

Geophysical Monitoring System

SAND2024-02659R

March 2024



GMS SOH Configuration Guide

Version 1.23 (for GMS PI 23 Open Source Release)

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.



U.S. DEPARTMENT OF
ENERGY



This page intentionally left blank.

GMS SOH Configuration Guide

Version 1.23 (for GMS PI 23 Open Source Release)

Sandia National Laboratories
P.O. Box 5800
Albuquerque, New Mexico 87185-MS0401

ABSTRACT

This document is a guide to setting the system and processing configuration for the Geophysical Monitoring System (GMS) Station State-of-Health (SOH) Monitoring application.

TABLE OF CONTENTS

1	Introduction.....	8
1.1	Description	8
1.2	System Configuration Description	8
1.3	Processing Configuration Description	8
1.4	Processing Configuration Levels.....	10
1.4.1	Default	10
1.4.2	Profile.....	11
1.4.3	Station	11
1.4.4	Channel	12
1.5	SOH Processing Description	12
2	GMS System Configuration	14
2.1.1	GMS System Configuration Properties	14
3	GMS Processing Configuration	25
3.1	Station Reference.....	25
3.1.1	CSS Formatted Station Reference Files	25
3.1.2	Station Data	25
3.1.3	Station Group Definitions	26
3.2	SOH Processing Config	26
3.2.1	Configuration or Data Acquisition	26
3.2.1.1	Global Parameters.....	26
3.2.1.2	ConnMan Station Parameters.....	27
3.2.1.3	DataMan Station Parameters.....	28
3.2.1.4	Data Frame Receiver Channel Lookup	29
3.2.2	General SOH Configuration.....	29
3.2.2.1	Processing Time Period	29
3.2.2.2	SOH Display Parameters	30
3.2.2.3	System Messages Settings	30

3.2.2.4	SOH Rollup Time Tolerance.....	30
3.2.3	Station Group Configuration.....	31
3.2.3.1	Station Groups	31
3.2.3.2	Station Group Capability Rollup.....	32
3.2.3.2.1	Default	33
3.2.3.2.2	Station Group	33
3.2.3.2.3	Station Group Capability Rollup Structure	34
3.2.4	Station Configuration.....	34
3.2.4.1	SOH Environmental Monitor Types	35
3.2.4.1.1	Default	35
3.2.4.1.2	Profile	36
3.2.4.1.3	Station	36
3.2.4.2	SOH Monitor Time Windows	36
3.2.4.2.1	Default	37
3.2.4.2.2	Profile	37
3.2.4.2.3	Station	38
3.2.4.3	SOH Monitor Thresholds.....	38
3.2.4.3.1	Default	39
3.2.4.3.2	Profile	40
3.2.4.3.3	Station	41
3.2.4.3.4	Channel.....	42
3.2.4.4	Channels Used in SOH Status by SOH Monitor Type	42
3.2.4.4.1	Default	43
3.2.4.4.2	Station	44
3.2.4.4.3	Channel List Structure	45
3.2.4.5	Monitor Types Included in Station Status Rollup	45
3.2.4.5.1	Default	45
3.2.4.5.2	Profile	46
3.2.4.5.3	Station	46

3.2.4.6	Monitor Types Included in Channel Status Rollup	46
3.2.4.6.1	Default	47
3.2.4.6.2	Profile	47
3.2.4.6.3	Station	48
3.2.4.7	Channel Capability Rollup	48
3.2.4.7.1	Default	49
3.2.4.7.2	Profile	49
3.2.4.7.3	Channel.....	50
3.2.4.7.4	Channel Capability Rollup Structure	50
3.2.4.8	Station Capability Rollup	51
3.2.4.8.1	Default	52
3.2.4.8.2	Station	52
3.2.4.8.3	Station Capabilty Rolllup Structure	53
3.2.4.9	ACEI Merge Tolerance.....	54
3.2.4.9.1	Default	54
3.2.4.9.2	Station	55
3.2.4.9.3	Channel.....	55
4	User Preferences.....	56
4.1	Default User Preferences	56
5	Updating Configuration.....	57
5.1	System Config.....	57
5.2	Other Configuration	57
5.2.1	Overrides.....	58
5.2.2	Generating Station Reference and Station Processing from CSS	58
6	SOH Processing Configuration Guidance	60
6.1	Definitions	60
6.2	SOH General Configuration Parameters	60
6.2.1	Reprocessing Interval.....	60

6.2.2	Acknowledgement Quiet Duration	60
6.2.3	Available Quiet Durations	61
6.2.4	SOH Station Stale Duration	61
6.2.5	SOH Historical Durations	61
6.3	Channel Monitor Configuration Parameters	62
6.3.1	Calculation Interval	62
6.3.2	Back Off Duration.....	62
6.3.3	Good Threshold	63
6.3.4	Marginal Threshold.....	64
6.4	General Recommendations.....	65
6.4.1	PI13 Default Config Parameters	65
7	Appendix A	68

1 INTRODUCTION

1.1 Description

The Geophysical Monitoring System (GMS) Station State-of-Health (SOH) monitoring capability allows the system controller to view current SOH values and calculated statistics for stations and channels, view trend plots of SOH values, be notified when station SOH status changes, and acknowledge or quiet notifications while the station issues are being investigated. The SOH monitoring capability includes components to acquire CD 1.1 protocol station data, extract SOH information from the raw data packets, process the raw SOH information for display, store the SOH information, and display the SOH information in an interactive display. The application uses system and processing configuration to provide the system controller with mission-relevant information about station health.

This document is a guide to setting the system and processing configuration for GMS SOH monitoring display parameters.

1.2 System Configuration Description

GMS consists of a set of services providing basic system resources, GMS system resources, and GMS processing services deployed on a Kubernetes cluster with the gmskube tool. On deployment, the gmskube utility loads default station metadata and processing configuration into the system and may load configuration overrides as specified by gmskube command line options.

Default GMS configuration files are included in every release of the application.

System configuration values are defined in Section 2 of this document.

1.3 Processing Configuration Description

The processing configuration contains several configuration objects. Each configuration object is contained in a separate folder within the processing config (i.e., the config/processing folder). Each configuration object is made up of various configuration options. Different configuration options can be contained in different files or the same files.

The file name is not important to the operation of SOH; however the file names are important to the SOH Configuration Tool. Generally, the default configuration option(s) are contained in a single default.json file, overrides that effect a set of station are contained in a {profile}.json, and overrides that are specific for the station are contained in a {station}.json file.

The default processing configuration is included under /config/processing.

Each processing configuration option has a format which includes the following:

Name - Each file contains a name (listed inside the file). The name describes the file. The name does not have an impact on the processing; however, correct naming is important for operating with the SOH Configuration Tool in some cases.

Constraints – Each configuration option contains a list of one or more constraints. Most configuration objects require or allow a DEFAULT constraint. Other constraints are allowed depending on the type of configuration object (details below). Each constraint contains the following information:

- **ConstraintType** – Either DEFAULT or the cast type of the value given in the constraint. Currently, the only other value for this is STRING. When the constraint type is DEFAULT, the constraint type is the only information included in the constraint (i.e., there is no criterion, operator, or value).
- **Criterion** – This is what is constrained. What can be used as a criterion depends on the configuration object type. Possible criterion are: StationName, ChannelName, MonitorType, StationGroupName, and protocol.
- **Operator** – The operator is used to specify if the value is a single value or list of values, and if the configuration option is for the listed values or for values not listed. The operator is further divided into two options:
 - **Type** – EQ (equal) or IN (in list). EQ is used if the value contains a single value. IN is used if the value contains a list of values.
 - **Negated** – True or False. False is used when the parameters will apply to the values list. True is used when the parameters will apply to the values not listed. For operation with the SOH Configuration Tool only false should be used.
- **Value** – This is the value or list of values the configuration option is being restrictively applied to.

Parameters – This lists the parameter types and parameter values. The parameter types are specific to the configuration object.

There are four possible combinations of operators between the type and negated. In this document, they will be referred to as follows:

Operator (Referred)	Operator Type	Operator Negated
EQ	EQ	False
IN	IN	False
NOT EQ	EQ	True
NOT IN	EQ	True
EQ*	IN	False

EQ* is used in the case where the IN operator is used how the list of valid values is limited to one. This is typically used by the SOH Configuration Tool.

There are 18 configuration objects included in the processing configuration:

1. acei-merge.processor.mergre-tolerance
2. connman.station-parameters
3. dataframe-receiver.channel-lookup
4. dataman.station-parameters
5. soh-control.channel-capability-rollup
6. soh-control.channels-by-monitor-type
7. soh-control.rollup-stationsoh-time-tolerance
8. soh-control.soh-monitor-thresholds
9. soh-contro.soh-monitor-timewindows
10. soh-control.soh-monitor-types-for-rollup-channel
11. soh-control.soh-monitor-types-for-rollup-station
12. soh-control.station-capability-rollup
13. soh-control.station-env-monitor-types
14. soh-control.station-group-capability-rollup
15. soh-control.station-group-name
16. soh-control
17. ui.common-settings
18. uisoh-settings

There are other files in the processing configuration which related to IAN which are not discussed in this document (see the GMS IAN Configuration Guide for more detail).

1.4 Processing Configuration Levels

There are four different levels of Processing Configuration Levels.

1.4.1 Default

Every processing configuration item must have at least one default configuration. Each default configuration contains a DEFAULT constraint. Typically this is the only constraint included in a default.json file and there is only one configuration item. The only exception to this rule is the

soh-control.monitor-thresholds configuration in which there is a default configuration for each monitor type.

Typically the default configuration is stored in a default.json file. The only exceptions to this rule are ui.soh-setting and ui.common-settings configuration which are named ui.soh-settings.json and ui.common-settings.json. Using a file name of default.json is important for any configuration item that is controlled by the SOH Configuration Tool.

The SOH Configuration Tool uses the default configuration when determining what the resolved configuration of a station is and when determining when to create/delete a configuration overrides. The SOH Configuration Tool does not edit the default configurations. If it is desired to edit the default.json files they will need to be manually edited. Only the parameter values of these file should be edited. The default.json files should not be deleted.

1.4.2 Profile

The concept of a Profile was to have a default configuration that could be applied to multiple Stations. When a Station was part of the profile the defaults applied for the station would be those of the profile instead of the universal default. When the station was not part of a profile then the universal default would apply. A listed Station could be configured to deviate from its profile by configuring the individual station.

Each profile configuration contains a DEFAULT constraint and StationName constraint which contains the list of Stations which use that profile. It is extremely important that a Station not be listed more than one profile configuration within the same configuration item unless there are additional constraints (either MonitorType or StationGroupName) to distinguish them.

The SOH Configuration Tool uses the profile configuration when determining what the resolved configuration of a station is and when determining when to create/delete a configuration override. The SOH Configuration Tool does not create or edit the profile configurations. If it is desired to create or edit the {profile}.json files it will need to be manually. Additional {profile}.json files may be created or existing ones can be deleted.

1.4.3 Station

Configuration which is specific to a station is generally edited by the SOH Configuration Tool. The only exception to this rule is the acei-merge-processor.merge-tolerance configuration which was not included in the SOH Configuration Tool. Configuration specific to a station is included in a {station}.json profile. Typically the only constraint for a station level files is the StationName; the exception to this rule is the soh-control.soh-monitor-thresholds which also

includes a MonitorType constraint and the soh-control.station-capability-rollup which also includes a StationGroupName constraint.

1.4.4 Channel

Configuration which is specific to a Channel is generally edited by the SOH Configuration Tool. The only exception to this rule is the acei-merge-processor.merge-tolerance configuration. The only two configuration options which have channel level configurations are soh-control.soh-monitor-thresholds and soh-control.channel-capability rollup.

1.5 SOH Processing Description

GMS Station SOH processing is designed to be configurable and allow the system maintainer to define the station groups, stations, channels, and SOH monitors (SOH monitors are individual status items such as latency of a data packet or GPS status of a sensor channel) that are processed and displayed. Two rollups of SOH status are supported: a worst of SOH status rollup and a mission capability rollup. Each of these can be configured separately.

Data acquisition statistics and SOH status values vary by channel and typically fluctuate over the short term, so a pure real-time display of the raw values could be noisy and cause unneeded attention. To smooth out these variations for display, GMS processing services compute the SOH monitors using configurable time windows and use configurable thresholds to define when a monitor is good, marginal, or bad. This results in many potential configurations, but it is expected that the default configuration will apply to many stations, and some other station groups can be configured similarly. To support the exceptions, GMS provides the option to configure any item as needed.

Two of the most important configuration parameters are the backoffDuration and calculationInterval. These define the SOH Calculation Time Window used to select the data packets that are included in a SOH calculation at each SOH Calculation Time, as shown in the Figure 1.

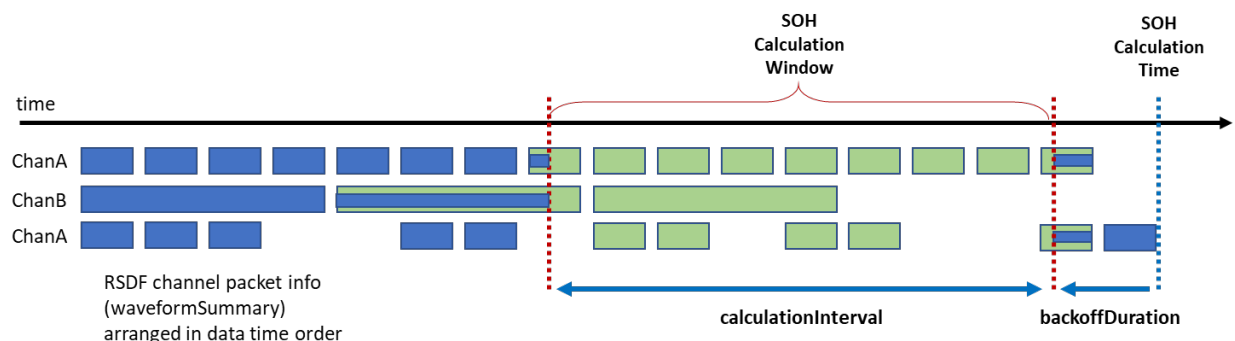


Figure 1. SOH Calculation Time Window

In Figure 1, the data packets used to compute the percent data missing, the data lag, and the percent bad SOH environment values are the green packets that fall within the SOH Calculation Window.

- It is important for the `backoffDuration` to be tuned based on the nominal data latency for each station, so data packets that are not expected to be received yet are not included in the SOH Calculation Window, but the `backoffDuration` isn't so large that the data being displayed are old.
- It is also important for the `calculationInterval` to be long enough to smooth out the variation in station status values and also long enough to include some data packets when data latency is higher than normal, so relevant statistics may be displayed about the station but not so long that relevant changes in the SOH values are not noticed.

Another important parameter is the `reprocessingPeriod` that defines the time delay between SOH calculations. This parameter defines the frequency that the display will be updated with new SOH information. Smaller `reprocessingPeriod`s mean the SOH calculations are performed more often and will require more processing power. To avoid missing data packets in the SOH calculations, the `reprocessingPeriod` should be smaller than the smallest `calculationInterval`.

For flexibility in display of SOH status for different stations, the thresholds used to determine when a value is good, marginal, or bad are all configurable but should be kept as common as possible for user understandability.

These parameters and others are defined in the Section 3 of this document. Additional guidance and examples are provided in Section 5.

2 GMS SYSTEM CONFIGURATION

2.1.1 GMS System Configuration Properties

GMS includes a system framework based on etcd to distribute system-level parameters such as network hosts and ports, usernames, and timeouts.

System parameters are used by five services:

- OSD Services (including postgres database parameters)
- Kafka Service
- Processing Configuration Service
- Interactive Analysis Config Service
- Processing Services

System parameters are stored in the GMS release:

/config/system/gms-system-configuration.properties

# Values Common to All GMS Controls	
port	Port is a positive integer value
idle-timeout	Text String of the idle-timeout value using ISO-8601 duration
min-threads	Positive integer that is the minimum number of threads allocated
max-threads	Positive integer that is the maximum number of threads allocated

# Default DB Connection Info	
sql_url	Text string of the URL to connect to the PostgreSQL database
sql_user	Text string of the username to connect to the PostgreSQL database
sql_elev_user	Text string of the username to connect to the PostgreSQL database
c3p0_connection_pool_size	Number for the connection pool size

# Default backoff retry policy	
retry_max_attempts	Positive integer of the maximum retry attempts
retry_min_backoff	Positive integer of minimum backoff retry attempts
retry_max_backoff	Positive integer of maximum backoff retry attempts
retry_backoff_units	Text string to set the units of the backoff retry

# Default Retry for processing Config	
processing-retry-initial-delay	Positive integer for retry of the initial delay processing
processing-retry-max-delay	Positive integer for retry of maximum delay processing
processing-retry-delay-units	Text string to set the units of the delay processing
processing-retry-max-attempts	Positive integer for maximum number of retry attempts processing

# Values common to all GMS Services	
experimental-enabled	Boolean value defaulted to false.
osd.host	Text string of the osd repository service name
osd.c3p0_connection_pool_size	Number for the connection pool size
preloader.c3p0_connection_pool_size	Positive Integer for the connection pool size

# Global ignite properties	
ignite-failure-detection-timeout	Number for the timeout of the basic network operations
ignite-instance-name	Text string of the ignite instance name
ignite-kubernetes-ipfinder	Boolean value defaulted to true

# Global kafka properties for producers/consumers	
kafka-bootstrap-servers	Text string of the different bootstrap servers (separated by commas)
kafka-key-serializer	Text string providing the full qualified Java object name used to write the key part of the kafka message into a provided kafka topic
kafka-value-serializer	Text string providing the full qualified Java object name used to write the value part of the kafka message into a provided kafka topic
kafka-key-deserializer	Text string providing the full qualified Java object name used to read the key part of the kafka message from a provided kafka topic
kafka-value-deserializer	Text string providing the full qualified Java object name used to read the value part of the kafka message from a provided kafka topic

# Session timeout for consumers (default to 10s measured in ms)	
kafka-consumer-session-timeout	Text string of kafka consumer session time in milliseconds

# Heartbeat interval measured milliseconds	
kafka-consumer-heartbeat-interval	Text string of kafka consumer heartbeat interval time in milliseconds
reactor-kafka-key-serializer	Text string of the reactor kafka key serializer path
reactor-kafka-value-serializer	Text string of the reactor kafka value serializer

# Reactor kafka shared settings	
reactor-kafka-request-timeout	Positive integer for the max amount of time the client will wait

# Reactor kafka consumer settings	
reactor-kafka-consumer-session-timeout	Text string of reactor kafka consumer session time in milliseconds
reactor-kafka-consumer-max-poll-interval	Text string of reactor kafka consumer max poll interval time in milliseconds
reactor-kafka-consumer-max-poll-records	Positive integer for the reactor kafka consumer max number of poll records
reactor-kafka-auto-commit	Boolean text string true or false
reactor-kafka-auto-commit-interval	Positive integer for the reactor kafka auto-commit interval
reactor-kafka-consumer-heartbeat-interval	Text string for reactor kafka consumer heartbeat interval time in milliseconds

# Reactor kafka sender settings	
reactor-kafka-sender-acks	Text string for reactor kafka sender acks
reactor-kafka-sender-delivery-timeout	Text string for reactor kafka sender delivery timeout time in milliseconds
# Kafka properties	
verification-attempts	Positive integer for the number of verification attempts
streams-close-timeout-ms	Positive Integer with time in milliseconds
connection-retry-count	Positive Integer for the connection retry counts
retry-backoff-ms	Positive Integer with time in milliseconds for retry backoff
# Gms kafka topics	
kafka-rsdf-topic	Text string for kafka raw station data frame.
kafka-acei-topic	Text string for kafka acei malformed topic
kafka-sohextract-topic	Text string for soh extract topic
kafka-malformed-topic	Text string for kafka malformed topic
# Config for Configuration Consumers	
config-cache-expiration	Text String of the configuration cache expiration using ISO-8601 duration
# Config for mapping DB Accounts to URLs	
soccpro_jdbc_url	Text string of the URL to connect to the soccpro database
al1_jdbc_url	Text string of the URL to connect to the AL1 database
al2_jdbc_url	Text string of the URL to connect to the AL2 database

# Config for HTTP Service Client Retry Policies	
service-client-send-retry-initial-delay	Positive integer for retry of the initial delay for service client send
service-client-send-retry-max-delay	Positive integer for retry of the maximum delay for service client send
service-client-send-retry-delay-units	Text string to set the units of the service client send retry
service-client-send-retry-max-attempts	Positive integer for retry of the maximum attempts for service client send
service-client-upgrade-retry-initial-delay	Positive integer for retry of the initial delay for service client upgrade
service-client-upgrade-retry-max-delay	Positive integer for retry of the maximum delay for service client upgrade
service-client-upgrade-retry-delay-units	Text string to set the units of the service client upgrade retry
service-client-upgrade-retry-max-attempts	Positive integer for retry of the maximum attempts for service client upgrade

# Global config for ConnMan/DataMan	
cd11-dataconsumer-baseport	The port number used as the base for assigning port offsets

#Config for Signal Enhancement Configuration Client Retry Policies	
sec-client-max-retry-attempts	Used Signal Enhancement Configuration
sec-client-min-backoff-duration	Used for Signal Enhancement Configuration

# Config Loader	
config-loader.host	Text string of event location service
config-loader.port	Port is a positive integer value
config-loader.statusEndpoint	Text string of the URL to connect to the PostgreSQL database

# File Store	
file-store.configLoaderStatusCheckRetryIntervalMillis	Positive integer for file store

# Config for cd11 ConnMan control	
# This value is hard coded as a default in Cd11ConnManUtil in order to satisfy fortify	
# If it changes for any reason that needs to be updated as well	
connman.data-manager-ip-address	Text string of the data manager used to bring in the data
connman.connection-manager-well-known-port	Port number for da-connman connection

#Data-provider-ip-address will be used for validation in the future but now is just used in log statements	
connman.data-provider-ip-address	Text string of the IP address of the data provider
connman.bind-retries	Positive integer for number of da-connman bind retries
connman.bind-initial-wait	Text string of the da-connman bind initial wait

#Config for CD1.1 DataMan	
dataman.application-id	Text string of the da-dataman application identifier
dataman.gap-storage-path	Text string of the da-dataman gap storage path
#Currently, never expire	
dataman.gap-expiration-days	Negative integer for number of days for da-da-dataman gap expiration
dataman.gap-storage-interval-minutes	Positive integer for number of minutes for da-dataman gap storage

# Config for CD1.1 RSDF Processor	
cd11-rsdf-processor.application-id	Text string of the raw station data frame processor application identifier

Config for waveform QC Control

#Config for beam control

# Config for event-location-control-service	
event-location-control.host	Text string of event location service

# Config for signal-detection-association-control-service	
signal-detection-association-control.processing-configuration-root	Text string of location of configuration-base

# Config for ui processing configuration service	
ui-processing-configuration-service.processing-configuration-root	Text string for the default address of processing configuration for UI processing configuration service

# Config for Event Magnitude Control	
event-magnitude-control.processing-configuration-root	Text string for the default address of processing configuration for Event Magnitude Control

# Config for Amplitude Control	
amplitude-control.processing-configuration-root	Text string for the default address of processing configuration for Amplitude Control

# Config for station soh control	
soh-control.processing-configuration-root	Text string of the location of processing configuration for soh-control

# Config for ssam-control application	
station-soh-analysis-manager.application-id	Text string of the station SOH analysis manager application identifier
station-soh-analysis-manager.quieted_list_input_topic	Text string of the station SOH analysis manager quieted list input topic
station-soh-analysis-manager.soh_station_input_topic	Text string of the station SOH analysis manager SOH station input topic
station-soh-analysis-manager.capability_rollup_input_topic	Text string of the station SOH analysis manager capability rollup input topic
station-soh-analysis-manager.materialized_view_output_topic	Text string of the station SOH analysis manager materialized view output topic
station-soh-analysis-manager.system_message_ui_output_topic	Text string of the station SOH analysis manager system message ui output topic
station-soh-analysis-manager.system_message_soh_output_topic	Text string of the station SOH analysis manager system message soh output topic
station-soh-analysis-manager.status_change_input_topic	Text string of the station SOH analysis manager status change input topic
station-soh-analysis-manager.quieted_status_change_output_topic	Text string of the station SOH analysis manager quieted status change output topic
station-soh-analysis-manager.status_change_output_topic	Text string of the station SOH analysis manager status change output topic
station-soh-analysis-manager.retry-max-attempts	Positive integer for maximum number of soh analysis manager retry attempts
station-soh-analysis-manager.retry-backoff-ms	Positive Integer with time in milliseconds for retry backoff
station-soh-analysis-manager.max_cache_init_retries	Positive integer for maximum number of soh analysis manager cache initial attempts

# Config for the soh-control application	
soh-control.sohAppId	Text string of the SOH application
soh-control.application-id	Text string of the SOH control application identifier
soh-control.sohInputTopic	Text string of the input topic location for SOH extract
soh-control.stationSohOutputTopic	Text string of the output topic location for station SOH
soh-control.capabilitySohRollupOutputTopic	Text string of the output topic location for SOH capability rollup
soh-control.monitorLoggingPeriod	Time interval for producing logging messages with performance statistics
soh-control.controlConfigUpdateIntervalMs	Time in milliseconds for checking updates
soh-control.maxRequestSize	Positive Integer in bytes for maximum request size SOH control
soh-control.fetchMaxBytes	Integer for fetching maximum bytes SOH control
soh-control.maxAcquiredBytes	Integer for maximum acquired bytes SOH control

# Config for SOH Kafka Storage Consumers	
osd-rsdf-kafka-consumer.host	Text string of the raw station data frame kafka consumer service
osd-rsdf-kafka-consumer.application-id	Text string of the raw station data frame kafka application identifier
osd-rsdf-kafka-consumer.input-topic	Text string of the raw station data frame kafka consumer input topic
osd-systemmessage-kafka-consumer.host	Text string of the OSD system message kafka consumer service
osd-systemmessage-kafka-consumer.application-id	Text string of the OSD system message kafka consumer application ID
osd-systemmessage-kafka-consumer.input-topic	Text string of the OSD system message kafka consumer input topic
soh-status-change-kafka-consumer.host	Text string of the SOH status change kafka consumer service
soh-status-change-kafka-consumer.application-id	Text string of the SOH status change kafka consumer application ID
soh-status-change-kafka-consumer.input-topic	Text string of the SOH status change kafka consumer input topic
osd-station-soh-kafka-consumer.host	Text string of the OSD station SOH kafka consumer service
osd-station-soh-kafka-consumer.application-id	Text string of the OSD station SOH kafka consumer service
osd-station-soh-kafka-consumer.input-topic	Text string of the OSD station SOH kafka consumer input topic
osd-station-soh-kafka-consumer.reactor-kafka-consumer-max-poll-records	Positive integer for the osd station soh kafka consumer max number of poll records
soh-quieted-list-kafka-consumer.host	Text string of the SOH quieted list kafka consumer service
soh-quieted-list-kafka-consumer.application-id	Text string of the SOH quieted list kafka application identifier
soh-quieted-list-kafka-consumer.input-topic	Text string of the SOH quieted list kafka consumer input topic
capability-soh-rollup-kafka-consumer.host	Text string of the SOH rollup kafka consumer service
capability-soh-rollup-kafka-consumer.application-id	Text string of the SOH rollup kafka application identifier
capability-soh-rollup-kafka-consumer.input-topic	Text string of the SOH rollup kafka consumer input topic

# Config for the acei-merge-processor	
acei-merge-processor.application-id	Text string of the acei merge processor application identifier
acei-merge-processor.service-client-send-retry-initial-delay	Positive integer for the acei merge processor service client send retry initial delay
acei-merge-processor.service-client-send-retry-max-delay	Positive integer for the acei merge processor service client send retry maximum delay
acei-merge-processor.input-topic	Text string is renamed to acei-merge-processor.input-topic
acei-merge-processor.reactor-kafka-consumer-max-poll-records	Positive integer for the acei merge processor reactor kafka consumer max number of poll records

# Temporarily longer timeouts for StationSohControl and SSAMControl to account for station group query	
station-soh-analysis-manager.client-timeout	Text string of the station SOH analysis manager client timeout in ISO-8601 format
soh-control.client-timeout	Text string of the SOH control client timeout in ISO-8601 format

# Config for Processing Configuration Service	
processing-cfg.processing-configuration-root	Text string of the location of the configuration-base
processing-cfg.host	Text string of the processing configuration service
processing-cfg.sql_url	Text string for the default address of processing configuration sequel service
processing-cfg.sql_user	Text string for processing the configuration sequel user
processing-cfg.c3p0_connection_pool_size	Positive integer of processing the configuration c3p0 connection pool size

# Config for User Manager	
user-manager.host	Text string of the user manger service
user-manager.sql_url	Text string for the default address of user manager sequel service
user-manager.sql_user	Text string for the user manager sequel user
user-manager.c3p0_connection_pool_size	Positive integer of the user manager c3p0 connection pool size
user-manager.schema	Text string of the user manager schema

# Config for sohLoader app	
soh-loader.station_soh_url	Text string for the default address of SOH loader station service
soh-loader.analog_soh_url	Text string for the default address of SOH loader analog service
soh-loader.boolean_soh_url	Text string for the default address of SOH loader Boolean service
soh-loader.time_span	Text string of the SOH loader time span in ISO-8601 format
soh-loader.soh_datatype_to_load	Positive integer of SOH loader data type to load

# Dataset-specific config for cd11-data-provider is done through the conf files in the	
# Data provider area that are specific to each scenario	
# Example java/gms/core/data-acquisition/cd11-station-receiver/cd11-data-provider/resources/conf	
cd11-data-provider.retry-initial-delay	Positive integer for the cd11 data provider initial delay retries
cd11-data-provider.retry-delay-units	Text String for the cd11 data provider retry delay units in seconds
cd11-data-provider.retry-max-attempts	Text String for the maximum number of cd11 data provider retry attempts

3 GMS PROCESSING CONFIGURATION

3.1 Station Reference

3.1.1 CSS Formatted Station Reference Files

The inputs for the station reference information are CSS flat files. The required flat files are affiliation.dat, network.dat, instrument.dat, sensor.dat, site.dat, and sitechan.dat. The loader expects the affiliation.dat, instrument.dat, sensor.dat, site.dat, and sitechan.dat for a specific station to be in a directory named for the station. Additionally, there is a responses directory that contains the Frequency Amplitude Phase (FAP) formatted, response files for the station's instruments (see Figure 2).

The network.dat file describes the specific networks (station groups) for all stations. For this reason, the network.dat file is at the same level as the station directories. A difference in the site.dat and sitechan.dat flat files is that the N/A value for offdate is 2268324, not -1.

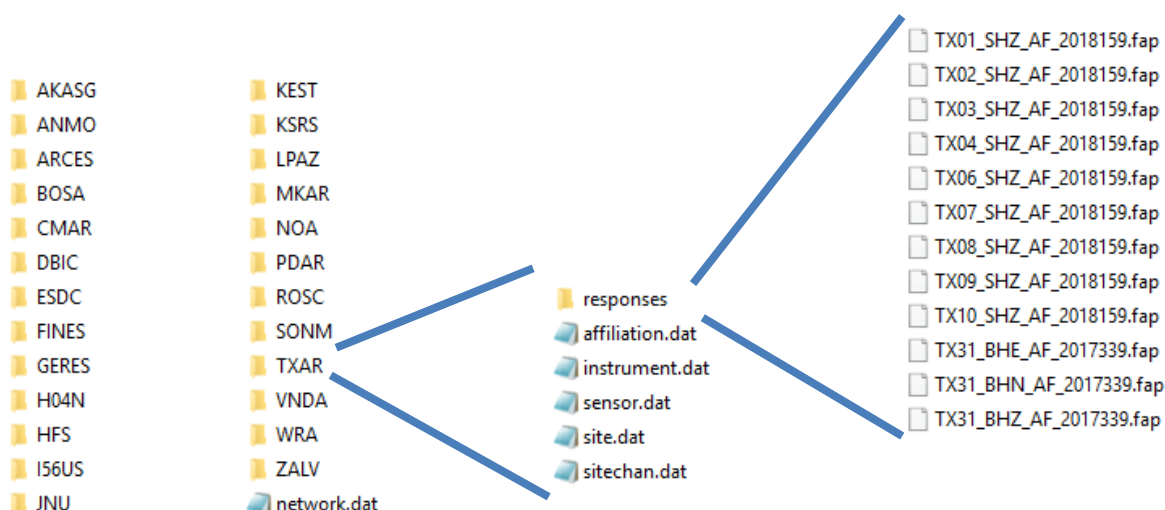


Figure 2. Example of the directory structure for station reference information. Each station level directory contains CSS flat files for affiliation, instrument, sensor, site, and sitechan. The responses directory holds the FAP response files for the station.

Station reference files are stored in the GMS release:

/config/station-reference/data

3.1.2 Station Data

The stationdata folder is data generated by the CSS-to-COI Converter based upon the CSS Formatted Station Reference Files. The CSS-to-COI Converter generates a number of files which

are used by SOH to determine the Station reference data. The SOH Configuration Tool uses the `processing-station-group.json` file generated by the CSS-to-COI Converter.

The `stationdata` folder is not included in the main conversation as the information is created at build time. However, if changes to the station reference data are made then a `stationdata` folder must be added under the `{custom-config-location}/processing/station-reference` folder and the CSS-to-COI Converter needs to be run.

3.1.3 Station Group Definitions

The `processing-station-group-definitions.json` file contains the information about which stations are included in which station group. This file is edited by the SOH Configuration Tool.

The file is located as follows with the defined information for each Station Group:

`config/station-reference/definitions/processing-station-group-definitions.json`

parameter	type	description
name	String	Name of the Station Group
description	String	Description of the Station Group
stationNames	String Array	List of Station Names contained in the Station Group

3.2 SOH Processing Config

3.2.1 Configuration or Data Acquisition

The following section covers configuration related to data acquisition. Configuration related to data acquisition is either created by the Station Manipulator Tool or points to configuration created by the Station Manipulator Tool.

3.2.1.1 Global Parameters

The `global.cd11.station-parameters` configuration gives information about acquiring channels. The `global.cd11.station-parameters` configuration includes a single `default.json` file, which contains a single configuration option with the default constraint. The `global.cd11.station-parameters` configuration file can be created by the Station Manipulator Tool, however it could also be manually created. Stations with in this file are listed in alphabetical order.

The `global.cd11.station-parameters` configuration is located as follows with the defined format:

`/config/processing/global.cd11.station-parameters/default.json`

global.cd11.station-parameters Configuration				
	name	station-acquisition-config		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	parameters	type	description	
	stations	Complex Station Acquisition Array	Array of Complex Station Acquisition objects. Each Complex Station Acquisition object gives information needed to acquire station data.	

The Complex Station Acquisition object used by the global.cd11.station-parameters:

parameter	Type	description
acquired	Boolean	Set to true if acquiring the data from the station; set to false if not acquiring the data. Always set to true when created by the Station Manipulator Tool.
portOffset	Integer	Offset from a starting port number which is configured in System configuration (cd11-dataconsumer-baseport). Numbers should be sequential without gaps starting at 0.
frameProcessingDisabled	Boolean	Set to true if acquiring the data from the station but not processing the data. Always set to true when created by the Station Manipulator Tool.
stationName	String	String of station name that is being configured

3.2.1.2 ConnMan Station Parameters

The connman.station-parameter configuration object points the da-connman service to the global.cd11.station-parameters configuration to use. This file is set and should not be modified.

The connamn.station-parameters configuration is located as follows with the defined format:

/config/processing/connman.station-parameters/default.json

connman.station-parameters Configuration				
	name	connman		
	constraintType	criterion	operator	Description
	DEFAULT	—	—	Defines the constraint as default
	parameters	type	description	
	\$ref=global.cd11.station-parameters	Complex Reference Type	Complex type which gives the reference to the constraints used for the global.cd11.station-parameters.	

The Complex Reference Type used by the connman.station-parameters configuration:

parameter	type	description
criteria	String	Criteria for the global.cd11.station-parameters configuration item. Value is "DEFAULT"
value	String	Value for the global.cd11.station-parameters configuration item. Value is "DEFAULT".

3.2.1.3 DataMan Station Parameters

The dataman.station-parameters file points the da-dataman service to the global.cd11.station-parameters file. This file is set and should not be modified. Parameters used by the da-dataman service are in the GMS file:

/config/processing/dataman.station-parameters/default.json

dataman.station-parameters Configuration				
	name	station-acquisition-config		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	parameters	type	description	
	\$ref=global.cd11.station-parameters	Complex Reference Type	Complex type which gives the reference to the constraints used for the global.cd11.station-parameters.	

The Complex Reference Type used by the dataman.station-parameters configuration (this is the same as the connman.station-parameters-configuration):

parameter	type	description
criteria	String	Criteria for the global.cd11.station-parameters configuration item. Value is "DEFAULT"
value	String	Value for the global.cd11.station-parameters configuration item. Value is "DEFAULT".

3.2.1.4 Data Frame Receiver Channel Lookup

The dataframe-receiver.channel-lookup file is created by the Station Manipulator Tool. The file gives a list of all Channels.

/config/processing/dataframe-receiver.channel-lookup/cd11.json

dataframe-receiver.channel-lookup Configuration				
	name	cd-1.1		
	constraintType	criterion	operator	description
	String	protocol	EQ	Constrains the protocol. Since SOH only received CD1.1 data "CD11" is the only valid option.
	parameters	type	description	
	channelIdsByPacketName	String list	List of names of channel Ids by packet name. Each channel has a listing like: "ABC.ABC.BHZ" : "ABC.ABC.BHZ".	

3.2.2 General SOH Configuration

The following section contains general configuration for SOH. These files are not used or edited by the SOH Configuration Tool.

3.2.2.1 Processing Time Period

The soh-control configuration object configures the reprocessing period parameter (the time between each round of SOH calculations).

The soh-control configuration object contains a single default.json file which includes a single reprocessingPeriod parameter. The soh-control configuration is not edited by the SOH Configuration Tool; manual changes are required.

The soh-control configuration object is located as follows with the defined constraints:

/config/processing/soh-control/default.json

soh-control Configuration				
	name	soh-control-default		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	parameters	type	description	
	reprocessingPeriod	duration	Duration between execution of SOH processing operations	

3.2.2.2 SOH Display Parameters

The ui.soh-settings configuration object contains parameters used by the UI for SOH. The ui.soh-settings configuration object contains a single default.json file. The ui.soh-settings configuration is not edited by the SOH Configuration Tool; manual changes are required.

The ui.soh-settings configuration object is located as follows with the defined constraints:

config/processing/ui.soh-settings/ui.soh-settings.json

ui.soh-settings Configuration				
	name	ui-soh-settings		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	parameters		type	description
	redisplayPeriod		duration	Time between display updates in PI11 (not used in PI12 and beyond)
	acknowledgementQuietDuration		duration	default acknowledgement quiet time
	availableQuietDurations		list of durations	List of selectable durations for quieting a channel monitor
	sohStationStationStaleDuration		duration	Time to wait for SOH objects before setting declaring data outdated (i.e., Last Update Time shows red)
	sohHistoricalDurations		list of durations	List of durations for quick selection on the Trends displays
	samplesPerChannel		number	Number of samples allowed on the Trend Display for each Channel
	maxQueryIntervalSize		number	Maximum query size allowed in the search results

3.2.2.3 System Messages Settings

3.2.2.4 SOH Rollup Time Tolerance

The soh-control.rollup-stationsoh-time-tolerance defines how stale Channel Monitor Status values can be to be included in the Channel Capability Rollup. The soh-control.rollup-stationsoh-time-tolerance is located as follows with the defined parameters:

config/processing/soh-control.rollup-stationsoh-time-tolerance/default.json

soh-control.rollup-stationsoh-time-tolerance Configuration				
	name	default-rollup-stationsoh-time-tolerance		
	constraintType	criterion	Operator	description
	DEFAULT	String	—	Defines the constraint as default
	parameters	type	description	
	rollupStationSohTimeTolerance	duration	A value of duration (e.g., PT5M).	

3.2.3 Station Group Configuration

The following section covers configuration related to Station Group. Configuration in this section is edited on the Station Group tab of the SOH Configuration Tool.

3.2.3.1 Station Groups

The soh-control.station-group-names configuration defines which Station Groups are used. Configuration of the capability calculation can be configured per Station Group; Stations are grouped by Station Group in the SOH Overview display, and both the SOH Overview and SOH Details display allow the user to filter Stations by Station Group. Stations not part of a Station Group listed in the soh-control.station-group-names configuration will not be shown on the UI.

The Stations which are included in the Station Group must be defined in the config/station-reference/stationdata portion of the configuration.

The soh-control.station-group-names configuration contains a single default.json file which lists the Station Groups displayed on the UI and defined which order they are display in. The soh-control.station-group-name configuration object is edited by the SOH Configuration Tool.

The soh-control.station-group-names configuration object is located as follows with the defined constraints:

config/processing/soh-control.station-group-names/default.json

Configuration Option				
	Name	default-station-group-names		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	parameters	type	description	
	stationGroupNames	String list	List of names of station groups used in SOH processing	

3.2.3.2 Station Group Capability Rollup

The soh-control.station-group-capability-rollup configuration object configures the Station Group Capability Status. The Station Group Capability Status is calculated based on the Station Capability Statuses. The Station Group Capability Rollup configuration specifies which Station to include and which operator type (BEST_OF, WORST_OF, MIN_GOOD_OF) to use when calculating the Station Capability Status. The Station Group Capability Status is displayed on the SOH Overview display.

The Station Group Capability Status rolls up the statuses from one of the following:

- 1) The Station Capability Status for the Stations listed in stationOperands.
- 2) The results of the sub rollups given by rollupOperatorOperands (which includes an operatorType and list of Stations for its stationOperands).
- 3) The Station Capability Status for all Stations in the Station Group when neither the stationOperands nor rollupOperatorOperands are provided.

3.2.3.2.1 Default

The default configuration for soh-control.station-group-capability-rollup is located as follows with the following format:

config/processing/ soh-control.station-group-capability-rollup/default.json

soh-control.station-group-capability-rollup Default Configuration				
	name	default-station-group-names		
	constraintType	criterion	operator	description
	DEFAULT	—	—	defines the constraint as default. NOTE: Name must be exact: "default-station-group-capability-rollup"
	parameters		type	description
	stationsToGroupRollupOperator		Complex Station Group Capability Rollup structure	Complex structure which describes how to calculate the Station Group Capability Status. Structure is described below

3.2.3.2.2 Station Group

The station group configuration for soh-control.station-group-capability-rollup is located as follows with the following format:

config/processing/ soh-control.station-group-capability-rollup/{station group}.json

soh-control.station-group-capability-rollup Station Group Configuration				
	Name	{station group}_CAPABILITY_ROLLUP		
	constraintType	criterion	operator	description
	String	StationGroup pName	Any	Defines the constraint as string. NOTE: Name must be exact: "ALL-station-group-capability-rollup"
	Parameters		type	description
	StationGroupName		Complex Station Group Capability Rollup structure	Complex structure which describes how to calculate the Station Group Capability Status. Structure is described below

3.2.3.2.3 Station Group Capability Rollup Structure

The complex Station Group Capability Rollup structure is defined below:

parameters	type	description
operatorType	string	Type of operation that the rollup calculation will perform. Valid values are: <ul style="list-style-type: none"> BEST_OF – The best status (GOOD is better than MARGINAL; MARGINAL is better than BAD) WORST_OF – The worst status (BAD is worse than MARGINAL; MARGINAL is worse than GOOD) MIN_GOOD_OF – Count of the number of statuses included in the roll up which are good compared to the goodThreshold and marginalThreshold.
goodThreshold	integer	Number of Stations with a GOOD Station Capability Status required to make the Station Group Capability Status GOOD. The goodThreshold is only included if the operatorType is MIN_GOOD
marginalThreshold	integer	Number of Stations with a MARGINAL Station Capability Status required to make the Station Group Capability Status MARGINAL. The marginalThreshold is only included if the operatorType is MIN_GOOD
stationOperands	string list	Provides a list of Station Names to include in the Station Group Capability Rollup. The stationOperands is optional. If provided, the rollupOperatorOperands should not be provided. If neither is provided, all Stations in the Station Group are included. The stationOperands can only be included if the configuration option is constrained to a specific Station Group.
rollupOperatorOperands	Complex Station Group Capability Rollup structure	Provides two or more sub rollups to include in the Station Group Capability Rollup. The rollupOperatorOperands is optional. If provided, the stationOperands should not be provided. If neither is provided, all Stations in the Station Group are included. The rollupOperatorOperands can only be included if the configuration option is constrained to a specific Station. Each sub rollup includes: <ol style="list-style-type: none"> operatorType (plus goodThreshold and marginalThreshold if the operatorType is MIN_GOOD_OF) stationOperands giving list of Stations.

3.2.4 Station Configuration

The configuration in this section covers configuration specific to how an individual Station is configured. Station and Channel level configurations within this section are created and edited

by the SOH Configuration Tool. Default and Profile level configurations within this section are used by the SOH Configuration Tool but are not created or edited by the tool.

3.2.4.1 SOH Environmental Monitor Types

The soh-control.station-env-monitor-types configuration contains a list of environmental monitor types which a station has. All stations are required to have the MISSING, TIMELINESS, and LAG monitor types; however which environmental monitor types the station contains is configurable. Since SOH is only capable of receiving data in CD1.1 format, SOH only processes environmental issues that are part of the CD1.1 format.

While SOH is capable of handling a configuration with any combination of environmental issues, the SOH Configuration Tool is only capable of handling either ALL environmental issues or no environmental issues.

The SOH Configuration Tool edits the {station}.json files for the soh-control.station-env-monitor-types configuration. However, the SOH Configuration Tool only allows a Station to be defined as having ALL environmental monitor types or no environmental monitor types.

3.2.4.1.1 Default

The default configuration for soh-control.station-env-monitor-types is located as follows with the following format:

config/processing/soh-control.station-env-monitor-types/default.json

soh-control.station-env-monitor-types Default Configuration				
	name	default-station-env-monitor-types		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	parameters	type	description	
	envMonitorTypes	String List	List of environmental monitor types to be included for the Station. List may be empty.	

3.2.4.1.2 Profile

The profile configuration for soh-control.station-env-monitor-types is located as follows with the following format:

config/processing/soh-control.station-env-monitor-types /{profile}.json

soh-control.monitor-types Profile Profile Configuration				
	name	{profile}-station-env-monitor-types		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	STRING	StationName	IN	List of Station Name(s) to which this configuration option applies
	parameters	type	description	
	envMonitorTypes	String List	List of environmental monitor types to be included for the Station. List may be empty.	

3.2.4.1.3 Station

The station configuration for soh-control.station-env-monitor-types is located as follows with the following format:

config/processing/soh-control.station-env-monitor-types /{station}.json

soh-control.station-env-monitor-types Station Configuration				
	name	{station}_ENV_MONITOR_TYPES		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	STRING	StationName	EQ*	List of Station Name(s) to which this configuration option applies
	parameters	type	description	
	envMonitorTypes	String List	List of environmental monitor types to be included for the Station. List may be empty.	

3.2.4.2 SOH Monitor Time Windows

The soh-control.soh-monitor-timewindows configuration contains the backOffDuration and calculationInterval parameters used for the Channel Monitor Value calculations. The soh-control.soh-monitor-timewindows configuration can contain constraints for StationName. The parameters in the soh-control.soh-monitor-timewindows configuration by StationName.

3.2.4.2.1 Default

The default configuration for soh-control.soh-monitor-timewindows is located as follows with the following format:

config/processing/soh-control.soh-monitor-timewindows/default.json

soh-control.soh-monitor-timewindows Default Configuration				
	name	default-soh-monitor-timewindows		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	parameters	type	description	
	backOfDuration	duration	Time offset between calculation time and calculation interval	
	calculationInterval	duration	Time length of SOH calculation window	

3.2.4.2.2 Profile

The profile configuration for soh-control.soh-monitor-timewindows is located as follows with the following format:

config/processing/soh-control.soh-monitor-timewindows/{profile}.json

soh-control.soh-monitor-timewindows Profile Configuration				
	name	{profile}-soh-monitor-timewindows		
	constraintType	criterion	operator	description
	Default	—	—	Defines the constraint as default
	STRING	StationName	IN	Station Name(s) to which this configuration option applies
	parameters	type	description	
	backOfDuration	duration	Time offset between calculation time and calculation interval	
	calculationInterval	duration	Time length of SOH calculation window	

3.2.4.2.3 Station

The station configuration for soh-control.soh-monitor-timewindows is located as follows with the following format:

config/processing/soh-control.soh-monitor-timewindows/{station}.json

soh-control.monitor-timewindow Station Configuration				
	name	{station}_TIMEWINDOWS		
	constraintType	criterion	operator	description
	Default	—	—	Defines the constraint as default
	STRING	StationName	EQ*	Station Name to which this configuration option applies
	parameters	Type	description	
	backOfDuration	Duration	Time offset between calculation time and calculation interval	
	calculationInterval	Duration	Time length of SOH calculation window	

3.2.4.3 SOH Monitor Thresholds

The soh-control.soh-monitor-thresholds configuration contains the goodThreshold and marginalThreshold parameters used for the Channel Monitor Status calculations. The soh-control.soh-monitor-thresholds configuration can contain constraints for MonitorType, StationName, and ChannelName. The soh-control.soh-monitor-thresholds configuration must include a MonitorType constraint, and the Monitor Types included must all have the same SOH Value Type (see Appendix A) with the goodThreshold and marginalThreshold values being a duration (e.g., PT5M) when the SOH Value Type is DURATION and a numeric value (e.g., 5.1) and when the SOH Value Type is PERCENT. All Monitor Types listed in Appendix A must be covered by a DEFAULT_{MonitorTypes}.json file.

3.2.4.3.1 Default

There is one default configuration per Monitor Type. The default configuration for soh-control.soh-monitor-thresholds is located as follows with the following format:

config/processing/soh-control.soh-monitor-thresholds/default.json

soh-control.soh-monitor-threshold Default Configuration				
	name	default-soh-monitor-thresholds-{monitor type}		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	STRING	MonitorType	EQ	MonitorType(s) to which this configuration option applies. Monitors covered by the same configuration option must have the same sohValueType (see Appendix A for a list of valid Monitor Types)
	parameters	type	description	
	goodThreshold	percent (numeric) or duration	Threshold for transition from good to marginal status. For Monitor Types with a sohValueType of DURATION, a duration value will be given (e.g., PT5M). For Monitor Types with a sohValueType of PERCENT, a numeric value will be given (e.g., 5)	
	marginalThreshold	percent (numeric) or duration	Threshold for transition from good to marginal status. For Monitor Types with a sohValueType of DURATION, a duration value will be given (e.g., PT5M). For Monitor Types with a sohValueType of PERCENT, a numeric value will be given (e.g., 5)	

3.2.4.3.2 Profile

The profile configuration for soh-control.soh-monitor-thresholds is located as follows with the following format:

config/processing/soh-control.soh-monitor- thresholds/{profile}.json

soh-control.soh-monitor-thresholds Profile Configuration				
	name	{profile}-soh-monitor-thresholds-{monitor type}		
	constraintType	criterion	operator	description
	Default	—	—	Defines the constraint as default
	STRING	MonitorType	EQ	MonitorType(s) to which this configuration option applies. Monitors covered by the same configuration option must have the same sohValueType (see Appendix A for a list of valid Monitor Types)
	STRING	StationName	IN	Station(s) to which this configuration option applies
	parameters	type	description	
	goodThreshehold	Percent (numeric) or duration	Threshold for transition from good to marginal status. For Monitor Types with a sohValueType of DURATION, a duration value will be given (e.g., PT5M). For Monitor Types with a sohValueType of PERCENT, a numeric value will be given (e.g., 5)	
	marginalThreshold	percent (numeric) or duration	Threshold for transition from good to marginal status. For Monitor Types with a sohValueType of DURATION, a duration value will be given (e.g., PT5M). For Monitor Types with a sohValueType of PERCENT, a numeric value will be given (e.g., 5)	

3.2.4.3.3 Station

The station configuration for soh-control.soh-monitor-thresholds is located as follows with the following format:

config/processing/soh-control.soh-monitor- thresholds/{station}.json

soh-control.soh-monitor-thresholds Station Configuration				
	name	{monitor type}_MONITOR_THRESHOLDS_FOR_{station}		
	constraintType	criterion	Operator	description
	Default	—	—	Defines the constraint as default
	STRING	MonitorType	EQ*	MonitorType(s) to which this configuration option applies. Monitors covered by the same configuration option must have the same sohValueType (see Appendix A for a list of valid Monitor Types)
	STRING	StationName	EQ*	Station(s) to which this configuration option applies
	parameters	type	description	
	goodThreshold	percent (numeric) or duration	Threshold for transition from good to marginal status. For Monitor Types with a sohValueType of DURATION, a duration value will be given (e.g., PT5M). For Monitor Types with a sohValueType of PERCENT, a numeric value will be given (e.g., 5)	
	marginalThreshold	percent (numeric) or duration	Threshold for transition from good to marginal status. For Monitor Types with a sohValueType of DURATION, a duration value will be given (e.g., PT5M). For Monitor Types with a sohValueType of PERCENT, a numeric value will be given (e.g., 5)	

3.2.4.3.4 Channel

The channel configuration for soh-control.soh-monitor-thresholds is located as follows with the following format:

soh-control.soh-monitor-thresholds Channel Configuration			
name	{monitor_type}_MONITOR_FOR_CHANNEL_{channel name}_FOR_STATION_{station}_THRESHOLDS		
constraintType	criterion	Operator	description
Default	—	—	Defines the constraint as default
STRING	MonitorType	EQ*	MonitorType(s) to which this configuration option applies. Monitors covered by the same configuration option must have the same sohValueType (see Appendix A for a list of valid Monitor Types)
STRING	StationName	EQ*	Station to which this configuration option applies
STRING	ChannelName	EQ*	Channel to which this configuration option applies.
Parameters	type	description	
goodThreshold	percent (numeric) or duration	Threshold for transition from good to marginal status. For Monitor Types with a sohValueType of DURATION, a duration value will be given (e.g., PT5M). For Monitor Types with a sohValueType of PERCENT, a numeric value will be given (e.g., 5)	
marginalThreshold	percent (numeric) or duration	Threshold for transition from good to marginal status. For Monitor Types with a sohValueType of DURATION, a duration value will be given (e.g., PT5M). For Monitor Types with a sohValueType of PERCENT, a numeric value will be given (e.g., 5)	

3.2.4.4 Channels Used in SOH Status by SOH Monitor Type

The soh-control.channels-by-monitor-type configuration lists the Channels which rollup to the Station Worst of Monitor Value and Status for a specific Monitor Type. The results for the TIMELINESS, LAG, and MISSING Monitor Types are displayed on the Station Statistics Display. The results for individual types of Environmental Monitors are displayed on the Environmental Issue Drill Down Display. A given monitor type can either be configured to use all channels or use a specific list of channels. The default is always to use all channels. Because of this there is no profile level for soh-control.channels-by-monitor-type (as all channels is the default and specific channels require a specific station). All monitor types must always be included.

3.2.4.4.1 Default

The default configuration for soh-control.channels-by-monitor-type can only be configured to use all channels for all monitor types. This configuration should not be modified. The default configuration for soh-control.channels-by-monitor-type is located as follows with the following format:

config/processing/soh-control.channels-by-monitor-type/defaults.json

soh-control.channels-by-monitor-type Default Configuration			
name	default-channels-by-monitor-type		
constraintType	criterion	operator	description
DEFAULT	StationName	EQ	Defines constraint as default.
parameters	type		description
MISSING	Channel List Structure		Configure to USE_ALL Channels
LAG	Channel List Structure		Configure to USE_ALL Channels
TIMELINESS	Channel List Structure		Configure to USE_ALL Channels
ENV_AUTHENTICATION_SEAL_BROKEN	Channel List Structure		Configure to USE_ALL Channels
ENV_BACKUP_POWER_UNSTABLE	Channel List Structure		Configure to USE_ALL Channels
ENV_CALIBRATION_UNDERWAY	Channel List Structure		Configure to USE_ALL Channels
ENV_CLIPPED	Channel List Structure		Configure to USE_ALL Channels
ENV_CLOCK_DIFFERENTIAL_TOO_LARGE	Channel List Structure		Configure to USE_ALL Channels
ENV_DEAD_SENSOR_CHANNEL	Channel List Structure		Configure to USE_ALL Channels
ENV_DIGITIZER_ANALOG_INPUT_SHORTED	Channel List Structure		Configure to USE_ALL Channels
ENV_DIGITIZER_CALIBRATION_LOOP_BACK	Channel List Structure		Configure to USE_ALL Channels
ENV_DIGITIZING_EQUIPMENT_OPEN	Channel List Structure		Configure to USE_ALL Channels
ENV_EQUIPMENT_HOUSING_OPEN	Channel List Structure		Configure to USE_ALL Channels
ENV_EQUIPMENT_MOVED	Channel List Structure		Configure to USE_ALL Channels
ENV_GPS_RECEIVER_OFF	Channel List Structure		Configure to USE_ALL Channels
ENV_GPS_RECEIVER_UNLOCKED	Channel List Structure		Configure to USE_ALL Channels
ENV_MAIN_POWER_FAILURE	Channel List Structure		Configure to USE_ALL Channels
ENV_VAULT_DOOR_OPENED	Channel List Structure		Configure to USE_ALL Channels
ENV_ZEROED_DATA	Channel List Structure		Configure to USE_ALL Channels

3.2.4.4.2 Station

The station configuration for soh-control.channels-by-monitor-type is located as follows with the following format:

config/processing/soh-control.channels-by-monitor-type/{station}.json

soh-control.channels-by-monitor-type Station Configuration			
name	{station}_MONITOR_CHANNEL_SELECTIONS		
constraintType	criterion	operator	description
STRING	StationName	EQ	Name of station to which this configuration option applies
parameters		type	description
MISSING		Channel List Structure	Either USE_ALL or Included Channels
LAG		Channel List Structure	Either USE_ALL or Included Channels
TIMELINESS		Channel List Structure	Either USE_ALL or Included Channels
ENV_AUTHENTICATION_SEAL_BROKEN		Channel List Structure	Either USE_ALL or Included Channels
ENV_BACKUP_POWER_UNSTABLE		Channel List Structure	Either USE_ALL or Included Channels
ENV_CALIBRATION_UNDERWAY		Channel List Structure	Either USE_ALL or Included Channels
ENV_CLIPPED		Channel List Structure	Either USE_ALL or Included Channels
ENV_CLOCK_DIFFERENTIAL_TOO_LARGE		Channel List Structure	Either USE_ALL or Included Channels
ENV_DEAD_SENSOR_CHANNEL		Channel List Structure	Either USE_ALL or Included Channels
ENV_DIGITIZER_ANALOG_INPUT_SHORTED		Channel List Structure	Either USE_ALL or Included Channels
ENV_DIGITIZER_CALIBRATION_LOOP_BACK		Channel List Structure	Either USE_ALL or Included Channels
ENV_DIGITIZING_EQUIPMENT_OPEN		Channel List Structure	Either USE_ALL or Included Channels
ENV_EQUIPMENT_HOUSING_OPEN		Channel List Structure	Either USE_ALL or Included Channels
ENV_EQUIPMENT_MOVED		Channel List Structure	Either USE_ALL or Included Channels
ENV_GPS_RECEIVER_OFF		Channel List Structure	Either USE_ALL or Included Channels
ENV_GPS_RECEIVER_UNLOCKED		Channel List Structure	Either USE_ALL or Included Channels
ENV_MAIN_POWER_FAILURE		Channel List Structure	Either USE_ALL or Included Channels
ENV_VAULT_DOOR_OPENED		Channel List Structure	Either USE_ALL or Included Channels
ENV_ZEROED_DATA		Channel List Structure	Either USE_ALL or Included Channels

3.2.4.4.3 Channel List Structure

The complex structure for Channel List is composed of the following:

parameters	type	description
channelsMode	String	Type of operation used to determine the list of Channels List. Valid values are: <ul style="list-style-type: none">USE_ALL – All valid Channels (i.e., all Channels for the Station) will be used. This option should be the only one used in the default.USE_LIST – Only the Channels listed will be used
channels	String list	List of channels that will be used. This list is only used when the channelsMode is USE_LIST. When the channelsMode is USE_ALL then the list should be empty.

3.2.4.5 Monitor Types Included in Station Status Rollup

The soh-control.monitor-types-for-rollup-station configuration defines Monitor Types which will roll up for the Station Worst of Status which is displayed on the SOH Overview and SOH Details displays. When a Monitor Type is not included in the Rollup for Station Status, that Monitor Type appears in dark grey on the SOH Details Display (as opposed to the color for the Status). For a list of Monitor Types which can be included, see the SOH Value and Status section.

3.2.4.5.1 Default

The default configuration for soh-control.monitor-types-for-rollup-station is located as follows with the following format:

config/processing/soh-control.monitor-types-for-rollup-station/default.json

soh-control.monitor-types-for-rollup-station Default Configuration				
	name	default-soh-monitor-types-for-rollup-station		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default. Note: Name must be exact: "default-soh-monitor-types-for-rollup-station"
	parameters		type	description
	sohMonitorTypesForRollup		string list	List of monitor types for roll up (see Appendix A for a list of valid Monitor Types)

3.2.4.5.2 Profile

The profile configuration for soh-control.monitor-types-for-rollup-station is located as follows with the following format:

config/processing/soh-control.monitor-types-for-rollup-station/{profile}.json

soh-control.monitor-types-for-rollup-station Profile Configuration				
name		{profile}-soh-monitor-types-for-rollup-station		
constraintType	criterion	operator	description	
STRING	StationName	IN	Name(s) of stations to which this applies	
parameters		type	description	
sohMonitorTypesForRollup		string list	List of monitor types for roll up (see Appendix A for a list of valid Monitor Types)	

3.2.4.5.3 Station

The station configuration for soh-control.monitor-types-for-rollup-station is located as follows with the following format:

config/processing/soh-control.monitor-types-for-rollup-station/{station}.json

soh-control.monitor-types-for-rollup Station Configuration				
name		{AAK}_MONITOR_TYPES		
constraintType	criterion	operator	Description	
STRING	StationName	Any	Name(s) of stations to which this applies	
parameters		type	Description	
sohMonitorTypesForRollup		string list	List of monitor types for roll up (see Appendix A for a list of valid Monitor Types)	

3.2.4.6 Monitor Types Included in Channel Status Rollup

The soh-control.monitor-types-for-rollup-channel configuration defines Monitor Types which will roll up for the Channel Worst of Status. The Channel Worst of Status is not displayed on the UI nor used in any other calculation. The soh-control.monitor-types-for-rollup-channel also controls which channel monitors track unacknowledged changes. In order to operate with the SOH Configuration Tool the soh-control.monitor-types-for-rollup-channel at the default and profile level should be the same stations and monitor type list as the soh-control.monitor-types-for-rollup-station.

3.2.4.6.1 Default

The default configuration for soh-control.monitor-types-for-rollup-channel is located as follows with the following format:

config/processing/soh-control.monitor-types-for-rollup-channel/default.json

soh-control.monitor-types-for-rollup-channel Default Configuration				
	name	default-soh-monitor-types-for-rollup-channel		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default. NOTE: Name must be exact: "default-soh-monitor-types-for-rollup-channel"
	parameters		type	description
	sohMonitorTypesForRollup		string list	List of monitor types for roll up (see Appendix A for a list of valid Monitor Types)

3.2.4.6.2 Profile

The profile configuration for soh-control.monitor-types-for-rollup-channel is located as follows with the following format:

config/processing/soh-control.monitor-types-for-rollup-channel/{profile}.json

soh-control.monitor-types-for-rollup Profile Configuration				
	name	{profile}-soh-monitor-types-for-rollup-channel		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default.
	STRING	StationName	IN	Name(s) of stations to which this applies
	Parameters		type	description
	sohMonitorTypesForRollup		string list	List of monitor types for roll up (see Appendix A for valid monitor type)

3.2.4.6.3 Station

The station configuration for soh-control.monitor-types-for-rollup-channel is located as follows with the following format:

config/processing/soh-control.monitor-types-for-rollup-channel/{station}.json

soh-control.monitor-types-for-rollup-channel Station Configuration				
	name	{station}_MONITOR_TYPES		
	constraintType	criterion	operator	description
	STRING	StationName	IN	Name of station to which this applies
	Parameters		type	description
	sohMonitorTypesForRollup		string list	List of monitor types for roll up (see Appendix A for a list of valid Monitor Types)

3.2.4.7 Channel Capability Rollup

The soh-control.channel-capability-rollup configuration object configures the Channel Capability Status. The Channel Capability Status is calculated based on the Channel Monitor Status of the various Monitor Types. The Channel Capability Rollup configuration specifies which Monitor Types to include and which operator type (BEST_OF, WORST_OF, MIN_GOOD_OF) to use when calculating the Channel Capability Status. The Channel Capability Status is not displayed on the UI but is used to calculate the Station Capability Status.

The Channel Capability Status rolls up the statuses from one of the following:

- 1) The Channel Monitor Status for the Monitor Types listed in sohMonitorTypeOperands.
- 2) The results of the sub rollups given by rollupOperatorOperands (which includes an operatorType and list of Monitor Types for its sohMonitorTypeOperands).
- 3) The Channel Monitor Status for all Monitor Types when neither the sohMonitorTypeOperands nor rollupOperatorOperands are provided.

The SOH Configuration Tool does not allow editing of Channel Capability Rollup at a station level.

3.2.4.7.1 Default

The default configuration for soh-control.channel-capability-rollup is located as follows with the following format:

config/processing/ soh-control.channel-capability-rollup/default.json

soh-control.channel-capability-rollup Default Configuration				
	name	default-channel-capability-rollup		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default. NOTE: Name must be exact "default-channel-capability-rollup"
	parameters		type	description
	sohMonitorsToChannelRollupOperator		Complex Channel Capability Rollup structure	Complex structure which describes how to calculate the Channel Capability Status. Structure is described below

3.2.4.7.2 Profile

The profile configuration for soh-control.channel-capability-rollup is located as follows with the following format:

config/processing/ soh-control.channel-capability-rollup/{profile}.json

soh-control.channel-capability-rollup Profile Configuration				
	name	{profile} – PROFILE – CHANNEL CAPABILITY ROLLUP		
	constraintType	criterion	operator	description
	STRING	StationGroupName	Any	Name(s) of station groups to which this applies
	STRING	StationName	Any	name(s) of stations to which this applies
	Parameters		type	description
	sohMonitorsToChannelRollupOperator		Complex Channel Capability Rollup structure	Complex structure which describes how to calculate the Channel Capability Status. Structure is described below

3.2.4.7.3 Channel

The channel configuration for soh-control.channel-capability-rollup is located as follows with the following format:

config/processing/ soh-control.channel-capability-rollup/{station}.json

soh-control.channel-capability-rollup Channel Configuration				
name	{station}_{CHANNEL}_CHANNEL_CAPABILITY_ROLLUP			
constraintType	criterion	operator	description	
STRING	StationGroupName	Any	Name(s) of station groups to which this applies	
STRING	StationName	EQ	name(s) of stations to which this applies	
STRING	Channel	Any	name(s) of Channel to which this applies	
parameters		type	description	
sohMonitorsToChannelRollupOperator		Complex Channel Capability Rollup structure	Complex structure which describes how to calculate the Channel Capability Status. Structure is described below	

3.2.4.7.4 Channel Capability Rollup Structure

The complex structure for Channel Capability Rollup is composed of the following:

parameters	type	description
operatorType	string	Type of operation that the rollup calculation will perform. Valid values are: <ul style="list-style-type: none"> BEST_OF – The best status (GOOD is better than MARGINAL. MARGINAL is better than BAD.) WORST_OF – The worst status (BAD is worse than MARGINAL. MARGINAL is worse than GOOD.) MIN_GOOD_OF – The number of statuses included in the roll up which are good compared to the goodThreshold and marginalThreshold.
goodThreshold	integer	Number of Monitor Types with a GOOD Channel Monitor Status required to make the Channel Capability Status GOOD. The goodThreshold is only included if the operatorType is MIN_GOOD.
marginalThreshold	integer	Number of Monitor Types with a GOOD Channel Monitor Status required to make the Channel Capability Status GOOD. The goodThreshold is only included if the operatorType is MIN_GOOD.

parameters	type	description
sohMonitorTypeOperands	string list	Provides a list of Monitor Types to include in the Channel Capability Rollup. The sohMonitorTypeOperands is optional; if provided, the rollupOperatorOperands should not be provided. If neither is provided, then ALL Monitor Types are included.
rollupOperatatorOperands	complex channel capability rollup structure	Provides two or more sub rollups to include in the Station Capability Rollup. The rollupOperatorOperands is optional; if provided, the channelOperands should not be provided. if neither is provided, then ALL Stations in the Station Group are included. Each sub rollup includes: <ol style="list-style-type: none">1. operatorType (plus goodThreshold and marginalThreshold if the operatorType is MIN_GOOD_OF)2. sohMonitorTypeOperands giving list of Stations.

3.2.4.8 Station Capability Rollup

The soh-control.station-capability-rollup configuration object configures the Station Capability Status. The Station Capability Status is calculated based on the Channel Capability Status. The Station Capability Rollup configuration specifies which Channels to include and which operator type (BEST_OF, WORST_OF, MIN_GOOD_OF) to use when calculating the Station Capability Status. The Station Capability Status is displayed on the SOH Overview and SOH Details display.

The Station Capability Status rolls up the statuses from one of the following:

- 1) The Channel Capability Status for the Channels listed in channelOperands.
- 2) The results of the sub rollups given by rollupOperatorOperands (which will include an operatorType and list of Channels for its channelOperands).
- 3) The Channel Capability Status for all Channels for the Station when neither the channelOperands nor rollupOperatorOperands are provided.

3.2.4.8.1 Default

The default configuration for soh-control.station-capability-rollup is located as follows with the following format:

config/processing/soh-control.station-capability-rollup/default.json

Configuration Option				
	name	default-station-capability-rollup		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default. NOTE: Name must be exact "default-station-capability-rollup"
	Parameters		type	description
	channelsToStationRollupOperator		Complex Station Capability Rollup structure	Complex structure which describes how to calculate the Station Capability Status. Structure is described below.

3.2.4.8.2 Station

The station configuration for soh-control.station-capability-rollup is located as follows with the following format:

config/processing/soh-control.station-capability-rollup/{station}.json

Configuration Option				
	name	{station}_{station group name}_CAPABILITY_ROLLUP		
	constraintType	criterion	operator	description
	STRING	StationName	EQ*	Name of the station to which this applies
	STRING	StationGroupName	EQ*	Name of station group to which this configuration applies
	Parameters		type	description
	channelsToStationRollupOperator		Complex Station Capability Rollup structure	Complex structure which describes how to calculate the Station Capability Status. Structure is described below.

3.2.4.8.3 Station Capability Rollup Structure

The complex structure for Station Capability Rollup is composed of the following:

parameters	type	description
operatorType	string	Type of operation that the rollup calculation will perform. Valid values are: <ul style="list-style-type: none"> BEST_OF – The best status (GOOD is better than MARGINAL; MARGINAL is better than BAD) WORST_OF – The worst status (BAD is worse than MARGINAL; MARGINAL is worse than GOOD) MIN_GOOD_OF – Count of the number of statuses included in the roll up which are good compared to the goodThreshold and marginalThreshold.
goodThreshold	integer	Number of Channels with a GOOD Channel Capability Status required to make the Station Capability Status GOOD. The goodThreshold is only included if the operatorType is MIN_GOOD.
marginalThreshold	integer	Number of Channels with a GOOD Channel Capability Status required to make the Station Capability Status GOOD. The goodThreshold is only included if the operatorType is MIN_GOOD.
channelOperands	string list	Provides a list of Channel Names to include in the Station Capability Rollup. The channelOperands is optional. If provided, the rollupOperatorOperands should not be provided. If neither is provided, all Stations in the Station Group are included. The stationOperands can only be included if the configuration option is constrained to a specific Station Group.
rollupOperatorOperands	Complex Station Capability Rollup structure	Provides two or more sub rollups to include in the Station Capability Rollup. The rollupOperatorOperands is optional. If provided, the channelOperands should not be provided. If neither is provided, all Stations in the Station Group are included. The rollupOperatorOperands can only be included if the configuration option is constrained to a specific Station. Each sub rollup includes: <ol style="list-style-type: none"> operatorType (plus goodThreshold and marginalThreshold if the operatorType is MIN_GOOD_OF) channelOperands giving list of Stations.

3.2.4.9 ACEI Merge Tolerance

The ACEI Merge Processor Merge Tolerance configuration object configures the time tolerance for two ACEI objects to be apart and still be merged into a single object. The ACEI data will be merged when the difference in their time is less than or equal to the merge-tolerance. This can be seen on the Environmental Trends Display. When the gap in data is smaller than the merge-tolerance then a gap will be shown on the Environmental Trends Display. When the gap is larger than the merge-tolerance then no gap will be shown. While the ACEI Merge Tolerance can be set differently for different stations or channels, typically there is just one universal setting for it. Thus, the ACEI Merge Tolerance is not something that can be controlled in the SOH Configuration Tool.

3.2.4.9.1 Default

The default configuration for soh-control.channel-capability-rollup is located as follows with the following format:

config/processing/acei-merge-processor.merge-tolerance/default.json

Configuration Option				
	name	default-merge-tolerance		
	constraintType	criterion	operator	description
	DEFAULT	—	—	Defines the constraint as default
	parameters	type	description	
	merge-tolerance	duration	Tolerance for which ACEIs will be merged when less than or equal to the tolerance	

3.2.4.9.2 Station

It is possible to create an `acei-merge-processor.merge-tolerance` configuration specific to a Station. The default configuration for `soh-control.channel-capability-rollup` is located as follows with the following format:

config/processing/acei-merge-processor.merge-tolerance/{station}.json

Configuration Option				
	name	{station(s)}-merge-tolerance		
	constraintType	criterion	operator	Description
	STRING	StationName	Any	name(s) of station to which this applies
	parameters	type	Description	
	merge-tolerance	duration	Tolerance for which ACEIs will be merged when less than or equal to the tolerance	

3.2.4.9.3 Channel

It is possible to create an `acei-merge-processor.merge-tolerance` configuration specific to a Channel.

config/processing/acei-merge-processor.merge-tolerance /{station}.json

Configuration Option				
	name	Description		
	{station channel name(s)}	A configuration option for acei-merge-processor-tolerance that applies to specific Channel		
	constraintType	criterion	operator	Description
	STRING	StationName	EQ	Name of station to which this applies
	STRING	ChannelName	Any	Name(s) of Channel to which this applies
	parameters	type	Description	
	merge-tolerance	duration	Tolerance for which ACEIs will be merged when less than or equal to the tolerance	

4 USER PREFERENCES

4.1 Default User Preferences

There is a defaultUserPreferences.json file which defines the default layout for the display. This file is not a processing configuration file and thus does not have constraints.

config/user-preferences/defaultUserPreferences.json

parameter name	type	description
defaultLayoutName	string	Name of the default Layout
defaultsohLayoutName	string	Name of the default Layout
userID	string	Value is defaultUser
currentTheme	string	Name of the current theme
audibleNotifications		
workspaceLayouts	Complex Workspace Layout Structure List	List of one or more Complex Structures detailing the workspace layout

Each Complex Workspace Layout Structure is comprised of:

parameter name	type	description
name	string	Name of the Layout
supportedUserInterfaceMode	string list	List of User Interface Modes which the layout can be used for. Valid values include SOH and ANALYST
layoutConfiguration	string	Layout of the tabs Note this is not easily human readable.

5 UPDATING CONFIGURATION

5.1 System Config

The default set of system configuration values are built into the SOH system and should generally not be changed. If required, individual system configuration values may be overwritten. Environment variables, provided to the system via **gmskube** on initial deployment, can be specified to override any value.

Environment variable names are restricted to alphanumeric characters and an underscore. By convention, environment variable names are specified with uppercase characters. System configuration names must be translated into corresponding environment variable names to specify them for override. The transformation rules are:

1. The prefix `GMS_CONFIG_` is added to the name to avoid collision with other potentially identical environment variables.
2. The characters are all converted to upper case to match the UNIX convention.
3. Any dash character (`-`) is replaced with a single underscore (`_`).
4. Any period (`.`) is replaced with two underscores (`__`).

For example, to override the value of `cd11-rsdf-processor.retry-backoff-ms`, the environment variable `GMS_CONFIG_CD11_RSDF_PROCESSOR__RETRY_BACKOFF_MS` would be specified.

To specify this override when starting the system, it would be provided via a `--set` argument to **gmskube**. Any number of overrides can be specified, just by specifying multiple `--set` arguments. To override `cd11-rsdf-processor.retry-backoff-ms` to 2 seconds, the following would be specified in the deployment command:

```
$ gmskube install --set  
GMS_CONFIG_CD11_RSDF_PROCESSOR__RETRY_BACKOFF_MS=2000 ...
```

5.2 Other Configuration

The default set of processing configuration, station reference, station processing, and user preferences will automatically be loaded when a new instance of the system is freshly deployed.

These processing config files are expected to be organized in the following subdirectories under a top-level, configuration directory:

- **Processing**
This directory contains processing configuration used to configure processing components in the system.
- **Station-reference/stationdata**

This directory contains several JSON files that contain the Common Object Interface (COI) representations of station reference configuration and station processing configuration. Note that these files should not be edited directly, but should instead be generated from a set of source CSS-formatted files in **station-reference/data**

- **User-preferences**

This directory contains a JSON file which specifies the user preferences for the user interface.

5.2.1 Overrides

The processing configuration, station reference, station processing, and user preferences can be overwritten at startup by providing an alternate set of configuration files in the directory structure specified above.

The path to the top-level directory of this alternate configuration can be specified via the `--config` argument to **gmskube install**. Note that the alternate set of files may be sparse, and any directories not found in the overrides will fall back to default values in the default configuration.

```
%gmskube install --tag {RELEASE} --type soh --config path-to-my-configuration ...
```

After the system has been initially deployed, the processing configuration can be updated by running **gmskube reconfig**. Note that on update, most SOH components will be automatically restarted to use the new configuration. The updated processing config must be specified under a processing subdirectory and must match the same directory structure specified above.

```
% gmskube reconfig --config path-to-my-configuration ...
```

In addition to processing config, a new `station-reference/stationdata/processing-station-group-definition.json` file can also be included in the configuration to update the station group definitions. It is important to note that no other configuration will be updated as part of a reconfig operation.

5.2.2 Generating Station Reference and Station Processing from CSS

To update station reference and station processing configuration, users should first edit the myriad of CSS specification files found in their override copy of the *station-reference/data* directory. After updates have been made to those CSS files, the **gms-css-to-coi** program can be used to generate the station reference and station processing configuration JSON files:

```
$ gms-css-to-coi -s path-to-my-config/station-  
reference/data -d path-to-my-config/station-  
reference/stationdata
```

This conversion must be done prior to running **gmskube install** with the `-config` argument for the alternate configuration to be read. Note that this configuration is not updated on a **gmskube reconfig** operation.

6 SOH PROCESSING CONFIGURATION GUIDANCE

This section provides recommendations for SOH configuration values, including the Reprocessing Interval, the Redisplay Interval, the Acknowledgement Quiet Duration, the list of Available Quiet Durations, and for each Channel Monitor, the Good Threshold, Marginal Threshold, Calculation Interval, and the Back Off Duration.

6.1 Definitions

Max Time to Process SOH Calculations – This is the maximum time required to process the SOH calculations. Determining the value requires benchmarking the system and depends on the number of stations and channels being processed. The value should be less than 1 second.

Trend Display Acceptable Performance Limit – The duration of time which the Trend Displays can return before the performance becomes unacceptable.

Packet Length – This is the length of the packet. For CD1.1 packets, this is 10 seconds.

Minimum Latency – This is the minimum latency experienced by the Channel.

Minimum Normal Latency – This is the minimum latency which is considered normal for the Channel.

Maximum Normal Latency – This is the maximum latency which is considered normal for the Channel. For determining defaults, use the Maximum Normal Latency of any Channel covered by the defaults.

Sample Frequency – This is the frequency at which the data is sampled on the Channel.

n – Any positive non-zero integer can be used as n to satisfy the equation. The number used for n in one equation does not have to relate to the number used for n in a different equation.

6.2 SOH General Configuration Parameters

6.2.1 Reprocessing Interval

The Reprocessing Interval is a duration specified in seconds, minutes, or hours. It must be a positive number.

Reprocessing Interval > Max Time to Process SOH Calculations

The Reprocessing Interval cannot be faster than the time required to process SOH Calculations. Failure to set the Reprocessing Interval higher than the Max Time Required to Process SOH Calculation may result in the system failing to work properly.

6.2.2 Acknowledgement Quiet Duration

The Acknowledgement Quiet Duration is a duration specified in seconds, minutes, hours, or days.

Acknowledgement Quiet Duration >= 0

Setting the Acknowledgement Quiet Duration interval to zero will mean that there is no quiet interval following acknowledgement.

Acknowledgement Quiet Duration \geq MAX(Calculation Interval)

This is a loose recommendation. Setting the Acknowledgement Quiet Duration to be greater than the Calculation Interval will give enough time for all data in the current calculation window to be filtered during the quiet interval. Since there is only one acknowledgement interval, and the Calculation Interval is per Channel Monitor, it may be beneficial to throw out especially high Calculation Intervals.

6.2.3 Available Quiet Durations

The Available Quiet Durations are a list of durations specified in seconds, minutes, hours, or days.

Available Quiet Duration $>$ Reprocessing Period

If a duration on the list of Available Quiet Duration is not greater than the reprocessing period, then it might not be quieted after the next update.

Available Quiet Duration \geq MAX (Calculation Interval + Back Off Duration)

It is recommended that at least one available quiet duration is greater than the maximum Calculation Interval plus Back Off Duration. This allows the user to select a quiet interval which is long enough for all current data to be filtered out.

6.2.4 SOH Station Stale Duration

The SOH Station Stale Duration is the time duration before the UI declares the data outdated.

SOH Station Stale Duration $>$ Reprocessing Period

The SOH Station Stale Duration should be greater than the reprocessing period otherwise under normal processing might be declared old.

6.2.5 SOH Historical Durations

The SOH Historical Duration is a list of durations for easy selection on the Trend displays.

SOH Historical Duration \gg Reprocessing Interval

All SOH Historical Durations should be a magnitude longer than the Reprocessing Interval (a minimum of 100 times greater is recommended). If the SOH Historical Duration is 50 times longer than the Reprocessing Interval, it will display 50 points on the graph.

SOH Historical Duration \gg Calculation Interval

All SOH Historical Durations should be significantly greater than the shortest Calculation Interval (a minimum of 10 times greater is recommended), and the largest SOH Historical Duration should be significantly longer than the longest Calculation Interval (again a minimum of 10 times greater is recommended). Selecting a SOH Historical Duration that is less than the Calculation Interval will result in averages being calculated using SOH values that cover less time than the original data covered by the SOH values.

SOH Historical Duration \leq Trend Display Acceptable Performance Limit

All Historical Durations should be less than the Trend Display Acceptable Performance Limit; otherwise, the performance on the trend display would become unacceptable with a default selection.

6.3 Channel Monitor Configuration Parameters**6.3.1 Calculation Interval**

The Calculation Interval is a duration specified in seconds, minutes, or hours, and it must be a positive number.

Calculation Interval \geq Reprocessing Interval

If the Calculation Interval is less than the Reprocessing Interval, then there can be received data which will not affect any SOH calculation

Calculation Interval \geq Packet Length

It is recommended that the Calculation Interval be greater than or equal to the Packet Length.

6.3.2 Back Off Duration

The Back Off Duration is a duration specified in seconds, minutes, or hours and it must be a non-negative number.

Back Off Duration ≥ 0

Setting the Back Off Duration to zero ensures the end of the calculation window is equal to the Calculation Time. For the Missing Data Monitor, this will result in data which is currently in route under normal latency or is going to be included in a packet which has not yet passed its end time to be reported as missing; thus zero for the Back Off Duration is not recommended for the Missing Data Monitor.

Back Off Duration \geq Maximum Normal Latency + Packet Length - Calculation Interval

Failing to meet this requirement may result in no data being included in the calculation even under normal conditions. This means under normal conditions, it's possible for 100% of data to be considered missing, and latency and environmental issues will be reported as Unknown.

Back Off Duration \geq Maximum Normal Latency + Packet Length

In order to ensure consistent sampling of data, the back off duration should be greater than the maximum normal latency plus the packet length such that under normal circumstances data has been received for the entire calculation interval. For the Missing Data Monitor, if this condition is not met, data which is not expected to be received while operating under normal condition will be treated as missing. This includes data which has not been received due to normal latency and data not received because it is part of a packet currently being created on the system. This is less important for the Latency and Environmental Monitors; however, if this

condition is not met, the amount of data used in the calculation will be less than the Calculation Interval suggests should be included.

6.3.3 Good Threshold

For the Timeliness Monitor Type:

The Good Threshold for the Timeliness Monitor Type is duration specified in seconds, minutes, or hours and must be a non-negative number.

Good Threshold \geq Maximum Normal Latency + Packet Length

Keeps data with the normal latency range reporting good Timeliness.

Good Threshold = Maximum Normal Latency + Packet Length

Do this to keep data with the normal latency range reporting good Timeliness, and data outside the normal latency range reporting as marginal Timeliness.

For the Lag Monitor Type:

The Good Threshold for the Lag Monitor Type is a duration specified in seconds, minutes, or hours, and it must be a non-negative number.

Good Threshold \geq Maximum Normal Latency

Do this to keep data within the normal latency range reporting good Lag.

Good Threshold = Maximum Normal Latency

Do this to keep data within the normal latency range as reporting good Lag, and data outside the normal latency range reporting as marginal.

For the Missing Data Monitor Types:

The Good Threshold for the Missing Data Monitor Type is a percentage between 0 and 100.

Good Threshold $\geq 1/(\text{Packet Length} \times \text{Sample Frequency})$

The ending time of a packet is the time of the last sample of data in that packet. The starting time of the next packet is the time of the first sample of data in that packet. The time in between the first sample in the next packet and the last sample in the previous packet not accounted for is counted as Missing. This is a minimal amount, but enough that the Good Threshold should not be set to 0%, as this will result in the data always being marginal.

Good Threshold $< 100\%$

Setting the Good Threshold to 100% would mean that data is always good and never Marginal or Bad. In some situations, this might be needed.

For Environmental Issues Monitor Types:

The Good Threshold for the Environmental Issues Monitor Type is a percentage between 0 and 100.

Good Threshold $\geq 0\%$

Setting the Good Threshold to Zero will mean that having any single environmental bit set within the calculation window will cause the SOH Status for that Environmental Monitor to be Marginal or Bad.

Good Threshold $< 100\%$

Setting the Good Threshold to 100% would mean that data is always good and never Marginal or Bad.

6.3.4 Marginal Threshold**Marginal Threshold $>$ Good Threshold**

If the Marginal Threshold was not equal to the Good Threshold, the Status will never be Marginal. In some cases, this may be a needed outcome, to only have Good and Bad. In which case, setting the Marginal Threshold to be equal to the Good Threshold is acceptable.

For the Timeliness Monitor Type:

The Marginal Threshold for the Timeliness Monitor Type is duration specified in seconds, minutes, or hours, and it must be a non-negative number.

For the Lag Monitor Type:

The Marginal Threshold for the Lag Monitor Type is a duration specified in seconds, minutes, or hours, and it must be a non-negative number.

Marginal Threshold $<<$ Calculation Interval + Back Off Duration

Late arriving data does not affect the SOH Calculations. Thus, data that is more latent than the Calculation Interval plus the Back Off Duration will not affect the Lag Calculation. It is recommended that the Marginal Threshold be significantly less than the Calculation Interval plus the Back Off Duration to ensure the Lag Monitor can be BAD (the exact definition of significantly is subjective).

For the Missing Data Monitor Types:

The Marginal Threshold for the Missing Data Monitor Type is a percentage between 0 and 100.

Marginal Threshold < 100

If the Marginal Threshold was set to 100, the Status would never be BAD. In some cases, it might be needed, in which case, setting the Marginal Threshold to 100 is acceptable.

Marginal Threshold \geq Good Threshold + $[(\text{Packet Length}/\text{Calculation Interval}) * 100]$

In this equation, the Packet Length/Calculation Interval is equal to one packet on the equation. This could have also been expressed as $1/(\text{Calculation Interval}/\text{Packet Length})$. It is recommended that the Marginal Threshold and Good Threshold are further apart than the effect of a single packet on the equation; otherwise, the equation will only calculate out to be

Marginal if the packet with missing data was either a partial packet at the beginning or ending of the calculation window or the Channel Reported only partial data for the packet.

For Environmental Issues Monitor Types:

The Good Threshold for the Environmental Issues Monitor Type is a percentage between 0 and 100.

Marginal Threshold < 100

If the Marginal Threshold is set to 100, the Status would never be BAD. In some cases, it might be needed, in which case setting the Marginal Threshold to 100 is acceptable.

Marginal Threshold \geq Good Threshold + [(Packet Length/Calculation Interval) * 100]

In this equation the Packet Length/Calculation Interval is equal to one packet on the equation. This could have also been expressed as $1/(\text{Calculation Interval}/\text{Packet Length})$. It is recommended that the Marginal Threshold and Good Threshold are further apart than the effect of a single packet on the equation, otherwise, the equation will only calculate out to be Marginal if the packet with the set environmental issue was either a partial packet at the beginning or ending of the calculation window.

6.4 General Recommendations

SOH processing configuration may be customized as needed for the station, channel, and monitor type. For simplicity, default configuration should be defined at the highest level possible and only customized when needed for effective processing. For example:

1. Set the Calculation Interval the same across all monitors types.
2. Set the Back Off Duration the same across all monitor types.
3. Set the Good Threshold and Marginal Threshold the same for all Environmental Issues Monitor Types.
4. Set all Monitor Types to roll up for each Channel.
5. Set all Monitor Types to roll up for each Station.

6.4.1 PI13 Default Config Parameters

Processing and display values:

- Reprocessing Interval: 20 seconds
- Acknowledge Quiet Duration: 5 minutes
- Available Quiet Intervals: 5 minutes, 15 minutes, 1 hour, 24 hours, and 7 days
- SOH Station Stale Duration: 5 minutes
- SOH Historical Durations: 6 hours, 12 hours, and 24 hours

Seismic Primary Stations & MiniSeed Stations:

backOffInterval: 5 minutes

calculationInterval: 10 minutes

Timeliness:

goodThreshold: 5 minutes

marginalThresold: 15 minutes
Lag:
goodThreshold: 5 minutes
marginalThresold: 15 minutes
Missing:
goodThreshold: 2%
marginalThresold: 10%
Environmental:
goodThreshold: 0%
marginalThresold: 75%

Seismic Auxiliary Stations (without longer delay):

backOffInterval: 45 minutes
calculationInterval: 30 minutes
Timeliness:
goodThreshold: 45 minutes
marginalThresold: 75 minutes
Lag:
goodThreshold: 45 minutes
marginalThresold: 75 minutes
Missing:
goodThreshold: 2%
marginalThresold: 10%
Environmental:
goodThreshold: 0%
marginalThresold: 75%

Seismic Auxiliary Stations (with longer delay):

backOffInterval: 90 minutes
calculationInterval: 60 minutes
Timeliness:
goodThreshold: 90 minutes
marginalThresold: 150 minutes
Lag:
goodThreshold: 90 minutes
marginalThresold: 150 minutes
Missing:
goodThreshold: 2%
marginalThresold: 10%
Environmental:
goodThreshold: 0%
marginalThresold: 75%

Hydro Acoustic Stations:

backOffInterval: 5 minutes
calculationInterval: 10 minutes
Timeliness:
 goodThreshold: 5 minutes
 marginalThresold: 15 minutes
Lag:
 goodThreshold: 5 minutes
 marginalThresold: 15 minutes
Missing:
 goodThreshold: 10%
 marginalThresold: 20%
Environmental:
 goodThreshold: 0%
 marginalThresold: 75%

Infrasound Stations:

backOffInterval: 5 minutes
calculationInterval: 10 minutes
Timeliness:
 goodThreshold: 5 minutes
 marginalThresold: 15 minutes
Lag:
 goodThreshold: 5 minutes
 marginalThresold: 15 minutes
Missing:
 goodThreshold: 5.01%
 marginalThresold: 10%
Environmental:
 goodThreshold: 0%
 marginalThresold: 75%

7 APPENDIX A

The following table gives a list of Monitor Types and the corresponding Result Types.

Monitor Type	SOH Value Type
MISSING	PERCENT
TIMELINESS	DURATION
LAG	DURATION
ENV_AUTHENTICATION_SEAL_BROKEN	PERCENT
ENV_BACKUP_POWER_UNSTABLE	PERCENT
ENV_CALIBRATION_UNDERWAY	PERCENT
ENV_CLIPPED	PERCENT
ENV_CLOCK_DIFFERENTIAL_TOO_LARGE	PERCENT
ENV_DEAD_SENSOR_CHANNEL	PERCENT
ENV_DIGITIZER_ANALOG_INPUT_SHORTED	PERCENT
ENV_DIGITIZER_CALIBRATION_LOOP_BACK	PERCENT
ENV_DIGITIZING_EQUIPMENT_OPEN	PERCENT
ENV_EQUIPMENT_HOUSING_OPEN	PERCENT
ENV_EQUIPMENT_MOVED	PERCENT
ENV_GPS_RECEIVER_OFF	PERCENT
ENV_GPS_RECEIVER_UNLOCKED	PERCENT
ENV_MAIN_POWER_FAILURE	PERCENT
ENV_VAULT_DOOR_OPENED	PERCENT
ENV_ZEROED_DATA	PERCENT