
Troubleshooting DCS Messages

STIWG Training Seminar

Microcom Design, Inc.

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Agenda

➤ Basic Filtering

- Dialog
- Conditions
- Operators

➤ Advanced Filtering

- Full Datetime Filter
- By Day Datetime Filters
- Nested Filters

➤ ARM Messages

➤ Troubleshooting

Filter Dialog

- Used to query DADDS website message data, and contains the following controls to define specific message filters:
 - Apply Filter button to submit the query to the server.
 - Link to select 'ALL' (AND) or 'ANY' (OR) options for a filter condition.
 - 'ADD NEW CONDITION' button (blue arrow icon, top left) used to add additional conditions.
 - 'ADD NEW CONDITION' link provided to add additional conditions.
- Open the dialog by clicking the 'FILTER' link located on the grid toolbar.

Filter Dialog

FILTER DATA

APPLY FILTER

SELECT RECORDS WHERE ALL OF THE FOLLOWING APPLY
[\[CLICK HERE TO ADD NEW CONDITION\]](#)

MESSAGE	ADDRESS
	GROUP
	CHANNEL
	BAUD RATE
	SIGNAL STRENGTH
	PHASE NOISE
	MESSAGE QUALITY
	FREQUENCY DEVIATION
	CARRIER TIME
	CARRIER TIME (BY DAY)
	END TIME
	END TIME (BY DAY)
	MESSAGE TIME
	ARM
	SATELLITE ID
	CS MODE
	DATA TYPE
	DATA LENGTH

:: POWERED BY EASYQUERY.NET ::

Filter Conditions

- Conditions depend on the data set and are normally available for each field displayed in the grid being filtered
- Click the 'CLICK HERE TO ADD A NEW CONDITION' link, followed by the desired option from the resulting conditions list to add a new condition.
- One or more conditions can be defined in a filter to query data for a specific set of results.
- Multiple conditions further refine queries to return more precise data sets for use in troubleshooting and analysis.

Filter Type Operators

- Operators determined by the data type of field being queried:
- String Type
 - Starts With, Not Starts With, Contains, Does Not Contain, Is Equal To, Is Not Equal To
- Number Type
 - Is Equal To, Is Not Equal To, Is Between, Is Not Between, Is Greater Than, Is Less Than
- DateTime Type
 - Is Between, Is Equal To, Is Greater Than, Is Less Than
- Select List Type
 - Is Equal To, Is Not Equal To

AND/OR Operators

- Advanced feature used to create complex queries.
 - Default selection is 'ALL' used for majority of filters.
- Changed via the blue 'ALL' (or 'ANY') link to the right of the text 'SELECT RECORDS WHERE' at the top of the dialog window.
- Determines how boolean operators are applied to the filter condition when generating the query to the database
 - 'ALL' selection is analogous to the boolean 'AND' operator and returns data that meets all conditions contained the query.
 - **'Return all messages found from platform X and channel Y and belonging to group USGS01'**
 - 'ANY' selection is analogous to the boolean 'OR' operators and returns data that meets any condition contained in the query.
 - **'Return all messages found from platform X or platform Y or platform Z'**

Datetime Filters

- DateTime conditions allow users to create queries that restricts the resulting data to a defined time frame.
- The message carrier or message end time can be used to add a DateTime condition to the query.
 - End time has the best performance.
- Two ways to add a carrier or end time condition to the filter:
 - Default - Manual entry in Julian format (DD/YYYY HH:MM:SS)
 - By Day - Automatically entry from date picker selections

Example - Datetime 'Full' Filter

- Create a message filter representing the statement below using the default (full) DateTime entry method:

“Return messages with end times between 13:00z and 13:05z on March 28th 2024”

- Browse to the messages tab, clear any existing filters, and open the filter dialog.
- Click the ‘ADD NEW CONDITION’ link and select ‘End Time’ from the condition list
- Enter the Julian DateTime ‘24/088 13:00:00’ in the left text box for lower limit.
- Enter the Julian DateTime ‘24/088 13:05:00’ in the right text box for upper limit.
- Verify entries match Julian format exactly, and click the ‘Apply Filter’ button to submit the query

Example - Datetime 'By Day' Filter

- Create a message filter representing the statement below using the 'BY DAY' DateTime method implemented with datepicker controls:

“Return messages with end times between March 28th 2024 and March 30th 2024”

- Browse to the messages tab, clear any existing filters, and open the filter dialog.
- Click the 'Add New Condition' link and select 'END TIME (BY DAY)' from condition list.
- Click the left text box and select March 28th from the datepicker to set the lower limit.
- Click the right text box and select March 30th from the datepicker to set the upper limit.
- Click 'Apply Filter' to submit the query. Selections are automatically entered into the text boxes.

Nested Filters

- Nested filters are an advanced filtering technique that allows for the creation of complex, multi-part message data queries.
- They involve one or more main conditions, each with one or more sub-conditions.
 - Allows main conditions to have different sub-sets of data in the query.
- While use of nested filters is uncommon, they can be valuable in certain situations.
 - Queries containing multiple platforms and their corresponding time windows.
 - Queries for platform messages on multiple channels.

Example - Nested Filter

- The following example demonstrates how to use nested filters with the 'ALL/ANY' (AND/OR) operators to create a query that represents the statement below by changing how individual filter conditions are linked together in the overall query

“Return all messages on channel 183 and have an ARM code ‘G’ or ‘?’ ”

- Browse to messages tab, clear filters, and open the filter dialog.
- Click the 'ADD NEW CONDITION' link and select 'CHANNEL' from the list of conditions. Enter 183 in the condition text box.
- Click the 'ADD NEW CONDITION' button and then 'OPEN NEW BRACKET' to add new condition set. Default option is 'ANY' (boolean OR).
- In new bracket, change default condition to 'ARM' and select 'GOOD MSG (G)' from the ARM values list.
- Click the 'ADD NEW CONDITION' button for the ARM condition and select 'Add New Condition After Current' from the list to add a second condition to the 'Any' bracket.
- Change new 'ANY' bracket condition to 'ARM' and select 'PARITY MSG (?)' from the ARM values list.
- Click the 'APPLY FILTER' button to apply the filter to message data.

ARM Messages

- Informational messages are generated when DADDS detects problems with a platform's message reception.
- They are phony messages generated and disseminated by DADDS to alert users to potential problems with a platform.
- Within the website, informational messages are identified by the abnormal response message, or 'ARM' code, and can have the following values:
 - 'W' character for messages received on the wrong channel.
 - 'T' / 'U' characters for messages received with timing errors.
 - 'A' / 'B' / 'I' characters for messages received with address errors.
 - 'M' character for messages that were not received at all.
 - 'G' character for messages received with no errors (actual message).
 - '?' character for messages received with parity errors (actual message).

Address ARM Messages

- There are three types of address informational messages generated by DADDS:
 - Bad Address Errors (B)
 - Invalid Address Errors (I)
 - Correctable Address Errors (A)
- Bad address messages have the ARM character 'B' and are generated when an invalid DCP address is received that cannot be corrected.
- Invalid address messages have the ARM character 'I' and are generated when a received DCP address not present in the DADDS database.
- Correctable address messages have the ARM character 'A' and are generated when a transmission is received with an invalid DCP address that can be corrected via the BCH code.

Timing ARM Messages

- There are two types of timing informational messages generated by DADDs:
 - Message Timing Errors
 - Unexpected Message Errors
- Timing messages have the ARM character 'T' and are generated when a message is not received entirely within its window.
- Unexpected messages have the ARM character 'U' and are generated when a message is received completely out of its window.
- Timing messages normally indicate problems with a platform's transmit configuration, GPS synchronization or radio hardware.

Missing Messages

- Missing informational messages are a special type of ARM message that is generated by DADDS when an transmission is not received within 2 minutes of its expected time window.
- They are generated for 48 hours after the last successful reception of a platform's message to notify users of the problem.
- After 48 hours, the platform is marked as inactive and missing messages are no longer generated by DADDS.
- For a missing message to be generated, the expected message must be completely missing.
- Messages received completely outside of their window, or received on a wrong channel will not trigger a missing message to be generated.

Troubleshooting

- Where is my platform's message data?
- Why am I receiving missing messages?
- Why am I experiencing poor reception?
- Am I being 'stepped on' by another platform?
- What do the informational messages being received along with message data mean?

Troubleshooting

- Views and Netlists are valuable tools for troubleshooting problems with message reception.
 - Allow users to store pre-defined filters in the database to save time.
- The following slides will detail how to use filters to obtain specific sets of DCS data for review.
- Analysis of message timing and other parameters in the filter results provides clues into the cause of the reception issues, and what actions to take to resolve the problem.
- In addition, ARM messages and message data can provide clues, and are important to consider when debugging a problem.

Filter Message Data

- The first step to take when troubleshooting missing data is to create a message data filter for the problem platform.
- Login to a DADDs website and open the messages filter dialog:
 - Add a new 'ADDRESS' condition to the filter and select the 'STARTS WITH' (default) or 'EQUAL TO' operator.
 - Enter the problem platform's DCP address in the condition text box.
 - Add a second 'END TIME (BY DAY)' condition and select the 'GREATER THAN' operator.
 - Select the day prior to the last time the message was received and apply the filter.
- Save the filter as a View for quick re-call while debugging.
- If desired, export the results to an excel file for offline analysis of the data using Microsoft Excel or other software capable of reading XLS formatted files.

Analyze Messages

- Review the messages leading up to the last received message from the platform.
 - Are there any informational or missing messages?
 - Are there any indicators in the actual data of transmissions leading up to the outage?
 - Does the message quality (performance) change leading up to the last received message?
- Query all 4 DCS websites to determine if reception issue is specific to a DADDs processing strand.
 - Real-time servers associated with DCS1-4 are re-booted periodically, during which time no messages will appear from that server on its website.
 - It is possible for messages to be received at Wallops but not NSOF, and visa-versa.

Analyze Performance

- Signal strength, frequency deviation, message quality, phase noise and parity errors provide insight into a platform's health.
- High frequency deviation can indicate transmitter hardware problems.
- Low signal strength, message quality and/or high phase noise normally indicate RFI or antenna issues.
- Did the performance decrease leading up to the outage occur gradually or suddenly?
 - Sudden decrease followed by an outage indicates a site issue, such as a misaligned antenna or dead transmitter.
 - Does it follow the diurnal with good message reception during the day and poor or missing messages overnight?
 - Gradual or periodic decrease prior to the outage points to local RFI or DCP interference due to timing issues.

Analyze Channel

- To debug possible interference from other DCPs, a query on the channel the message was received on can be helpful.
- Create a message data filter on the channel the platform is transmitting on.
- Add a few 'END TIME BETWEEN' conditions with time ranges starting few minutes before and after the expected transmission for a few hours prior to the outage.
- Look at the transmissions occurring immediately before and after the platform's window:
 - Is there another message overlapping the window in any of the time ranges?
 - Are there timing/channel informational messages from other platforms, or does a neighboring transmission moving very close to the window?
 - If so, it is possible your platform is being 'stepped on' by another transmission.
 - Contact DCS support for help in resolving the DCP interference.

Analyze ARM Messages

- Are any informational messages present in the platform query results?
- If so, what are they and when were they received?
 - Timing ARM messages indicate the platform is having problems transmitting on schedule.
 - Wrong channel ARM message indicates a configuration or transmitter hardware issue.
 - Address ARM messages indicate possible configuration, platform registration or interference issues.
 - Missing ARM messages indicate reception gaps and possible interference with the platform's transmissions.

Analyze Data

- Depending on the transmit or message data format, some clues may be found in the message data.
- The first character of CS2 messages corresponds to platform GPS time synchronization events.
 - “ ‘ “ (single quote) indicates that a GPS synchronization occurred prior to the message's transmit time.
 - “ b“ indicates that no GPS synchronization has occurred.
 - Missing GPS synchronizations along with timing informational messages prior to an outage points to GPS issues (drifting transmissions).
 - Check the platform's GPS hardware and antenna.
- Message data (ASCII or decoded) may include battery voltage readings depending on the platform configuration.
 - Decreasing battery voltage readings prior to an outage points to battery and/or charging issues.

Ionospheric Scintillation

➤ **Ionosphere:**

- Part of the upper atmosphere.
- Consists of multiple layers beginning at 85 km and ranging to 600 km; scintillation affects occur around 350 km.
- Electrons and charged atoms/molecules ionized by ultraviolet radiation from the Sun.
- Creates refraction and diffraction of radio signals.

➤ **Scintillation:**

- Refraction: Unexpected phase shifts.
- Diffraction: Amplitude and phase variations due to multipath summing and cancellation.

➤ **Solar Cycle:**

- Approximately every 11 years the Sun enters a period of increased solar activity, known as the solar maximum.
- Ultraviolet radiation increases, which increases ionospheric scintillation.
- We are currently approaching solar maximum.
- DCS is experiencing interference caused by scintillation, particularly South American users.

Ionospheric Scintillation

- Interference caused by ionospheric scintillation has fairly specific symptoms and should be easily identified.
 - The majority of platforms experiencing interference from scintillation will be located in South America due to a geomagnetic anomaly.
 - Platforms located in high latitudes may experience interference from scintillation, so Canadian users may be affected as well.
 - Interference caused by scintillation occurs in a specific window starting around 0z and ending around 5z.
 - Messages may be missing, have parity errors and/or truncated message data due to signal strength and phase fluctuations caused by scintillation.