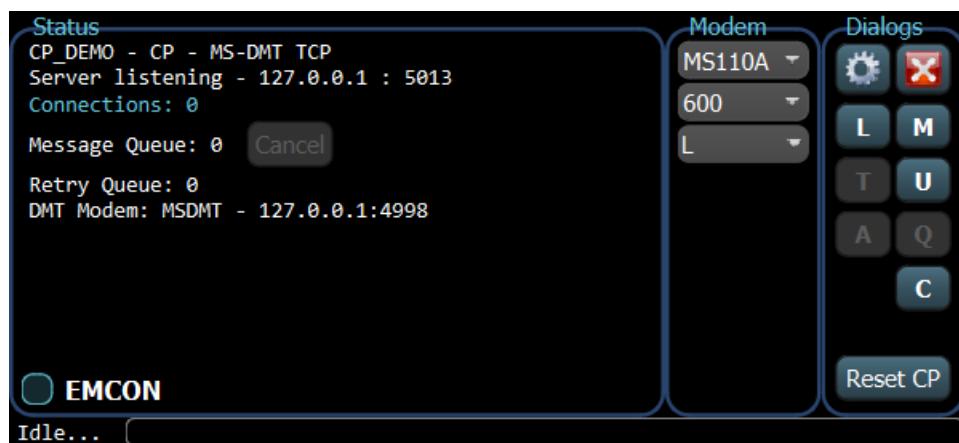


COMMUNICATIONS PROCESSOR

OPERATOR INSTRUCTION MANUAL

UPDATED - 21 NOVEMBER 2023



Copyright and License

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WHAT'S NEW

- ACP-201 Chat is now part of the Communications Processor application
- Chat messages are now acknowledged if addressed to a callsign other than ALL
- ALE UI has been simplified
- Default style sheet is QSS_Dark_Blue

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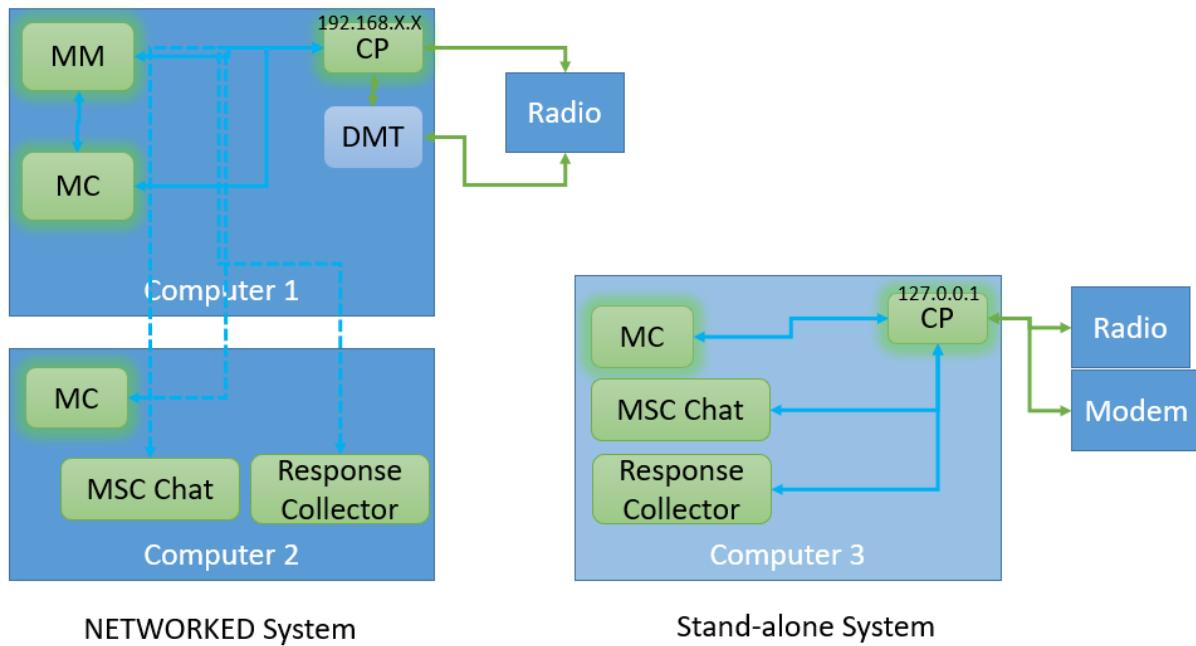
MINIMUM SYSTEM REQUIREMENTS

- Windows 7 or above
- Air-gapped computer or air-gapped network (not connected to the internet)
- No virus scanner/nanny-ware applications or at least white list MSC folder/sub-folders
- Any modern multi-core processor of 1GHz or higher speed
- 4 Gig RAM
- Min screen resolution 1024x768 (1920x1080 preferred)
- Running on Linux under Wine is not supported

PURPOSE

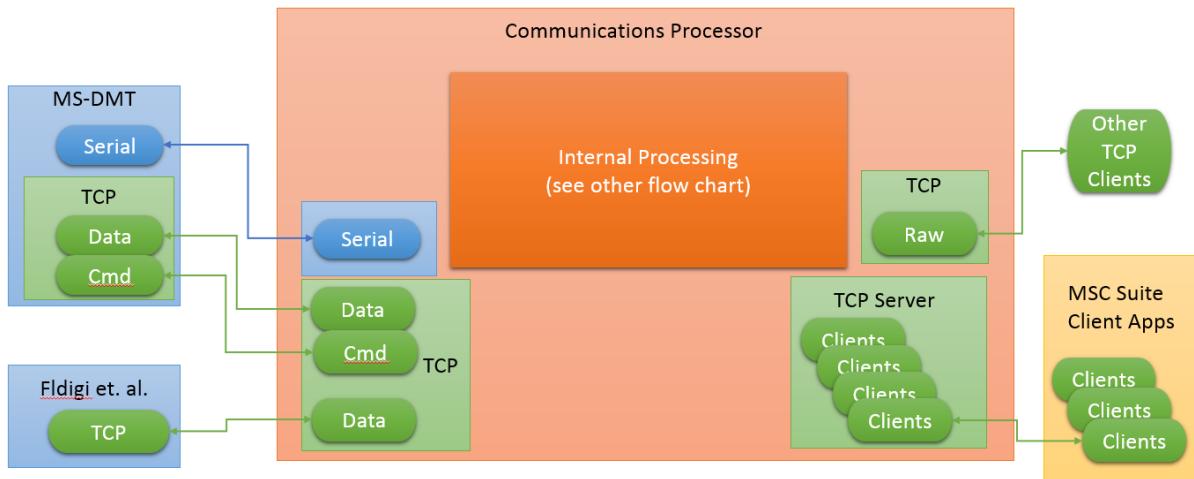
- The Communications Processor (CP) does exactly as the name implies, it processes the data exchange between the client applications and the modem.
- By providing a TCP interface in the CP we allow multiple clients to connect to the CP and send and receive data.
- The CP allows multiple simultaneous connections and reception of simultaneous messages. The messages are sorted by priority, stored in a queue, and sent to the modem in order.
- All data processing, compression, checksum, and encryption are done in the CP which simplifies all other applications since they are not burdened with this processing.
- Received data is passed through the cipher module and each available key is used to try to decipher the data stream. Once a successful decipher is detected that key is used to decrypt the rest of the data. This alleviates the operator from having to attend to the CP and change keys to match the distant end.
- Once the data has been decrypted it is stored on disk for safe keeping and sent to all connected clients. Each client then decides if the data pertains to them or not.

HOW IT WORKS (THE BIG PICTURE)

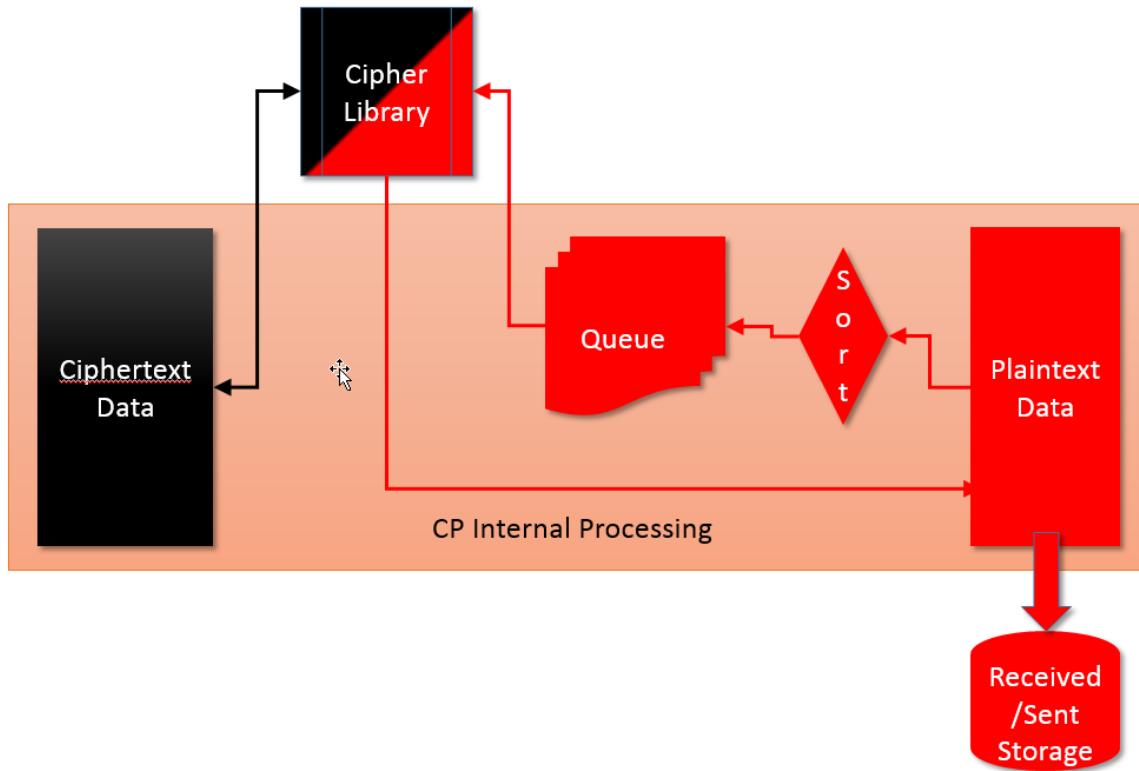


- MSC Suite is designed to operate on a Local Area Network (LAN) segment. A LAN segment is a segregated part of the LAN that is air-gapped (not connected to) or firewalled from the Internet or other networks/ LAN segments.
- All server applications (CP, Message Machine (MM)) broadcast their listening IP address and port over the LAN segment and to all the client applications (MSC Chat/Response Collector). This allows the client applications to auto configure their user interface (UI) with the server connection data. Now to connect to a server all you do is select that server (identified by its Position Identifier) and press the connect button.
- To allow multiple computers on the same LAN segment to see these broadcasts, they must all be configured to connect to the same LAN segment, and all connected via a switch, either via Wi-Fi or cable.

- If an isolated CP is desired (not seen by other applications on the same LAN segment) then assign it to listen on the localhost IP (127.0.0.1). Now broadcasts will only be seen by applications running on the same computer as the CP.



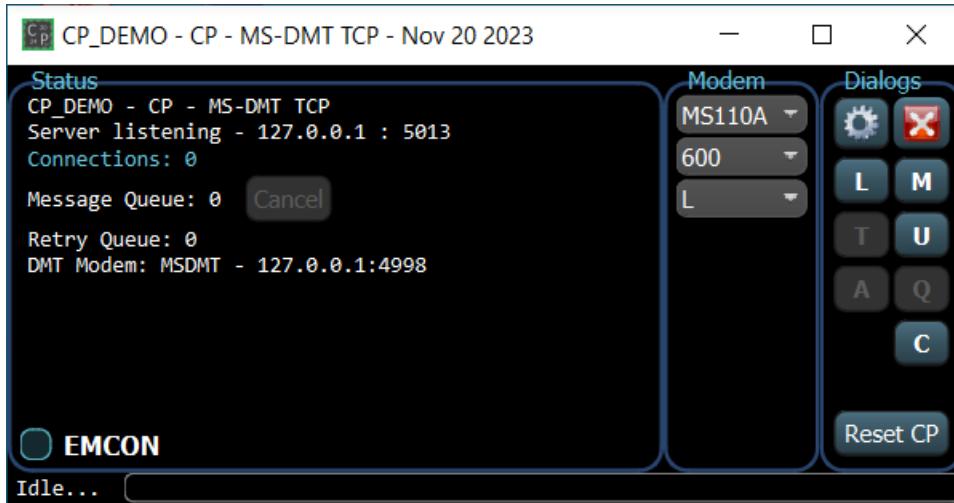
- Data from the MSC Suite client applications is sent by TCP to the CP. The data is then internally processed before being sent to a modem.
- Data from the modem is received either by Serial or TCP connections. The data is then internally processed before being sent to the MSC Clients.



- Sending Data
 - Plaintext data from the MSC Suite clients is sorted by priority and stored in a queue.
 - A copy of the XML file is saved to the SENT folder.
 - Each message in the queue is in turn sent to the cipher library where it is encrypted.
- Receiving Data
 - Ciphertext data from the modem is sent to the cipher library where it is decrypted and then sent to all the connected clients.
 - A copy of the XML file is saved to the RECEIVED folder.

THE LAYOUT

MAIN WINDOW



Once configured, CP will quite happily run in the system tray, out of sight. However, it can also be used to control aspects of the modem (compatible modems only) such as modem speed and interleave. Depending on the modem selected, the modem waveform can be chosen from the list of available waveforms.

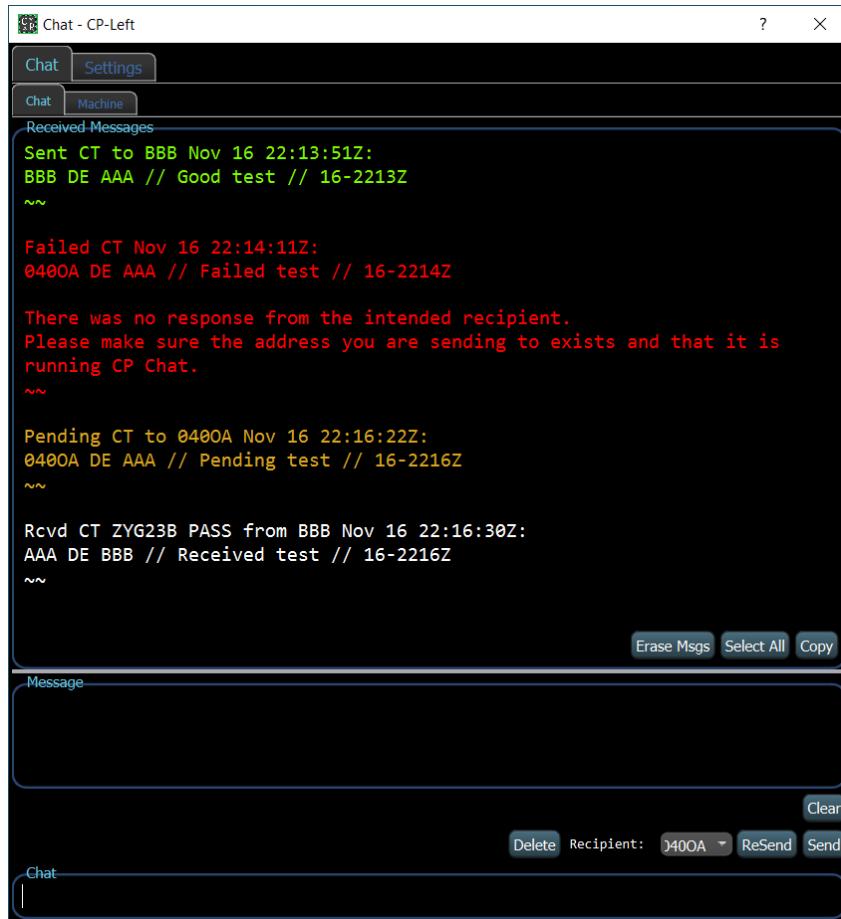
- Application title bar shows Position ID, application name, modem type selected, and release date
- CP Status – Indicates the status of the CP
 - Shows Position ID, application name, and selected modem type
 - Shows TCP Server listen IP and port or error when server cannot bind to an address or port
 - Shows IP and port TCP server is currently bound to.
 - Also number of clients connected to server
 - Message Queues – Shows number of messages in current message queue and retry queue

- **EMCON** – Sets CP to Emergency Condition mode. No data will be transmitted. Any data sent to CP will be added to retry queue if enabled in settings
- Modem Control – Change modem settings
- Settings Dialog (Gear Icon) – Displays Settings dialog
- Log Dialog (L) – Displays application log dialog
- Modem Dialog (M) – Displays modem dialog
- TCP Dialog (T) – Displays TCP dialog
- UDP Dialog (U) – Displays UDP dialog
- ALE Dialog (A) – Displays ALE dialog. Must have MARS-ALE enabled in settings.
- Queue (Q) – Displays retry queue if not empty
- Chat Dialog – Displays Chat dialog if not shown
- Reset CP – Reset all wait loops (useful when ALE is enabled) if CP becomes unresponsive
- Cancel – Cancels current message queue and sends messages to retry queue if enabled in settings. Does not cancel the current transmission as that data is already in the modem.
- TX/RX Status – Indicates status of CP application. Shows current data transfer status or idle depending on whether the CP is transmitting or receiving data or is idle.
- Receive Data Progress Bar – Shows % data received from modem serial interface. For small messages this may not show any progress. Progress bar will lag behind transmission due to latency in the data path. Progress bar indicates data received from the modem serial port and will continue to indicate progress after the transmission is over. Progress bar cannot show transmit data progress as there is no feedback from modem for outgoing data.

RADIO MODEM INTERFACE

Progress bar will not work if distant end is not using Checksum Header.

CHAT DIALOG (CP CHAT)



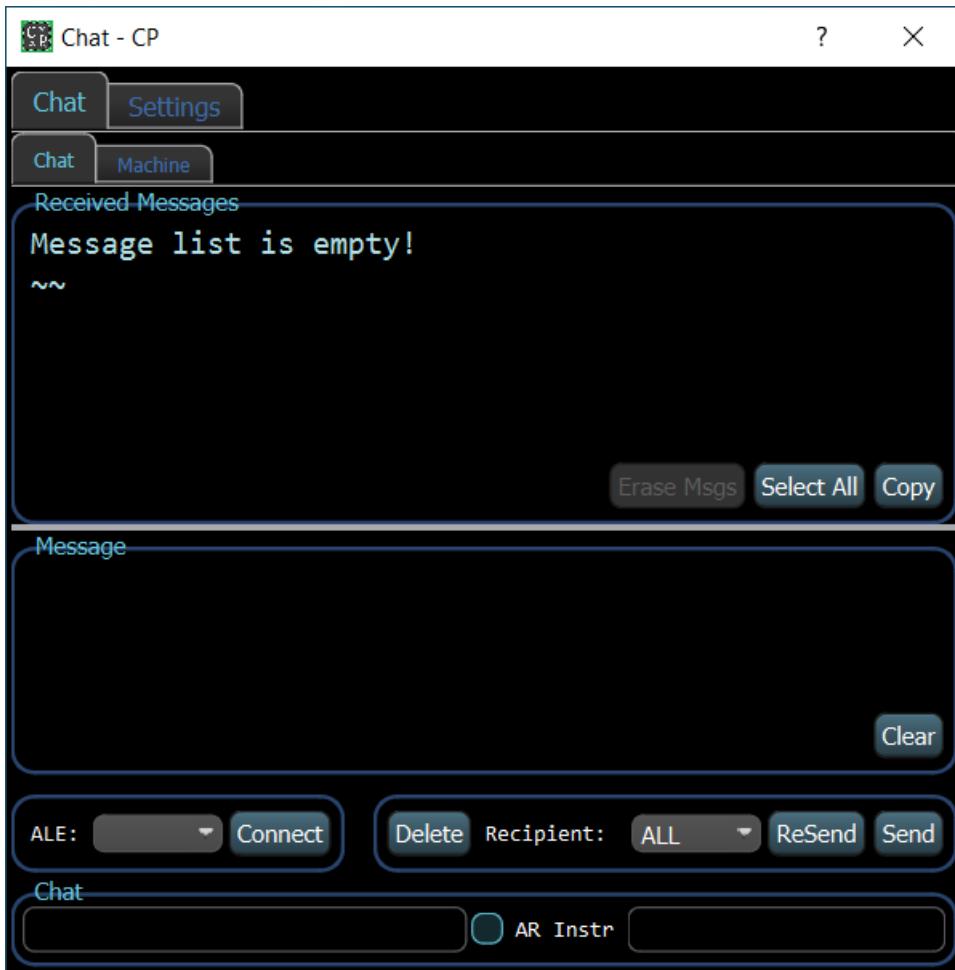
A new feature added to CP is the Chat dialog, or CP Chat. While the CP Chat layout is similar to MSC Chat, it functions differently and the over the air protocol is different than MSC Chats protocol. The updated protocol allows clients to acknowledge messages addressed to them.

One thing you'll notice right off the bat is the text is color coded. Color coding is used to distinguish messages by status.

- A green color indicates either a message was sent to ALL or a message was sent to an individual call sign and an acknowledgement for that message was received back.

- An amber color indicates a message was sent to an individual call sign and is waiting for an acknowledgement.
- A red color indicates a message did not receive an acknowledgement within the specified period. The period is calculated by multiplying the number of tries by the delay between tries. Both these settings can be configured in the Chat dialog Settings tab.
- Received messages are colored using the text color for the QTextBrowser widget.
- Messages are retained between CP restarts but can be allowed to expire by setting Message retention in CP Chat settings. Setting Message retention to zero disables message expiration and all messages will be kept indeterminately.
- The Erase Msgs button will delete the entire message list. There is no method to erase a single or select range of messages. Use Message retention to keep the message database manageable and from using memory resources.

CHAT TAB



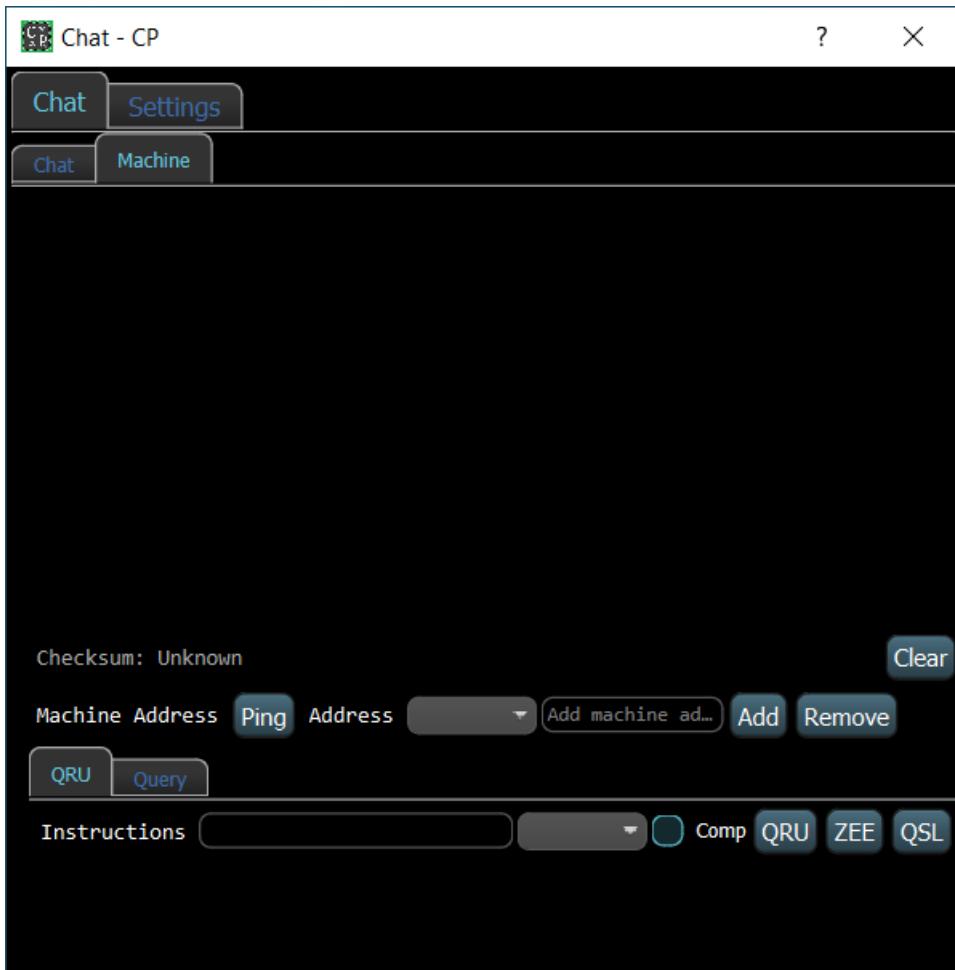
The Chat tab is laid out much like MSC Chat so it should be familiar.

- Received messages are displayed at the top in a QTextBrowser widget in the color defined for QTextBrowser widget in the selected style sheet
- Sent messages are displayed based on the colors defined above
- Multi-line messages are created in the Message group box
- The Clear button will clear all text from the Message group box
- If MARS-ALE is enabled the ALE group box will be displayed. Use the ALE drop down menu to select an ALE address (supplied by MARS-ALE or you can temporarily enter a new ALE address). You may

RADIO MODEM INTERFACE

either press the Connect button to establish a link to the selected ALE address prior to sending a message or just sent a message while an ALE address is selected, and CP will try to establish a link before sending the message to the modem.

MACHINE TAB



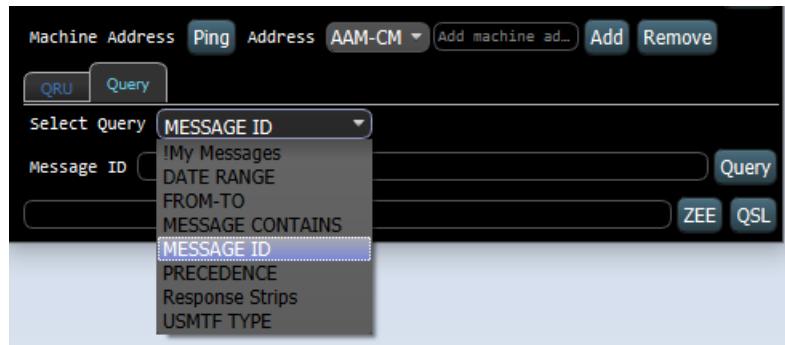
The Machine tab functions identically to MSC Chat Machine tab.

The Machine tab is where you send machine queries to Message Machine and receive responses.

- Text window - Outgoing queries and incoming responses are displayed
- Address – Add and select the machine address of the Message Machine you are working
- Ping – Press the Ping button and CP Chat will send a query to MM and MM will respond
- Add/Remove Machine addresses as needed

- Machine query commands:
 - Comp – Will instruct the distant Message Machine to compress the data it is about to return. It is recommended that compression be used to speed the transfer of what could be a large amount of data.
 - QRU – Enter the comma separated recipient RI(s) or call sign(s) in the Instructions text line and press the QRU button. To save time, QRU instructions are saved to the pull-down menu for future use.
 - ZEE – Enter a line number from the response list of messages and press the ZEE button. Comma separated line numbers can also be entered, i.e. “1,2,3”, and MM will send those messages.
 - QSL – Enter line number(s) of a message and press the QSL button. Your call sign will be added to the message(s) and they will no longer show up in future QRU queries.

SQL QUERY TAB



The SQL Query tab provides a very powerful tool to query for messages.

The prebuilt queries make using SQL Queries simple, just select the query template from the pull-down menu and fill in the blanks before pressing the Query button.

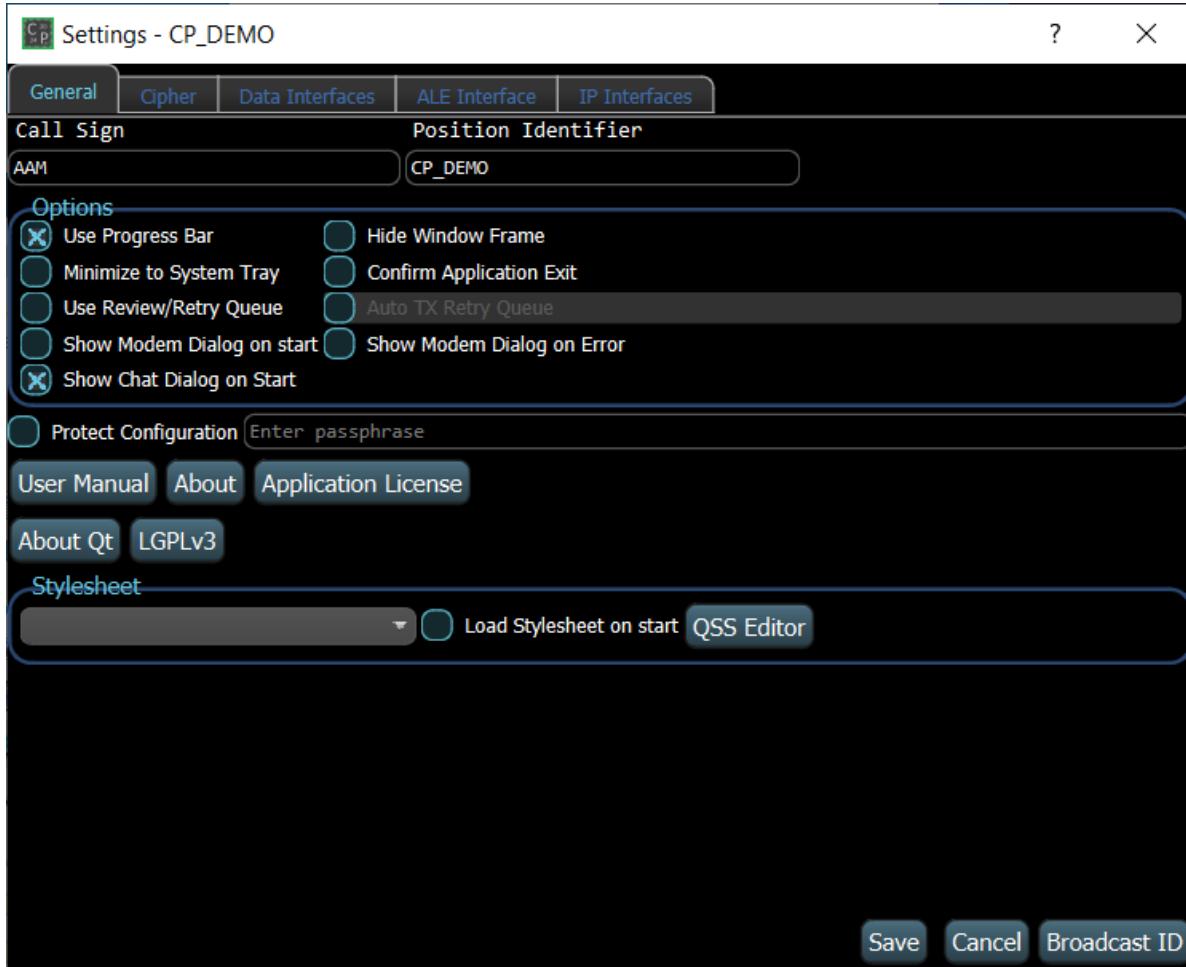
Queries can be added or removed in the Settings tab.

Creating SQL queries is beyond the scope of this document, however more information can be found here: [SQL Syntax](#)

APPLICATION DIALOGS

SETTINGS DIALOGS

GENERAL SETTINGS



- Call Sign – Enter your assigned call sign (single word only). Used for Chat and as last ditch call sign if none is included in XML document.
- Position Identifier – Use a unique identifier that describes the CP and the Radio/Modem it interfaces with. This is used to find the CP connection from client applications. **Do not set the position**

identifier application the same as any other application. This will break the auto-discovery and self-configuration processes.

- Options group box:
 - Use Progress Bar – Displays RX Data progress bar as data is received from modem. Sender must be using MSC compatible application.
 - Hide Window Frame – removes window frame to aide in UI de-clutter.
 - Use Review/Retry Queue – Enables the retry queue. Retry queue is used to store messages that could not be processed for one reason or another. Useful with ALE.
 - Confirm application exit – a message will appear when exiting application
 - Minimize to System Tray – Application runs in system tray (recommended).
 - Show Modem Dialog on Activity – If checked Modem Dialog will display with either inbound or outbound data activity.
 - Show Modem Dialog on Error – if message was received with checksum error or unknown Modem Dialog will be shown
 - Show Chat Dialog on Start – Chat dialog will be shown when application starts. Recommend this be checked as CP Chat is now the default MSC Chat application.
- Protect configuration – Password protect application configuration. Useful in multi-operator situations where IT sets the application configuration and password protects it.
- Help Buttons:

- User Manual - Displays the CP operators manual (what you are reading now).
- About – Displays the application About dialog.
- Application License – Displays the application license document
- Stylesheet – Select desired style sheet. Style sheets stored in global MSC/QStyleSheets folder. Default style sheet is QSS_Dark_Blue
- QSS Editor will open the style sheet editor to edit style sheet (default cannot be edited)
- Save – Saves and applies settings. The TCP server and serial ports will close and reopen using the new settings if changes.
- Cancel – Reverts any changes and closes Setting Dialog
- Broadcast ID – Initiates UDP handshake to populate client connections combo box

STYLESHEETS

Style sheets are used to apply changes to the look and feel of the user interface (UI). Most of the features of the UI widgets can be changed by style sheets.

Since everyone's tastes differ, this allows everyone to select from available style sheets, tweak an existing style sheet or create a completely new one.

Style sheets (.qss) files are globally stored in the MSC:/QStyleSheets folder. Subfolders can be used to help manage style sheets. All subfolders are searched for qss files and displayed in the Select Stylesheet combo box.

- Select Stylesheet combo box is used to select an available style sheet from MSC:/QStyleSheets
- Load Stylesheet on start will automatically apply the selected style sheet when MSC Chat starts.
- QSS Editor will open the selected style sheet in the Style Sheet Editor (separate download)

For more information on Qt Style Sheets visit:

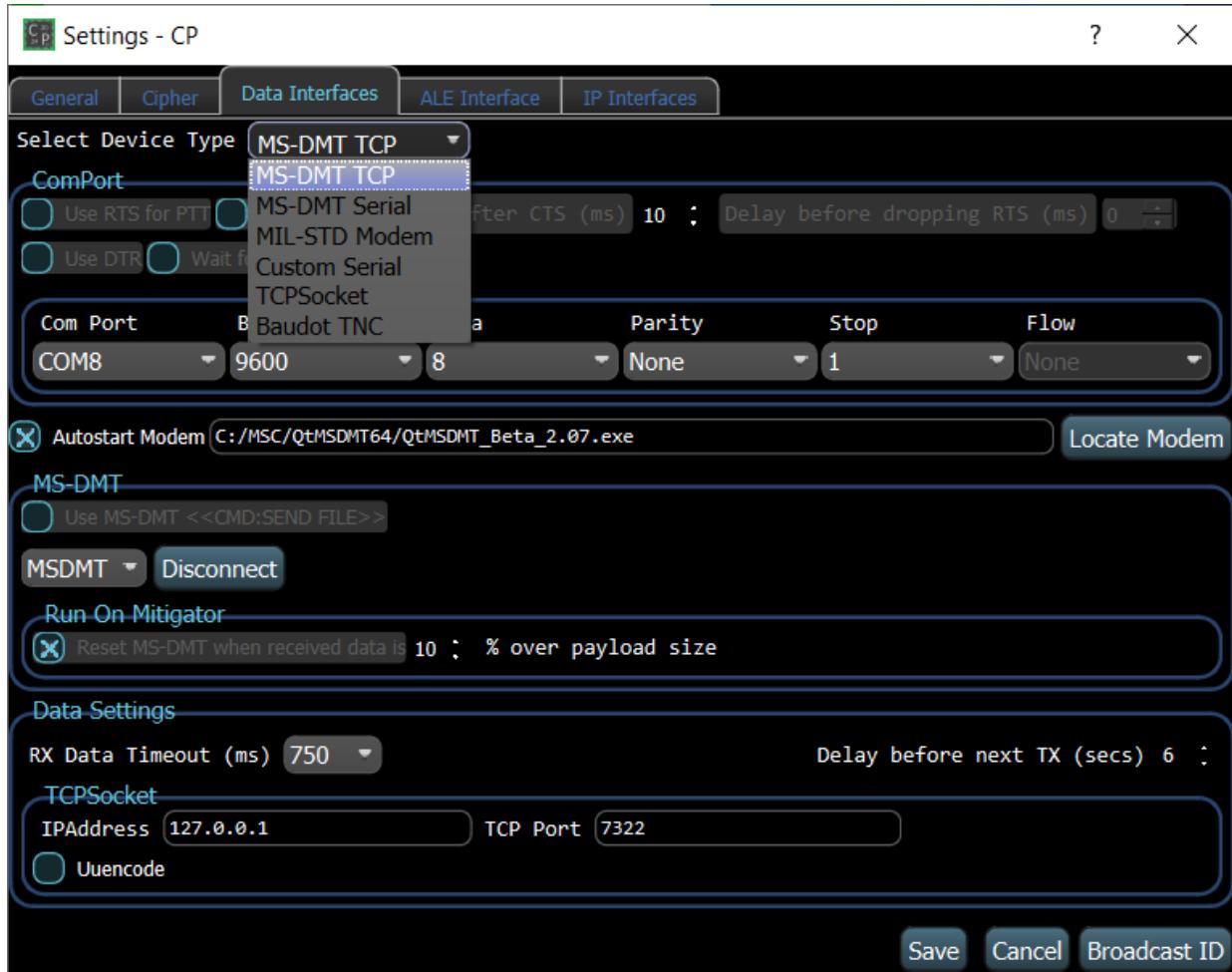
<https://doc.qt.io/qt-5stylesheet.html>

CIPHER SETTINGS



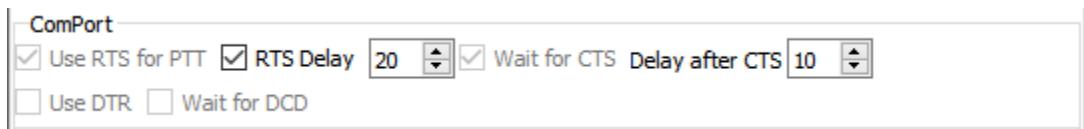
- Allow PT data – Allows CP to send plaintext data. Client applications should provide plaintext warning before sending data to CP.
- Cipher Initialization Status – Shows status of cipher module initialization

DATA INTERFACE SETTINGS



- Select Device Type
 - MS-DMT TCP – If using MS-DMT as modem and wish to connect to it via TCP (preferred method)
 - MS-DMT Serial – If using MS-DMT as a modem and wish to connect to it via virtual serial port
 - MIL-STD Modem – Selects RTS/CTS for use with hardware modems that conform to MIL-STD keying
 - Custom Serial – Allows operator to select any combination of serial configuration to match a hardware modem
 - TCPSocket – For TCP modems

- Baudot TNC – for use with M/RTTY application
- ComPort Group Box
 - Make sure Serial Port (Com Port) settings match the configuration of the modem.
 - Software flow control (XON/XOFF) cannot be used since cipher text contains flow control characters.



- Use RTS for PTT – If your modem requires RTS signal for PTT then select this option
- RTS Delay – amount of delay to wait before dropping RTS – use only if your modem truncates the final bytes of the outgoing data
- RTS Delay in milliseconds
- Wait for CTS – If your modem uses CTS to control flow of data to the modem
- Delay after CTS – delay after modem raises CTS before CP sends data – adjust if modem truncates the first few bytes of data
- Locate Modem – Locate software modem application (fldigi, MS-DMT etc)
- Autostart Modem – will spawn the software modem application
- MS-DMT Group Box
 - Use MS-DMT <<CMD:SEND FILE>> - for MS-DMT Serial
 - MS-DMT Client to connect to

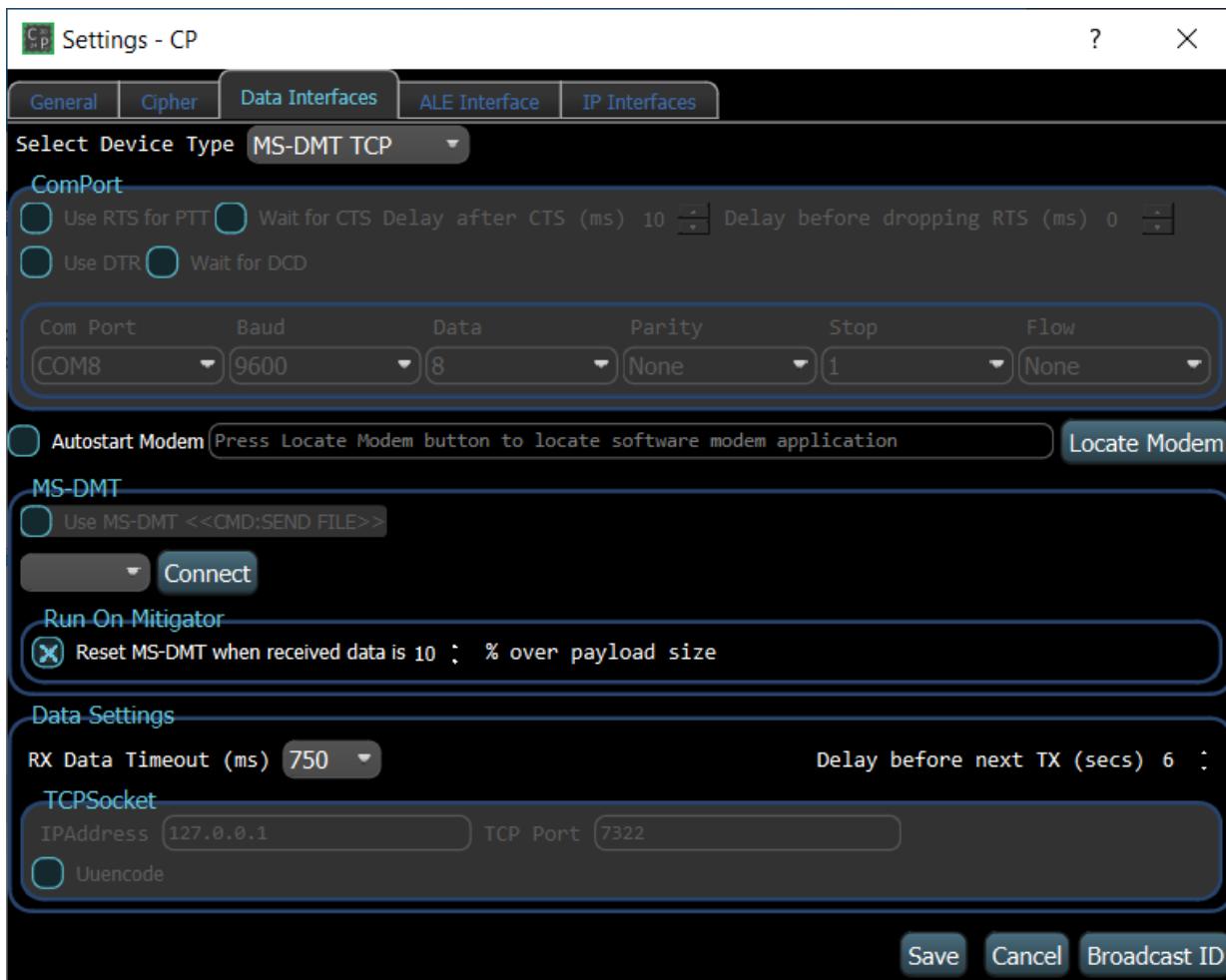
- Run On Mitigator – Sender must be using MSC compatible application. If more data has been decoded than expected, a Modem Reset command is sent.
- Data Setting Group Box
 - RX Data Timeout – used for serial modems where status of modem is not known. Not used for MS-DMT TCP as DMT signals when data reception is complete.
 - Delay before next TX – number of seconds between transmission of queued messages
- TCPSocket – for IP based Software Modems like fldigi.
 - Set the IP address and Port the software modem is listening on.
 - Uuencode the encrypted data for 7 bit waveforms
- Save – Saves and changes made to configuration
- Cancel – Ignores any changes made to configuration
- Broadcast ID – Sends a “hel” datagram to initiate a response from other MSC compatible applications

TCP CONNECTION TO MS-DMT

The communication protocol between MS-DMT and CP allows CP to auto connect to MS-DMT no matter the start up sequence.

When MS-DMT starts it sends out “hello” datagrams that CP listens for and when properly configured CP then connects to MS-DMT.

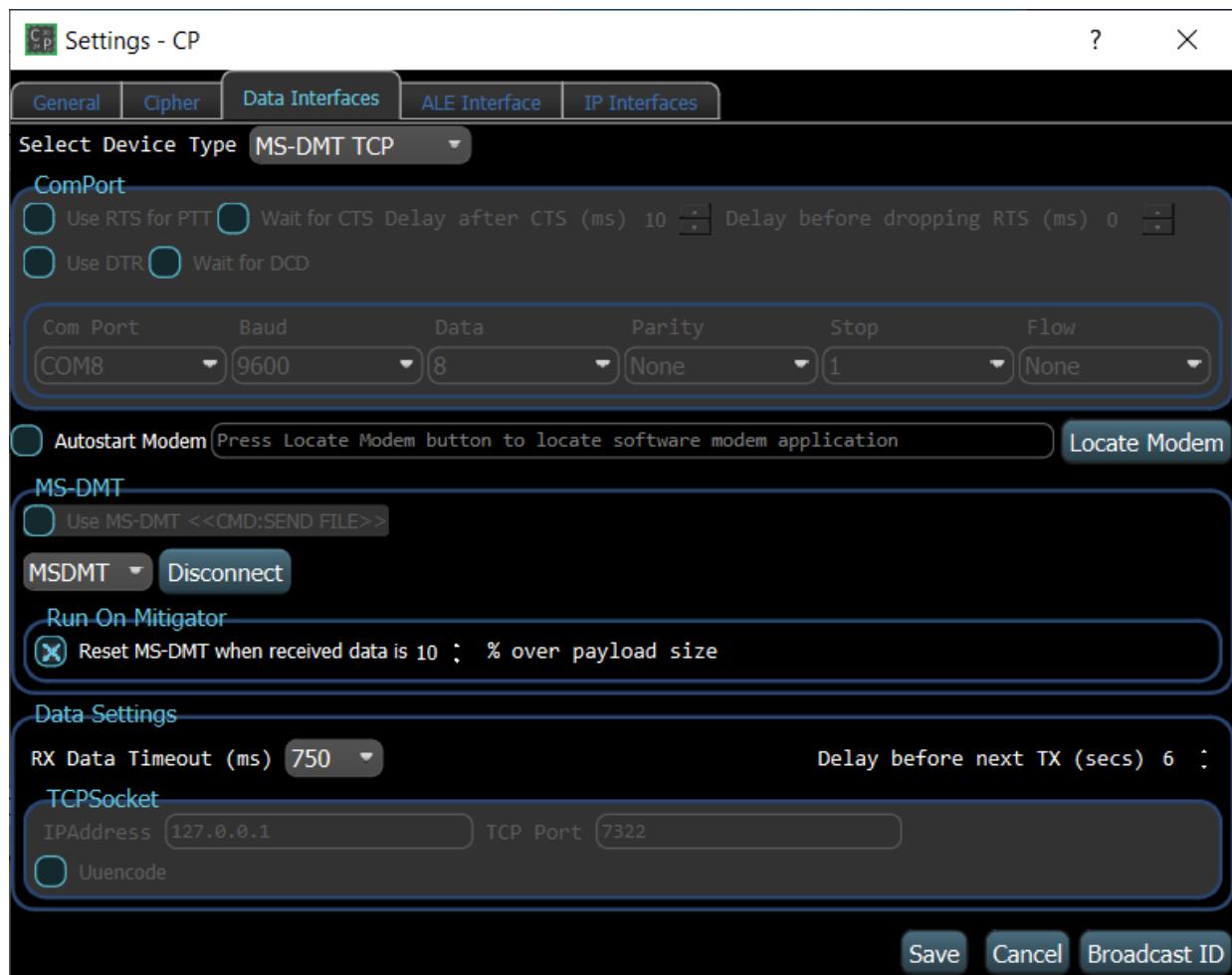
However to configure this to automatically happen a configuration sequence must be followed.



- With MS-DMT not running and no MS-DMT PositionID configured in CP, the settings should look like the image above.

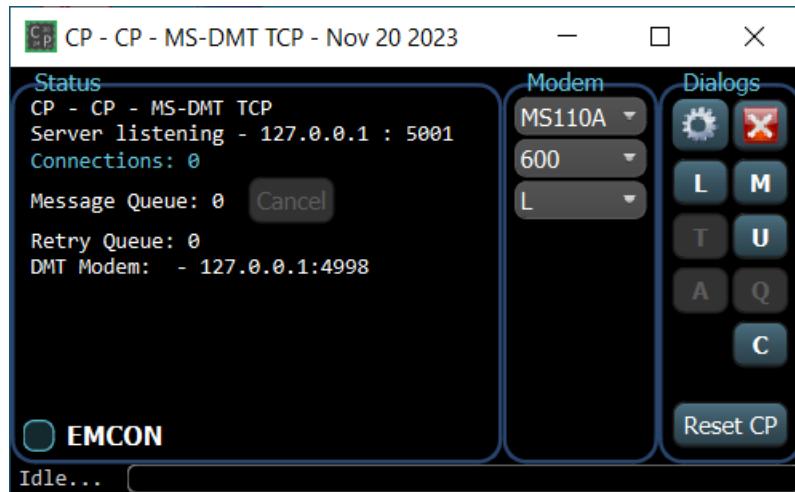
- If the Connect button says “Disconnect”, press the Disconnect button to clear the currently configured DMT PositionID.
- Now start MS-DMT

- With DMT running, DMT’s positionID should now show in the MS-DMT connections combo box.
- Press the Connect button to connect to the currently selected DMT.



- The Connect button should now display “Disconnect” as there is a positionID stored in CP

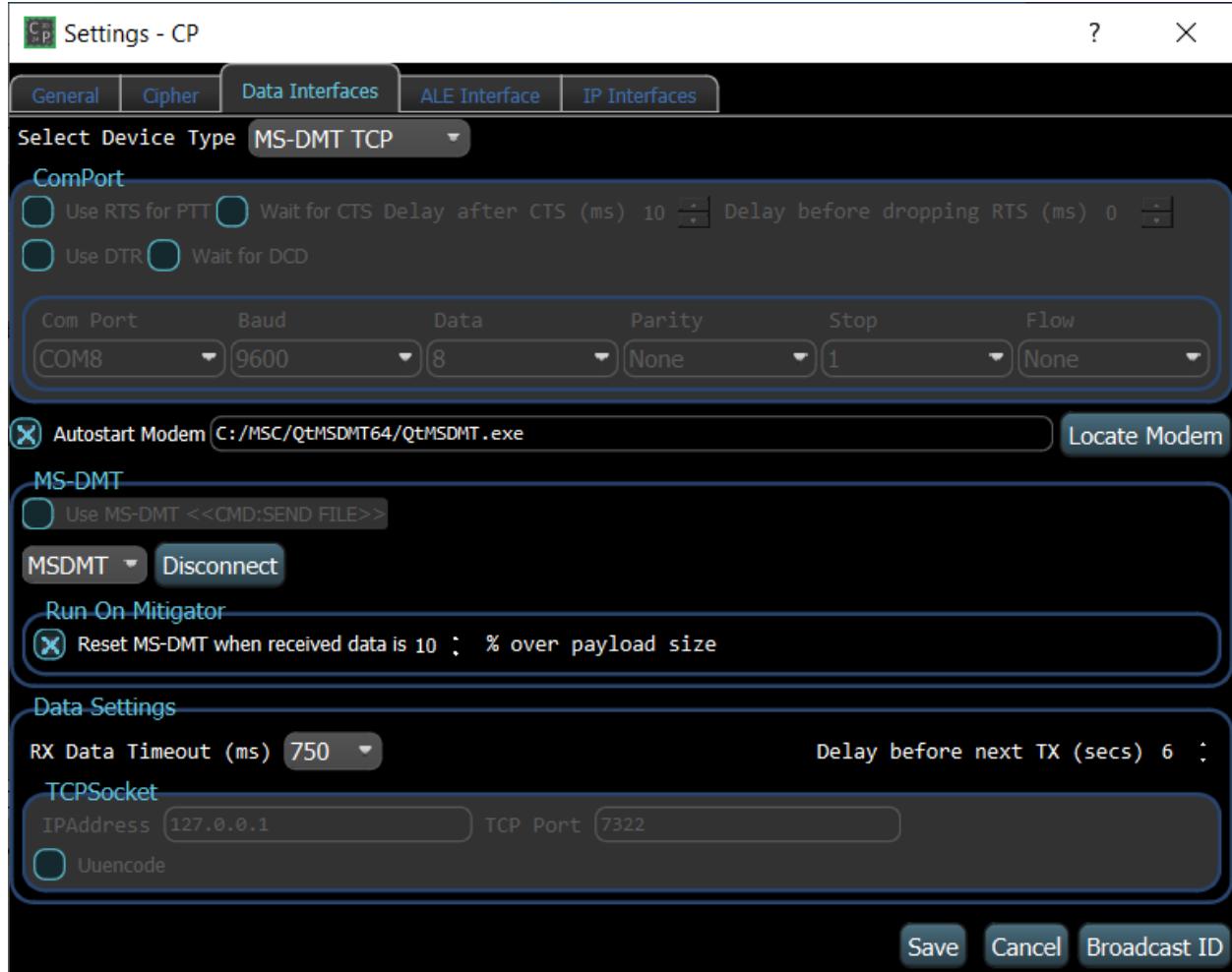
- The Modem Connection status should show a connected status.



- Press the Settings Save button to save the current settings
- CP should auto connect to MS-DMT no mater the start up sequence of CP and MS-DMT

CP may be configured to auto start any software modem (fldigi, MS-DMT etc.)

RADIO MODEM INTERFACE



- Press the Locate modem button and navigate to where the software modem is installed
- Select the software modem exe file and press Open
- To autostart the software modem select the Autostart Modem checkbox
- Ensure all instances of the software modem are closed prior to proceeding
- Press the Settings Save button
- CP will create a software modem process and start the software modem application

RADIO MODEM INTERFACE

- Now when CP is opened/closed the software modem application will also open/close

ALE INTERFACE SETTINGS

When ALE is enabled, the CP operates quite differently.

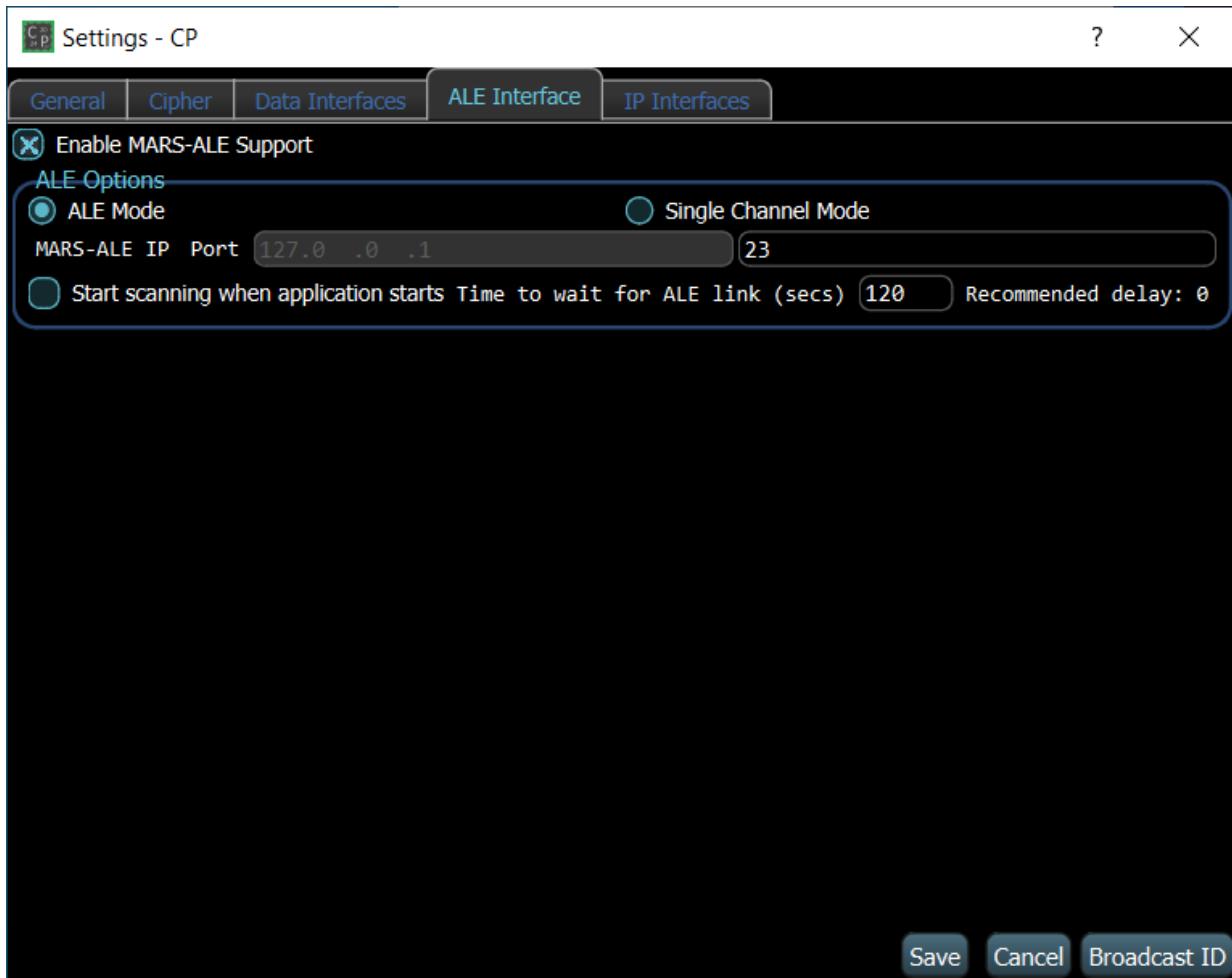
A link must be established prior to any data being sent to the modem. A link may be established manually in either the MARS-ALE application, the CP itself, or from a terminal client that has ALE connection support.

A message sent from a client that supports ALE can also be used to establish a link prior to that message being sent to the modem. If an ALE address is selected at the time the message is sent from the terminal client, the CP will try to establish a link with that ALE address prior to sending the message data to the modem.

If there is a current ALE link in progress, any data addressed to that same ALE address, or any data with a blank ALE address will be sent to the modem.

Any message addressed to an ALE address other than the linked address will be spooled in the CP until the current link is cleared.

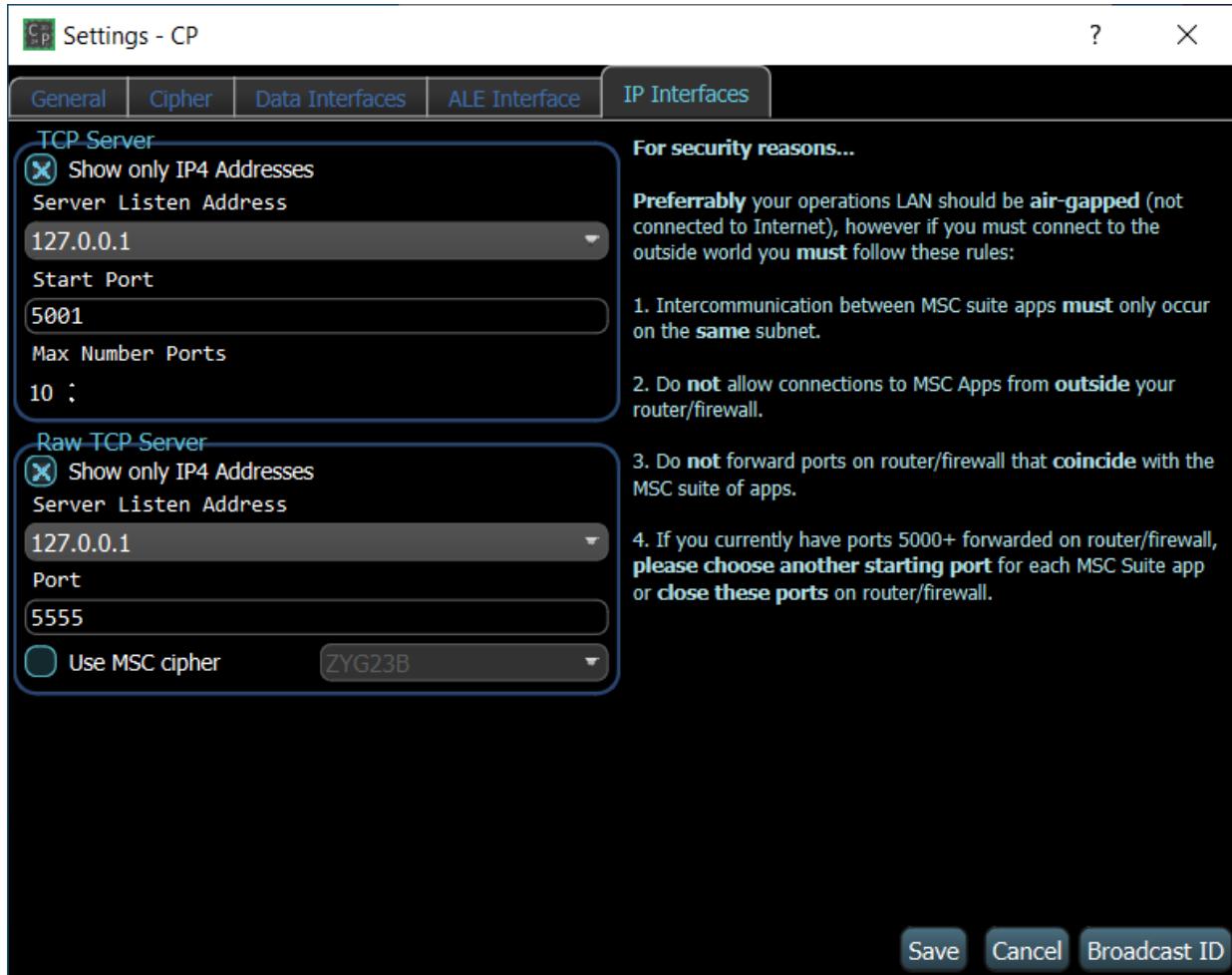
RADIO MODEM INTERFACE



- When MARS-ALE support is enabled the CP communicates with MARS-ALE to establish an ALE link with the specified ALE address prior to sending message data to the modem.
- If a link could not be established, the message is stored in the retry queue if the Use Retry Queue option is enabled. The retry queue is processed every 15 minutes.
- When MARS-ALE support is enabled, yet operator wishes to operate in single channel mode, then the Single Channel Mode radio button should be selected. The requirements when operating in this mode is, CP must not think MARS-ALE is scanning and operator must manually select the desired radio channel.

- Currently the CP must run on the same computer as MARS-ALE and changing the IP Address is disabled.
- You may adjust the Port number in case of a conflict with another application.
- If operator wishes to force MARS-ALE into scan mode when CP is started, then enable the Start scanning check box.
- The Time to wait for ALE link is used in the event communications is lost with MARS-ALE so the CP will not be stuck in ALE calling state. The recommended value is calculated using the formula $15 + (15 * \#channels)$. If timeout is occurring before a link has been attempted on all channels in the scan group, adjust this number to a higher value.

IP INTERFACE SETTINGS



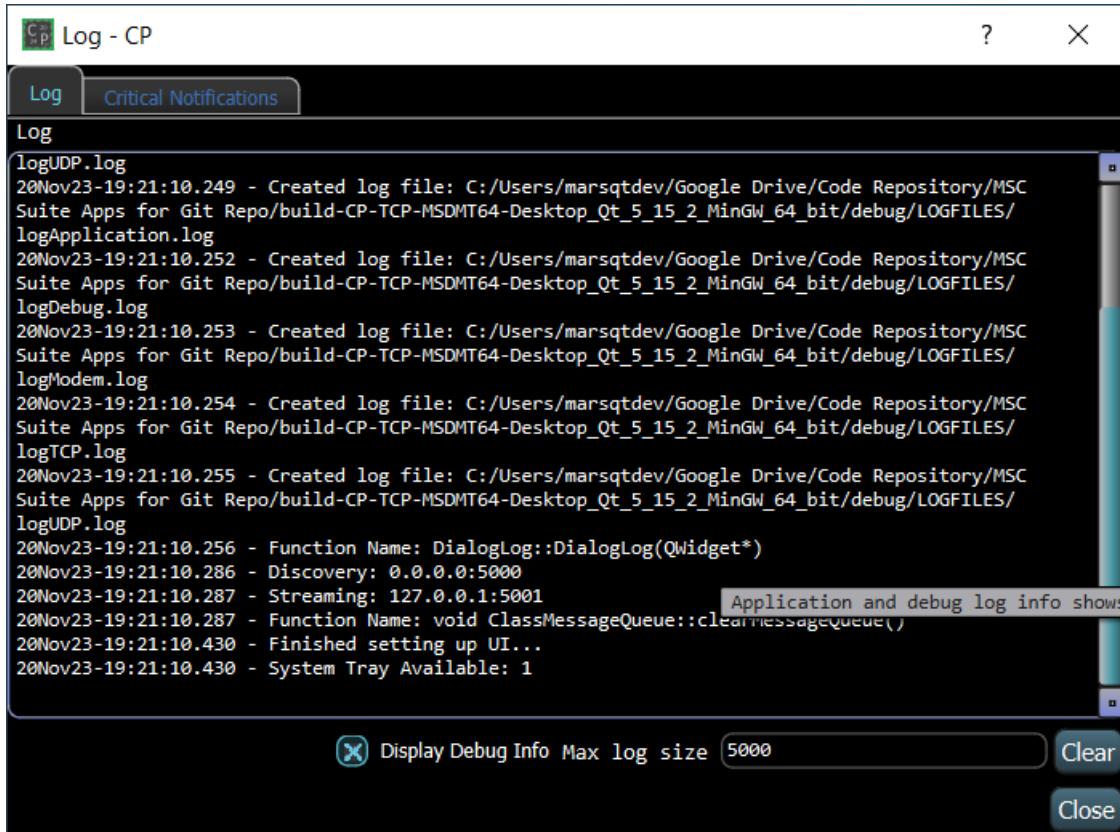
- IP Address – This is the IP address the server will listen on. If the localhost IP (127.0.0.1) is selected then the CP will only listen on the local machine for connections and all networked computers will not detect the CP nor be able to connect to it.
- Starting Port – This is the starting port for the CP to listen on. If this port is in use then the next sequential port will be tried. This sequence continues for the number of ports set in Max Number Ports. Once a free port has been found this port is saved in configuration and used again when the application is started.

- Max Number Ports – The maximum number of ports to try in the event the desired port is used.
- Raw TCP Server – Used to connect other applications via TCP. For example, putty can be configured to connect to the CP. Use CP cipher will allow any terminal that does not have its own cipher to use the CP's cipher.

SECURITY PROTOCOL

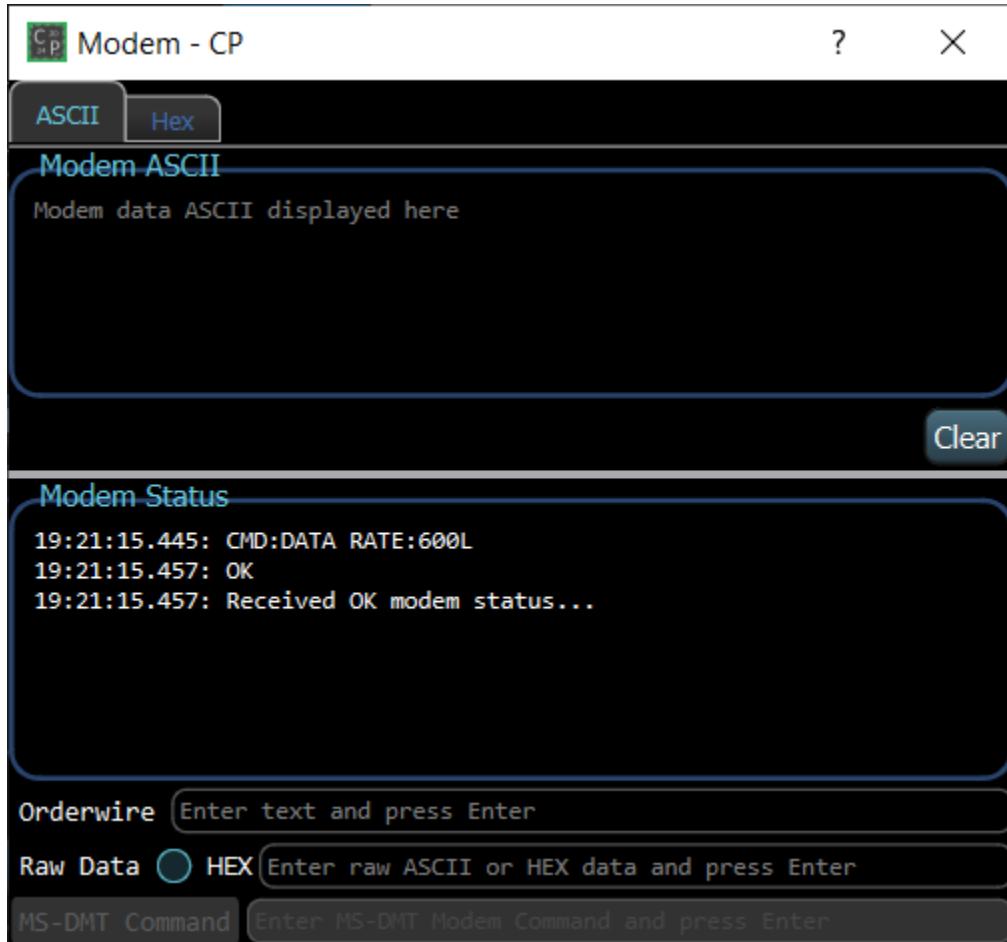
- To mediate concerns that any data being transferred must not be transferred over the internet, a Security Protocol has been established. The Security Protocol is as follows:
- **Preferably** your operations LAN should be **air-gapped** (not connected to Internet), however if you must connect to the outside world you **must** follow these rules:
 - Intercommunication between MSC suite apps **must** only occur on the **same** subnet.
 - Do **not** allow connections to MSC Apps from **outside** your router/firewall.
 - Do **not** open ports on router/firewall that **coincide** with the MSC suite of apps (default port 5000).
 - If you currently have ports 5000+ opened on router/firewall, **please choose another starting port** for each MSC Suite app.

LOG DIALOG



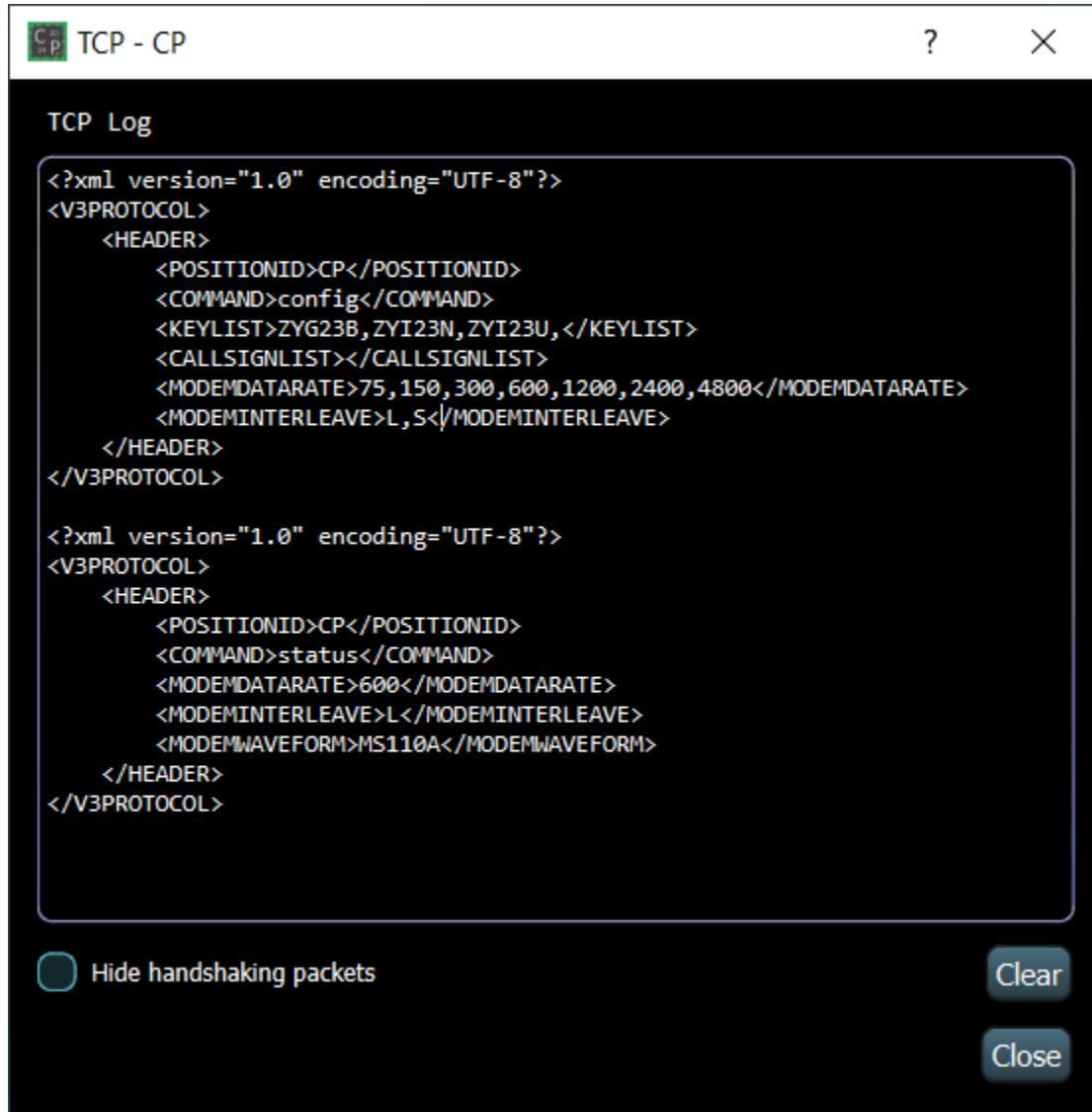
- Displays application log and debugging information.
- When troubleshooting an issue with CP it is recommended that Display Debug Info be checked as this will provide verbose information.
- Max log size is used to set the amount of log data that is stored in memory as this information, especially in debug mode, can be a strain on memory resources
- If there are any critical errors the Log dialog will be shown and set to the Critical Notifications tab. This allows CP to continue operation (if it can) without any pop up error dialogs that halt application processing until the operator acknowledges the dialog.

MODEM DIALOG



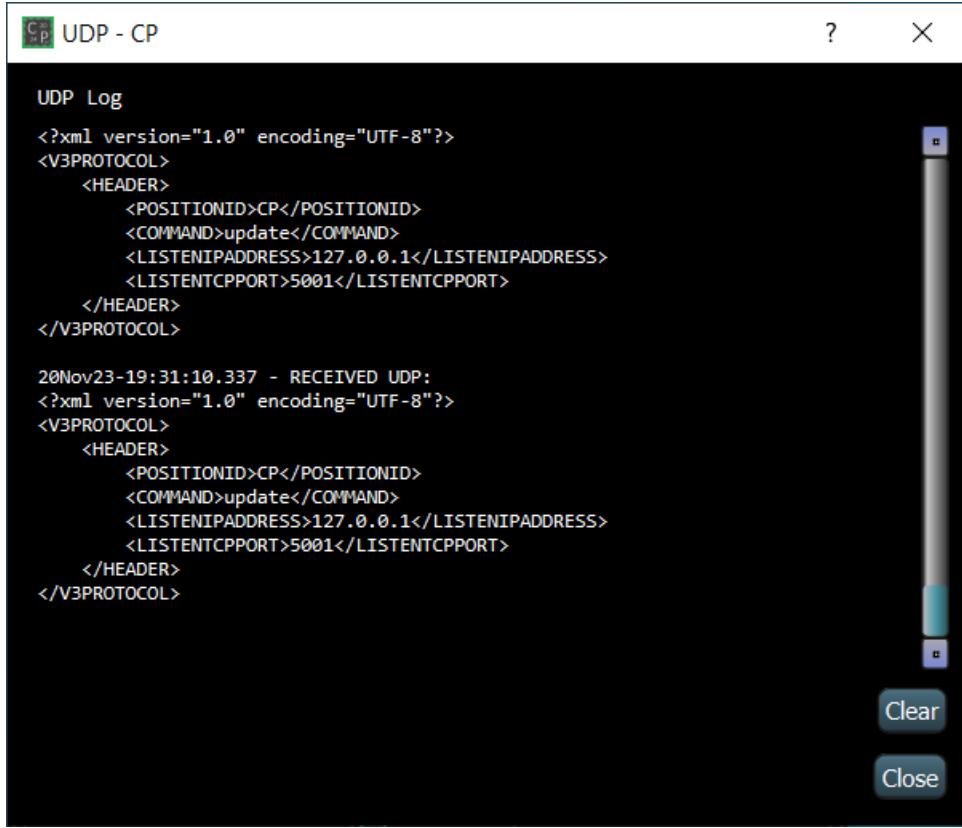
- Displays ASCII and HEX data sent to and received from the modem
- True Orderwire communications (not Chat) can be sent from the Modem dialog. They bypass all messaging processing and are sent in the clear. Orderwire communications are used between operators to establish the circuit prior to any formal message traffic is processed.
- Raw data in ASCII or HEX can be sent, also bypassing any message processing. This is useful for troubleshooting between two stations.

TCP DIALOG



- Only when an MSC compatible application is connected to CP will the TCP button [T] be enabled
- The TCP dialog displays all the TCP communications (config/status/data PDUs). Useful for troubleshooting.

UDP DIALOG



The screenshot shows a window titled "UDP - CP" with the sub-titler "UDP Log". The window contains a scrollable text area displaying XML log entries. The first entry is a configuration message:

```
<?xml version="1.0" encoding="UTF-8"?>
<V3PROTOCOL>
  <HEADER>
    <POSITIONID>CP</POSITIONID>
    <COMMAND>update</COMMAND>
    <LISTENIPADDRESS>127.0.0.1</LISTENIPADDRESS>
    <LISTENTCPPORT>5001</LISTENTCPPORT>
  </HEADER>
</V3PROTOCOL>
```

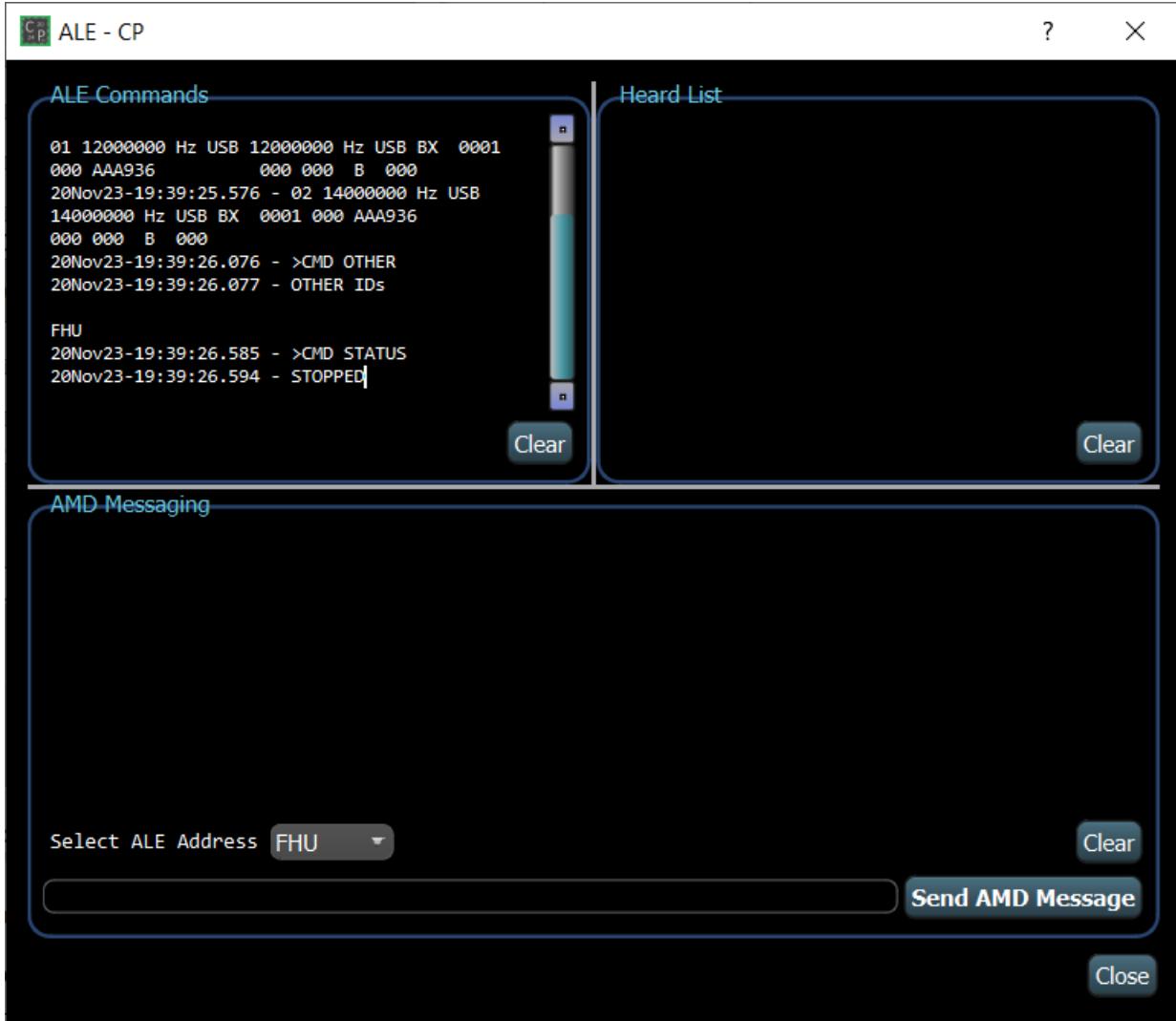
The second entry is a timestamped log message:

```
20Nov23-19:31:10.337 - RECEIVED UDP:
<?xml version="1.0" encoding="UTF-8"?>
<V3PROTOCOL>
  <HEADER>
    <POSITIONID>CP</POSITIONID>
    <COMMAND>update</COMMAND>
    <LISTENIPADDRESS>127.0.0.1</LISTENIPADDRESS>
    <LISTENTCPPORT>5001</LISTENTCPPORT>
  </HEADER>
</V3PROTOCOL>
```

At the bottom right of the window are two buttons: "Clear" and "Close".

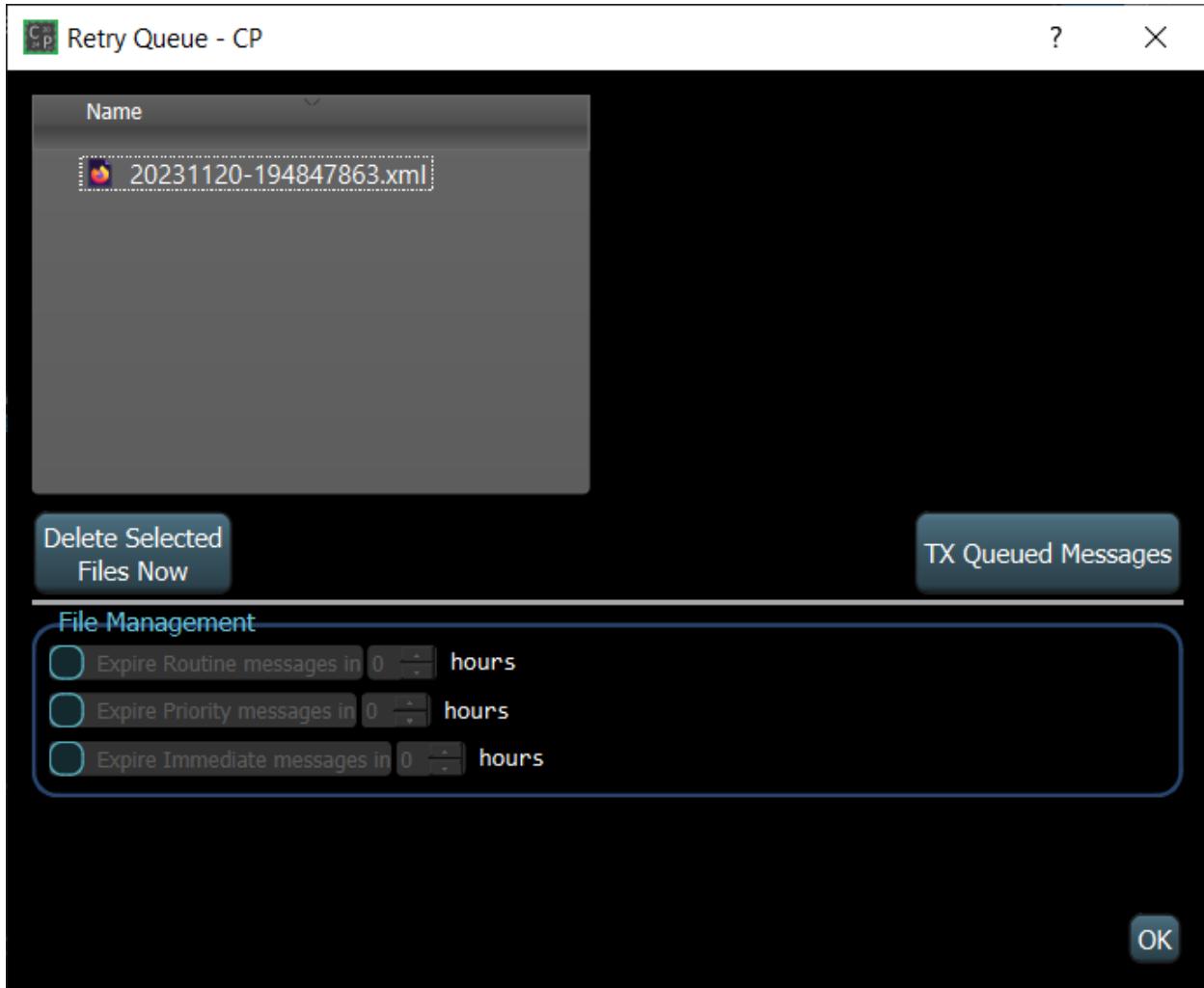
- UDP Datagrams sent between MSC compatible applications are displayed in the UDP Dialog. Useful for troubleshooting.

ALE DIALOG



- Only when MARS-ALE is enabled and CP is connected to MARS-ALE will the ALE Dialog button [A] be enabled
- The ALE dialog displays ALE commands between CO and MARS-ALE
- It also displays any ALE addressed it knows about (Heard List)
- AMD messages can be sent and received from the ALE dialog

RETRY QUEUE DIALOG



- Enable Use Retry Queue in Settings/General tab to utilize the Retry queue
- The Retry Queue button [Q] will only be enabled if there are messages in the Retry queue

TROUBLESHOOTING

Here are some tips when something isn't working as it should.

1. Messages are received at the client applications (terminal) in separate chunks and not as a single message.
 - a. The serial timeout value is not set high enough. 750ms is the default and for most serial devices this is adequate. However some serial devices, particularly Rapid-M modems using the DataPoint software, require a much higher setting, usually in the 4000ms to 6000ms range, depending on what version of DataPoint you are using.
2. Receive random messages containing “<<CMD:DATA RATE?...” at the client applications (terminal)
 - a. This is caused by incomplete commands received from MS-DMT that do not properly pass the modem command parser. The usual culprit is using a virtual serial port emulator and splitting or sharing the serial port between several applications. Qt QSerialPort does not support sharing the serial port and data either goes missing or is delayed enough that the 750ms serial port timeout expires. Either discontinue sharing the virtual serial port or increase the serial port timeout to allow for the delay in data.