CW STATION v.16: PC Audio Routing, CW Keyer & Decoder

Complete User Manual

by IU7IWT

CW Decoding • CAT Radio Control (Icom / Yaesu / Kenwood) • Telegraphy TX • CW SSB • Phone • Cabrillo & ADIF Log • VISUAL CLUSTER • Log Map • eQSL.cc Upload • QSL Card by Gmail • Video Connect with always-on chat (up to 8 stations) • SCAN • RTTY MODE • PSK MODE • RTTY XY Scope • FT8 MODE • WSPR • CONTEST MODE • OPERATOR PANEL



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What's new in this edition

This edition of the manual adds the functions listed below to version 16 of CW STATION. Every new function has its own chapter; the chapters follow the RTTY XY Scope (Sec. 21).

Area	New function	Section
Digital modes	**FT8 MODE** - FT8 / FT4 / FT2 window: band activity with country flags, answer with a double click, standard messages Tx1-Tx6, automatic sequence, ADIF log FT8_LOG.adi, QRZ button and FT8 MAP.	22
Digital modes	**WSPR** - weak signal propagation reporter: decoding of WSPR beacons, beacon transmission with power in dBm, WHO HEARD ME, list and world map with distances. No LOG.	23
RECEPTION pane	**CONTEST MODE** - resizable window with the score of the selected contest (QSO, multipliers, points, rates) and a talking dial of the band with the call signs logged and their frequencies.	24
RECEPTION pane	**OPERATOR PANEL** - RECEPTION and TX CW (VIA CAT) detached into a separate resizable window, so that the main waterfall becomes larger.	25
VIDEO CONNECT	**Always-on text chat** - the chat works at once, also without webcam and with nobody connected; whoever asks to connect enters the chat automatically and receives the messages already written. Audio and video still need your OK.	15.1, 15.5

1. PROGRAM OVERVIEW

CW Station is a Windows software designed for radio amateurs operating in telegraphy (CW) or phone (SSB). It combines multiple control features within a single interface:

- Real-time CW decoding from radio audio input (USB soundcard or microphone), complete with audio spectrum, a narrow-band waterfall of the CW band (0-3 kHz, 32 bins) and automatic signal tracking;
- CAT Radio Control (Icom CI-V, Yaesu, Kenwood): reads frequency, mode, filter, band, S-meter / power level, and allows VFO tuning via mouse wheel or keyboard arrows;
- Telegraphy Transmission: typed text or macros output via the transceiver's internal keyer (CAT command), via a secondary COM port manipulating keying lines (DTR / RTS), or NEW v.16 as an audio tone on a selectable sound-card output (**CW SSB**), so that CW can be sent with the radio in SSB mode (Sec. 16);
- Phone Operations: PTT via CAT (VOX-free operation) and microphone audio processor (10-band parametric EQ with live FFT visualization, compressor, master volume);
- Cabrillo QSO Logging, QRZ.com callsign lookup, and Partial Check database matching;
- ADIF logbook (OPEN LOG) - open, edit, search and analyze logs in ADIF format coming from other logging programs; every QSO you log is added to it, and stations you have already worked are highlighted while you type their callsign (Sec. 12);
- NEW v.16 VISUAL CLUSTER - a large horizontal talking dial of the band you are on, showing the live DX cluster spots, the VFO needle in real time, filters by mode and country, and one-click tuning of frequency and mode (Sec. 13);
- NEW v.16 Log Map - the statistics of your log shown on a zoomable map, with markers and curved distance lines from your own grid locator (Sec. 12.8.1);
- NEW v.16 CW SSB - telegraphy sent as an audio tone to a sound-card output chosen by you, with adjustable pitch and optional automatic PTT via CAT, instead of CAT / DTR / RTS keying (Sec. 16);
- NEW v.16 SCAN - fast scan of a frequency range or of a whole band: the radio is tuned step by step, the S-meter is read at every step and the signals received are drawn on a spectrum and on a waterfall, like an SDR, with the list of the frequencies where there is activity (Sec. 18);
- 9 Transmission Macros, editable directly inside the software via mouse right-click.

1.1 Where the program saves its files

All configuration and log files are stored in the user's Documents\CW-IU7IWT\ directory:

File	Content / Description
CONFIG.TXT	Main window settings (radio model, ports, knobs, macros, ADIF log file, your grid locator, CW SSB output and options, etc.). Saved via the SAVE CONFIG button and loaded automatically upon startup.
LOG.TXT	QSO log in Cabrillo 3.0 format, updated whenever the INS. LOG button is pressed.
LOG.ADI	Default ADIF logbook. Created by the first INS. LOG if no other ADIF file has been opened. You can also open any other .adi / .adif file with OPEN LOG (Sec. 12).
LOG.ADI.bak	Safety copy of the ADIF file, made automatically the first time the file is overwritten in each working session.
VOXPHONE.TXT	PHONE window settings (soundcards, EQ bands, compressor, gain). Automatically saved when closing the PHONE window.
CTY.DAT NEW v.16	Optional. Country file (from country-files.com). If present in the program folder or in Documents\CW-IU7IWT\, the VISUAL CLUSTER uses it to identify the country of each call sign precisely (Sec. 13.8).

1.2 System Requirements

- Windows OS with .NET Framework (WPF Application); NAudio library is utilized for audio stream management.
- A radio equipped with a CAT/USB interface for control functions (optional for receive-only decoding).
- For Decoding: Audio input carrying radio signal (IC-7300 and modern transceivers stream audio over USB via "USB Audio CODEC"; the program auto-selects devices containing "7300" or "USB").
- For CW Transmission: Transceiver supporting CW CAT commands or a secondary COM port connected to the key jack (see Sec. 3.2); or, with NEW v.16 CW SSB, a sound-card output connected to the transceiver's audio input, with the radio in USB / LSB (see Sec. 16).
- NEW v.16 For the VISUAL CLUSTER: an Internet connection (TCP / telnet toward a DX cluster server) and your call sign set in Macro 4.

1.3 What's new in v.16 NEW v.16

Area	New function	Section
Top bar	New VISUAL CLUSTER button.	3.3, 13.2
Top bar	New **CW SSB** button: telegraphy as an audio tone on a selectable sound-card output (no CAT keying), with adjustable pitch and automatic PTT via CAT.	3.3, 16
Decoder	CW decoding optimized: narrow-band spectrum and waterfall of the CW band (0-3 kHz, 32 bins of about 94 Hz), single decoded bin highlighted, bins centred on their own frequency.	4.1, 6
VISUAL CLUSTER	Large horizontal, zoomable talking dial of the current band with live DX cluster spots and call signs, VFO needle updated in real time.	13.3
VISUAL CLUSTER	Filters by emission mode (CW / PHONE / DIGI), by country, by spot age and by band.	13.2
VISUAL CLUSTER	Click (or double click) on a spot tunes the radio to the spot frequency **and sets the mode** (CW, LSB, USB or DATA) and copies the call sign into the CALL SIGN box.	13.5
CAT control	New mode-setting command for all supported protocols (Icom CI-V, Yaesu ASCII, Yaesu legacy, Kenwood).	10.4, 13.5
LOG window	New box for your own **grid locator**, saved in CONFIG.TXT.	12.3
Statistics window	New **map** of the log: zoomable, with markers and curved distance lines.	12.8.1

> **Note on marks:** in this edition the label NEW v.16 identifies only what was added in version 16. The functions introduced in v.15 (ADIF log, already-worked highlighting, statistics) are now part of the standard feature set and are no longer labeled.

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2. FIRST STEPS: QUICK START

2.1 Receive Only (Decoding)

1. In the top bar, select your radio model and click CONNECT (optional but recommended: enables frequency display, S-meter, QSY).
2. Under AUDIO INPUT, select the soundcard device receiving audio from your radio.
3. Click START RX: spectrum and waterfall scrolling will initiate.
4. Adjust AUDIO IN VOL and WATERFALL CONTRAST until CW signals appear clearly on the waterfall.
5. Click directly on a signal trace in the waterfall: its audio bin is selected (or automatically tracked if AUTO-TRACK is enabled).
6. Decoded text appears in the RECEPTION pane. Use CLEAR to empty it.

2.2 Transmitting in CW

1. Set your radio to CW mode (the software logs a warning if mode read via CAT is not CW). With CW SSB (Sec. 2.4) the radio must be in USB / LSB instead.
2. Select output mode: CAT-connected radio (if supported), CW KEY via secondary COM port (DTR/RTS), or NEW v.16 CW SSB (audio output).
3. Adjust CW TX SPEED.
4. Type into the bottom-right text input (characters transmit instantly) or trigger macros using Shift+1...9.
5. Press DELETE to immediately abort active transmission.

TRANSMISSION NOTICE: Prior to any transmission tests, ensure your rig is connected to a dummy load or tuned to an unused frequency.

2.3 Finding stations with the VISUAL CLUSTER NEW v.16

1. Connect the radio (CONNECT) and enter your call sign in Macro 4 (right-click the macro, then SAVE CONFIG).
2. Click **VISUAL CLUSTER** in the top bar. The dial opens on the band of your VFO and starts receiving spots.
3. Click a call sign on the dial: the radio is tuned to the spot frequency, the mode is set (CW / LSB / USB / DATA) and the call sign appears in the CALL SIGN box.
4. Use the CW / PHONE / DIGI buttons and the COUNTRY list to keep only the spots you are interested in.

2.4 Sending CW through the audio output (CW SSB) NEW v.16

1. Set the radio to USB / LSB (or DATA) and connect the PC sound-card output (for example the radio's USB audio CODEC) to the radio's audio input.
2. In the top bar choose the audio output in the list next to the **CW SSB** button and, if you wish, the tone pitch in Hz.
3. Leave the PTT box ticked to let the program key the transmitter via CAT, or untick it and use VOX.
4. Click **CW SSB**: the button lights and shows "CW SSB ON". Type into the instant type line or use the macros: the CW is sent as an audio tone.
5. Press DELETE to stop at once; click CW SSB again to return to CAT / CW KEY keying. Full details in Sec. 16.

2.5 Scanning the band with SCAN NEW v.16

1. Connect the radio (CONNECT): SCAN uses the CAT link to tune the radio and to read the S-meter.
2. Click **SCAN**, placed next to the VFO A / MODE / FIL / band indicators, on the left of the frequency display. The SCAN window opens on the band of your VFO.
3. Choose the range in the RANGE list (a band, ALL HF, or Custom with FROM / TO in kHz) and the STEP (500 Hz is a good value for CW, 2.5 - 5 kHz for phone).
4. Press **START**: the radio sweeps the range again and again. The spectrum and the waterfall show where the signals are and the ACTIVITY list on the right collects their frequencies.
5. Double click a frequency of the ACTIVITY list (or click on the spectrum or on the waterfall): the scan stops and the radio is tuned there.
6. Press **STOP** (or Esc) to end the scan: the radio returns to the frequency it had before. Full details in Sec. 18.

Further functions added in v.16 NEW v.16

Area	New function	Section
Top bar	New VIDEO CONNECT button: live video link, audio and chat with up to 8 radio amateurs at the same time.	15
Top bar	New **CW SSB** button: CW telegraphy as an audio tone on a selectable output, with automatic PTT via CAT.	16
LOG window	New eQSL button on every QSO: sends the QSL to eQSL.cc and marks the contact as sent.	14
LOG window	New **send mail** button on every QSO: prints your call sign, your name in calligraphy, your position with a small map and the QSO data on your own QSL image and opens a ready Gmail message for the correspondent.	17
Radio display	New **SCAN** button (left of the frequency, next to VFO A / MODE / FIL / band): fast scan of a frequency range or of the whole HF band, with spectrum, waterfall and list of the active signals; a click tunes the radio.	5, 18

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3. TOP CONTROL BAR

3.1 Radio Connection (Primary CAT)

Control	Function & Description
Radio Model	Select from supported transceivers list (Sec. 10). Changing model disconnects current session and resets baud rate and CI-V address to defaults.
COM Port	CAT interface port. Automatically refreshes every ~1 sec upon USB adapter insertion/removal (when disconnected). Pre-selects standard USB interface drivers.
Baud Rate	115200 / 57600 / 38400 / 19200 / 9600 / 4800. Must match menu setting on transceiver (Icom: CI-V baud rate; Yaesu: CAT RATE; Kenwood: PC baud rate). Default: 19200.
CI-V Address	2-digit hexadecimal input, visible only for Icom models (e.g. 94 for IC-7300). Auto-fills based on model selection; manually editable for unlisted models.
CONNECT / DISCONNECT	Opens or closes primary CAT COM port. Button label reflects currently selected radio model.
Status Indicator	DISCONNECTED (Red): Port closed. NO RESPONSE (Amber): Port open but radio unresponsive (check baud, address, wiring). CONNECTED (Green): Normal operation.

Upon establishing connection, the system log confirms if CAT CW transmission is supported for the model (unsupported on FT-817/857/897 and legacy Icom units; see Sec. 10) and notes that phone mode uses PTT via CAT.

3.2 CW KEY - Secondary CAT for Keying

Utilized for keying via hardware lines (DTR and/or RTS) on a secondary COM port attached to the transceiver's CW key input jack. The internal keyer generates precise dot/dash timing.

Control	Function & Description
CW KEY Port	COM port connected to hardware keying interface. Must differ from primary CAT port (validated by software).
DTR / RTS	Select active keying control line(s). At least one must be checked to enable connection.
CONNECT KEY / DISCONNECT KEY	Opens or closes port (9600 baud rate; DTR/RTS lines initialized in off state).
TEST	Transmits "VVV" test sequence at active speed to verify keying circuit. Transceiver will key up.
Status Light	OFF = Closed; READY = Open; KEY = Line actively keyed at present instant.

> **NOTE:** When CW KEY port is open, all CW data (macros, live typing, callsigns, serials) is routed via DTR/RTS keying lines regardless of primary CAT connection state. Secondary port keying takes priority over CAT CW commands. Radio mode must be set to CW. When NEW v.16 **CW SSB** is ON (Sec. 3.3, 16) it takes priority over both: the CW is sent as an audio tone and the radio mode must be USB / LSB.

3.3 Other Top Bar Buttons

Button	Function & Description
CW SSB NEW v.16	Toggle. When lit ("CW SSB ON"), telegraphy is **not** sent via CAT: the program generates the CW tone and sends it to the audio output selected in the list beside the button. The same box holds the tone pitch (Hz) and the PTT option (automatic PTT via CAT). The button stays lit while the mode is active. See Sec. 16.
MACRO	Load custom .txt file containing macros (one message per line, max 9 lines). Can also be edited via right-click (Sec. 7.3).
PTT (F9)	Phone PTT: switches transceiver to transmit mode via CAT commands without relying on VOX. Button turns red ("TX F9") during transmission.
AUDIO MIC	Opens PHONE window (microphone DSP suite with EQ, FFT spectrum, compressor, and spacebar PTT). See (Sec. 8).
PARTIAL CHECK	Loads callsign database file for instant callsign auto-completion suggestions in CALL SIGN field during contests. Stations already present in the ADIF log are highlighted in the list (Sec. 12.9).
OPEN LOG	Opens the LOG window: load an ADIF log from another program, edit it, search it, view statistics and the log map. QSOs saved with INS. LOG are added to this log automatically. See Sec. 12.
VISUAL CLUSTER NEW v.16	Opens the VISUAL CLUSTER window: a large talking dial of the current band with the DX cluster spots, the VFO needle in real time, filters by mode and country, and one-click tuning of frequency and mode. Only one window can be open at a time: pressing the button again brings it to the front. The button stays lit while the window is open. See Sec. 13.
VFO FT-101 / VFO	Toggles VFO knob visual styling: metallic knob with linear tuning scale (TS-520 style) or Yaesu FT-101ZD dial wheel style.
SAVE CONFIG	Saves operating configuration to CONFIG.TXT, including modified macros, the current ADIF log file, your grid locator and the CW SSB settings. Button displays "SAVED" for 1.5 seconds.

4. CONTROL KNOBS AND RX AUDIO PANEL

4.1 Audio Bin & Frequency Mapping NEW v.16

The decoder no longer works on the whole audio spectrum: it is optimized for the CW band. The audio is analysed with an FFT at 48 kHz sampling rate (512 samples per spectrum), so each bin is **48000 / 512 = 93.75 Hz** wide, and the bin graph and the waterfall show only the **32 bins that cover the CW band, 0-3 kHz**.

Each bin is **centred on its own frequency**: bin *k* is at *k* x 93.75 Hz. Examples: bin 7 = 656 Hz, bin 8 = 750 Hz, bin 10 = 937.5 Hz (default CENTRAL BIN), bin 12 = 1125 Hz. The engine decodes a **single active bin** at a time: choose the bin nearest to the pitch of the station you are listening to. The bars of the bin graph are drawn centred on the frequency of their bin, with a frequency label in Hz every 4 bins, and the decoded bin is highlighted in green.

Below the waterfall, the "Cursor" label shows the active bin and its audio frequency, for example **Bin 10 · 938 Hz**, followed by AUTO-TRACK when automatic tracking is on.

5. RADIO DISPLAY, VFO, AND S-METER

Display Element	Behavior & Description
VFO A Indicator	Static status label.
Operating Mode	Operating mode returned via CAT (CW, USB, LSB, etc.). Must begin with "CW" for CAT / CW KEY transmission; with CW SSB the radio must be in USB / LSB. The label also follows mode changes ordered by the VISUAL CLUSTER (Sec. 13.5).
FIL n	Active receiver filter selection (when reported by radio firmware).
Amateur Band	Amateur radio band calculated from operating frequency (Appendix A); displays "GEN" out of band or "--" disconnected.
SCAN Button NEW v.16	Placed with the VFO A, mode, FIL and band indicators, on the left of the LED frequency. Opens the SCAN window (Sec. 18): fast scan of a range or of the whole band with spectrum and waterfall. The button stays lit while the window is open. While a scan is running the LED frequency and the S-meter of the main window are not updated: they are aligned again with the radio when the scan ends.
LED Frequency Meter	Amber matrix display formatted as "MHz.kHz.Hz" (Hz shown in smaller digits). Illumined when CAT link is active.
VFO Control Knob	Drag with mouse to adjust frequency by selected QSY STEP per detent. Clockwise = increase; Counter-clockwise = decrease. Commands are throttled every ~50 ms to prevent visual flicker.
Keyboard Tuning	Left / Right arrow keys adjust frequency down / up by QSY STEP (active when text boxes are not focused).
Analog S-Meter	Amber backlit meter: SIGNAL scale (S1-S9 orange, +20/+40/+60 dB red) and Po / RF OUTPUT scale (0-100%). Displays S-units on RX and switches to RF power output during TX. Backlight dims slightly under heavy needle deflection.
S-METER Text	RX: Signal value (e.g. S7, S9+20). TX: "PO n%" when true power is returned, otherwise displays "TX".

6. SPECTRUM, WATERFALL, & SIGNAL SELECTION

6.1 The Three Visual Modes NEW v.16

- **Full Spectrum Display:** shows the complete audio spectrum curve, from 0 to half the sampling frequency, with frequency labels in kHz placed at automatic intervals so that they never overlap.
- **32-Bin CW Band Bar Chart:** bar chart of the 32 bins that cover the CW band (0-3 kHz, about 94 Hz each). Every bar is centred on the frequency of its bin; the bin being decoded is highlighted in green, the other bins are drawn in teal; a frequency label in Hz appears every 4 bins.
- **Narrow-Band Waterfall (0-3 kHz):** rolling spectrograph history of the CW band. Click on the trace of the correspondent you wish to decode: the bin under the click is selected. A visual marker tracks the active bin.

6.2 Signal Selection Methods

- **Waterfall Click:** selects the clicked bin directly. If auto-track is active, it locks onto the nearest signal peak.
- **CENTRAL BIN Box:** manually enter the bin number (bin 10 = 937.5 Hz; the "Cursor" label shows the bin and its frequency in Hz).

Changing bins resets decoder buffers: prior decoded text is committed to the RX history pane.

6.3 Auto-Track System

When enabled, the tracking engine scans for the strongest signal peak within the configured range (±300, ±500 [default], ±800, or ±1200 Hz) around the current bin every ~50 ms. The tracking marker shifts only if all conditions are met:

- Peak amplitude exceeds background noise floor and squelch threshold;
- Signal is at least ~2.3 dB stronger than current bin level;
- Peak persistence is verified continuously for ~0.3 seconds.

7. TELEGRAPHY TRANSMISSION (CW TX)

7.1 Three Output Modes NEW v.16

Mode	Operation & Details	Requirements
CAT Keyer	Text sent to radio via CAT commands (Icom: command 0x17; Yaesu/Kenwood: KY command). Timing and elements generated natively by transceiver keyer. Speed set via radio settings.	Radio connected via CAT; CW CAT support; mode set to CW.
CW KEY (DTR/RTS)	Software keyer generates dot/dash timing directly and toggles DTR/RTS lines on secondary COM port. Takes precedence over CAT keying.	CW KEY port connected; hardware interface wired to radio key input; mode set to CW.
CW SSB (audio) NEW v.16	Software keyer generates dot/dash timing and a sine tone (soft attack and release, no clicks) sent to the selected sound-card output. Nothing is sent via CAT or DTR/RTS keying; PTT can be given via CAT. Speed set by the CW TX VEL. knob. Takes precedence over both other modes (Sec. 16).	CW SSB button ON; audio output connected to the radio's audio input; mode set to USB / LSB; PTT via CAT or VOX.

Supported printable CW character set: A-Z, 0-9, and symbols / ? , . = + - :. Unsupported characters are omitted; line breaks convert to spaces.

7.2 Instant Type Line

The text input box located at bottom-right transmits each character immediately as it is typed (auto-converted to uppercase). Pressing Enter inserts a space and clears the buffer. Backspace does not recall transmitted elements.

7.3 The 9 Transmission Macros

Nine pre-configured macro buttons appear above the TX history log, labelled [Shift+1] through [Shift+9]. Clicking a button or pressing Shift+1…9 triggers transmission. Macro 4 is highlighted in orange as the MyCall container.

Right-Click Macro Editing. Macros can be edited directly inside the application without modifying CONFIG.TXT manually. Right-click any macro button to open the editor dialog, update text, and click OK. Remember to press SAVE CONFIG in the top bar to persist changes.

v.16: Macro 4 (MyCall) is also used as the call sign for the login to the DX cluster of the VISUAL CLUSTER (Sec. 13.6). If it is empty or shorter than 3 characters the VISUAL CLUSTER does not connect.

v.16: text selected with the mouse in the RECEPTION pane is copied at once, without spaces, into the CALL SIGN box (Sec. 7.3.1). A new "?" button next to the CALL SIGN box transmits the call sign followed by "?" (Sec. 7.3.2).

7.3.1 Selecting the call sign with the mouse (RECEPTION pane) NEW v.16

The decoded text in the RECEPTION pane can be selected with the mouse. This lets you capture in one gesture a call sign that the decoder has printed with gaps between the letters (for example I U 7 I W T) and send it straight to the CALL SIGN box (Sec. 7.4), without typing it.

Step	What happens
1. Drag	Keep the left mouse button pressed and drag over the characters in the RECEPTION pane. The selection may include the spaces between the letters.
2. Release	When you release the button, the selected text is copied at once into the CALL SIGN box with all spaces and line breaks removed and in uppercase. Example: the selection "I U 7 I W T" becomes IU7IWT. The previous content of the box is replaced.
3. Use the box	The CALL SIGN box behaves as if you had typed the call sign: Partial Check suggestions and the already-worked warning (Sec. 12.9) are shown, Enter transmits it, Left-Shift + Enter opens QRZ.com.

Selection while the decoder is running. The decoder keeps adding characters at the end of the pane while you work. The selection you made stays exactly on the text you highlighted: new characters that arrive afterwards are not added to it. If the highlighted text itself is modified (for example when the decoder corrects the provisional letters at the end of the line) the selection is cleared and you simply select it again.

Notes. A simple click without dragging selects nothing and leaves the CALL SIGN box unchanged. Select only the letters of the call sign: everything that is highlighted is copied (spaces and line breaks excepted).

7.3.2 The "?" button (ask for a repeat of the call sign) NEW v.16

A small button labelled "?" is placed immediately to the right of the CALL SIGN box. When you press it, the program transmits in CW the text contained in the CALL SIGN box followed by the character "?". For example, with IU7IWT in the box the transmitted text is IU7IWT?. It is the quick way to ask the other station whether the call sign you have copied is correct.

Control	Function & Operating Instructions
"?" button	Transmits the CALL SIGN text + "?" using the active output mode (CAT keyer, CW KEY via DTR/RTS, or CW SSB, Sec. 7.1). The usual CW conditions apply: the radio must be in CW mode (USB / LSB with CW SSB).
Empty CALL SIGN box	Only the character "?" is transmitted.
Abort	Press DELETE to stop the transmission immediately, as for any other CW transmission (Sec. 7.6).
TX history log	The transmitted text appears in the TX history log like every other message.

Practical example: (1) the decoder shows a weak call sign as "I U 7 I W T"; (2) select it with the mouse: IU7IWT appears in the CALL SIGN box; (3) press "?": the program sends IU7IWT?; (4) when the other station confirms, press Enter to send the call sign, or use the macros, and log the QSO with INS. LOG.

7.4 CALL SIGN Box, DE, QRZ, and Serial Numbers

Control	Function & Operating Instructions
CALL SIGN Box	Destination station callsign (forced uppercase). Press Enter to transmit. Press Left-Shift + Enter to open QRZ.com profile. Displays Partial Check matches while typing. If the callsign is already in your ADIF log, the box turns red and its tooltip shows the previous QSO (Sec. 12.9). NEW v.16: a click on a spot in the VISUAL CLUSTER writes the spot call sign here.
de / Shift+0	Transmits sequence: " DE ". Requires non-empty CALL SIGN and Macro 4.
QRZ Button	Launches default web browser to callsign page on QRZ.com (https://www.qrz.com/db/CALLSIGN).
send Field	Outbound contest serial number (read-only). Starts at 001 and auto-increments upon pressing INS. LOG. Saved in CONFIG.TXT.
received Field	Inbound serial number (up to 6 characters). Enter received report before logging; defaults to 000 if blank.
TX (near received)	Transmits active outbound "send" serial number in CW.

Control	Function & Operating Instructions
INS. LOG	Appends QSO entry to LOG.TXT file in Cabrillo format and to the ADIF log (Sec. 12.6), increments send serial, and resets received input.
CLEAR TXT	Clears TX history log display (log automatically truncates above 60,000 characters).

7.5 QSO Logging (Cabrillo 3.0 Format)

Pressing INS. LOG appends QSO data to Documents\CW-IU7IWT\LOG.TXT formatted to Cabrillo 3.0 standards. The header is initialized automatically upon first write:

```
START-OF-LOG: 3.0 CALLSIGN: [Macro 4 MyCall] CONTEST: CONTEST-NAME CATEGORY-OPERATOR: SINGLE-OP
```

Formatted QSO line example:

```
QSO: 14030 CW 2026-10-25 1830 IU7IWT 599 001 DL1ABC 599 123
```

The same QSO is also added to the ADIF logbook and saved to the ADIF file at the same moment. The Cabrillo file and the ADIF log are independent: you can keep using LOG.TXT for contest submission while the ADIF log serves as your general logbook (Sec. 12).

7.6 Aborting Transmission & TX History Log

Press DELETE to immediately abort an active transmission (in CW SSB mode the tone stops at once, the queue is emptied and the automatic PTT is released). CLEAR TXT empties the TX history log display, which is automatically truncated above 60,000 characters.

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8. PHONE OPERATIONS: PTT VIA CAT & AUDIO MIC

8.1 PTT via CAT (VOX-Free Operation)

Phone PTT operates strictly via CAT commands without reliance on audio VOX. Requires active primary CAT link.

Control	Function & Behavior
PTT / F9 Button	Latch toggle: press once to engage transmit (button lights red "TX F9"), press again to return to RX.
Ctrl + Spacebar	Momentary PTT (main window): hold to transmit; release to immediately return to RX.
Spacebar (AUDIO MIC)	Momentary PTT (AUDIO MIC window): hold spacebar to transmit; release to return to RX.

8.2 The AUDIO MIC (PHONE DSP) Window

Clicking AUDIO MIC opens the dedicated microphone DSP suite. Audio pipeline: Microphone Input → 10-Band Equalizer → Dynamics Compressor → Output Volume → Transceiver Audio Input.

Control	Function Description
Audio Source	Microphone / audio line input device. Locked while audio stream is running.
Audio Output	Output soundcard feeding transceiver TX audio line (supports Windows Default).
START / STOP	Toggles 48 kHz mono real-time audio processing loop.
Status Indicator	OFF (Red), ACTIVE (Green: DSP running), TX (Amber: PTT engaged).
OUTPUT LEVEL Meter	Peak level meter displaying output signal amplitude to monitor against digital clipping.
COMPR. n dB Meter	Gain reduction meter (0 to 24 dB) indicating active compressor attenuation.

8.3 10-Band Parametric Equalizer

Each band (B1-B10) features adjustable Gain (-15 to +15 dB), Center Frequency (20 Hz to 16 kHz log scale), and Q factor (0.3 to 10). Default preset optimizes voice clarity for SSB transmission by cutting low rumble/high hiss and boosting 2-3 kHz presence:

Band	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Freq (Hz)	100	200	400	800	1200	1800	2500	3200	4500	7000
Gain (dB)	-6	-2	0	0	+1	+2	+3	+2	-4	-8

8.4 FFT DISPLAY - Post-EQ Signal Spectrum

The FFT DISPLAY button inside the AUDIO MIC window renders a real-time spectral analyzer display of the signal after equalizer processing. This visual feedback allows operators to immediately observe how adjusting gain, frequency, or Q parameters shapes the voice frequency spectrum prior to transmission.

8.5 Compressor & Master Volume Parameters

Parameter	Range / Default	Functional Description
COMPRESSOR	On / Off (Default: On)	Master toggle for dynamic compression module.
Threshold	-60 to 0 dB (Default: -24)	Signal level above which dynamic compression is applied.
Ratio	1:1 to 20:1 (Default: 4:1)	Compression slope applied to signals exceeding threshold.
Attack / Release	1-100 ms / 20-1000 ms	Speed of compression onset (8 ms) and gain recovery time (180 ms).
Makeup Gain	0 to 24 dB (Default: +6)	Post-compression gain boost to restore overall audio level.

---

9. THE CONFIG.TXT FILE & SAVE CONFIG

Clicking SAVE CONFIG writes current settings to Documents\CW-IU7IWT\CONFIG.TXT. This structured text file retains radio models, port bindings, knob positions, macro strings, the ADIF log file in use (key AdifFile), your own grid locator entered in the LOG window (Sec. 12.3) and the NEW v.16 CW SSB settings: audio output (key SsbDevice), tone pitch (SsbHz), automatic PTT option (SsbPtt) and on/off state (SsbOn). If CW SSB was ON when the configuration was saved, it is switched on again at the next start. Note that phone settings are saved independently in VOXPHONE.TXT upon closing the AUDIO MIC window.

---

10. SUPPORTED RADIOS

The program natively communicates using four CAT dialect protocols: Icom CI-V (binary), Yaesu ASCII (modern models), Yaesu Legacy (5-byte binary), and Kenwood ASCII. Baud rates must match transceiver menu settings. For radios without CW via CAT, use the CW KEY port (Sec. 3.2) or NEW v.16 CW SSB (Sec. 16), which does not need CAT for keying.

10.1 Icom (CI-V Protocol) - Default Baud Rate: 19200

Model	CI-V Address (Hex)	CW via CAT Support
IC-7300	94	Yes
IC-7610	98	Yes
IC-705 / IC-9700	A4 / A2	Yes
IC-7100 / IC-7851 / IC-7800	88 / 8E / 6A	Yes
IC-7700 / IC-7600 / IC-7410 / IC-7200	74 / 7A / 80 / 76	Yes
IC-7000 / IC-9100	70 / 7C	Yes
IC-756PRO III / IC-746PRO / IC-706MKIIG / IC-718	6E / 66 / 58 / 5E	No (Requires CW KEY port)
Generic CI-V	94 (User editable)	Yes

10.2 Yaesu Transceivers

Model	Protocol Type	Default Baud Rate	CW via CAT Support
FT-2000, FTDX-5000, FTDX-1200, FT-950, FT-450D	ASCII	4800	Yes (KY)
FTDX-3000	ASCII	4800	Yes (KY)
FT-991A, FT-710, FTDX-10, FTDX-101D/MP	ASCII	38400	Yes (KY)
FT-891	ASCII	9600	Yes (KY)
FT-817 / FT-857D / FT-897D	Legacy 5-byte	4800 / 9600	No (Requires CW KEY port)

10.3 Kenwood Transceivers (ASCII Protocol - CW via CAT: Yes)

Supported models (Baud rates: TS-590S/SG: 9600; TS-890S / TS-990S: 115200; TS-480, TS-2000, TS-870S, TS-570D: 9600).

10.4 Mode setting via CAT NEW v.16

Starting from v.16 the program can also **set** the operating mode of the radio (previously it could only read it). The command is used by the VISUAL CLUSTER when you click a spot (Sec. 13.5). The program asks the radio for one of four modes: **LSB**, **USB**, **CW** and **DATA** (USB with data processing). The command is sent right after the frequency change, in the same CAT cycle, and the mode is read back so that the MODE label is updated at once.

Protocol	How the mode is set	Notes
Icom CI-V	Command 0x06 (LSB 00, USB 01, CW 03).	For IC-7300, IC-7610, IC-705 and IC-9700 the DATA flag (command 1A 06) is switched ON for DATA and OFF for LSB / USB / CW, so that a previous digital session does not remain active. Only the mode byte is sent: the filter setting is left to the radio.
Yaesu ASCII	MD0x; (LSB 1, USB 2, CW 3, DATA-USB C).	Used by FT-991A, FT-710, FTDX series, FT-891, FT-950, FT-450D, FT-2000.
Kenwood	MDx; (LSB 1, USB 2, CW 3).	DATA is sent as USB: the data/voice processing is selected on the radio.
Yaesu legacy	5-byte command 07 (LSB 00, USB 01, CW 02, DIG 0A).	FT-817, FT-857D, FT-897D.

11. TROUBLESHOOTING GUIDE

Symptom	Probable Cause & Resolution
"NO RESPONSE" Status	Port open but radio unresponsive: verify baud rate matches radio menu, check CI-V address (Icom), verify USB interface cable. Try secondary virtual COM port.
"Cannot Open Port" Error	COM port occupied by external software (WSJT-X, logger, etc.) or disconnected. Close competing software or select correct port.
CW Output Fails	Verify: (1) Radio set to CW mode (USB / LSB for CW SSB); (2) Transceiver supports CAT CW, or CW KEY is connected, or CW SSB is ON with an audio output selected; (3) CW KEY status turns to "KEY" during TX; (4) Correct DTR/RTS line selected.
CW SSB: "Select the audio output for CW SSB" NEW v.16	No audio output is selected in the list next to the CW SSB button. Choose the output connected to the radio's audio input and press CW SSB again.
CW SSB: "Unable to open the audio output" NEW v.16	The device is in use (for example by the AUDIO MIC window or another program), unplugged or disabled in Windows. Close the other program or stop AUDIO MIC, reopen the list (it refreshes while CW SSB is OFF), select the output and retry.
CW SSB is ON but the radio does not transmit NEW v.16	Check: radio in USB / LSB (or DATA), not CW; PTT box ticked and radio connected via CAT, otherwise enable VOX on the radio or press PTT (F9); the radio's modulation input is set to the USB audio / line input that receives the selected output.
CW SSB: first letter weak or missing NEW v.16	The radio needs time to switch to TX (typical with VOX). Use the PTT box (the program waits about 150 ms after PTT before the first tone) or increase the VOX delay on the radio.
CW SSB: signal distorted or too wide NEW v.16	The tone is generated at a fixed level (half of full scale). Lower the Windows volume of the output or the radio's audio input level until the ALC does not move; switch off speech processor / compressor and keep the pitch inside the SSB passband (300-1500 Hz).
Waterfall Static / Black Screen	Adjust WATERFALL CONTRAST and AUDIO IN VOL. Verify correct input audio device is selected and active.
Decoding Garbled / Errors	Weak signal or interference: adjust SQUELCH, centre the CENTRAL BIN on the signal peak (the signal must fall inside the highlighted bin of the 32-bin CW band, 0-3 kHz), or enable AUTO-TRACK; ensure audio input is not clipping (0-100% level).
"Unable to save the log" / "QSO saved in LOG.TXT but not in the ADIF log"	The ADIF file is read-only, locked by another program (close the other logger), or its folder does not exist or is not writable. Use SAVE AS... in the LOG window to choose another location.
Log opens but some QSOs are missing or fields look wrong	The file is probably not valid ADIF (e.g. Cabrillo or a plain text export). Export the log from the other program again in ADIF format (.adi / .adif).
Station already worked is not highlighted	Highlighting requires the exact callsign in the log (a /P, /M or country prefix is ignored). Check that the log is loaded (file name shown at the bottom of the LOG window) and that the CALL field of the QSO is filled.

Symptom	Probable Cause & Resolution
VISUAL CLUSTER: "Call sign missing..." NEW v.16	Macro 4 (MyCall) is empty or too short. Right-click macro 4, enter your call sign, press SAVE CONFIG and press RECONNECT in the VISUAL CLUSTER.
VISUAL CLUSTER: no spots arrive NEW v.16	Check the status text next to the DXHEAT button. If the server is unreachable choose another one in the CLUSTER list (or type host:port) and press RECONNECT; check that the firewall allows the program to reach the server port. Also check the filters (MODE buttons, COUNTRY = ALL, AGE) and the BAND selector.
VISUAL CLUSTER: the radio changes frequency but not mode NEW v.16	Make sure the radio is connected in CAT (CONNECT) and the model is the right one. For DATA on Icom the model must be IC-7300 / 7610 / 705 / 9700; other models receive USB. Check that no other program is controlling the radio at the same time.
VISUAL CLUSTER: a spot has the wrong mode or country NEW v.16	The mode is deduced from the spot comment and, if missing, from the band plan; the country from the call sign prefix. Install CTY.DAT for exact countries (Sec. 13.8).

12. ADIF LOG (OPEN LOG)

12.1 Overview

The OPEN LOG button in the top bar opens the LOG window, a complete logbook based on the ADIF standard (Amateur Data Interchange Format, files with extension .adi or .adif), which is understood by virtually every logging program. With it you can:

- load a log created by another logging program and keep working on it;
- edit any QSO directly in the table, add new QSOs by hand and delete wrong ones;
- automatically receive every QSO you save with INS. LOG in the main window;
- search the whole log instantly and open a statistics window;
- see at once, while typing a callsign in the main window, whether you have already worked that station;
- NEW v.16: enter your own grid locator and see the log on a zoomable map with the distances (Sec. 12.8.1).

12.2 The log file and where it is stored

Item	Behavior
Default file	Documents\CW-IU7IWT\LOG.ADI. Used when no other ADIF file has been opened. It is created automatically by the first INS. LOG.
Last file used	The program remembers the ADIF file in use (key AdifFile in CONFIG.TXT) and reopens it at every startup; the number of QSO loaded is reported in the TX history log. The key is updated automatically when you open another file (if CONFIG.TXT already exists); otherwise press SAVE CONFIG once.
Safety copy	The first time in each working session that an existing ADIF file is overwritten, a copy named filename.bak is made next to it. Files are written to a temporary file first and then replaced, so an interruption cannot leave a half-written log.
Closing the program	If the log has unsaved changes and a file is selected, it is saved automatically when you close the main window.
Cabrillo log	LOG.TXT is not touched by any of this and keeps working exactly as described in Sec. 7.5.

12.3 The LOG window

Control	Function & Description
LOAD ADIF	Opens a file selector for .adi / .adif files. See Sec. 12.5.
SAVE	Writes the log in ADIF format to the current file. If no file is selected yet, behaves like SAVE AS...
SAVE AS...	Saves the log to a new file name or folder; that file becomes the current log file.
ADD QSO	Adds an empty QSO with the current UTC date and time and mode CW, selects it and starts editing the CALL cell. The search filter is cleared so that the new row stays visible.
DELETE	Deletes the selected QSO (several rows can be selected with Ctrl / Shift). A confirmation is requested. The file on disk changes only when you press SAVE.
STATISTICS	Opens the statistics window (Sec. 12.8), which also contains the log map (Sec. 12.8.1). Only one statistics window is open at a time.
SEARCH	Filter box above the table (Sec. 12.7). The button with the cross clears it.
MY GRID LOCATOR NEW v.16	Box where you type your own Maidenhead grid locator (e.g. JN70). It is the starting point of the distances drawn on the log map (Sec. 12.8.1). The value is saved in the configuration (CONFIG.TXT).
Status line	At the bottom: number of QSO shown / total, the log file in use, and "* unsaved changes" when there are edits not yet written to disk (also shown as * in the window title).

12.4 Columns and editing

Double-click a cell (or select it and press F2) to edit it, then press Enter to confirm. Click a column header to sort by that column; by default the most recent QSO is shown first. The table shows these columns:

Column	ADIF field	Notes
DATE (UTC)	QSO_DATE	Shown as yyyy-MM-dd. You can type 2026-10-28 or 20261028.
TIME	TIME_ON	UTC, shown as HH:mm or HH:mm:ss according to the original data.
CALL	CALL	Converted to uppercase.
BAND	BAND	If empty, the band is worked out from FREQ for statistics.
FREQ MHz	FREQ	In MHz, with a dot as decimal separator (a comma is converted).
MODE	MODE	Uppercase (CW, SSB, FT8...).
RST S / RST R	RST_SENT / RST_RCVD	Report sent / received.
STX / SRX	STX, STX_STRING / SRX, SRX_STRING	Serial numbers sent / received. Numeric values are saved as STX / SRX, values with letters as the _STRING fields.
NAME, QTH, GRID, COUNTRY, COMMENT	NAME, QTH, GRIDSQUARE, COUNTRY, COMMENT	Free text; GRID is converted to uppercase.

NOTE: Every ADIF field found in a loaded file - including those that are not shown as columns (e.g. DXCC, CQZ, EQSL_QSL_SENT, notes written by other programs) - is kept and written back when you save. Loading and re-saving a log with CW Station does not lose information.

12.5 Loading a log from another program

Press LOAD ADIF and choose the file exported by your other logging program (the export function is usually called "Export ADIF"). The result depends on whether a log is already open:

- **No log open (or empty):** the file is opened as the current log and its name is remembered for the next start.
- **A log is already open:** a question appears. YES = open the new file as the current log (replacing the one in memory; if you have unsaved changes you are asked to save them first). NO = import its QSOs into the current log; QSOs already present (same callsign, date, time to the minute, band and mode) are skipped, and the number of new QSOs is reported. After an import press SAVE to write the merged log to the current file.

Text encoding (UTF-8 or Latin-1) is recognized automatically and the lengths of the fields are interpreted according to the ADIF specification. Both .adi and .adif files are accepted. Files exported by CW Station can be imported into other programs in the same way.

12.6 QSOs saved with INS. LOG

When you press INS. LOG in the main window the QSO is written to LOG.TXT (Cabrillo) and, at the same time, added to the ADIF log, which is immediately saved to its file. The ADIF record contains:

ADIF field	Value
CALL	Callsign in the CALL SIGN box.
QSO_DATE, TIME_ON	Current UTC date and time (HHmmss).
BAND, FREQ	Taken from the radio frequency read via CAT. If the radio is not connected they are left empty and can be filled in later in the LOG window.
MODE	CW.
RST_SENT, RST_RCVD	599 / 599.
STX, SRX	The "send" and "received" serial numbers (SRX_STRING if the received value contains letters).
STATION_CALLSIGN, OPERATOR	Your callsign (Macro 4 MyCall), when set.

A line in the TX history log confirms the operation, e.g. [LOG]: ADIF → LOG.ADI (125 QSO). If the ADIF file cannot be written (read-only file, missing folder) a warning appears, but the QSO is still stored in LOG.TXT.

IMPORTANT: Saving writes the whole ADIF log, including any edits that you have made in the LOG window and not yet saved. If you need to discard edits, close the LOG window and answer NO to the save question before logging the next QSO.

12.7 Searching the log

Type in the SEARCH box: the table is filtered while you type (after a very short pause). The search is not case-sensitive and covers all fields of every QSO, including the date and time as displayed. Entering several words separated by spaces shows only the QSOs that contain all of them. Examples:

- **DL1ABC** - every QSO with that station;
- **20M CW** - 20 m QSOs made in CW;
- **2026-10** - everything logged in October 2026;
- **ROMA** - stations whose QTH, name or comment contains "ROMA".

The status line shows how many QSOs match. Editing is possible while a filter is active; clear the filter with the cross button to see the whole log again.

12.8 Statistics window

The STATISTICS button opens a separate window that is updated automatically every time the log changes (you can keep it open while logging). The top panel summarizes the whole log:

- total QSOs, unique callsigns, and number of different countries / prefixes;
- number of bands and of modes used;
- first and last QSO date, number of active days, QSOs in the last 30 days and the average number of QSOs per active day.

Below it, the GROUP BY list selects a table with the number of QSOs, the percentage and a proportional bar:

Group by	Result
Band	QSOs per band, ordered from the lowest to the highest frequency.
Mode	QSOs per mode, most used first.
Year / Month	Activity per year or per month (yyyy-MM), in chronological order.
Hour (UTC)	QSOs per hour of the day, useful to see when you operate most.
Country / prefix	Uses the COUNTRY field of the log when present; otherwise the prefix of the callsign (e.g. IU7, DL1). It is an approximation, not a full DXCC entity count.
Most worked call signs	The 50 stations contacted most often.

12.8.1 Map of the log (statistics on the map) NEW v.16

The statistics of the log can also be seen on a map. The map shows where your QSOs have been made and how far, with the same data as the statistics table, and is meant to give you an immediate picture of your activity.

What the map shows

- **Your station:** the starting point of every line, placed from the grid locator entered in the MY GRID LOCATOR box of the LOG window (Sec. 12.3). Without a locator the distances cannot be computed, so enter it first.
- **Markers (placemarks):** one marker for each worked station / location of the log.
- **Distances:** the distance of each contact from your station is drawn as a **curved line** joining your position to the marker. Long contacts therefore appear as wide arcs, short ones as small curves.

Zoom and navigation

- **Zoom:** the map is zoomable, so that you can look at the whole world or enlarge one area (e.g. Europe) to separate close markers.

Step by step

1. Open the LOG window (OPEN LOG) and type your grid locator in the MY GRID LOCATOR box.
2. Press SAVE CONFIG in the main window (recommended) so the locator is remembered at the next start.
3. Open the STATISTICS window and open the map of the log.
4. Zoom in and out to inspect the markers and the curved distance lines.

12.9 Already-worked stations: CALL SIGN box and Partial Check

The log is also used in the main window to warn you about stations you have already contacted:

- **CALL SIGN box:** when the callsign you typed is present in the log, the box turns red and its tooltip shows the summary of the previous QSOs, for example ALREADY WORKED ✔ 3 QSO · last 2026-10-28 20m CW. The color returns to normal as soon as the callsign changes.
- **Partial Check list:** while you type, stations that are already in the log are listed first, on a red background, followed by the usual matches from the Partial Check database. Each of them shows the number of QSOs and the date, band and mode of the last one. They are shown even if the callsign is not in the Partial Check database. The header line also reports how many of the matches are already worked (e.g. PARTIAL CHECK · 12 found · 2 already worked ✔).
- **Immediate update:** right after INS. LOG the CALL SIGN box turns red, because the QSO is now in the log. The same happens when you add, edit or delete QSOs in the LOG window.
- **Variants of a callsign:** prefixes and suffixes are ignored when comparing, so I1ABC/P, I1ABC/M and EA8/I1ABC are all recognized as the station I1ABC.

Highlighting works for any log loaded from other programs, so you immediately know whether a station is a duplicate even if the previous QSO was made years ago with another software. Only the callsign is compared: bands and modes are not, so in a contest where the same station can be worked again on another band, use the tooltip or the list entry to check the details of the previous QSO.

12.10 Closing the LOG window

If the log contains unsaved changes when you close the LOG window, a question appears: YES saves the log, NO discards the changes (the file is read again from disk), CANCEL keeps the window open. The statistics window (and the map) is closed together with the LOG window.

13. VISUAL CLUSTER

13.1 Overview NEW v.16

The VISUAL CLUSTER is a separate window that shows, on a large horizontal **talking dial**, the whole band you are operating on, with the spots of the DX cluster written on it as call signs. It answers the question *"who is on the air right now on my band, and where?"* at a glance, and lets you jump to a station with a single click.

- The band is chosen **automatically from the frequency of your VFO** (or manually, Sec. 13.2).
- The **red needle** of the dial is your VFO: it moves in real time while you tune the radio, with a LED read-out of the frequency.
- Each **spot** is a label with the call sign and a thin stem pointing to its exact frequency, colored by emission mode.
- **Filters** by mode (CW / PHONE / DIGI), country, spot age and band.
- The dial can be **zoomed and scrolled** down to a few kHz to separate crowded signals.
- A click on a spot **tunes the radio** to the frequency **and sets the mode**, and copies the call sign into the CALL SIGN box.
- The graphics follow the look of the program: dark glass, amber LED digits and the phosphor-green of the radio display.

Opening the window NEW v.16

Click the **VISUAL CLUSTER** button in the top bar (Sec. 3.3). The window opens in front of the main window and immediately connects to the DX cluster. Only one VISUAL CLUSTER window can exist: if it is already open the button simply brings it to the front. The button is lit while the window is open. The window can be resized freely: the dial scales with the width and the height, showing more rows of call signs when it is taller. Closing the window closes the connection to the cluster.

> **Requirements:** Internet access, and your call sign in **Macro 4** (Sec. 7.3), used as login name for the cluster. To tune the radio the CAT link must be connected; without CAT the dial and the spots work normally, only the tuning is disabled.

13.2 The top bar of the window NEW v.16

Control	Function & Description
BAND	**AUTO** (default): the dial follows the band of the radio VFO and changes by itself when you change band. Or choose 160m, 80m, 60m, 40m, 30m, 20m, 17m, 15m, 12m, 10m, 6m, 4m, 2m manually: useful to watch a band without moving the radio, or when the radio is not connected.
MODE: CW / PHONE / DIGI	Three toggle buttons. Lit = spots of that emission mode are shown; dark = hidden. CW = telegraphy; PHONE = SSB / FM / AM voice; DIGI = FT8, FT4, RTTY, PSK and other digital modes. All three are lit at start.
COUNTRY	List of the countries **present in the spots of the current band** (updated automatically, in alphabetical order). **ALL** shows every country; choosing one shows only the spots of that country. The selected country stays in the list even if it has no spots for a moment.
AGE	Maximum age of the spots shown: 10, 30, 60 (default), 120 or 240 minutes. Older spots disappear from the dial; the older a spot, the fainter its label.
– / +	Zoom out / zoom in on the dial (the mouse wheel does the same, Sec. 13.4).
FIT	Shows the whole band again.
FOLLOW VFO	Toggle. When lit and the dial is zoomed in, the view is kept **centered on the VFO needle**: tuning the radio makes the scale slide under the needle, like on a real receiver. When dark, the view stays where you left it, and is moved only when the needle gets close to the edge of the window.
CLUSTER	DX cluster server to connect to (host:port). The list proposes several servers; the field is editable, so you can type any other telnet cluster as *host:port*.
RECONNECT	Closes the connection and reconnects to the server written in the CLUSTER field (use it after changing server or after setting your call sign).
DXHEAT	Opens the DXHeat DX cluster page (dxheat.com/dxc) in your web browser, to compare or to see the spots with the site's own tools.
Status text	Right of the buttons: connection state (Connecting to ..., Connected: host:port as CALL, Disconnected - retrying ..., or the error found).

13.3 The talking dial NEW v.16

The scale

- The scale shows the frequencies **in kHz** with long labelled ticks (major) and short ticks (minor). The spacing of the ticks adapts to the zoom: from 1000 kHz steps on a full band down to a few tens of Hz when you zoom in, always keeping the numbers readable.
- At the bottom right the label shows the band and the visible range (e.g. *20m 14000 - 14350 kHz*).
- Below the numbers a **colored strip** shows the segments of the band plan: **green = CW**, **blue = DIGI**, **amber = PHONE**. The legend is written under the strip (Sec. 13.7 for the exact limits).

The spots

- Every spot is a small box with the **call sign** and a vertical **stem** going down to the exact frequency of the signal on the scale.
- The color of the box and of the stem is the emission mode: green CW, blue DIGI, amber PHONE.
- **New spots are bright, old ones fade**: the label becomes fainter as the spot gets older, up to the AGE limit chosen in the top bar.
- **Automatic arrangement:** labels are placed on several rows so that they do not overlap, giving priority to the most recent spots. If a very crowded area has no free row, the stem is still drawn (thinner) and the label appears as soon as you zoom in enough. The number of rows grows with the height of the window.
- A spot already known (same call sign within 1 kHz) is not duplicated: the newest one replaces the old one.
- The **selected** spot (the last one clicked) and the spot under the mouse are drawn with a white, thicker border.

The VFO needle

- A **red needle** with a small triangle marks the current frequency of your VFO. It is updated in real time (also when you turn the VFO knob or use the arrows in the main window).
- Above the needle a **LED display** (amber digits on black) shows the exact frequency as MHz.kHz.Hz.
- If the VFO is outside the part of the band you are looking at, a red message with an arrow (◄ or ►) at the border tells you on which side it is, with its frequency.
- When the radio is not connected (or does not answer) the needle is not drawn and the dial shows the band chosen in the BAND list.

13.4 Mouse commands on the dial NEW v.16

Action	Result
Mouse wheel	Zoom in (wheel forward) or out (wheel back), **centered on the point under the mouse**: the frequency under the cursor stays where it is.
Drag with the left button	When the dial is zoomed in: scrolls the band left / right (the cursor becomes a double arrow). Not active on the full band.
Move the mouse over a spot	The pointer becomes a hand, the spot is highlighted and a **tooltip** shows: call sign, frequency, mode, country, spotter, UTC time and comment.
Move the mouse on the scale	The bottom bar of the window shows the frequency under the cursor ("cursor 14025.30 kHz").
Click on a spot	Selects the spot, shows its details in the bottom bar, **tunes the radio to its frequency and sets its mode**, and writes the call sign in the CALL SIGN box (Sec. 13.5).
Double click on a spot	Same as a single click (frequency + mode + call sign).
Double click on the scale	Tunes the radio to the clicked frequency (rounded to 10 Hz), with the mode foreseen by the band plan at that frequency. The call sign box is not touched. Works only on the scale area, not on the spots.

13.5 Tuning the radio from a spot (frequency and mode) NEW v.16

When you click a spot the program does three things, in this order:

1. writes the call sign of the spot in the **CALL SIGN** box of the main window (ready to be sent with Enter, to open QRZ.com, or to check the Partial Check / already-worked warning);
2. sets the radio **frequency** to the frequency of the spot;
3. sets the radio **mode** according to the table below, and reads it back, so the MODE label of the main window shows the new mode.

Spot type	Frequency	Mode set on the radio
CW	any	**CW**

Spot type	Frequency	Mode set on the radio
PHONE (voice)	below 10 MHz (160, 80, 40 m)	**LSB**
PHONE (voice)	60 m and from 10 MHz up (20, 17, 15, 12, 10, 6, 4, 2 m)	**USB**
DIGI (FT8, FT4, RTTY, PSK…)	any	**DATA** (USB with data processing)

- The mode shown for the spot is the one deduced from the comment or from the band plan (Sec. 13.7): if a digital spot has no hint in the comment and falls in a voice segment, it is treated as PHONE.
- How the mode is sent to each radio family is described in Sec. 10.4.
- The **TUNE** button in the bottom bar repeats the same operation (frequency + mode + call sign) on the selected spot, for example after you have moved the VFO by hand.
- If the radio is not connected nothing is sent (the call sign is still copied).

TX safety: tuning from a spot only changes frequency and mode in reception. Always check that the frequency is clear before transmitting, and remember that on some radios changing mode changes also the filter and the power settings stored for that mode.

13.6 Where the spots come from NEW v.16

The spots are received from a **DX cluster** through a telnet connection (TCP). A DX cluster is the worldwide network where radio amateurs and automatic skimmers report the stations they hear: the same network the DXHeat site collects. DXHeat itself does not offer a public interface for programs, so the VISUAL CLUSTER connects directly to cluster servers.

- **Login:** the program logs in with the call sign of Macro 4. No password is needed on the servers proposed. If the call sign is missing the status line shows "Call sign missing: load the macro file (4th macro = your call sign)".
- **History:** a few seconds after the login the program asks the server for the last 200 spots, so that the dial is not empty at start; then new spots arrive live.
- **Servers:** the list contains several public clusters. If a server does not answer or drops the connection, the program waits 4 seconds and **tries the next server of the list** by itself, until it connects. The server written in the CLUSTER field is tried first. The names in the list are public servers that can change or be unavailable: if none works, type a server of your choice.
- **Duplicates and memory:** the program keeps the spots of the last 4 hours (the AGE list only chooses how many are shown). A new spot of the same call sign within 1 kHz replaces the old one.
- **Bands:** only spots inside the amateur bands listed in Sec. 13.8 are used.

13.7 How mode and country of a spot are determined NEW v.16

Emission mode. The cluster does not tell the mode, so the program deduces it in two steps:

1. **from the comment** of the spot: words such as FT8, FT4, RTTY, PSK, JT65, JT9, JS8, MSK, OLIVIA, WSPR, SSTV, DATA, DIGI mean DIGI; the word CW (or beacon / NCDXF) means CW; SSB, USB, LSB, FM, AM, PHONE, VOICE mean PHONE;
2. if the comment gives no hint, **from the frequency**, using the band plan (IARU Region 1, simplified) below.

Band	CW	DIGI	PHONE
160 m	1810 - 1838	1838 - 1843	1843 - 2000
80 m	3500 - 3570	3570 - 3600	3600 - 3800
60 m	5351.5 - 5354	-	5354 - 5366.5
40 m	7000 - 7040	7040 - 7060	7060 - 7200
30 m	10100 - 10130	10130 - 10150	-
20 m	14000 - 14070, 14099 - 14101	14070 - 14099	14101 - 14350
17 m	18068 - 18095, 18109 - 18111	18095 - 18109	18111 - 18168
15 m	21000 - 21070	21070 - 21150	21150 - 21450
12 m	24890 - 24915	24915 - 24931	24931 - 24990
10 m	28000 - 28070, 28190 - 28225	28070 - 28190	28225 - 29700
6 m	50000 - 50100	50300 - 50500	50100 - 50300, 50500 - 54000
4 m	70000 - 70100	-	70100 - 70500
2 m	144000 - 144150, 144400 - 144490	144490 - 146000	144150 - 144400

Limits in kHz. The band plan is a guide: a station operating outside its usual segment can be shown with a different mode. Where the spot comment contains the mode, the comment always wins.

Country. The country is found from the **prefix of the call sign**, choosing the longest matching prefix. For calls with a slash the program ignores /P, /M, /MM, /AM, /QRP and call area digits, and uses the prefix part (e.g. EA8/IU7IWT is recognized as Canary Is.).

- **Without CTY.DAT:** an internal table with the main prefixes of about 200 countries and the most common islands is used. Special cases (rare islands, Asiatic Russia, special event calls) can be listed under the main country or as "?" (spots with unknown country appear only with COUNTRY = ALL).
- **With CTY.DAT:** if the file CTY.DAT (free from country-files.com) is placed in the program folder or in Documents\CW-IU7IWT\, the program loads it at start and the countries become those of the official DXCC list, including exceptions for single call signs.

13.8 Using CTY.DAT NEW v.16

1. Download the latest **cty.dat** from country-files.com.
2. Copy it (name CTY.DAT) in the folder of the program or in Documents\CW-IU7IWT\.
3. Restart CW Station: the file is read once, when the first spot is processed after the program starts.

Bands covered by the VISUAL CLUSTER NEW v.16

Band	Range (kHz)	Band	Range (kHz)	Band	Range (kHz)
160 m	1810 - 2000	17 m	18068 - 18168	6 m	50000 - 54000
80 m	3500 - 3800	15 m	21000 - 21450	4 m	70000 - 70500
60 m	5351.5 - 5366.5	12 m	24890 - 24990	2 m	144000 - 146000
40 m	7000 - 7200	10 m	28000 - 29700		
30 m	10100 - 10150				
20 m	14000 - 14350				

These ranges are the ones of IARU Region 1 (Europe, Africa, Middle East). Spots outside them are ignored. They differ slightly from the table of Appendix A, which is used only for the band label of the main display.

13.9 The bottom bar of the window NEW v.16

Element	Function
Information line (left)	Details of the selected spot: call sign, frequency in kHz, mode, country, spotter (de), UTC time and comment. Before any selection it reminds the main mouse commands.
Spot counter	Band and number of spots shown after the filters (e.g. "20m: 41 spot").
Cursor read-out	Frequency under the mouse pointer, in kHz.
TUNE	Repeats the tuning of the selected spot (frequency, mode, call sign). Enabled only after a spot has been selected.
QRZ.com	Opens in the browser the QRZ.com page of the selected call sign.

13.10 Practical use: a short example NEW v.16

1. You are on 20 m in CW at 14025 kHz. Click VISUAL CLUSTER: the dial opens on 20 m and the needle is at 14025.
2. Switch off PHONE and DIGI to keep only CW spots; choose in COUNTRY the country you are looking for (e.g. Japan).
3. Zoom with the wheel around the call sign you are interested in, until the label is clearly readable.
4. Click it: the radio goes to the frequency, mode CW is set, the call sign is already in the CALL SIGN box.
5. Listen, check with the red CALL SIGN box if you have already worked it, call with the macros, log with INS. LOG.

13.11 Notes and limits NEW v.16

- The spots are reports by other people: frequency and call sign can be wrong or out of date. The dial shows them as received.
- The accuracy of mode and country is described in Sec. 13.7: it is an automatic deduction.
- If the cluster connection is interrupted the dial keeps showing the spots already received until they reach the AGE limit; reconnection is automatic.

- The window does not transmit anything to the cluster except the login and the history request: you cannot send spots from CW Station.

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14. eQSL.cc UPLOAD

14.1 Overview NEW v.16

The LOG window can send an electronic QSL to **eQSL.cc** (www.eQSL.cc) directly from CW Station. Starting from the QSO you choose in the log, the program builds an ADIF record and uploads it to the ImportADIF web service of eQSL.cc, which takes care of the electronic QSL card. You do not need to export a file or to open the web site: one QSO is sent at a time, so you decide which contacts to confirm.

- The upload starts from a button on the row of each QSO in the LOG window (Sec. 12.3).
- When eQSL.cc accepts the QSO, it is marked as **sent** in the log and the date of sending is stored with it.
- Your user name can be remembered in CONFIG.TXT; the **password is never saved**.

> **Requirements:** Internet access, an eQSL.cc account (user name and password) and a QSO that contains call sign, date, time, band (or frequency) and mode.

14.2 Sending a QSL step by step NEW v.16

1. Click **OPEN LOG** in the top bar and find the QSO you want to confirm (the SEARCH box helps, Sec. 12.7).
2. Press the **eQSL** button in the row of that QSO.
3. If the QSO lacks data needed by eQSL.cc, a message tells which one is missing (CALL, DATE, TIME, BAND or FREQ, MODE). Fill the cell in the table and press the button again.
4. If the QSO is already marked as sent, the program asks *"A QSL for CALL was already sent. Send it again?"*: YES continues, NO stops.
5. The **eQSL.cc** window opens with a summary of the QSO (call sign, date and time in UTC, band, mode). Enter your user name and password, and if you wish a QTH nickname and a message (Sec. 14.3).
6. Press **SEND**. The status line shows "Sending..." (the connection is abandoned after 30 seconds).
7. On success a message confirms that the QSL was sent and that the contact is **marked as SENT**. Press **SAVE** in the LOG window to store this mark in the log file.

> **Note:** sending the QSL changes the QSO in memory only. The file on disk is updated when you press SAVE; if you forget, the LOG window asks whether to save when you close it (Sec. 12.10).

14.3 The eQSL.cc window: fields and data sent NEW v.16

Field	Function & Description
Summary line	Call sign, date, time (UTC), band and mode of the QSO that is going to be sent. It is for information only.
User name	Your eQSL.cc login name. If it is already filled, the cursor goes directly to the password box.
Password	Your eQSL.cc password. It is kept in memory **only until you close CW Station**: during the same session the window proposes it again, so you type it once. It is never written to CONFIG.TXT or to any other file.
QTH nickname (optional)	Name of the QTH profile of your eQSL.cc account to be used for this QSL. Useful if the account has more than one profile; leave empty otherwise.
Message (optional)	Text sent together with the QSL (it is stored in the QSLMSG field of the record).
Remember option	When ticked, user name and QTH nickname are saved in CONFIG.TXT (keys EqslUser and EqslNick) and proposed again at the next start. The password is not saved.
SEND / CANCEL	SEND uploads the QSO. CANCEL closes the window without sending. While the upload is running the SEND button is disabled.

Data sent to eQSL.cc. The program sends the user name and password together with a minimal ADIF record containing: **CALL**, **QSO_DATE**, **TIME_ON** (hours and minutes), **BAND** (the one of the QSO or the band worked out from FREQ), **MODE**, and, when present, **FREQ**, **RST_SENT**, the **QTH nickname** and the **message**. Other fields of the log are not sent. The request goes to www.eQSL.cc over a secure (HTTPS) connection.

14.4 Results and troubleshooting NEW v.16

Message	Meaning & Resolution
QSL sent to eQSL.cc.	The upload was accepted. The QSO is marked as SENT and the sending date (EQSL_QSLSDATE, UTC) is stored. Press SAVE in the LOG window.
eQSL.cc already has this QSO (duplicate).	The same contact was already uploaded. The QSO is marked as SENT as well. Press SAVE.
eQSL.cc needs call sign, date, time, band and mode. Missing: …	Complete the indicated column in the LOG table. BAND may stay empty if FREQ is filled in, because the band is worked out from the frequency.
Enter your eQSL.cc user name and password.	Both boxes are required before SEND.
Error text returned by eQSL.cc	The window shows the message sent back by the site (for example a wrong user name or password). Correct the data and press SEND again: the window stays open.
eQSL.cc answered HTTP nnn.	The site answered with an error code, usually a temporary problem of the server. Try again later.
Connection problem: …	No Internet connection, a firewall blocking the program, or no answer within 30 seconds.
Unexpected answer from eQSL.cc…	The answer was not recognized. The last answer of the site is saved in Documents\CW-IU7IWT\eqsl_last_response.html (it never contains the password): keep it if you ask for support.

Remember: a QSO is marked as SENT only when eQSL.cc accepted it (or already had it). A failed upload does not change the log.

15. VIDEO CONNECT NEW v.16

15.1 Overview and requirements

VIDEO CONNECT opens a live link between CW Station operators, with webcam, audio and a text chat. Up to 8 stations (you and 7 others) can be connected at the same time, each one shown in its own tile. It is meant to let you see and talk with your correspondents while you are in QSO in CW or in phone, or to hold a round table between friends.

- The call sign is the address. To be reached, a station must have its VIDEO CONNECT window open: both sides need the window.
- The video runs in a small web page inside the window (Microsoft Edge WebView2). The stations talk directly to each other; Internet is used to find each other and to carry the link.
- The webcam and the microphone are switched on as soon as the window opens, before any call, if they are present. Closing the window switches them off.
- **NEW v.16 The text chat is always on.** The window works even without webcam and microphone, and even when nobody is connected: you can write at once, and whoever asks to connect enters the chat **automatically, without any authorisation** (only audio and video need your OK, Sec. 15.3). See Sec. 15.5.

Requirements: Internet access; the Microsoft Edge WebView2 Runtime installed; your call sign in Macro 4 (Sec. 7.3); the file Video\VideoConnect.html in the program folder. A webcam and a microphone are needed only for video and audio: without them the window stays online in **chat-only mode** (Sec. 15.5). If Macro 4 is empty the program reminds you that the call sign is needed to be reached by the other station.

15.2 The window

Click VIDEO CONNECT in the top bar. Only one window can exist: if it is already open, the button brings it to the front, and it stays lit while the window is open. The CONNECT TO box is pre-filled with the call sign that is in the CALL SIGN box of the main window, so you can call the station you are working with a single click. Closing the window hangs up all the links.

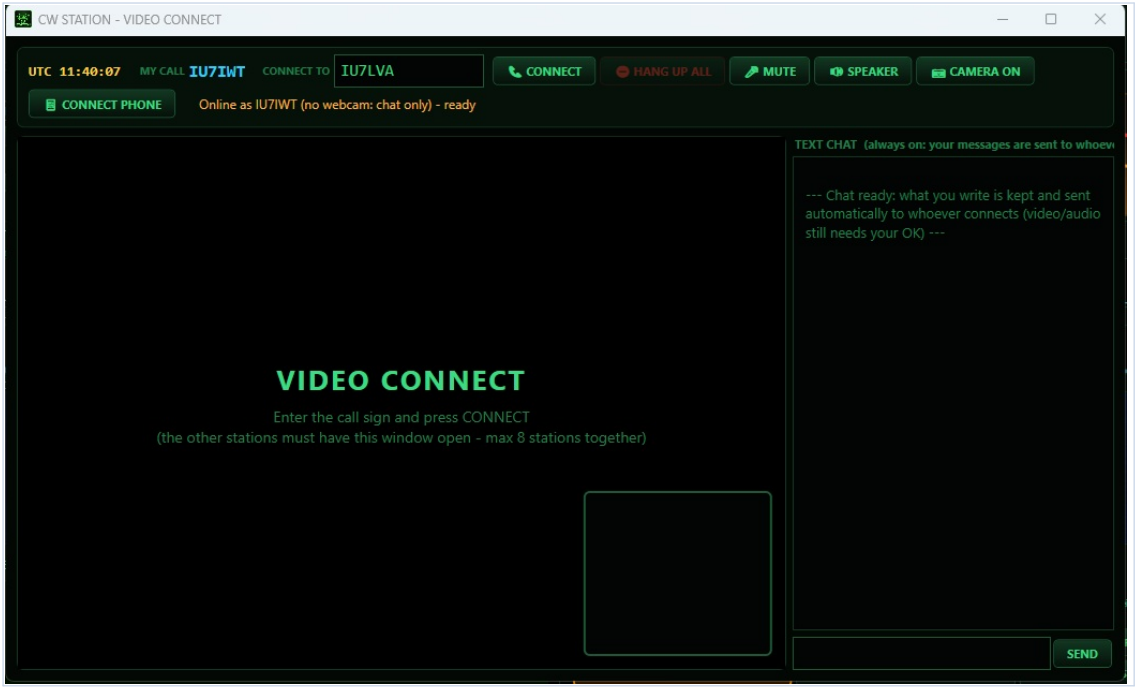

Figure 15.1 - The VIDEO CONNECT window just opened: online in chat-only mode (no webcam), text chat ready.

Control	Function & Description
UTC	Small clock with the UTC time, at the left of the top bar. Under the call sign of each station in the video the local time of the correspondent's country is shown, worked out from the prefix of the call sign.
MY CALL	Your call sign (Macro 4): it is the name under which the other stations find you.
CONNECT TO	Call sign of the station to add to the link (it must have VIDEO CONNECT open). Pressing Enter in the box is the same as CONNECT.
CONNECT	Calls the station. Disabled when 8 stations are already together.
HANG UP ALL	Closes the links with all the stations. Enabled when at least one station is connected.

Control	Function & Description
MUTE	Mutes / unmutes your microphone toward all the stations. When muted the button turns red (MUTED).
SPEAKER	Mutes / unmutes the audio of the other stations on your PC. When muted the button turns red (SPK OFF).
CAMERA ON / OFF	Switches your webcam image on or off for the others; the audio goes on. When off the button turns red.
CONNECT PHONE	Connects the audio and video of your smartphone, on the same Wi-Fi network as the PC, to the window.
Status text	Progress and errors: starting, **Online as CALL (no webcam: chat only) - ready**, calling, connected with CALL, microphone muted, link closed, and so on.
STATIONS n/8	Appears when a link is active: number of stations together (you included) and their call signs.
Video area	One tile for each remote station, with its call sign at the top left. With one remote station the picture fills the area; with more stations the tiles are arranged in a grid that adapts to their number (up to 7 remote stations). Your own image is a small mirrored preview at the bottom right. With no connected station it shows the VIDEO CONNECT start screen.
TEXT CHAT	**NEW v.16** Log of the messages and of the connection events, with the box to write and the SEND button. **Always enabled**, also with nobody connected and without webcam (Sec. 15.5).

15.3 Calling and answering

To call a station

1. Type its call sign in CONNECT TO and press CONNECT (or Enter). The status line shows "Calling CALL...".
2. The other operator receives the question "CALL is calling you for a video link. Accept?" and answers YES or NO.
3. If the answer is YES the tile of the station appears, the status line shows "Connected with CALL" and a line "--- CALL connected ---" is added to the chat log.
4. If the station does not answer within 30 seconds the program writes "CALL did not answer"; if it has not opened VIDEO CONNECT it writes "Station CALL is not online (it must open VIDEO CONNECT)". When the call is refused or not answered the link is closed on both sides and the window is ready to call the same station again.

To answer a call: keep the VIDEO CONNECT window open. When another station calls you, the question above appears: YES accepts, NO refuses. If a group link is already active, accepting a new incoming call adds the station to the group. If you already have 7 stations connected, further calls are refused automatically.

NEW v.16 Chat and call: the station that asks to connect enters your text chat at once, without waiting for your answer, and receives the messages already written. The question "Accept?" decides only about audio and video.

15.4 Up to eight stations together

- The maximum is 8 stations at the same time: you and 7 remote stations. The counter STATIONS n/8 shows how many are in the link.
- You can add the stations one by one with CONNECT. But it is enough to call one station that is already in the link: the newcomer is introduced to the others and connects to each of them by itself, and the stations already in the link accept it without asking again. Only the operator of the station called first receives the question.
- When 8 stations are together CONNECT is disabled, the status line shows "Maximum of 8 stations reached." and any other incoming call is refused.
- If a station leaves, its tile disappears, the chat shows "--- CALL disconnected ---" and the others stay connected.
- If two stations call each other at the same moment, the program solves it automatically: only one link is kept.
- To keep the link smooth every station sends a video of moderate size (about 480 x 360 pixels, at most 15 pictures per second), because it is sent to up to seven stations.
- With many stations the load on your PC and on your Internet connection grows, because every station sends its video to all the others. Use a wired connection if possible, close the other programs that use the webcam or the network and, if the link is not smooth, reduce the number of stations.

15.5 Always-on text chat NEW v.16

The TEXT CHAT panel, at the right of the video area, is independent of the video link. It works as soon as the window is open and shows the message "Chat ready: what you write is kept and sent automatically to whoever connects (video/audio still needs your OK)".

Situation	What happens
Window just opened, nobody connected	The box and the SEND button are enabled. What you write is shown in the log, is kept, and is sent automatically to every station that connects afterwards.
No webcam or no microphone	The window goes online anyway: the status line reads "Online as CALL (no webcam: chat only) - ready". The chat works completely; video and audio are sent only if the device is available.
A station asks to connect (for example from its own VIDEO CONNECT window or from the phone)	It enters the chat **automatically, without authorisation**, and receives at once the messages already written. A line "--- CALL connected ---" is added to the log.
Audio and video	They still need your consent: the question "CALL is calling you for a video link. Accept?" (Sec. 15.3) is the only authorisation required.
A station leaves	The chat shows "--- CALL disconnected ---"; the chat stays active for the others and for you.

Writing. Write the message in the box under the chat log and press Enter or SEND: the text (up to 500 characters) is sent to all the connected stations. Each line shows the UTC time (HH:mm), the call sign and the text; connections and disconnections are marked with "---". A sound signals a new connection request or a new chat message.

15.6 Notes and troubleshooting

- Use headphones, or switch the SPEAKER off, to avoid echo between the stations.
- The link uses the microphone and the playback device that are the default ones of Windows. Check that they are not the USB audio device of the radio, otherwise the radio audio would be sent to the other stations.
- VIDEO CONNECT does not use CAT, PTT or the radio: it works independently of the transceiver and nothing is recorded.
- The quality depends on the Internet connection of every station. Some networks (strict firewalls, shared mobile connections) can prevent the direct link between two stations.
- The same call sign can be online on one computer only.

Message	Probable Cause & Resolution
File not found: ...\Video\VideoConnect.html	The folder Video with the file VideoConnect.html is missing from the program folder. Copy it next to the program.
WebView2 error / "Unable to start the video component"	The Microsoft Edge WebView2 Runtime is not installed or cannot start. Install or repair it.
Unable to load the video library (Internet connection needed).	The page could not load its video library: check the Internet connection and the firewall, then reopen the window.
Webcam/microphone not available: ... **NEW v.16**	No webcam or microphone found, or another program is using them, or Windows privacy settings block them. The window stays online in chat-only mode and the chat keeps working. To use video and audio close the other program or allow access, then reopen the window.
Network problem: check the Internet connection.	The connection to the service that puts the stations in contact was lost. Check the Internet link.
Station CALL is not online ...	The other station has not opened VIDEO CONNECT, or the call sign is wrong. Ask it to open the window.
CALL did not answer.	No answer within 30 seconds. Call again.
The call sign CALL is already online on another computer.	Your call sign is in use in another VIDEO CONNECT window. Close that one.
Maximum of 8 stations reached.	Eight stations (you included) are already together. Hang up one link before adding another.
Video component still starting, wait a moment...	The window is not yet online: wait for "Online as CALL - ready" in the status line.

16. CW SSB: TELEGRAPHY THROUGH AN AUDIO OUTPUT NEW v.16

16.1 Overview NEW v.16

CW SSB lets you send telegraphy while the radio is in **SSB mode**. Instead of keying the transmitter (CAT keyer or DTR / RTS lines), CW Station generates the Morse elements itself, produces the CW tone and sends it to a **sound-card output of your choice**. The transceiver receives that tone on its audio input and transmits it as a single-sideband signal, which on the air is an ordinary CW signal.

- When CW SSB is **ON** the telegraphy is **not** sent via CAT: no CW command (Icom 0x17, Yaesu / Kenwood KY) and no DTR / RTS keying is used.
- Typed text, macros, call sign, serial numbers, "DE" and the "?" button are all sent through the audio output, with the speed of the CW TX VEL. knob.
- It is useful with radios that have no CW-over-CAT function and no key jack (Sec. 10), when the radio is used on its USB audio connection, or whenever you prefer to transmit CW with the radio in USB / LSB.
- The transmitted frequency is the dial frequency **plus the tone pitch in USB** (minus the pitch in LSB). Example: dial 14.025.000 in USB with a 700 Hz pitch gives a CW signal on 14.025.700.

16.2 The CW SSB controls in the top bar NEW v.16

The controls are placed in the top bar, next to the CW KEY controls (Sec. 3.2):

Control	Function & Description
CW SSB button	Toggle. OFF: the label is "CW SSB" and telegraphy follows the usual modes (CW KEY or CAT keyer). ON: the button is lit and shows "CW SSB ON"; the telegraphy goes to the audio output. If no output is selected a message asks you to select one.
Audio output list	Playback devices of Windows: "Default output" followed by every sound card found (for example the radio's "USB Audio CODEC"). The list is refreshed each time you open it while CW SSB is OFF; it is locked while CW SSB is ON. The first time the program prefers a device whose name contains "USB" or "CODEC". The choice is saved with SAVE CONFIG.
Pitch (Hz)	Frequency of the CW tone, from 300 to 1500 Hz (default 700 Hz). It can be changed also while CW SSB is ON: the new pitch is used at once.
PTT box	Ticked by default. When ticked, the program switches the transmitter to TX via CAT while it sends CW and back to RX when the message is finished (Sec. 16.4). Untick it if you use the radio's VOX or if the radio is not connected via CAT.

16.3 Setting up and starting CW SSB NEW v.16

1. Connect the audio: PC sound-card output → audio input of the radio. With radios that have a USB audio CODEC (for example the IC-7300) the USB cable carries it; in the radio menu select the USB audio as modulation source.
2. Set the radio to **USB** or **LSB** (or DATA), not CW. The mode can be set from the radio or via CAT (Sec. 10.4).
3. Open the audio output list in the top bar and select the sound card connected to the radio. Do not leave "Default output" if the PC also plays system sounds: they would be sent to the radio.
4. Set the tone pitch (default 700 Hz) and decide whether the program must give PTT via CAT (PTT box) or you use VOX.
5. Click **CW SSB**. The button lights, the TX history log reports that CW SSB is ON and on which device; if the radio is still in CW mode (as read via CAT) the log warns you to use USB / LSB.
6. Test on a dummy load or on an unused frequency, adjusting the output volume (Windows volume of the device or the radio's audio input level) until the radio's ALC does not move.

TRANSMISSION NOTICE: CW SSB transmits as soon as you type or press a macro. Before any test make sure the radio is connected to a dummy load or tuned to an unused frequency.

16.4 Transmitting and PTT NEW v.16

With CW SSB ON, type in the instant type line, press the macro buttons (Shift+1…9) or use "DE", "?", the serial number buttons: every character is sent as dots and dashes of the chosen pitch. The TX history log shows the text and the letters of a macro are highlighted as they are sent, as in the other modes.

Item	Behavior
Speed	Set by the CW TX VEL. knob: the value is the length of the dot in ms, so the speed in words per minute is 1200 / dot length (60 ms = 20 WPM).
Timing	Dash = 3 dots; space inside a letter = 1 dot; space between letters = 3 dots; space between words = 7 dots (Appendix B). Line breaks become word spaces.
Tone	Sine wave with soft attack and release (about 4 ms): no key clicks. The tone level is fixed at half of the digital full scale; adjust the volume downstream (Windows / radio).
PTT box ticked and radio connected via CAT	When you start sending and the radio is in RX, the program switches it to TX via CAT, waits about 150 ms and then sends the first element. About 0.4 s after the last element the PTT is released and the radio returns to RX.
PTT box not ticked, or radio not connected	The program sends no PTT command: use the radio's VOX, or hold the PTT yourself (PTT / F9 or Ctrl + Spacebar, Sec. 8.1).
PTT already engaged by hand	It is left as it is: the program releases only a PTT that it switched on itself.
DELETE	Stops the tone immediately, empties the queue of characters and releases the PTT given by the program (Sec. 7.6).

16.5 Switching CW SSB off, priority and saved settings NEW v.16

- Click **CW SSB** again (or close the program): the tone stops, the queue is emptied, the PTT given by the program is released and the telegraphy goes back to the CW KEY port or to the CAT keyer.
- While it is ON, CW SSB has **priority over both the CAT keyer and the CW KEY port** (Sec. 7.1).
- SAVE CONFIG stores the audio output, the pitch, the PTT option and the ON / OFF state (Sec. 9). If CW SSB was ON, it is switched on again at the next start; if the saved audio output cannot be opened a message is shown and CW SSB stays OFF.
- Receiving is not affected: the decoder, spectrum and waterfall work as usual while CW SSB is ON.

16.6 Notes NEW v.16

- Use an output that is not used by other programs: if the AUDIO MIC (PHONE) window or another program holds the same device, CW SSB cannot open it (Sec. 11).
- Keep the radio's speech processor / compressor off and the microphone out of use, so that only the CW tone is transmitted.
- A pure tone through the SSB filter gives a narrow signal: keep the audio level low enough to avoid ALC action and splatter, and operate inside the CW portions of the band plan.
- The audio output is not a sidetone for the operator: to monitor your own CW use the radio's monitor function.

17. QSL CARD: PERSONAL QSL VIA GMAIL NEW v.16

17.1 Overview and requirements NEW v.16

The LOG window can prepare your **personal QSL card** for any contact and send it to the correspondent **by e-mail with Gmail**. Starting from the QSO you choose in the log, CW Station opens the **QSL CARD** window, takes the image of your own card, prints on it your call sign, your name in calligraphy, your geographic position with a small map (both worked out from your own grid locator) and the data of the contact (call sign of the station worked, date, UTC time, frequency, report and mode), saves the finished card as a PNG file and opens a Gmail message, already addressed and written, ready to be sent.

- The card is built on **your own image**: a picture, scan or graphic file of your QSL (PNG, JPG or BMP). The program does not create the background of the card: it adds the text (call sign, name, position and QSO data) and, if you wish, a small map.
- One card is made for **one QSO at a time**, so you decide which contacts to confirm. The same window and the same layout can be used for all the QSOs of the log.
- The e-mail address of the correspondent is stored in the log, in the **email** column of the QSO, and is proposed again the next time you open the window.
- Gmail does not accept an attachment passed by a program: the card is therefore **saved in a folder and copied to the clipboard**, so that you can paste it into the message with Ctrl+V (Sec. 17.6).
- The e-mail is **not sent automatically**: the message leaves only when you press Send in Gmail. The QSL by e-mail is independent of the eQSL.cc upload (Sec. 14) and does not change the SENT mark of the QSO.

Requirements: Internet access, a Gmail account in which you are logged in with the default web browser of Windows, the image of your QSL card and the e-mail address of the station you want to confirm. The CAT connection and the radio are not needed.

17.2 Opening the QSL CARD window NEW v.16

1. Click **OPEN LOG** in the top bar and find the QSO you want to confirm (the SEARCH box helps, Sec. 12.7).
2. If you already know the address, type it in the **email** column of the QSO (double-click the cell, then Enter). This column replaces the former COMMENT column listed in Sec. 12.4. You can also type the address later, in the QSL CARD window.
3. Press the **send mail** button in the row of that QSO. The QSL CARD window opens (title "CW STATION - QSL CARD / SEND MAIL"): the preview of the card is on the left, the controls are on the right, and the e-mail box already holds the address stored in the log.

The preview is redrawn at once whenever you change a control. The window can be resized and the card is always shown entire.

17.3 The QSL CARD window: controls NEW v.16

The controls are placed in the right-hand panel, from top to bottom:

Control	Function & Description
LOAD CARD IMAGE…	Opens a file selector (PNG, JPG, JPEG, BMP) to choose the image of your own QSL card. The card is shown at once in the preview and its file name appears under the button. The image is remembered and loaded again the next time.
MY CALL SIGN	Your call sign, printed at the top left of the card (forced uppercase). The first time it is taken from the QSO (the call sign of Macro 4 used when the QSO was logged, Sec. 12.6); afterwards the last one used is proposed.
print my call sign on the card	Tick box. Untick it if your card already has your call sign printed.
CALL SIGN SIZE	Slider: size of your call sign. If it would be wider than about 60% of the card it is reduced automatically.
MY NAME AND SURNAME NEW v.16	Your name, printed in calligraphy below the call sign (up to 60 characters). If the box is empty nothing is printed.
print my name on the card	Tick box. Untick it if your card already has your name printed or if you do not want it on the card.
CALLIGRAPHY STYLE NEW v.16	List of the calligraphic typefaces found on your PC among: Monotype Corsiva, Edwardian Script ITC, Palace Script MT, Vladimir Script, French Script MT, Freestyle Script, Kunstler Script, Brush Script MT, Lucida Calligraphy, Lucida Handwriting, Vivaldi, Mistral, Segoe Script and Ink Free (if none is installed, Segoe Script is used). Every entry is written in its own style. The name is underlined by a thin curved flourish.
NAME SIZE	Slider: size of the name. If it would be wider than about 55% of the card it is reduced automatically.
MY GRID LOCATOR NEW v.16	Your Maidenhead locator with 4, 6 or 8 characters (for example JN63 or JN63KL), forced uppercase. Under the box the program shows the corresponding coordinates (degrees and minutes, and decimal degrees) or the message "Invalid grid locator (use 4, 6 or 8 characters, e.g. JN63 or JN63KL)". The first time the box is filled with the locator stored in the QSO (MY_GRIDSQUARE field), if present; afterwards the last one used is proposed.
print my geographic position (grid + coordinates)	Tick box. Prints, below the name (or below the call sign), a line such as "QTH JN63KL 43°32'N 12°05'E" with the coordinates of the centre of the locator square. Nothing is printed if the locator is not valid.
draw a small map with my position	Tick box. Draws on the card a small map with your position marked on it (Sec. 17.4). A valid grid locator is needed.
Europe view	Tick box (ticked by default). When your position is in Europe (roughly between 10°W and 30°E, 34°N and 59°N) the map shows Europe in detail instead of the whole world.
MAP SIZE	Slider: width of the map, as a fraction of the width of the card.
MAP HORIZONTAL POSITION	Slider: moves the map from the left edge to the right edge of the card (default: right).
MAP VERTICAL POSITION	Slider: moves the map from the top to the bottom of the card (default: top).
draw the data in a grid (table)	Ticked: the data are written in a table with a caption above every box. Unticked: only the values are written, without frame and captions.
TABLE VERTICAL POSITION	Slider: moves the table up and down, to place it on a free band of your card.
TABLE HORIZONTAL SHIFT	Slider: moves the table slightly to the left or to the right.
TEXT SIZE	Slider: size of the characters of the table (the position line takes a similar size).
TABLE & DATA TRANSPARENCY NEW v.16	Slider from 0% (opaque, default) to 90%. It makes the table and the data of the QSO more transparent, so that the picture of your card shows through. The call sign, the name, the position line and the map are not affected. The percentage is shown in the label of the slider.
TEXT COLOR	Eight colour buttons and a box with the hexadecimal code (default #101A6E, dark blue). The colour is used for the call sign, the name, the position line and the table. Dark text is printed on a light semi-transparent background, light text on a dark one, so that the data stay readable on any card.
E-MAIL OF (call sign)	E-mail address of the correspondent. It is filled with the address of the log, if present.
MESSAGE	Text of the e-mail, editable. The button **DEFAULT TEXT** rebuilds the standard text (Sec. 17.6).
SAVE IMAGE	Saves the finished card as a PNG file (Sec. 17.5).
OPEN IN GMAIL	Saves the card, copies it to the clipboard and opens the Gmail message (Sec. 17.6).
OPEN FOLDER	Opens the folder of the saved card with the file highlighted (Sec. 17.5).
Status line	At the bottom of the panel: result of the last operation, for example the path of the saved file.

17.4 What is printed on the card NEW v.16

The data are taken from the row of the QSO in the LOG window. Your call sign is printed at the top left of the card in large outlined letters, so that it stays legible on any background; below it come, if you have enabled them, your name in calligraphy and the line with your geographic position, and in the corner you have chosen the small map (see below). The data of the contact are written in a one-row table, with its captions, at the position you have chosen:

Caption	Content
CONFIRMING QSO WITH	Call sign of the station worked (CALL column).
DAY / MONTH / YEAR	Date of the QSO in UTC: day with two digits, month with three letters (JAN, FEB ... DEC), year with four digits.
UTC	Time of the QSO in UTC, as hours and minutes separated by a colon (HH:MM).
MHz	Frequency of the QSO in MHz, with three decimals. If the FREQ cell is empty, the band of the QSO is printed instead.
RST	Report sent (RST S column).
MODE	Mode of the QSO (MODE column).

If a cell of the QSO is empty in the log (for example FREQ or RST S), the corresponding box of the table stays empty: complete the QSO in the LOG window and open the QSL CARD window again. A text that is too long for its box is reduced automatically.

Other elements of the card. Besides the table, the card can carry the following elements, all set in the window described in Sec. 17.3:

Element	What is printed
Call sign	Top left, in large outlined letters in the chosen colour (the outline is light for dark text and dark for light text). Reduced automatically if it would be wider than about 60% of the card.
Name NEW v.16	Your name and surname in the calligraphic typeface chosen, below the call sign. Under the name a thin crescent-shaped flourish rises toward the right and ends with a small ink drop on the left. Reduced automatically if wider than about 55% of the card.
Position line NEW v.16	One line such as "QTH JN63KL 43°32'N 12°05'E": your grid locator followed by latitude and longitude (degrees and minutes) of the centre of the locator square. It is placed below the name, or below the call sign if the name is not printed.
Small map NEW v.16	A simplified outline map built into the program (no Internet connection is needed): the whole world or, with Europe view and a position in Europe, Europe in detail. Land is drawn in light sand colour on a blue sea, with thin lines for parallels and meridians (every 30° on the world map, every 10° on the Europe map). Your position is a red marker with two dashed red lines crossing at it; your locator is written in white at the lower left of the map, which has a gold frame with rounded corners. Size and position are set with the MAP sliders (Sec. 17.3).

17.5 Saving the card, files and folders NEW v.16

Item	Behavior
SAVE IMAGE	Saves the finished card as a PNG file named QSL_CALL_yyyymmdd_hhmm.png (for example QSL_DL1ABC_20261025_1830.png) in the folder **QSL_SENT**, inside the data folder **Documents\CW STATION**. Saving the same QSO again replaces the file. OPEN IN GMAIL saves the card in the same way.
OPEN FOLDER	Opens Windows Explorer on the folder of the saved card, with the file highlighted. If the card of that QSO has not been saved yet, the program asks "Save it now?" and then opens the folder.
Folder not writable	The program uses Documents\CW STATION or, if it is not possible, the local application data folder or the temporary folder. If the file still cannot be written, a message appears and a file selector lets you choose another folder.
QSLCARD.TXT	Settings of the window, in the data folder: image, call sign, colour, name and calligraphy style and size, grid locator and position line, map options (on / off, Europe view, size and position), table and call sign options, sizes, position and transparency. The file is written when you close the window or press OPEN IN GMAIL and is read at the next opening, so the layout is prepared once for all the cards.

NOTE: the QSL files are kept in Documents\CW STATION, a folder separate from the configuration and log files stored in Documents\CW-IU7IWT (Sec. 1.1).

17.6 Sending the card with Gmail, step by step NEW v.16

1. Open the QSL CARD window of the QSO (Sec. 17.2) and, the first time, load the image of your card with **LOAD CARD IMAGE...**.
2. Check the preview: adjust call sign, name, position line, map, table position, text size, transparency and colour until the data are well readable and do not cover important parts of the card.
3. Type or check the e-mail address of the correspondent and, if you wish, edit the **MESSAGE**.
4. Press **OPEN IN GMAIL**. The program checks the address (it must contain "@" and no spaces, otherwise it asks for a valid one), saves the card in QSL_SENT, copies the image to the Windows clipboard, stores the address in the **email** column of the QSO and opens in the web browser a new Gmail message with recipient, subject and text already filled.
5. In the Gmail message click in the body, on the empty lines left after "Here is my QSL card:", and press **Ctrl+V**: the card appears in the message. If it does not, attach the saved file with the paperclip of Gmail (the path is written in the status line of the window, or use OPEN FOLDER).
6. Check the message and press **Send** in Gmail.
7. Back in CW Station, press **SAVE** in the LOG window to write the e-mail address of the correspondent in the log file (Sec. 12.3).

Default subject and text. The subject is built by the program; the text is proposed in the MESSAGE box and can be edited (the name of the station is used instead of its call sign if it is present in the log):

Subject: QSL from IU7IWT - QSO with DL1ABC 2026-10-25

Dear DL1ABC,

thank you very much for the QSO with IU7IWT on 2026-10-25 at 18:30 UTC, 14.030 MHz, CW, RST 599. Here is my QSL card:

Hope to meet you again on the air. 73 de IU7IWT

IMPORTANT: the program only prepares the message. Gmail opens in your web browser (you must be logged in to your Google account) and the e-mail leaves only when you press Send there: you can check the card and the text, or cancel, at any time.

17.7 Notes and troubleshooting NEW v.16

Message / symptom	Probable Cause & Resolution
Load the image of your QSL card first.	No card image has been loaded. Press LOAD CARD IMAGE... and choose the file.
Enter a valid e-mail address of the correspondent.	The address is empty, has no "@" or contains spaces. Correct it in the E-MAIL box and press OPEN IN GMAIL again.
Unable to open the image: ...	The file is damaged or is not an image. Use a PNG, JPG or BMP file.
Unable to save in the default folder ... Choose another location.	The data folder is protected against writing. Choose another folder in the file selector: the card is saved there.
Unable to open the browser: ...	Windows has no default web browser. Open mail.google.com by hand, write the message and attach the card saved in QSL_SENT (OPEN FOLDER).
Ctrl+V does not paste the card	The status line of the window did not report that the image was copied, or the cursor was not in the body of the message. Click in the body and try again, or attach the saved file with the paperclip.
Gmail asks to sign in or to choose the account	The default browser is not logged in to Google, or several accounts are open. Sign in with the account from which you want to send the QSL.
The data are hard to read on the card	Change TEXT COLOR, increase TEXT SIZE, reduce the TABLE & DATA TRANSPARENCY, or move the table with TABLE VERTICAL POSITION / HORIZONTAL SHIFT over a quieter area of the image.
Invalid grid locator (use 4, 6 or 8 characters, e.g. JN63 or JN63KL) NEW v.16	The MY GRID LOCATOR box contains a locator that is not valid: two letters (A-R), two digits and, optionally, two letters (A-X) and two digits. The position line and the map are not drawn until it is correct.
The map does not appear NEW v.16	Tick "draw a small map with my position" and check that the grid locator is valid. If the map covers an important part of your card, change MAP SIZE and the MAP HORIZONTAL / VERTICAL POSITION.
The name is not in calligraphy NEW v.16	Check that "print my name on the card" is ticked and that the name box is not empty. The typefaces offered are those installed in Windows: if the list contains only Segoe Script, install a calligraphic font and reopen the window.

18. SCAN: FAST BAND SCAN WITH WATERFALL NEW v.16

18.1 Overview NEW v.16

The **SCAN** button opens a window that turns your transceiver into a **band scope**. The program tunes the radio step by step over a range of frequencies, reads the S-meter at every step and draws what it finds on a spectrum and on a scrolling waterfall, so that you see at a glance **where there is activity** on the band, much as on an SDR receiver.

- The range can be an amateur band, the whole HF range (1.8 - 30 MHz) or any range typed in kHz.
- The **spectrum** shows the level found at every frequency in the last sweep; the points above the activity threshold are highlighted in orange.
- The **waterfall** keeps the history of the sweeps: every new sweep is a new row, so that steady carriers, beacons and busy segments stand out as bright traces.
- The **ACTIVITY list** gives the frequency and the S-meter level of every signal found. A double click on it, or a click on the spectrum or on the waterfall, tunes the radio.
- It works through the CAT link only: no additional hardware, audio input or SDR dongle is needed.

> **Requirements:** the radio must be connected in CAT (CONNECT) and in reception: a scan cannot start while the radio is transmitting. Unlike a real SDR, a transceiver receives one frequency at a time: the scan visits the frequencies in sequence, so a very short signal can be missed between two sweeps, and the level shown is the S-meter reading of the receiver (the mode and the filter of the radio are not changed).

18.2 Opening the window NEW v.16

Click **SCAN**, in the radio display area on the left of the LED frequency (Sec. 5). Only one SCAN window can be open at a time: if it is already open, the button simply brings it to the front. The button stays lit while the window is open. When the window opens, the RANGE list is set on the band of your VFO (on 20 m if the VFO is outside the bands of the list). Closing the window stops the scan and the radio returns to the frequency it had.

18.3 The controls of the SCAN window NEW v.16

The controls are placed in the bar at the top of the window:

Control	Function & Description
RANGE	List of the ranges: 160 m, 80 m, 60 m, 40 m, 30 m, 20 m, 17 m, 15 m, 12 m, 10 m, 6 m, **ALL HF 1.8-30 MHz** and **Custom**. Choosing a band fills FROM / TO with its limits (in kHz: 160 m 1810-2000, 80 m 3500-3800, 60 m 5351.5-5366.5, 40 m 7000-7200, 30 m 10100-10150, 20 m 14000-14350, 17 m 18068-18168, 15 m 21000-21450, 12 m 24890-24990, 10 m 28000-29700, 6 m 50000-52000).
FROM kHz / TO kHz	Start and end of the range, in kHz (a decimal point or comma can be used, e.g. 14025.5). Typing in these boxes switches RANGE to Custom. The start must be at least 30 kHz and the end greater than the start.
STEP	Distance between two frequencies read by the radio: 50 Hz, 100 Hz, 250 Hz, **500 Hz** (default), 1 kHz, 2.5 kHz, 5 kHz, 10 kHz. ALL HF selects 5 kHz. A sweep is limited to 3000 points: if the range would need more, the program increases the step by itself (in multiples of 50 Hz).
SPEED	Time the program waits after every change of frequency before reading the S-meter: **Max speed** (no wait), **Fast** (15 ms, default), **Normal** (30 ms), **Accurate** (60 ms). Faster sweeps are less accurate on weak signals, because the receiver has less time to settle.
Continuous	Ticked (default): the sweep is repeated again and again until STOP. Unticked: one sweep only, then the scan ends.
THRESHOLD	Slider (+3 … +50, default +12): how many units above the noise floor a level must be to count as a signal (Sec. 18.4).
START / STOP	START begins the scan. While a scan is running the button becomes **STOP** (the Esc key does the same) and the radio returns to its previous frequency. If the range is wrong or the radio is not ready, the status line explains why.
CLEAR	Erases the spectrum, the waterfall and the activity list; the next sweep starts from scratch.

18.4 Reading the display NEW v.16

The window is divided into the spectrum (top), the frequency scale, the waterfall (below) and the ACTIVITY list (right).

Element	Meaning
Spectrum curve (cyan)	Level read at every frequency in the latest sweep: the higher the curve, the stronger the signal.
Orange bars and labels	Points above the threshold. The frequencies (in MHz) of the ten strongest signals are written above their peaks.
Red dashed line	Activity threshold = noise floor + THRESHOLD. The noise floor is worked out automatically from the quietest part of the sweep (first quartile of the levels) and smoothed, so it follows the band conditions.
Green vertical line	Frequency the radio is reading at this moment (position of the scan).
Yellow vertical line	Frequency of your VFO.
Frequency scale	Labels in MHz at automatic intervals, adapted to the width of the range.
Waterfall	One row for each sweep. The top row is the sweep in progress: it is filled from left to right while the radio scans, and the part not yet scanned still shows the previous sweep. When a sweep ends the row moves down (about 160 rows of history are kept). Colours go from black / dark blue (noise) through blue and yellow to white (strong signal); the colour scale follows the noise floor automatically. Small orange marks on the upper edge of the waterfall point to the signals found.
ACTIVITY list	Signals found in the current sweep, in frequency order (up to 80): frequency as MHz.kHz.Hz and level as S-units (S1-S9, S9+dB). Neighbouring points above the threshold are joined into one signal, shown at its strongest point (gaps of less than about 300 Hz are bridged when the step is small). Double click = tune.
Status line	While scanning: current frequency, noise floor (as S-units) and number of signals found. At the right: frequency and level under the mouse pointer.

18.5 Tuning the radio and stopping the scan NEW v.16

- **Click on the spectrum or on the waterfall:** the radio is tuned to the frequency under the pointer; the scan stops and the radio stays on the new frequency.
- **Double click on a signal of the ACTIVITY list:** same as above, on the frequency of that signal. Mode and filter are not changed.
- **STOP, Esc or closing the window:** the radio goes back to the frequency it had before the scan.
- The scan **gives way to you**: turning the VFO knob, the arrow keys, a click on a spot of the VISUAL CLUSTER or pressing PTT stops the scan at once and the radio stays where you have put it.
- A scan cannot be started while the radio is transmitting.

18.6 Speed of the scan and choice of the step NEW v.16

The speed depends on how fast the radio answers on the CAT link: every point needs a frequency command, the waiting time chosen with SPEED and an S-meter reading. As a guide, an Icom radio at 19200 baud with SPEED = Fast reads about 25 points per second; Yaesu and Kenwood radios are slower. Example: 20 m (350 kHz) with a 500 Hz step is about 700 points, i.e. roughly half a minute per sweep. The step is a compromise between detail and time: scan a wide range with a large step first, then repeat on the interesting part with a narrow range and a small step.

Purpose	Suggested STEP
CW signals	250 - 500 Hz. A CW signal is only about 200 Hz wide: with a larger step it can fall between two points and not be seen.
SSB / phone	1 - 2.5 kHz.
Overview of a whole band or of the HF range	5 - 10 kHz, then repeat on a narrower range around the part you are interested in.

18.7 Practical example NEW v.16

1. You are on 20 m and want to know where the CW stations are. Click **SCAN**: the window opens on 20 m.
2. Set STEP to 500 Hz, leave SPEED on Fast and press **START**.
3. After the first sweep the spectrum shows the peaks and the ACTIVITY list is filled. If almost everything is orange, increase THRESHOLD; if you see too few signals, reduce it.
4. Let the waterfall run for a few sweeps: traces that stay on the same frequency are beacons or stations calling continuously, those that appear and disappear are QSOs in progress.

5. Double click a frequency of the list: the radio is tuned there and you can listen with the decoder and the waterfall of the main window. Then use the CALL SIGN box, the macros and INS. LOG as usual.

18.8 Notes and troubleshooting NEW v.16

> **Notes:** while the scan is running the radio receives the frequencies in turn, so the audio you hear and the decoder of the main window follow the scan: stop it before decoding or answering a station. The LED frequency and the S-meter of the main window are not updated during the scan and are aligned again with the radio when it ends. SCAN does not change the mode, the filter or the power of the radio.

Message / symptom	Probable Cause & Resolution
Radio not connected, or in transmission: scan not started.	The CAT link is closed or the radio is transmitting. Press CONNECT in the main window, return to reception and press START again.
Invalid range: enter From / To in kHz (To greater than From).	The FROM / TO boxes contain text that is not a number, TO is not greater than FROM, or FROM is below 30 kHz. Correct them (or choose a band in RANGE) and press START.
The scan stops by itself	You turned the VFO knob, used the arrow keys, clicked a spot of the VISUAL CLUSTER or pressed PTT: the scan always gives way to these commands. Press START again. If "Continuous" is not ticked the scan also ends after one sweep.
The scan is very slow	Increase the CAT baud rate (radio menu and main window), choose SPEED = Fast or Max speed, use a larger STEP or a narrower range.
The spectrum is flat, no signals	Check the antenna and the settings of the radio (RF gain, attenuator, preamp): the S-meter of the radio must move when you tune a signal by hand. Reduce THRESHOLD.
Too many signals / everything is orange	Increase THRESHOLD. On a crowded band or with a high noise level the activity is spread over the whole range.
A known signal is missing	Use a smaller STEP (a CW signal can fall between two points) or SPEED = Accurate. The reading depends on the filter of the radio: a signal outside the filter is not seen.

19. RTTY MODE: RADIOTELETYPE RECEPTION AND TRANSMISSION NEW v.16

19.1 Overview NEW v.16

The **RTTY MODE** button, placed next to **SCAN** on the left of the LED frequency (Sec. 5), turns CW Station from a telegraphy program into an **RTTY station**: the same window receives, decodes and transmits radioteletype (Baudot, 5 bits, frequency-shift keying with two audio tones), without any additional hardware or program.

- **Reception.** The audio of AUDIO INPUT (the same samples that feed the spectrum and the waterfall) is sent to an RTTY decoder. The decoded text appears in the **RECEPTION** pane, in place of the CW text.
- **Transmission.** The text typed in the instant type line, the macros, the call sign, *DE*, the serial numbers and the "?" button are sent as an RTTY tone (AFSK, continuous-phase) to the audio output chosen in the list beside the CW SSB button. PTT can be given via CAT.
- **Standard values.** MARK 2125 Hz, SPACE 2295 Hz (shift 170 Hz), 45.45 baud, the usual amateur RTTY. Shift (170, 200, 425, 450, 850 Hz) and speed (45.45, 50, 75, 100 baud) can be changed.
- **Tuning aids.** Two coloured lines on the waterfall mark the two tones, and the RTTY XY scope (Sec. 21) shows at a glance whether the signal is tuned and in sync.

> **Requirements:** START RX must be active for reception. For transmission an audio output connected to the radio must be selected in the list beside the CW SSB button, and the radio must be in **USB or USB-D** (LSB if you use the Reverse option). The CAT connection is needed only for the automatic PTT. RTTY MODE, PSK MODE (Sec. 20) and CW SSB use the same audio output and are mutually exclusive: switching one on switches the others off.

19.2 Switching RTTY MODE on and off NEW v.16

1. Click START RX and check that the spectrum and the waterfall are running.
2. Set the radio to USB or USB-D (see the note above for LSB). If the radio is connected via CAT and its mode is not USB / LSB, the TX history log reminds you.
3. Open the audio output list next to the CW SSB button and select the sound card connected to the radio (for example "USB Audio CODEC"). If no output is selected a message asks you to choose one.
4. Click **RTTY MODE**. The button lights, the TX history log reports "RTTY MODE ON" with the output device and the PTT option, the audio output list is locked and the **RTTY MODE window** (Sec. 19.3) opens.
5. Click on the waterfall between the two coloured lines to tune the station (Sec. 19.4); the decoded text appears in the RECEPTION pane.
6. To go back to telegraphy click RTTY MODE again, or close the RTTY MODE window: the PTT given by the program is released, the audio output is closed and the RECEPTION pane shows the CW decoder again.

19.3 The RTTY MODE window NEW v.16

The window opens in front of the main window while RTTY MODE is on. Every change takes effect at once, also during reception and transmission.

Control	Function & Description
Low tone (Hz)	Frequency of the lower of the two tones (default 2125 Hz). Type a value and press Enter, or click on the waterfall (Sec. 19.4). Range 300 Hz to 2900 Hz minus the shift.
Shift (Hz)	Distance between the two tones: 170 (default), 200, 425, 450 or 850 Hz.
Baud	Speed: 45.45 (default), 50, 75 or 100 baud.
Squelch	Off, Low, Medium or High. A reference filter outside the signal measures the noise; a character is printed only if the signal is stronger than the reference by about 8 dB (Low), 11 dB (Medium) or 14 dB (High). Medium is the default; Off prints everything, including noise.
TX level	Amplitude of the transmitted tone (default half of the digital full scale). Adjust it together with the Windows volume or the radio audio input level so that the ALC does not move.
Reverse (swap MARK / SPACE)	Exchanges the roles of the two tones: with Reverse the higher tone is MARK. Use it for stations received in LSB or transmitting with inverted polarity, and when the XY scope (Sec. 21) is mirrored.

Control	Function & Description
Unshift on space (USOS) in RX	Ticked by default: after a space the decoder returns to letters, as most RTTY programs do. Untick it if the other station does not use USOS and figures are printed as letters.
CLEAR RX	Empties the RTTY text in the RECEPTION pane.
MARK / SPACE line	Shows the frequencies in use, for example "MARK 2125 Hz / SPACE 2295 Hz".

19.4 Tuning a station on the waterfall NEW v.16

While RTTY MODE is on, the waterfall shows the position of the two tones:

Mark on the waterfall	Meaning
Cyan vertical line	The lower tone (Low tone).
Orange vertical line	The higher tone (Low tone + shift).
Pale band between the lines	The pair of tones that is being decoded. Yellow lines of the CW decoder remain visible but are not used by the RTTY decoder.

- **Click** on the waterfall **between the two traces** of the signal: the centre of the pair of tones moves to the clicked frequency (the Low tone becomes the clicked frequency minus half the shift) and the window shows the new value.
- The two traces of an RTTY signal alternate: each one lights up when its tone is sent. When both coloured lines lie on the two traces the decoder prints readable text; refine the position with the XY scope (Sec. 21).
- There is no automatic frequency control in the RTTY decoder: if the other station drifts, click again on the waterfall.

19.5 Receiving RTTY NEW v.16

- **How it works.** Two filters matched to one bit measure the MARK and SPACE tones; the decoder looks for the start bit, samples the five data bits at the centre of every bit and checks the stop bit. Characters with a wrong stop bit are discarded.
- **Letters and figures.** The LTRS / FIGS shift codes of the Baudot alphabet are followed automatically. Printed symbols: - ' $, ! : ( ) + # . / ? & ; and the digits. Bell, carriage return and null are not printed; a line feed starts a new line.
- **RECEPTION pane.** The text is shown in the usual pane and keeps scrolling to the end. Selecting a call sign with the mouse still copies it into the CALL SIGN box (Sec. 7.3.1). The **DELETE** button of the RECEPTION pane (the one that clears the text) also clears the RTTY text.
- **CW decoder.** While RTTY MODE is on the CW text is not shown; spectrum, bins and waterfall continue to work. When RTTY MODE is switched off the CW text comes back.

19.6 Transmitting RTTY NEW v.16

With RTTY MODE on, nothing is sent via CAT keyer or DTR / RTS: all the text goes to the audio output. Type in the instant type line, press the macros (Shift+1…9) or use the call sign, *DE*, serial number and "?" buttons, as in CW (Sec. 7).

Item	Behavior
Characters	Letters A-Z (lowercase is converted), digits 0-9, space and the symbols - ' $, ! : ( ) + # . / ? & ;. Other characters (for example " = @) cannot be represented in the Baudot table used and are omitted. A line break (Enter in the instant type line) is sent as carriage return + line feed.
Start of a transmission	If the PTT box is ticked and the radio is connected via CAT, the program switches the radio to TX; then a MARK carrier of about 0.2 s is sent, followed by two LTRS characters for synchronism and then the text. Without automatic PTT the carrier lasts about 4 bits.
Letters / figures	The program sends LTRS or FIGS only when needed. After a space inside figures the shift is sent again at the next character, so that the text is received correctly by programs that use USOS and by those that do not.
End of a transmission	A short MARK tail is added; about 0.5 s after the last character the PTT given by the program is released and the radio returns to RX.
PTT already engaged by hand	It is left as it is: the program releases only a PTT that it switched on itself. Without CAT use the VOX of the radio or the PTT (F9) button.

Item	Behavior
DELETE	Stops the tone immediately, empties the queue of characters and releases the PTT given by the program (as in Sec. 7.6).
Level	The tone is generated at the TX level set in the RTTY MODE window. Keep the speech processor off and the level low enough that the ALC does not move: RTTY is a continuous-carrier mode.

TRANSMISSION NOTICE: RTTY MODE transmits as soon as you type or press a macro. Before any test connect the radio to a dummy load or tune it to an unused frequency.

19.7 Notes and troubleshooting NEW v.16

Symptom	Probable cause & resolution
Nothing is printed	START RX is not running, the Low tone is not on the signal (click on the waterfall between the two traces), the baud rate or the shift are not those of the station, or the squelch is too high (try Low or Off).
Only garbage is printed	Wrong baud rate or shift, or MARK and SPACE are exchanged: tick or untick Reverse. The XY scope (Sec. 21) helps to find the cause.
Figures are printed as letters (or the opposite)	A shift code was lost on a weak signal, or the other station does not use USOS: change "Unshift on space".
RTTY MODE: "Select the audio output..."	No output is selected next to the CW SSB button. Choose the output connected to the radio and press RTTY MODE again.
"Unable to open the audio output"	The device is in use (AUDIO MIC, CW SSB, PSK MODE or another program) or unplugged. Close the other function and retry.
The radio does not transmit	Radio in USB / USB-D, PTT box ticked and radio connected via CAT (or VOX enabled), modulation input of the radio set to the USB audio.
Settings are lost at the next start	The RTTY settings are not stored in CONFIG.TXT: the default values (2125 Hz, 170 Hz, 45.45 baud) are used at every start.

20. PSK MODE: PSK31 AND SIMILAR MODES NEW v.16

20.1 Overview NEW v.16

The **PSK MODE** button, next to RTTY MODE, opens the **PSK MODE window**: a complete station for the phase-shift modes **BPSK31, BPSK63, BPSK125 and BPSK250**. Text is coded in Varicode (the PSK31 alphabet, in which frequent letters have short codes) and sent by reversing the phase of a single audio carrier: a phase reversal is a 0, no reversal is a 1. The carrier is shaped with a raised-cosine envelope, so the signal is very narrow (about 31 Hz for BPSK31).

- **Reception.** The decoder uses the audio of AUDIO INPUT (the same samples as the waterfall), finds the symbol timing by itself, follows the carrier with an automatic frequency control (AFC) and prints the text in the window.
- **Transmission.** The text written in the window, the CQ button, and also the instant type line and the macros of the main window, are sent as a PSK carrier to the audio output chosen beside the CW SSB button, with automatic PTT via CAT if the PTT box is ticked.
- **Modes.** BPSK31 (31.25 baud), BPSK63 (62.5), BPSK125 (125) and BPSK250 (250). QPSK modes (QPSK31, QPSK63) are not included.

> **Requirements:** the same as RTTY MODE (Sec. 19.1): START RX for reception, an audio output connected to the radio selected beside the CW SSB button, the radio in **USB or USB-D**. PSK MODE, RTTY MODE and CW SSB are mutually exclusive.

20.2 Opening and closing the window NEW v.16

1. Click START RX and set the radio to USB or USB-D.
2. Select the audio output next to the CW SSB button (the one connected to the radio).
3. Click **PSK MODE**. The button lights, the TX history log reports "PSK MODE ON" with the output device, the audio output list is locked and the PSK MODE window opens.
4. Click on the waterfall on the trace of the station you want to receive: the carrier frequency of the window is set to the clicked frequency (Sec. 20.4).
5. To leave, close the window or click PSK MODE again: the PTT given by the program is released and the audio output is closed.

20.3 The PSK MODE window NEW v.16

Control	Function & Description
Mode	BPSK31, BPSK63, BPSK125 or BPSK250. Choose the mode used by the other station: the signal of a faster mode is wider and cannot be decoded with a slower one.
Carrier Hz	Audio frequency of the carrier (default 1000 Hz, range 400 - 2800 Hz). Type a value and press Enter, or click on the waterfall.
AFC	Ticked by default. The decoder corrects the carrier frequency continuously by up to half the baud rate (about 15 Hz in BPSK31). Clicking on the waterfall or typing a new carrier resets the correction.
Squelch	Off, Low, Medium (default) or High: the signal must be stronger than a reference filter placed beside the carrier by about 6 dB, 9.5 dB or 12 dB. Off prints everything, including noise.
TX level	Amplitude of the transmitted carrier (default half of the digital full scale). Adjust it together with the Windows volume or the radio audio input level so that the ALC does not move.
CLEAR RX	Empties the RECEIVED area.
RECEIVED	Decoded text, scrolling to the end. A line break is shown when a carriage return or line feed is received.
TRANSMIT line	Type the text and press Enter: the whole line is sent, followed by a line break. The line is then cleared.
SEND	Same as Enter in the TRANSMIT line.
CQ	Sends "CQ CQ CQ DE call call call PSE K" with your call sign (Macro 4, Sec. 7.3). If Macro 4 is empty the status line asks you to set it.
STOP TX	Stops the transmission at once, empties the queue and releases the PTT given by the program.

Control	Function & Description
Status line	Carrier frequency, current AFC correction in Hz and the state: SIGNAL LOCKED (a PSK signal is received and the symbol timing is locked) or no signal.

20.4 Tuning a PSK signal NEW v.16

- The waterfall shows a pale band with a cyan and an orange line centred on the carrier of the window; the width of the band is the width of the mode (about 31 Hz for BPSK31).
- **Click** on the trace of the station: the carrier is set to the clicked frequency. A BPSK31 signal is a thin, steady trace with a slightly "fuzzy" look; when the status line shows **SIGNAL LOCKED** and the AFC value is small, the signal is being decoded.
- The AFC pulls in an error of up to half the baud rate; a larger error must be corrected by clicking again. If two stations are close together keep the carrier on the stronger one.
- The first characters after the signal appears may be lost: the decoder needs about one second to find the symbol timing. The preamble of the other station gives it that time.

Mode	Baud	Approximate width	Typical use
BPSK31	31.25	31 Hz	Standard keyboard-to-keyboard QSO, most activity.
BPSK63	62.5	63 Hz	Faster QSO on good signals.
BPSK125	125	125 Hz	Fast exchanges on strong signals.
BPSK250	250	250 Hz	Very fast, strong signals only.

20.5 Transmitting PSK NEW v.16

Item	Behavior
Characters	The ASCII characters (codes 0 to 127: letters, digits, punctuation) in Varicode, uppercase and lowercase kept as typed. Other characters (for example accented letters) are omitted. A line break is sent as carriage return + line feed.
Start of a transmission	If the PTT box is ticked and the radio is connected via CAT, the program switches the radio to TX and sends a preamble of phase reversals (at least 32 symbols, 1.5 seconds of symbols for the faster modes: about 1 s in BPSK31) so that the other station can lock before the text.
End of a transmission	A tail of 8 phase reversals is added; the carrier then fades out smoothly (no clicks) and, about 0.5 s after the end, the PTT given by the program is released.
Main window	While PSK MODE is on, the instant type line, the macros, the call sign, *DE* and the serial numbers of the main window are sent in PSK too, and the text appears in the TX history log. For long messages the TRANSMIT line of the PSK window is the more comfortable choice because it sends complete lines.
PTT already engaged by hand	Left as it is: the program releases only a PTT that it switched on itself.
STOP TX / DELETE	Stops the carrier immediately, empties the queue and releases the PTT given by the program.

> **TRANSMISSION NOTICE:** PSK MODE transmits as soon as you press SEND, CQ or Enter. Test on a dummy load or on an unused frequency. PSK is a linear mode: keep the audio level low so that the ALC does not move, or the signal becomes wide and distorted.

20.6 Notes and troubleshooting NEW v.16

Symptom	Probable cause & resolution
"no signal" and nothing decoded	START RX is not running, the carrier is not on the trace, the mode is not the one of the station, or the squelch is too high (try Low or Off).
SIGNAL LOCKED but only garbage	Wrong mode (BPSK31 / 63 / 125 / 250) or a signal that is not BPSK (for example QPSK, which is not supported), or a very weak or distorted signal.

Symptom	Probable cause & resolution
Some letters are missing	Weak or fading signal, or overlapping station. Increase the audio level of AUDIO IN VOL if the signal is weak; retune on the stronger station.
The radio does not transmit	Radio in USB / USB-D, PTT box ticked and radio connected via CAT (or VOX enabled), modulation input set to the USB audio of the radio.
The transmitted signal is too wide	The audio level is too high and the radio is compressing: lower the TX level of the window or the Windows volume until the ALC does not move.
Settings are lost at the next start	The PSK settings are not stored in CONFIG.TXT: the default values (BPSK31, 1000 Hz) are used at every start.

21. RTTY XY SCOPE: GREEN-PHOSPHOR TUNING INDICATOR NEW v.16

21.1 Overview NEW v.16

The main window carries a small **XY oscilloscope** with a green-phosphor display and persistence, like the old CRT monitors used for tuning RTTY. It sits **on the left of the LED frequency** and is **always on**: it does not need RTTY MODE, it is fed by the same audio as the spectrum and the waterfall, and it works as soon as START RX is running. The LED frequency, the VFO knob and the S-meter keep their order and are moved a little to the right.

- The **horizontal axis (X)** is the output of a band-pass filter on the MARK tone, the **vertical axis (Y)** is the output of a band-pass filter on the SPACE tone. The letters M and S at the ends of the axes remind you.
- The two tones are those of the RTTY MODE window (default MARK 2125 Hz, SPACE 2295 Hz, 170 Hz shift, 45.45 baud); the width of each filter follows the baud rate (1.5 times the baud rate, about 68 Hz at 45.45 baud). If you change them in the RTTY MODE window the scope follows.
- The size of the picture is adapted automatically (AGC), so a weak and a strong signal fill the screen in the same way.
- The trace is drawn in bright green with a lighter core and fades slowly (the light halves in about 0.16 s), so the last half second of movement stays visible, as on a real CRT.

21.2 Reading the display NEW v.16

What you see	Meaning
Two crossed ellipses forming a symmetric "+" cross	The signal is tuned and in sync: the MARK tone moves the spot along the horizontal axis, the SPACE tone along the vertical one. This is the picture to look for before relying on the decoder.
The cross is tilted, lopsided or one arm is much weaker	The two tones are not centred on the two traces. Click on the waterfall between the traces, or change Low tone and Shift in the RTTY MODE window, until the cross is symmetric.
The cross is mirrored (arms exchanged)	MARK and SPACE are exchanged (signal received in the other sideband or inverted polarity): tick or untick Reverse.
Only one arm (a line)	Only one of the two tones is present: carrier of an unmodulated station, or the other tone is outside the filter. Check the position and the shift.
A shapeless tangle of light	No RTTY signal in the filters: only noise. Tune on a station or check START RX and AUDIO IN VOL.
A blurred, rotating cloud	A signal of another mode, or an RTTY signal whose speed is not the one set (try 50, 75 or 100 baud).

21.3 Using the scope to tune NEW v.16

1. Start RX and open RTTY MODE (Sec. 19.2).
2. Click on the waterfall between the two traces of the station.
3. Watch the scope: refine the Low tone with small corrections until the two ellipses form a symmetric cross and the persistent image is steady.
4. If the cross is mirrored use Reverse; if it is too thin or too wide check the baud rate.
5. Read the decoded text in the RECEPTION pane: when the cross is good the text is clean.

> **Note:** the scope shows only RTTY: with PSK MODE or CW the picture is not meaningful. Being always on, it costs very little processing power and does not need any setting; its frame, the M / S letters and the glass reflection are only decoration.

22. FT8 MODE: FT8 / FT4 / FT2 STATION NEW v.16

22.1 Overview NEW v.16

The **FT8 MODE** button, placed with the other digital-mode buttons (next to RTTY MODE and PSK MODE), opens the **FT8 / FT4 / FT2** window: a complete station for the weak-signal digital modes. The program decodes all the stations heard in the audio passband, lets you answer a call with a double click, sends the standard messages, follows the QSO sequence and logs the contact.

- **Band activity.** Every decoded message is listed with UTC, signal level (dB), time offset (DT), audio frequency (Hz) and text; the flag of the country is shown on each row.
- **My QSO.** A separate list collects the messages addressed to you, your own transmissions and the logged contacts.
- **Six standard messages.** Tx1 … Tx6 are built automatically from the DX call, the locators and the reports; an automatic sequence can step through them.
- **Log.** The QSOs are saved in ADIF format in the file FT8_LOG.adi in your Documents folder. The Cabrillo log LOG.TXT is not used.
- **QRZ and MAP.** The QRZ button opens the profile of the selected station; the MAP button opens a world map of the QSOs with curved lines (Sec. 22.5).

Requirements: START RX running (the audio of the radio feeds the decoder); the PC clock synchronised with an NTP time server, because the time slots are fixed on UTC; for transmission an audio output connected to the radio selected in the list beside the CW SSB button, the radio in USB or USB-D with the speech processor off, and optionally the CAT connection for the automatic PTT. FT8 MODE uses the same audio output as CW SSB, RTTY MODE and PSK MODE: use one of these functions at a time.

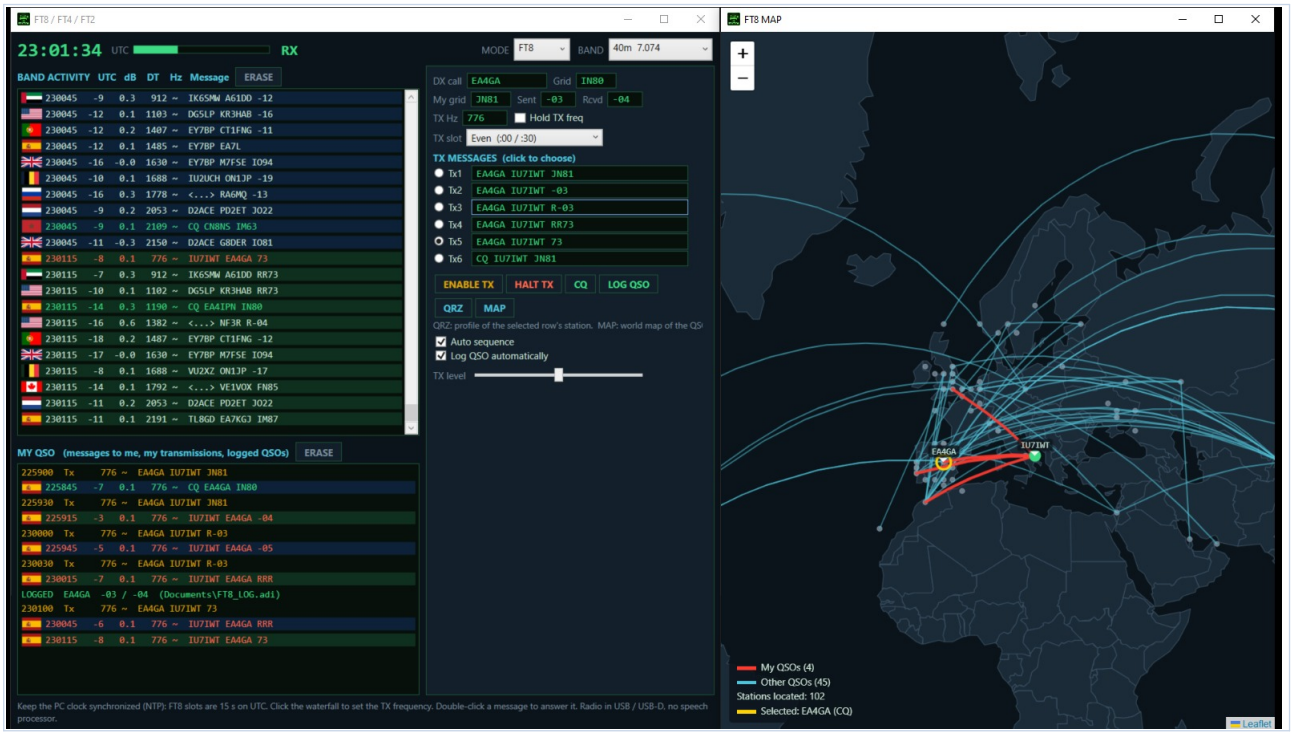

Figure 22.1 - The FT8 / FT4 / FT2 window (left) and the FT8 MAP window (right).

22.2 Opening and closing the window NEW v.16

1. Click START RX and check that spectrum and waterfall are running. Set the radio to USB or USB-D.
2. Select the audio output connected to the radio in the list beside the CW SSB button.
3. Click FT8 MODE: the button lights and the FT8 / FT4 / FT2 window opens.
4. Choose MODE (FT8, FT4 or FT2) and BAND in the top right of the window. Decoded messages start to appear when the first slot ends.
5. To leave, close the window or click FT8 MODE again: the PTT given by the program is released and the audio output is closed.

22.3 The FT8 / FT4 / FT2 window NEW v.16

Control	Function & Description
UTC clock and bar	UTC time with a bar that shows the progress of the current time slot, followed by the state: RX (receiving) or TX (transmitting).
MODE	FT8, FT4 or FT2. Choose the mode used by the other stations: the length of the slot depends on the mode (FT8: 15 s).
BAND	Band and dial frequency in use (for example 40m 7.074 MHz).
BAND ACTIVITY	List of all the decoded messages: UTC, dB, DT, Hz and message, with the flag of the country of the station. CQ calls and messages addressed to you are highlighted. Double-click a message to answer it. ERASE empties the list.
MY QSO	Messages to you, your transmissions (Tx) and the contacts logged (line "LOGGED ... (Documents\FT8_LOG.adi)"). ERASE empties the list.
DX call / Grid	Call sign and locator of the station you are working: filled by the double click.
My grid	Your own locator, used in the messages Tx1 and Tx6 and on the map.
Sent / Rcvd	Reports sent and received (for example -03 / -04).
TX Hz	Audio frequency of your transmission. Click on the waterfall of the main window to set it. **Hold TX freq**: keeps the frequency fixed even when you answer another station.
TX slot	Even (:00 / :30) or Odd: the slot in which you transmit. You must use the slot opposite to that of the station you are answering.
TX MESSAGES	Tx1 EA4GA IU7IWT JN81 (call, own call, locator); Tx2 report; Tx3 R + report; Tx4 RR73; Tx5 73; Tx6 CQ IU7IWT JN81. Click a line to choose the message to send; the selected line is framed.
ENABLE TX / HALT TX	ENABLE TX arms the transmission: the selected message is sent at the start of your next slot. HALT TX stops the transmission at once.
CQ	Selects Tx6 and sends your CQ call.
LOG QSO	Logs the contact in FT8_LOG.adi.
QRZ	Opens the QRZ.com profile of the station of the selected row.
MAP	Opens the FT8 MAP window (Sec. 22.5).
Auto sequence	Ticked: the program chooses the next Tx message by itself according to the messages received (report, R + report, RR73, 73).
Log QSO automatically	Ticked: the contact is logged as soon as the sequence is complete.
TX level	Amplitude of the transmitted tones. Adjust it with the Windows volume or the radio audio input level until the ALC does not move.

At the bottom of the window a reminder says: keep the PC clock synchronised (NTP), click the waterfall to set the TX frequency, double-click a message to answer it, radio in USB / USB-D, no speech processor.

22.4 Making a QSO step by step NEW v.16

1. Look at BAND ACTIVITY and choose a station: a CQ call, or a station that you want to work.
2. Set the TX frequency: click an empty place on the waterfall of the main window (or type TX Hz). Tick Hold TX freq if you want to keep it.
3. Double-click the message: DX call and Grid are filled, and the message to send is selected.
4. Check TX slot (opposite to the station) and press ENABLE TX. With Auto sequence ticked the program sends Tx1, Tx2, Tx3, Tx4 and Tx5 as the answers arrive. Without it, click the Tx line you want at each slot.
5. When the exchange of reports is complete the QSO is logged (automatically, or with LOG QSO). A line LOGGED appears in MY QSO.
6. Press HALT TX to stop at any time. To call CQ press CQ.

> **TRANSMISSION NOTICE:** the program transmits as soon as ENABLE TX or CQ is active. Before any test connect the radio to a dummy load or tune it to an unused frequency, and keep the audio level low so that the ALC does not move.

22.5 The FT8 MAP window NEW v.16

The MAP button opens a second window with a zoomable world map. Your station is the green marker; the stations located from their locators are drawn as small points. Curved lines join the stations that have worked each other:

Colour	Meaning
Red	My QSOs (the number is shown in the legend).
Cyan	Other QSOs: contacts between other stations seen in the messages.
Yellow	The station selected in the list (for example EA4GA CQ).

The legend at the bottom left also gives the number of stations located. Zoom with the wheel or with the + / - buttons and drag the map to move it.

22.6 Notes and troubleshooting NEW v.16

Symptom	Probable cause & resolution
Nothing is decoded	START RX is not running, the audio input level is wrong, the radio is not in USB / USB-D, or the PC clock is not synchronised: with an error of more than about one second the decoder loses the messages.
The radio does not transmit	Radio in USB / USB-D, audio output selected beside the CW SSB button, PTT box ticked and radio connected via CAT (or VOX enabled), modulation input of the radio set to the USB audio.
No answer from the other station	Wrong TX slot (use the opposite one), TX frequency on top of another station, or audio level too low. Choose an empty place on the waterfall.
The QSO is not logged	Complete the sequence, or press LOG QSO. Check that the folder Documents is writable: the file is FT8_LOG.adi.
The signal is wide or distorted	Audio level too high: lower TX level or the Windows volume until the ALC does not move.

23. WSPR MODE: WEAK SIGNAL PROPAGATION REPORTER NEW v.16

23.1 Overview NEW v.16

The **WSPR** button, next to the other digital-mode buttons, opens the **WSPR MODE - weak signal propagation reporter** window. WSPR is not a conversation mode: your station sends a very weak beacon (call sign, locator and power) and the stations that decode it report it. It is used to test how far a signal reaches, at which time and on which band, with a few milliwatts.

- **Reception.** The window decodes the WSPR signals of the band and lists them with UTC, SNR, DT, frequency, call sign, locator, power, distance in km and azimuth from your station.
- **Map.** Each decoded station is drawn on a map with a curved line to your station.
- **Transmission.** Beacon with call sign, locator and power in dBm, chosen from the window, with automatic PTT via CAT if the radio is connected.
- **No LOG.** WSPR MODE does not write anything in the Cabrillo log or in the ADIF logs: it is a propagation test, not a QSO.

Requirements: START RX running; PC clock synchronised (the WSPR slots are 2 minutes long and start on UTC); the radio in USB, tuned to the WSPR dial frequency of the band; for transmission an audio output connected to the radio selected beside the CW SSB button. Internet access is needed for the map tiles and for WHO HEARD ME.

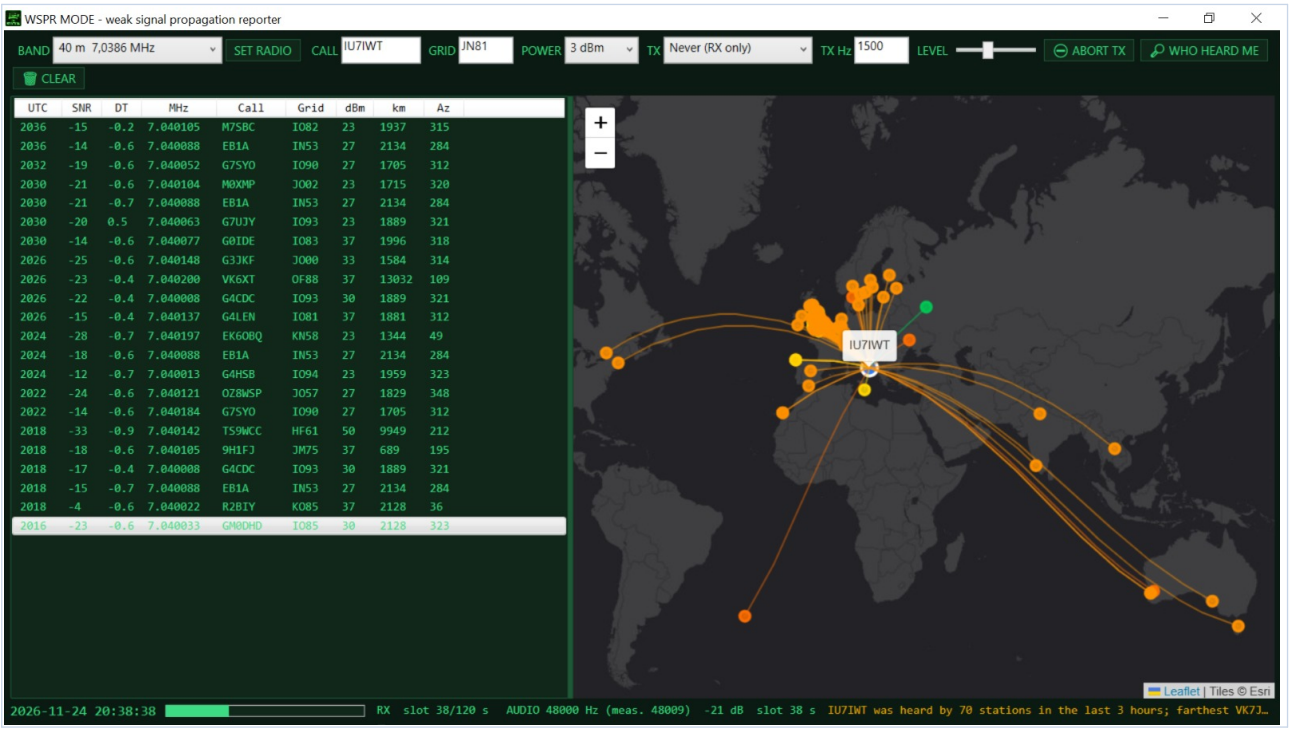

Figure 23.1 - The WSPR MODE window: list of the decoded stations (left) and map with the stations that heard you (right).

23.2 Opening the window and setting the radio NEW v.16

1. Click START RX and set the audio input of the radio.
2. Click WSPR: the window opens.
3. Choose the band in the BAND list, which shows the WSPR dial frequency (for example 40 m 7,0386 MHz).
4. Press SET RADIO: the radio is tuned to that frequency via CAT. The radio must be in USB.
5. Enter CALL, GRID and POWER (Sec. 23.3). The decoded stations appear at the end of each 2-minute slot.

23.3 The controls of the WSPR window NEW v.16

Control	Function & Description
BAND	List of the bands with the WSPR dial frequency of each one.
SET RADIO	Tunes the radio to the frequency of the selected band.
CALL	Your call sign, sent in the beacon.
GRID	Your Maidenhead locator (4 characters, e.g. JN81). It is the starting point of distances, azimuths and curved lines.
POWER	Power declared in the beacon, in dBm (for example 3 dBm). It is only the value written in the message: set the real power on the radio.
TX	How often the program transmits. **Never (RX only)**: reception only, nothing is transmitted. The other entries enable the beacon in the 2-minute slots.
TX Hz	Audio frequency of the beacon (default 1500 Hz, in the middle of the WSPR passband of about 200 Hz).
LEVEL	Slider: amplitude of the transmitted tones. Adjust it so that the ALC of the radio does not move.
ABORT TX	Stops the transmission in progress and releases the PTT given by the program.
WHO HEARD ME	Shows on the map the stations that have heard your beacon recently (reports from the Internet WSPR spot database).
CLEAR	Empties the list of the decoded stations.

Column	Content
UTC	Time of the slot in which the signal was decoded (HHMM).
SNR	Signal-to-noise ratio in dB (reference bandwidth 2500 Hz).
DT	Time offset of the signal from the slot, in seconds.
MHz	Frequency of the signal.
Call / Grid	Call sign and locator of the station.
dBm	Power declared by the station.
km / Az	Distance and azimuth (degrees) from your locator.

The **status line** at the bottom shows the UTC date and time with a bar for the progress of the 2-minute slot, RX or TX, the number of the second in the slot (for example "slot 38/120 s"), the audio sampling rate measured, the audio level in dB and, after WHO HEARD ME, a summary such as "IU7IWT was heard by 70 stations in the last 3 hours; farthest ...".

23.4 Receiving, transmitting and reading the map NEW v.16

- **Receiving.** With TX = Never (RX only) the window only decodes. The last decoded row is highlighted; click a row to see the station on the map.
- **Transmitting.** Choose a TX setting other than Never. At the start of the slot chosen the program switches the radio to TX via CAT, sends the beacon (about 110 seconds) and returns to reception. ABORT TX stops it.
- **Map.** Your station is marked by the label with your call sign. The decoded stations are the orange points joined to it by curved lines; the colour of a point changes with the signal. Zoom with the wheel or the + / - buttons.
- **Propagation test.** A few WSPR cycles on a band show at once which areas are open: the longest lines and the lowest SNR values tell how good the band is.

> **TRANSMISSION NOTICE:** WSPR transmits for almost the whole 2-minute slot. Use low power (a few watts or less), keep the ALC still and check that the frequency is clear before enabling the beacon.

23.5 Notes and troubleshooting NEW v.16

Symptom	Probable cause & resolution
Nothing is decoded	START RX not running, the audio of the selected input does not reach the program, the radio is not on the WSPR dial frequency (press SET RADIO) or not in USB, or the PC clock is not synchronised.
Nobody reports my beacon	Wrong frequency or audio level, clock not synchronised, TX Hz outside the WSPR passband, or the radio does not transmit: check USB mode, CAT PTT and the modulation input.
WHO HEARD ME shows nothing	No Internet connection, or no station has reported you yet: wait for a few slots.
The map is empty	No Internet connection for the map tiles, or no station decoded yet.

24. CONTEST MODE: SCORES AND TALKING DIAL NEW v.16

24.1 Overview NEW v.16

The **CONTEST MODE** button opens a resizable window that keeps the score of the contest you are taking part in. You choose the contest from a list of the best-known contests; the window sums up and updates by itself the QSOs, multipliers, points, score and rates, band by band, and shows on the right a vertical talking dial of the band you are on with the call signs you have logged and the frequency on which each one was worked.

- **Where the button is.** In the RECEPTION pane, on the left of the OPERATOR PANEL button (Sec. 25). It is also available in the OPERATOR PANEL window.
- **Data.** The QSOs are those saved with INS. LOG (Sec. 7.5): there is nothing to type twice. The statistics are recalculated at every new QSO.
- **Window.** It can be resized freely; the dial follows the height of the window.

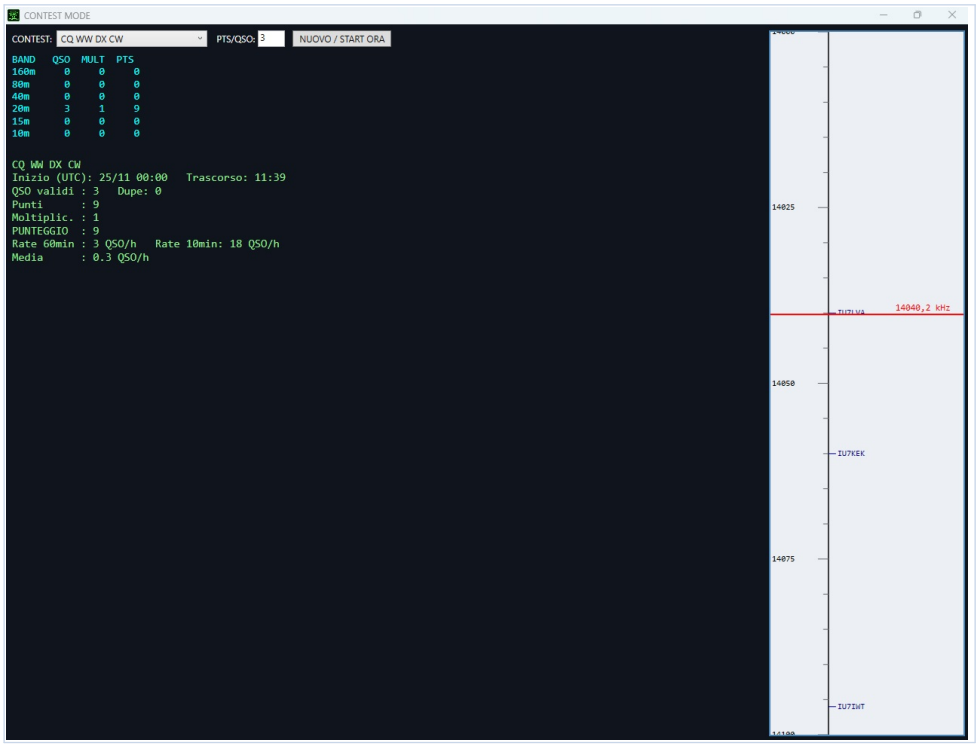

Figure 24.1 - The CONTEST MODE window: scores by band on the left, talking dial of the band on the right.

24.2 The CONTEST MODE window NEW v.16

Element	Function & Description
CONTEST	List of the contests (for example CQ WW DX CW). The scoring is calculated for the contest selected.
PTS/QSO	Points awarded for each QSO. Change it if the rules of your contest give a different value.
NUOVO / START ORA	"New / start now": starts a new contest period from the present moment. The start time is shown as "Inizio (UTC)".
Table BAND / QSO / MULT / PTS	For each band (160 m … 10 m): number of QSOs, multipliers and points.
Statistics	Name of the contest; start time (UTC) and elapsed time; valid QSOs and duplicates (Dupe); points; multipliers; **total score**; rate over the last 60 minutes and over the last 10 minutes (QSO/h); average rate (QSO/h) since the start.
Talking dial (right)	Vertical scale of the band in kHz. The call signs logged are written at the frequency of the QSO; the red line with the frequency (for example 14040,2 kHz) is your VFO and moves when you tune the radio.

The captions of this window are in Italian (Inizio, Trascorso, QSO validi, Punti, Moltiplic., PUNTEGGIO, Media): they correspond to start, elapsed time, valid QSOs, points, multipliers, score and average.

24.3 Using CONTEST MODE: a short example NEW v.16

1. Before the contest open CONTEST MODE, choose the contest in the CONTEST list and check PTS/QSO.

2. At the start press NUOVO / START ORA, so that the elapsed time starts from zero.
3. Work the stations as usual: type the call sign, send the macros and press INS. LOG for every QSO.
4. Watch the window: the table and the statistics are updated after each INS. LOG, the call sign appears on the dial at its frequency, and a duplicate is counted in Dupe.
5. Use the dial to see which frequencies you have already worked in the band and which are free.

In the example of Fig. 24.1: 3 valid QSOs on 20 m at 3 points each give 9 points; with 1 multiplier the score is 9; the rate of the last 10 minutes is 18 QSO/h, the rate of the last 60 minutes 3 QSO/h.

24.4 Notes NEW v.16

- The QSOs come from the log of the program: a QSO that is not saved with INS. LOG is not counted.
- Check the points per QSO and the multipliers against the official rules of the contest: the window is a working aid, not the official score.
- CONTEST MODE does not transmit and does not need the CAT connection, except to show the red VFO line on the dial.

25. OPERATOR PANEL: RECEPTION AND TX CW IN A SEPARATE WINDOW NEW v.16

25.1 Overview NEW v.16

The **OPERATOR PANEL** button is placed in the RECEPTION pane, on the left of the DELETE button (and on the right of CONTEST MODE). When you press it, the RECEPTION pane and the TX CW (VIA CAT) section are detached from the main window and moved into a separate, resizable window: RECEPTION above, call sign, serial numbers, macros and transmission history below.

- **Bigger waterfall.** In the main window the two panes disappear, so that the spectrum and the waterfall can use all the space, for example on a second monitor or maximised.
- **Everything keeps working.** Decoding, selecting the call sign with the mouse, macros, Shift+1...9 and the instant type line behave exactly as in the main window (Sec. 7).
- **Button state.** While the panel is detached the button reads "OPERATOR PANEL (ON)".

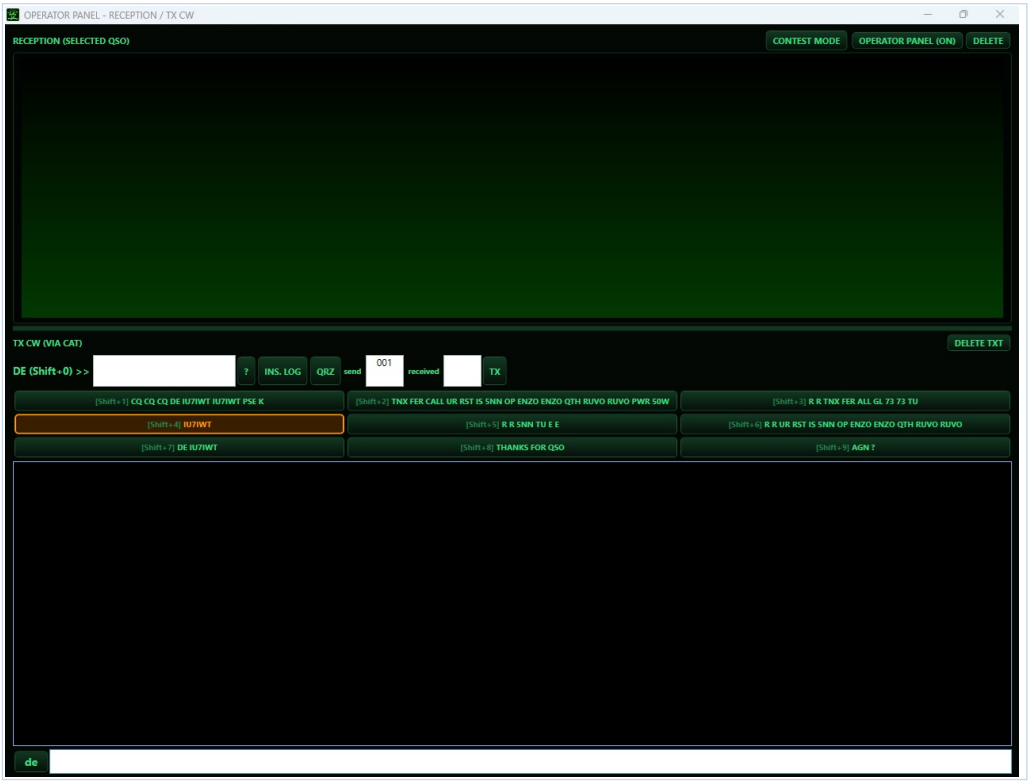

Figure 25.1 - The OPERATOR PANEL window: RECEPTION (top), TX CW (VIA CAT) with the macros and the TX history (below).

25.2 The window NEW v.16

Element	Function & Description
Title	OPERATOR PANEL - RECEPTION / TX CW.
RECEPTION (SELECTED QSO)	Decoded text, as in the main window. Select with the mouse to copy a call sign into the CALL SIGN box (Sec. 7.3.1).
CONTEST MODE	Opens the CONTEST MODE window (Sec. 24).
OPERATOR PANEL (ON)	Shows that the panel is detached. Press it again to bring the panes back into the main window.
DELETE	Clears the RECEPTION text (Sec. 7).
DE (Shift+0) >>, CALL SIGN, ?, INS. LOG, QRZ, send, received, TX	The same controls described in Sec. 7.3.2 and 7.4: call sign box, "?" button, INS. LOG, QRZ, outbound and inbound serial numbers and TX.
Macros [Shift+1] ... [Shift+9]	The nine macros; macro 4 (MyCall) is highlighted in orange. Right-click to edit (Sec. 7.3).
DELETE TXT	Clears the TX history.
TX history	Large area with the transmitted text.
de + type line	Instant type line at the bottom: each character is sent at once (Sec. 7.2).

25.3 Notes NEW v.16

- Resize the window to give more room to the reception text or to the history.
- Closing the OPERATOR PANEL window returns the panes to the main window.
- The settings of the main window, the CW output mode (CAT keyer, CW KEY, CW SSB) and the macros are the same in both places.

APPENDIX A: RECOGNIZED AMATEUR BANDS

The frequency display automatically translates the active operating frequency reported via CAT into the corresponding amateur radio band designation according to the table below:

Band	Frequency Range (MHz)	Band	Frequency Range (MHz)
160 m	1.800 - 2.000 MHz	15 m	21.000 - 21.450 MHz
80 m	3.500 - 4.000 MHz	12 m	24.890 - 24.990 MHz
60 m	5.250 - 5.450 MHz	10 m	28.000 - 29.700 MHz
40 m	7.000 - 7.300 MHz	6 m	50.000 - 54.000 MHz
30 m	10.100 - 10.150 MHz	4 m	70.000 - 70.500 MHz
20 m	14.000 - 14.350 MHz	2 m	144.000 - 148.000 MHz
17 m	18.068 - 18.168 MHz	70 cm / 23 cm	430-440 MHz / 1240-1300 MHz

Frequencies outside these defined ranges display the designation "GEN" (General Coverage). The ADIF log (Sec. 12) uses a slightly wider table of its own to fill the BAND field of the QSOs saved with INS. LOG. The VISUAL CLUSTER uses its own band table (Sec. 13.8).

APPENDIX B: MORSE CODE CHARACTER SPECIFICATIONS

Transmission Engine (Extended Character Set): Letters A-Z, Digits 0-9, and punctuation symbols / ? , . = + - : ; ( ) @ '.

Receive Decoder Engine: Decodes standard character set comprising letters A-Z, digits 0-9, and punctuation . , ? /. Any unrecognized element sequence is automatically discarded.

Morse Timing Standards:

- Dot Unit length (t): Base timing unit defined by WPM speed setting (with the software keyer, CW KEY and CW SSB, by the CW TX VEL. knob: WPM = 1200 / dot length in ms).
- Dash duration: Equal to 3 dot units (3t).
- Inter-character spacing: Equal to 3 dot units (3t).
- Inter-word spacing: Standardized at 7 dot units (7t). The receiver engine registers a word space for pauses exceeding 4.5 dot units.