. Edgeport USB-Serial adapters are known good.
Decoders

- Dominant soundcard MODEM in use today
- Exceeds performance of most other MODEMs
- Freeware since introduction in 2000
- Written by Mako, JE3HHT

MMTTY

- CTU
- CONTEST UNIVERSITY

64/94
How Do I Set It Up?

**MMTTY standalone**

- Leave UOS on
- Turn off: NET, AFC

Don’t click inside display

received text

transmitted text
How Do I Set It Up?

**MMTTY Option menu**

![MMTTY Option menu](image)

- **Soundcard levels**
- **MMTTY setup**
**How Do I Set It Up?**

**MMTTY Option/Setup/Demodulator**

<table>
<thead>
<tr>
<th><strong>Demodulator</strong></th>
<th><strong>AFC/ATC/PLL</strong></th>
<th><strong>Decode</strong></th>
<th><strong>TX</strong></th>
<th><strong>Font/Window</strong></th>
<th><strong>Misc</strong></th>
<th><strong>SoundCard</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Discriminator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIR resonator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIR BPF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mark</td>
<td>2125 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shift</td>
<td>170 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW</td>
<td>60 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Filter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit Amp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGC</td>
<td>checked</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over Sampling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smooth LPF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIR av.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freq</td>
<td>70 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FW</td>
<td>100 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFC Connection</td>
<td>checked</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Set tones (radio same)
How Do I Set It Up?

**MMTTY Option/Setup/TX**

- TX UOS on
- Select LTR
- 512 Tap, if PC has perf.
- FSK/PTT port
- Soundcard Line Out level
- AFSK PTT

**Setup MMTTY Ver1.66G**

- Demodulator
- AFC/ATC/PLL
- Decode
- TX
- Font/Window
- Misc
- SoundCard

- DIDDLE
  - NONE
  - BLK
  - LTR
- Random
- WaitTimer

- TX
  - UOS
  - Double shift
  - Disable Wait
  - Disable Rev
  - Always fix shift

- Digital Output
  - Char. Wait
  - Diddle Wait

- PTT & FSK
  - Port
  - NONE
  - Invert Logic
  - Radio command

- TxBPF/TxLPF
  - Tx BPF Tap
  - Tx LPF Freq

- Macro
  - Your Callsign
  - W0YK

- Input Button
  - 1X1

- Convert Immediately

- HAM
- Set Default(Demodulator)
How Do I Set It Up?

**MMTTY Option/Setup/Misc**

![MMTTY Setup Window]

- **AFSK**
- **FSK**
- **Soundcard**
- **Soundcard Format, 4x**
How Do I Set It Up?

**MMTTY Option/Setup/SoundCard**

Select receive Soundcard

Select transmit Soundcard (AFSK only)
2012 CQ WPX RTTY

3550 submitted logs
RTTY Contest Loggers

- **WriteLog** *(1994)*
  - created for RTTY *(CW & SSB came later)*
  - [www.rttycontesting.com/tutorials](http://www.rttycontesting.com/tutorials)

- **N1MM Logger+** *(2000; dedicated RTTY software designer)*
  - Free
  - [www.rttycontesting.com/tutorials](http://www.rttycontesting.com/tutorials)

- **Win-Test** *(2003; RTTY is low priority)*

All three integrate MMTTY and have similar functionality for basic RTTY contesting.
A Blizzard of Details! **this is fun??**

**Start Simple, then Enhance**

- **MMTTY (free)**
  - get RX working *(std audio cable from radio to PC)*
  - get TX working; use either:
    - **AFSK** *(2nd std audio cable from radio to PC)*
    - **FSK** *(keying cable or commercial interface)*
- Integrate MMTTY with logging software
- Enhance later
  - Audio isolation *(highly recommended)*
  - Higher capability interface (DIY or commercial)
  - Advanced setup: SO2V, SO2R, multiple decoders, ...
Resources

- [www.rttycontesting.com](http://www.rttycontesting.com) premier website
  - Tutorials and resources (beginner to expert)
  - WriteLog, N1MM Logger+ and MMTTY
- [rtty@groups.io](mailto:rtty@groups.io) Email reflector
  - RTTY contester networking
  - Q&A
- Software web sites
  - [hamsoft.ca/](http://hamsoft.ca/) (MMTTY)
  - [n1mm.hamdocs.com/tiki-index.php](http://n1mm.hamdocs.com/tiki-index.php) (N1MM Logger+)
  - [www.writelog.com](http://www.writelog.com) (WriteLog)
  - [www.win-test.com](http://www.win-test.com) (Win-Test)
- Software Email reflectors
  - [mmtty@yahoogroups.com](mailto:mmtty@yahoogroups.com) (MMTTY)
  - [N1MMLoggerplus@groups.io](mailto:N1MMLoggerplus@groups.io) (N1MM Logger+)
  - [Writelog@contesting.com](mailto:Writelog@contesting.com) (WriteLog)
  - [support@win-test.com](mailto:support@win-test.com) (Win-Test)
Clublog QSOs by Mode

% Share of Modes Stored in Club Log from 2017 to 2019

- FT8
- CW
- Phone
- RTTY
- Other
- PSK
The FT8 Explosion

LoTW Uploads by Mode
Digital Mode Trends
WSJT & WSJT-X Overview

- Weak Signal communication by Joe Taylor - eXperimental
- Developed for EME; adopted by HF
- Several modes (JT65, JT9, FT8, etc.)

  + Multi-channel
  + Weak signal (inaudible)
    + Longer DX
    + Lower power
    + Compromised antennas and/or QTH
  + Narrow bandwidth (4-176 Hz)
  + “Perfect” copy
FT8 Multi-Channel Reception

02:34:45
02:35:15
02:34:45
02:36:15

My Tx

His Tx
WSJT & WSJT-X Overview

- **Weak Signal** communication by Joe Taylor - eXperimental
- Developed for EME; adopted by HF
- Several modes (JT65, JT9, FT8, etc.)

  + Multi-channel
  + Weak signal (inaudible)
    + Longer DX
    + Lower power
    + Compromised antennas and/or QTH
  + Narrow bandwidth (4-176 Hz)
  + “Perfect” copy
  - Slow 1-6 minutes/QSO
  - Limited, fixed messages
WSJT & WSJT-X History

- 2001: FSK441 for meteor scatter
- 2002: JT6M for ionospheric scatter
- 2003: JT65 VHF/UHF EME
  - Adopted for QRP HF DXing; 176 Hz bandwidth; 60 sec. transmission
- 2014: JT9 for LF, MF and HF
  - 2 dB more sensitive than JT65; 16 Hz bandwidth
- Jun 2017: FT8 for 6m Es & HF
  - 50 Hz bandwidth; 15 second transmission
- May 2018: Baker Is. DXpedition > 11,000 FT8 HF QSOs
- Dec 2018: FT8 Roundup (first WSJT-X HF contest)
- Jan 2019: ARRL RTTY Roundup (FT8 permitted)
- Apr 2019: FT8 DX Contest
- Jun 2019: FT8 Makrothen (tentative)
- Sep 2019: SCC FT8 (tentative)
FT8 Standard QSO

- CQ K1ABC FN42
- W9XYZ K1ABC -11
- W9XYZ K1ABC RRR
- K1ABC W9XYZ EN37
- K1ABC W9XYZ R-09
- K1ABC W9XYZ 73
FT8 Short-Cycle QSO

- CQ K1ABC FN42
- W9XYZ K1ABC R-11
- W9XYZ K1ABC 73
  <CQ K1ABC>
- K1ABC W9XYZ -09
- K1ABC W9XYZ RR73

60 sec. rolling QSOs
FT8 DXpedition QSO

- CQ KH1/KH7Z

- K1ABC KH7Z -12
  <“CQ” for others>

- K1ABC RR73
  W9XYZ KH7Z -08
  W0YK KH7Z -13
  <“CQ” for others>

- W9XYZ KH7Z RR73
  W0YK KH7Z RR73
  • CTU •

- KH7Z K1ABC FN42

- KH7Z K1ABC R-14
  KH7Z W9XYZ EN37
  KH7Z W0YK CM97
  etc.

- KH7Z W9XYZ R-11
  KH7Z W0YK R-15
  KH7Z K9YC CM87
  KH7Z W6OAT CN87
  etc.

75 sec./QSO
60 sec./5 QSOs

QSO period 1
QSO period 2
QSO period 3
FT8 Contest QSO

- CQ RU K1ABC FN42
- W9XYZ K1ABC R 589 MA (CQ for others)
- W0YK K1ABC R 569 MA (final QSL for W9XYZ) (CQ for others)
- P49X K1ABC R 559 M (final QSL for W0YK)
- P49X K1ABC 73
- K1ABC W9XYZ 579 WI
- K1ABC W9XYZ RR73 K1ABC W0YK 559 CA
- K1ABC W0YK RR73 K1ABC P49X 529 1743
- K1ABC P49X RR73

75 sec./QSO  
30 sec./rolling QSO
FT8 Roundup

- 1-2 December 2018
- Replaced Ten-Meter RTTY Contest for 2018
  - Future TBD
- ARRL RTTY Roundup rules, except:
  - FT8 only
  - 100 watts maximum
  - Multi-channel Rx (no UNASSISTED SO)
  - Multi-stream Tx (no WSJT-X support yet)
  - Log submittal robot: ft8-ru@cqww.com; 7 day deadline
- Results:
  - 1277 logs submitted
  - Winner was a new ham
FT8 in ARRL RTTY Roundup

- 8-9 January 2019
- FT8 added to list of allowable digital modes
- FT8 QSOs → SO Unlimited (assisted only)
  - Due to multi-channel decoding of WSJT-X
- Results:
  - Record 2,598 logs submitted
    - 1,675 RTTY and RTTY/FT8 logs about normal
    - 923 FT8-only logs incremental
  - FT8 is the first non-RTTY digital mode to be significant
  - FT8 rate exceeded RTTY rate in some scenarios
  - Participation decrease impact between modes was low
  - Cross-mode QRM negligible
**FT8 DX Contest 2019**

- 13-14 April 2019 (12z to 12z)
- Sponsor: European FT8 Club
- ARRL RTTY Roundup rules
  - Low Power (100 watts), QRP (5 watts)
  - SO, MO [MS only??]
  - [QSO spotting assistance probably OK]
- Must use WSJT-X 2.0 or MSHV 2.14
FT8 Makrothen

- Possibly in June 2019
- Sponsor: K6TU & PL259 evaluating
- WSJT-X ARRL VHF Contest mode supports Makrothen
SCC FT8 Contest

- Possibly in September 2019
- Sponsor: SCC (Slovenia Contest Club)
- Details to be announced
Setting Up for FT8

- Download/install WSJT-X
  - Alternatively MSHV
- Hardware (radio and PC) same as AFSK
- Study the:
  - Quick Start Guide to WSJT-X 2.0, and
  - the WSJT-X User Guide
Conclusions

- FT8 is controversial
  - Explosive adoption threatens RTTY
  - Fear of robotic, unattended operation
  - Threatening to many “legacy” hams, but more appealing than CW/SSB/RTTY to new hams
- FT8 has instantly entrenched itself as:
  - A primary amateur mode
  - The pre-eminent digital DXing mode
- Will contest rules let FT8 be all it can be?
- Will FT8 subsume RTTY in digital contesting or become an additional mode? *(Contest participation will determine)*
- Multiple digital modes in a single contest:
  + Increases overall participation
  - Dilutes per-mode participation
  = Net?
Resources

- **WSJT-X 2.0 web site with download link:**
  [https://physics.princeton.edu/pulsar/k1jt/wsjtx.html](https://physics.princeton.edu/pulsar/k1jt/wsjtx.html)

- **WSJT-X 2.0 Quick-Start Guide:**
  [https://physics.princeton.edu/pulsar/k1jt/Quick_Start_WSJT-X_2.0.pdf](https://physics.princeton.edu/pulsar/k1jt/Quick_Start_WSJT-X_2.0.pdf)

- **MSHV web site:**
  [http://lz2hv.org/mshv](http://lz2hv.org/mshv)

- **FT8 Roundup web site with tutorial:**
  [https://www.rttycontesting.com/ft8-roundup](https://www.rttycontesting.com/ft8-roundup)

- **ARRL FT8 Press Release:**