

Empower Injection and Channel Status

Injection and Channel Status with focus on Data Incomplete Channel Status
What it is and What it is not

Injection Status - all possible values

Injection Status field was added in Empower Feature Release 4 Service Release 3 (E3 FR4 SR3)

- **Incomplete** – acquisition is either in progress, or injection was not completed
 - All injections start with this status and are then updated.
 - Possible power failure situation
 - Status cannot be updated due to lack of connectivity between LAC/E module and database
- **Complete** – acquisition completed normally
- **User abort** – Injection Log may have more information
- **Instrument Failure** – an instrument failure occurred during acquisition
 - Channel could be short or missing; channel may be fully acquired
 - Injection Log may have more information.
- **Non-Instrument Error** – an error unrelated to an instrument error occurred
 - Channel could be short or missing; channel may be fully acquired
 - Injection Log may have more information.
- **Imported** – data that was imported into Empower
- **Pre-Empower 3 SR3** – data that originated prior to E3 FR4 SR3 will not have a Channel Status

Normal progression:

- Incomplete > Complete

Channel Status - all possible values

Channel Status field was added in Empower Feature Release 4 Service Release 3 (E3 FR4 SR3)

- No Data File Created* – the initial status when Empower is preparing for acquisition
- Data Being Acquired – during acquisition of data
- Acquisition Finished – once checksum is calculated and .dat data file is closed
- No Data Acquired - if < 2 data points are present in the .dat data file
- Data Incomplete** – in the case of a buslace error, power fail, backup during acquisition (the channel within the backed up data), checksum error (preventing the checksum from being determined or stored in .dat data file header)
- Data Incomplete*** - network issues when the .dat datafile is being closed at end of acquisition
 - Data Incomplete does NOT occur due to an abort, instrument failure or buffering
- Verified as Complete – channel with status of Data Incomplete channel was verified by privileged user

Normal progression:

- No Data File Created* > Data Being Acquired > Acquisition Finished

*This status is momentary and transient and will not normally be seen

**the initial status at the time of the problem will be Data Being Acquired. Once the data is read (viewed in Review or processed), the Channel Status transitions to Data Incomplete or No Data Acquired if < 2 data points are present in the .dat file

***Empower provides an Instrument Failure Injection Status when the instrument driver notifies Empower that there is an Instrument Failure. In a scenario where the LAC/E module has become unavailable (due to power disruption, reboot, temporary network issue, etc.) the Injection and Channel Status may report either Injection Status = Incomplete and Channel Status = Data Incomplete **OR** Injection Status = Instrument Failure and Channel Status = Acquisition Finished based on the timing of when the driver communicates the instrument failure to Empower vs. the timing of when Empower closes the .dat file.

Injection and Channel Status

- Helps troubleshoot potential error situations such as Data Missing and Data Incomplete
 - Can easily detect these error conditions without bringing all data into Review.
 - These are not new error conditions; prior to E3 FR4 SR3 these statuses were displayed in Review only. The software logic for these errors is unchanged between E3 FR4 SR3 and prior versions and these errors are expected to be seen for the same reasons since Empower 2.
 - Injection and Channel Status is viewable in the Project Window
 - Therefore is searchable and more obvious; avoids the need to bring all project data into Review to assess for error conditions
- Partial list of statuses you will see:

	Injection Status	Channel Status
Acquisition in Progress	Incomplete	Data Being Acquired
Acquisition Completed Successfully	Complete	Acquisition Finished
Data aborted during pre-inject sequence	User Abort	No Data File Created No Data Acquired
Data aborted during acquisition	User Abort	Acquisition Finished
Instrument failure caused acquisition to stop	Instrument Failure	Acquisition Finished
Temporary network connectivity issue during closing of the .dat file***	Complete	Data Incomplete
During acquisition while in buffering mode (before recovery)	Incomplete	Data Being Acquired
Data was imported	Imported	blank
Data is from before SR3	Pre-Empower 3 SR3	blank

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Clarity of Messages on Plot in Review

Most statuses appear in Project Window; the following appear only on the chromatogram plot in Review and in Reports as in versions prior to E3 FR4 SR3:

- **Data Mismatch** (message only appears on chromatogram plot and is indicated by I42 Processing Code)
- **Bad Checksum** (message only appears on chromatogram plot and is indicated by I43 Processing Code)
- **Data Incomplete** (message only appears in Channel Status and on chromatogram plot and is indicated by I44 Processing Code)

- Instead of Data Missing which is seen in versions prior to E3 FR4 SR3, new discrete messages are shown on the chromatogram plot in Review and in Reports:
 - Data File Not Found (Processing Codes I47-52)
 - Project Directory Not Found (Processing Codes I53-I58)
 - Problem Reading Data File (Processing Codes I59 – I64)
- Message on the plot is in addition to Injection and Channel Status because something happened to the data after acquisition completed
- Results will have new processing codes in addition to I01 processing code

Provides Troubleshooting

- See entire picture when you assess:
Injection Status + Channel Status + Processing Codes
- When data with a Channel Status of Data Incomplete is background processed, a result is created, however no result data is present because the file is not readable by Empower.
 - A result is listed in project window, but the result is 'empty'
 - The result contains an I01 processing code, indicating: *Problem reading chromatogram, cannot detect peaks*. This code is further explained by one of the I42 - I70 codes that detail the issue.
 - Plots in Review and elsewhere, no chromatogram appears
 - Plots in Review and elsewhere, the chromatogram plot indicates 'Data Incomplete'

Data Incomplete – What it is not

- Is not a new error condition in E3 FR4 SR3. Data Incomplete was added in Empower 2.
- Does not occur due to buffering
- Does not occur due to user abort
- Does not occur due to instrument failure
- Does not definitively indicate that the chromatogram does not contain all the expected data points
 - Empower does not count data points nor does it confirm a correct run time or expected data points. Some instrument drivers may count data points in order to determine when to stop acquisition but this information is not provided to Empower and is not used by Empower in any manner.

Data Incomplete – What it is

A channel status of Data Incomplete occurs when a problem occurred preventing the data file header from being completed or the Channel Status from being updated. This can occur even when acquisition has gone to completion, but the final update to either the data file (.dat file) which includes updating the Channel Status, closing the file and doing a checksum cannot be completed; i.e. if there is no communication between the file server or database and LAC/E module. This could be a momentary connectivity issue which prevented the .dat file or database from being updated correctly.

- Empower does not report a specific error indicating this lack of network connectivity

When fully acquired data has a Data Being Acquired channel status because something happened at the end of acquisition causing the Being Acquired status not to update, the status will transition to No Data Acquired (if < 2 data points (or spectra if 3D data) are present) or Data Incomplete when the file is 'read' (when it is processed or brought into Review).

- Troubleshooting for this condition: Do not acquire in Run and Report or Run and Process Mode. When acquisition is complete, check to see if some channels are still in a Channel Status of Data Being Acquired. If so, back up this data and provide to Waters before 'reading' this data, i.e. processing or bringing it into Review.

Injection Status	Channel Status	Description
Incomplete	Data Incomplete	Acquisition didn't complete successfully. Possible lack of fileshare or database connectivity when the statuses and/or .dat file were being updated.
Complete	Data Incomplete	Since the Injection Status is Complete, we know that acquisition finished but the .dat data file was not finished (closed) properly. The Data Incomplete Channel Status is present with a Complete Injection status when there was a problem at the end of acquisition closing the data file or a problem updating the Channel Status. This could be due to lack of fileshare or database connectivity. If buffering did not subsequently occur, the connectivity issue was momentary. Network monitoring may be helpful for troubleshooting purposes.

Verifying Data as Complete

- Verifying data as complete can be done by a user with the Verify Incomplete Data in Raw Data Files privilege.
- The intent is to allow a privileged user to assess a Data Incomplete situation and subsequently allow the data to be useable within Empower.
 - This privilege allows a user to view the chromatogram and determine whether or not they want to verify it as complete. The verify action is audit trailed.
 - Data that is incomplete is not readable by Empower until it has been verified as complete. If such data is processed an 'empty' result with an I01 processing code is created.
 - The Empower software does not determine whether or not the data is complete during this verification process. It is up to the user to decide if the data should be verified as complete.



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