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GMS Configuration Guide

Version 1.4 (for GMS PI 16 Open Source Release)

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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 and Interactive Analysis (IAN) applications.

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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 program increment (PI) 15 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. All these components use system and processing configuration to provide the system controller mission-relevant information about station health.

GMS Interactive Analysis (IAN) provides components to access data from a legacy data processing system and display that data for analysis. The IAN application addressed in this guide is an early iteration including station information and waveform displays.

This document is a guide to setting the system and processing configuration for GMS SOH monitoring and IAN 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, listed here in the staging groups used when deploying the system. All these services use deployment configuration specified in the docker-compose-swarm-soh.yml file.

- Stage 1 services (3rd party baseline services)
  - bastion
  - etcd
  - javadoc
  - kafka1, kafka2, kafka3
  - postgres
  - prometheus
  - swagger
  - zoo1, zoo2, zoo3
- Stage 2 services (GMS baseline services)
  - These services may use GMS system configuration (etcd).
  - frameworks-osd-service
  - frameworks-osd-ttl-worker
  - frameworks-configuration-service

  - frameworks-osd-rsdf-kafka-consumer
  - postgresql-exporter
  - frameworks-osd-station-soh-kafka-consumer
- Stage 4 services (GMS specific services)
  - These services may use GMS system configuration and GMS processing configuration.
  - soh-control
  - rsdf-streams-processor
  - interactive-analysis-ui
  - interactive-analysis-api-gateway
  - da-dataman
  - interactive-analysis-config-service
  - da-connman

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 the GMS software repository gms-common.

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

1.3 Processing Configuration Description

The processing configuration contains several different types of 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. Generally, the default configuration option(s) are contained in a single default.json file, and the override configuration options (those without a default constraint) are contained in an override.json file. The default processing configuration is included under gms-common/config/processing.

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

Name - Each file contains a name (which is listed inside the file). The name should be descriptive of the file; however, the name does not have an impact on the actual processing.

Constraints – Each configuration option contains a list of one or more constraints. Most types of configuration objects require or allow a DEFAULT constraint.Other constraints are allowed

depending on the type of configuration object (details can be found 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 constraintType is the only information included in constraint (i.e., there is no criterion, operator, or value).

- **Criterion** – This is what is being constrained. What can be used as a criterion depends on the configuration object type. Possible criterion are: StationName, ChannelName, MonitorType, StationGroupName, sohValueType, 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** – Either EQ or IN. EQ (eg. equal) can be used if the value contains a single value. IN (eg. "in" list) is used if the value contains a list of values.

    - **Negated** – Either 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.

- **Value** – This is the value or list of values the configuration option is being restrictively applied.

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	IN	true

There are 21 different types of configuration objects included in the processing configuration:

- acei-merge.processor.mergre-tolerance
- connman.station-parameters
- dataframe-receiver.channel-lookup
- dataman.station-parameters

- global.cd11.station-parameters
- global.operational-time-period
- simulator-bridged-data-source-config
- soh-control
- soh-control.channel-capability-rollup
- soh-control.channels-by-monitor-type
- soh-control.rollup-stationsoh-time-tolerance
- soh-control.soh-monitor-thresholds
- soh-contro.soh-monitor-timewindows
- soh-control.soh-monitor-types-for-rollup-channel
- soh-control.soh-monitor-types-for-rollup-station
- soh-control.soh-monitor-value-and-status
- soh-control.station-capability-rollup
- soh-control.station-group-capability-rollup
- soh-control.station-group-name
- ui-analyst-settings
- ui-soh-settings

The soh-control.rollup-stationsoh-time-tolerance is for future use and not currently being used, because of this it will not be discussed further in this document.

1.4 SOH Processing Description

GMS Station SOH processing is designed to be very configurable, to allow the system maintainer to define the station groups, stations, channels, and SOH monitors (SOH monitors are the individual status items such as latency of a data packet or GPS status of a sensor channel) that are processed and displayed. Two different rollups of SOH status are supported: a basic 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 very 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 configuration items, but it is expected that default configuration will apply to many stations and some other groups of stations 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.

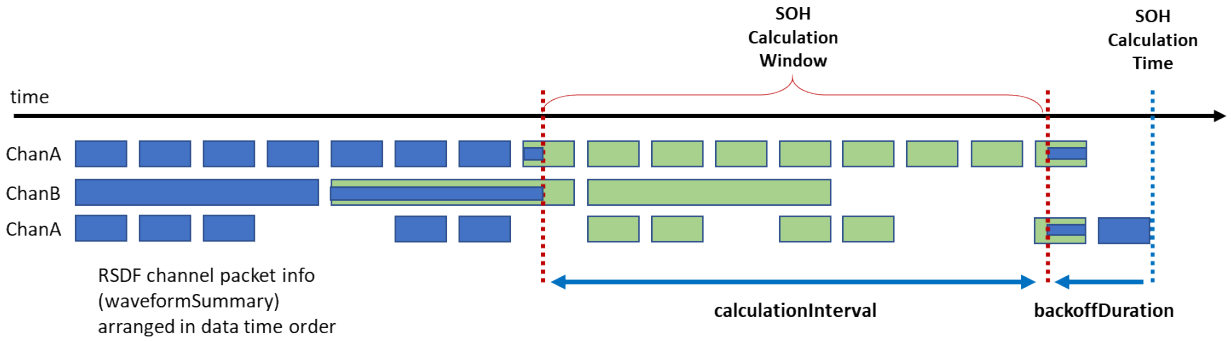

Figure 1. SOH Calculation Time Window

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 that 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 very 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 notices.

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 reprocessing periods 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 5 services:

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

System parameters are stored in the GMS code repository:

gms-common/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 that will be allocated
max-threads	Positive integer that is the maximum number of threads that will be 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
c3p0_connection_pool_size	Number for the connection pool size
#Default retry for processing config	
processing-retry-intial-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

waveforms-coi.host	Text string of the waveform's repository service name
signal-detection-coi.host	Text string of the signal detection service name
station-reference-coi.host	Text string of the station reference repository service name
performance-monitoring-coi.host	Text string of the performance monitoring service name
osd.host	Text string of the osd repository service name
osd.c3p0_connection_pool_size	Number for the connection pool size
# Values common to all GMS Services	
experimental-enabled	Boolean value defaulted to false.
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
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.application-batch-size-in-seconds	Positive integer of seconds for the batch size of the raw station data frame kafka consumer
osd-rsdf-kafka-consumer.input-topic	Text string of the raw station data frame kafka consumer input topic
osd-rsdf-kafka-consumer.buffer-size	Positive integer for the OSD raw station data frame kafka consumer buffer size
osd-rsdf-kafka-consumer.buffer-timeout	Text string of the OSD raw station data frame buffer timeout in ISO-8601 format
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.application-batch-size-in-seconds	Number of seconds for the batch size of the OSD system message kafka consumer
osd-systemmessage-kafka-consumer.input-topic	Text string of the OSD system message kafka consumer input topic

osd-systemmessage-kafka-consumer.buffer-size	Positive integer of the OSD system message kafka consumer buffer size
osd-systemmessage-kafka-consumer.buffer-timeout	Text string of the OSD system message kafka consumer buffer timeout in ISO-8601 format
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.application-batch-size-in-seconds	Number of seconds for the batch size of the SOH status change kafka consumer
soh-status-change-kafka-consumer.input-topic	Text string of the SOH status change kafka consumer input topic
soh-status-change-kafka-consumer.buffer-size	Positive integer of the SOH status change kafka consumer buffer size
soh-status-change-kafka-consumer.buffer-timeout	Text string of the SOH status change kafka consumer buffer timeout in ISO-8601 format
osd-station-soh-kafka-consumer.host	Text string of the OSD station SOH kafka consumer service
osd-station-soh-kafka-consumer.application-batch-size-in-seconds	Number of seconds for the batch size of the OSD station SOH kafka consumer
osd-station-soh-kafka-consumer.application-id	Text string of the OSD station SOH kafka application identifier
osd-station-soh-kafka-consumer.input-topic	Text string of the OSD station SOH kafka consumer input topic
osd-station-soh-kafka-consumer.buffer-size	Positive integer for the of the OSD station SOH kafka consumer buffer size
osd-station-soh-kafka-consumer.buffer-timeout	Text string of the OSD station SOH kafka consumer buffer timeout in ISO-8601 format
preloader.c3p0_connection_pool_size	Number for the connection pool size
soh-quieted-list-kafka-consumer.host	Text string of SOH quieted list kafka consumer service
soh-quieted-list-kafka-consumer.application-batch-size-in-seconds	Number of seconds for the batch size of the SOH quieted list kafka consumer
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

soh-quieted-list-kafka-consumer.buffer-size	Positive integer of the SOH quieted list kafka consumer buffer size
soh-quieted-list-kafka-consumer.buffer-timeout	Text string of the SOH quieted list kafka consumer buffer timeout in ISO-8601 format
capability-soh-rollup-kafka-consumer.host	Text string of SOH rollup kafka consumer service
capability-soh-rollup-kafka-consumer.application-batch-size-in-seconds	Number of seconds for the batch size of the SOH rollup kafka consumer
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
capability-soh-rollup-kafka-consumer.buffer-size	Positive integer of the SOH rollup kafka consumer buffer size
capability-soh-rollup-kafka-consumer.buffer-timeout	Text string of the SOH rollup kafka consumer buffer timeout in ISO-8601 format
# global ignite properties	
ignite-zookeeper-address	Text string of the ignite zookeeper address and port
ignite-instance-name	Text string of the ignite instance name
#Config for signal detection bridge	
signal-detection.oracle_wallet_location	Text string for the default address of signal detection oracle wallet location
signal-detection.tns_entry_location	Text string for the default address of signal detection TNS entry location
signal-detection.host	Text string of signal detection service
#Global kafka properties for producers/consumers	
kafka-bootstrap-servers	Text string of the different bootstrap servers (separated by commas)
kafka-compression-type	Text string of the compression type used
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 10 seconds measured in milliseconds)	
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 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	Reactor kafka consumer max number of poll records
reactor-kafka-auto-commit	Boolean text string true or false
reactor-kafka-consumer-heartbeat-interval	Text string for reactor kafka consumer heartbeat interval time in milliseconds
# reactor kafka sender settings	
reactor-kafka-sender-transaction-timeout	Text string for reactor kafka sender transaction timeout time in milliseconds
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-acquiredchannelsoh-topic	Text string for kafka acquired channel SOH topic
kafka-stationsohinput-topic	Text string for kafka station SOH input 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
# Global config for ConnMan/DataMan	
cd11-dataconsumer-baseport	The port number used as the base for assigning port offsets
# 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 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
#Config for DataMan	
dataman.application-id	Text string of the dataman application identifier
dataman.reactor-kafka-key-serializer	Text string for the default serializer to use for the key of a kafka output topic entry
dataman.reactor-kafka-value-serializer	Text string for the default serializer to use for the key of a kafka output topic entry
# Config for CD1.1 RSDF Processor	
cd11-rsdf-processor.application-id	Text string of the raw station data frame processor application identifier

cd11-rsdf-processor.reactor-kafka-key-serializer	Text string for the default serializer to use for the key of a kafka output topic entry
cd11-rsdf-processor.reactor-kafka-value-serializer	Text string for the default serializer to use for the key of a kafka output topic entry
# Config for waveform QC Control (QC – Quality Control)	
waveform-qc-control.processing-configuration-root	Text string for the default address of processing configuration for waveform QC Control
#Config for beam control	
beam-control.processing-configuration-root	Text string for the default address of processing configuration for beam control
# Config for event-location-control-service	
event-location-control.processing-configuration-root	Text string for the default address of processing configuration for event location control service
event-location-control.host	Text string of event location service
event-location-control.port	Port is a positive integer value for event location port
# 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_output_topic	Text string of the station SOH analysis manager system message 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
# Config for the soh-control application	
soh-control.sohAppId	Text string of SOH application
soh-control.application-id	Text string of the SOH control application identifier
soh-control.sohInputTopic	Text string of input topic location for SOH extract
soh-control.stationSohOutputTopic	Text string of output topic location for station SOH
soh-control.capabilitySohRollupOutputTopic	Text string of 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 for updates

soh-control.maxRequestSize	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 the acei-merge-processor	
acei-merge-processor.application-id	Text string of the acei merge processor application identifier
acei-merge-processor.input-acei-topic	Text string is renamed to acei-merge-processor.input-topic
acei-merge-processor.benchmark-logging-period-seconds	Positive Integer of the acei merge processor benchmark logging period in seconds
acei-merge-processor.cache-expiration-period-seconds	Positive Integer of the acei merge processor cache expiration period in seconds
acei-merge-processor.storage-period-milliseconds	Positive Integer of the acei merge processor storage period in milliseconds
acei-merge-processor.buffer-size	Positive integer of the acei merge processor buffer size
acei-merge-processor.buffer-timeout	Text string of the acei merge processor buffer timeout in ISO-8601 format
acei-merge-processor.processor-thread-count	Positive Integer of the acei merge processor thread count. Default set to 0.
max-items-per-db-interaction	Positive Integer of the acei merge processor maximum number of items per database interaction.
max-parallel-db-operations	Max number of database operations that can be performed in parallel.
min-items-to-perform-db-operations	Positive Integer of the acei merge processor minimum number of items per database operations.
# Config for filter control	
filter-control.processing-configuration-root	Text string for the default address of filter control processing configuration service
filter-control.max-threads	Positive integer number of the maximum number of filter control threads that will be allocated

# Config for fk control	
fk-control.processing-configuration-root	Text string for the default address of fk control processing configuration service
# Config for signal-detector-control	
signal-detector-control.processing-configuration-root	Text string for the default address of signal detector control processing configuration service
client-timeout	Text string of the client timeout in ISO-8601 format
# 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 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 configuration sequel user
processing-cfg.c3p0_connection_pool_size	Positive integer of processing configuration c3p0
#Config for Processing Station	
station-definition.jdbc_url	Text string for the default address of station definition jdbc service
station-definition.oracle_wallet_location	Text string for the default address of station definition oracle wallet location
station-definition.tns_entry_location	Text string for the default address of station

	definition TNS entry location
station-definition.host	Text string of station definition service
station-definition.schema	Text string of station definition schema
#Config for Processing Waveforms	
waveform-manager.jdbc_url	Text string for the default address of waveform manager service
waveform-manager.oracle_wallet_location	Text string for the default address of waveform manager oracle wallet location
waveform-manager.tns_entry_location	Text string for the default address of waveform manager TNS entry location
waveform-manager.host	Text string of waveform manger service
waveform-manager.schema	Text string of waveform manager schema
#Config for Processing Workflow	
workflow-manager.kafka-bootstrap-servers	Text string for the default port workflow manager kafka bootstrap servers
workflow-manager.jdbc_url	Text string for the default address of workflow manager service
workflow-manager.oracle_wallet_location	Text string for the default address of workflow manager oracle wallet location
workflow-manager.tns_entry_location	Text string for the default address of workflow manager TNS entry location
workflow-manager.host	Text string of workflow manger service
workflow-manager.schema	Text string of workflow manager schema
#Config for Bridge Simulator	
Remove bridged-data-source-simulator.jdbc_url	Text string for the default address of bridged data source simulator service
bridged-data-source-simulator.oracle_wallet_location	Text string for the default address of the bridged data source simulator oracle wallet location
bridged-data-source-simulator.tns_entry_location	Text string for the default address of bridged data source simulator TNS entry location

bridged-data-source-simulator.seed.jdbc_url	Text string for the default address of bridged data source simulator seed service
bridged-data-source-simulator.simulation.jdbc_url	Text string for the default address of bridged data source simulator simulation service
#config for osd ttl worker	
osd-ttl-worker.sql_user	Text string of username for the TTL worker in the PostgreSQL database
osd-ttl-worker.c3p0_connection_pool_size	Integer number for c3p0 connection pool size.
osd-ttl-worker.AcquiredChannelEnvironmentIssue.timeToLive	Time in hours for acquired channel environmental issues to live in OSD
osd-ttl-worker.AcquiredChannelEnvironmentIssue.cronSchedule	Text string of the cron job schedule for acquired channel environmental issues see *http://www.quartz-scheduler.org/documentation/quartz-2.3.0/tutorials/crontrigger.html* for cron scheduling details
osd-ttl-worker.RawStationDataFrame.timeToLive	Time in hours for raw station data frames to live in OSD
osd-ttl-worker.RawStationDataFrame.cronSchedule	Text string of the cron job schedule for raw station data frames see *http://www.quartz-scheduler.org/documentation/quartz-2.3.0/tutorials/crontrigger.html* for cron scheduling details
osd-ttl-worker.StationSoh.timeToLive	Time in hours for station SOH to live in OSD
osd-ttl-worker.StationSoh.cronSchedule	Text string of cron job schedule for station SOH see *http://www.quartz-scheduler.org/documentation*

	/quartz-2.3.0/tutorials/crontrigger.html for cron scheduling details
# 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.
# config for cd11-data-provider	
cd11-data-provider.input-source	Text String for cd11 data provider input source
cd11-data-provider.kafka-host	Text String for cd11 data provider kafka host
cd11-data-provider.kafka-port	Positive integer for cd11 data provider kafka port
cd11-data-provider.external-rsdf	Text String for cd11 data provider external raw station data frame
cd11-data-provider.external-bootstrap-servers	Text String for cd11 data provider external boot strap servers
cd11-data-provider.retry-initial-delay	Positive integer for number of cd11 data provider initial delay retries
cd11-data-provider.retry-max-delay	Positive integer for maximum number of cd11 data provider retries
cd11-data-provider.retry-delay-units	Text String for cd11 data provider retry delay units
cd11-data-provider.retry-max-attempts	Text String for 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 input for the station reference information are CSS flat files that follow the structure of the USNDC P3 Schema. 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 FAP formatted response files for the instruments for the station (see Figure 2**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 from USNDC P3 schema is that the N/A value for offdate is 2268324, not -1.

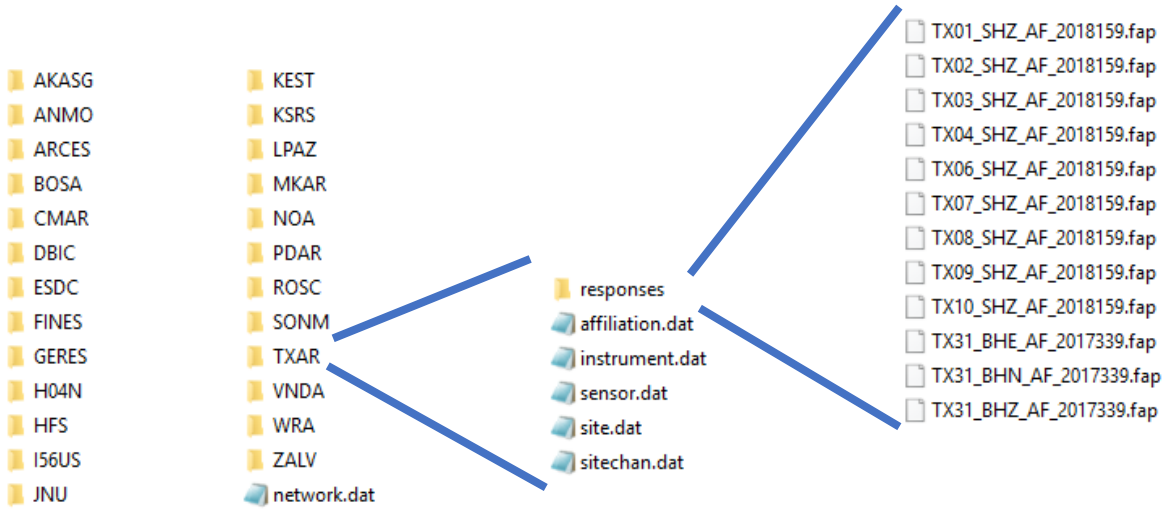

Figure 2. Example of the directory structure for station reference information. Each station level directory contains CSS flat files for affiliation, instrument, sensor, site and sitechan. The responses directory holds the FAP response files for the station.

Station reference files are in this directory in the GMS code repository:

gms-common/config/station-reference/data

3.2 SOH Processing Config

3.2.1 Global Parameters

Global parameters used by data acquisition components are in a file in the GMS code repository:

gms-common/config/processing/global.cd11.station-parameters/default.json

stationName	**Text string of station to acquire**
acquired	Set to true if acquiring the data from the station; set to false if not acquiring the data
frameProcessingDisabled	Set to true if acquiring the data from the station but are not processing the data
portOffset	Offset from a starting port number which is configured in System configuration (cd11-dataconsumer-baseport).
stationName	String of station name that is being configured

3.2.2 ConnMan Parameters

Parameters used by the da-connman service are in a file in the GMS code repository:

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

$ref=global.cd11.station-parameters	Pointer to the global station parameters

3.2.3 DataMan Parameters

Parameters used by the da-dataman service are in files in the GMS code repository:

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

$ref=global.cd11.station-parameters	Pointer to the global station parameters

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

Name	**Text string of protocol name**
channelIdsByPacketName	Text string comparing the channel information in the raw station data frame to the channel information in the channel-lookup object

3.2.4 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 contains a single default constraint and includes a single reprocessingPeriod parameter. The soh-control configuration object is located as follows with the defined constraints:

config/processing/soh-control/default.json

Configuration Option			
Name	**Description**		
default	The only configuration option for the soh-control configuration object.		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
parameters	**type**	**Description**	
reprocessingPeriod	duration	Duration between execution of SOH processing operations	

3.2.5 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 object is located as follows with the defined constraints:

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

Configuration Option			
Name	**description**		
default	The only configuration option for the ui.soh-settings configuration object.		
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

3.2.6 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 soh-control.station-group-names configuration does not define the Station Groups by listing the Stations which they include. 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.

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	**description**		
	default	The only configuration option for the soh-control.station-group-names configuration object.		
	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	

3.2.7 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 and MonitorType. While the parameters in the soh-control.soh-monitor-timewindows configuration can vary by MonitorType, typically, they will only vary by StationName.

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

Configuration Option				
	Name	**description**		
	default	The overall default for the soh-control.soh-timewindows configuration object. This configuration object is not required if all monitor types are covered by a default_{MonitorType(s)} configuration option for the soh-control.soh-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	
Configuration Option				
	Name	**description**		
	default {MonitorType(s)}	Zero or more default configuration options for the soh-control.soh-timewindows configuration object that are specific to a Monitor Type. Each Monitor Type would be covered by a different configuration option or covered by the default. This configuration object is not required. There is a default configuration option for soh-control.soh-timewindows. Typically, the soh-control.soh-timewindows configuration options will be the same across Monitor Types and this will not be used.		
	constraintType	**criterion**	**operator**	**description**
	DEFAULT	—	—	defines the constraint as default
	STRING	MonitorType	ANY	MonitorType(s) to which this configuration option applies (see Appendix A for a list of valid Monitor Types)
	parameters	**type**	**description**	
	backOfDuration	duration	time offset between calculation time and calculation interval	
	calculationInterval	duration	time length of SOH calculation window	

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

Configuration Option			
Name	**description**		
{Station(s)}	Zero or more override configuration options for the soh-control.soh-timewindows configuration object that are specific to a single station or list of stations.		
constraintType	**criterion**	**operator**	**description**
STRING	StationName	ANY	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	
Configuration Option			
Name	**description**		
{Station(s) MonitorType(s)}	Zero or more override configuration options for the soh-control.soh-timewindows configuration object specific to a Monitor Type. This configuration object is not required. There is a default configuration option for soh-control.soh-timewindows. Typically, the soh-control.soh-timewindows configuration options will be the same across Monitor Types and this will not be used.		
constraintType	**criterion**	**operator**	**description**
STRING	StationName	ANY	Stations(s) to which this configuration option applies
STRING	MonitorType	ANY	MonitorType(s) to which this configuration option applies (see Appendix A for a list of valid Monitor Types)
parameters	**type**	**description**	
backOfDuration	duration	time offset between calculation time and calculation interval	
calculationInterval	duration	time length of SOH calculation window	

3.2.8 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.

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

Configuration Option			
Name	**description**		
default {MonitorType(s)}	A default configuration option for each Monitor Type for the soh-control.soh-threshold configuration object that is specific to one or more Monitor Types. Each Monitor Type needs to be covered by a different default configuration option.		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
STRING	MonitorType	ANY	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).	

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

Configuration Option	
Name	**description**

	{Station MonitorType(s)}	Optional override configuration options for the soh-control.soh-threshold configuration object that are each specific to one or more Monitor Types and one or more Stations.		
	constraintType	**criterion**	**operator**	**description**
	STRING	MonitorType	ANY	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	ANY	Stations(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).	
Configuration Option				
	Name	**description**		
	{Channel(s) MonitorType(s)}	An override configuration option for the soh-control.soh-threshold configuration object that is specific to one or more Monitor Types and one or more Channels.		
	constraintType	**criterion**	**operator**	**description**
	STRING	MonitorType	ANY	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	ANY	Stations(s) to which this configuration option applies
	STRING	ChannelName	ANY	Channel Name(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).

3.2.9 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 not displayed on any display but are combined into one and displayed on the Station Statistics Display.

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

Configuration Option			
	Name	**description**	
	Default {MonitorType(s)}	Optional configuration options each for a specific Station for soh-control.soh-threshold configuration object	
	constraintType	**criterion**	**operator**	**description**
	STRING	StationName	EQ	name of station to which this configuration option applies
	parameters		**type**	**description**
	MISSING		Channel List Structure	Structure to identify included Channels
	LAG		Channel List Structure	Structure to identify included Channels
	TIMELINESS		Channel List Structure	Structure to identify included Channels
	ENV_AUTHENTICATION_SEAL_BROKEN		Channel List Structure	Structure to identify included Channels

	ENV_BACKUP_POWER_UNSTABLE	Channel List Structure	Structure to identify included Channels
	ENV_CALIBRATION_UNDERWAY	Channel List Structure	Structure to identify included Channels
	ENV_CLIPPED	Channel List Structure	Structure to identify included Channels
	ENV_CLOCK_DIFFERENTIAL_TOO_LARGE	Channel List Structure	Structure to identify included Channels
	ENV_DEAD_SENSOR_CHANNEL	Channel List Structure	Structure to identify included Channels
	ENV_DIGITIZER_ANALOG_INPUT_SHORTED	Channel List Structure	Structure to identify included Channels
	ENV_DIGITIZER_CALIBRATION_LOOP_BACK	Channel List Structure	Structure to identify included Channels
	ENV_DIGITIZING_EQUIPMENT_OPEN	Channel List Structure	Structure to identify included Channels
	ENV_EQUIPMENT_HOUSING_OPEN	Channel List Structure	Structure to identify included Channels
	ENV_EQUIPMENT_MOVED	Channel List Structure	Structure to identify included Channels
	ENV_GPS_RECEIVER_OFF	Channel List Structure	Structure to identify included Channels
	ENV_GPS_RECEIVER_UNLOCKED	Channel List Structure	Structure to identify included Channels.
	ENV_MAIN_POWER_FAILURE	Channel List Structure	Structure to identify included Channels
	ENV_VAULT_DOOR_OPENED	Channel List Structure	Structure to identify included Channels
	ENV_ZEROED_DATA	Channel List Structure	Structure to identify included Channels

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

Configuration Option		
	Name	**description**

Default {MonitorType(s)}	Optional configuration options each for a specific Station for soh-control.soh-threshold configuration object.		
constraintType	**criterion**	**operator**	**description**
STRING	StationName	EQ	name of station to which this configuration option applies
parameters		**type**	**description**
MISSING		Channel List Structure	Structure to identify included Channels
LAG		Channel List Structure	Structure to identify included Channels
TIMELINESS		Channel List Structure	Structure to identify included Channels
ENV_AUTHENTICATION_SEAL_BROKEN		Channel List Structure	Structure to identify included Channels
ENV_BACKUP_POWER_UNSTABLE		Channel List Structure	Structure to identify included Channels
ENV_CALIBRATION_UNDERWAY		Channel List Structure	Structure to identify included Channels
ENV_CLIPPED		Channel List Structure	Structure to identify included Channels
ENV_CLOCK_DIFFERENTIAL_TOO_LARGE		Channel List Structure	Structure to identify included Channels
ENV_DEAD_SENSOR_CHANNEL		Channel List Structure	Structure to identify included Channels
ENV_DIGITIZER_ANALOG_INPUT_SHORTED		Channel List Structure	Structure to identify included Channels
ENV_DIGITIZER_CALIBRATION_LOOP_BACK		Channel List Structure	Structure to identify included Channels
ENV_DIGITIZING_EQUIPMENT_OPEN		Channel List Structure	Structure to identify included Channels
ENV_EQUIPMENT_HOUSING_OPEN		Channel List Structure	Structure to identify included Channels

	ENV_EQUIPMENT_MOVED	Channel List Structure	Structure to identify included Channels
	ENV_GPS_RECEIVER_OFF	Channel List Structure	Structure to identify included Channels
	ENV_GPS_RECEIVER_UNLOCKED	Channel List Structure	Structure to identify included Channels
	ENV_MAIN_POWER_FAILURE	Channel List Structure	Structure to identify included Channels
	ENV_VAULT_DOOR_OPENED	Channel List Structure	Structure to identify included Channels
	ENV_ZEROED_DATA	Channel List Structure	Structure to identify included Channels

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: • **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.

3.2.10 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.

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

Configuration Option			
Name	**description**		
default	The default configuration option for soh-control.monitor-types-for-rollup-station		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
parameters		**type**	**description**
sohMonitorTypesForRollup		string list	list of monitor types for roll up (see Appendix A for a list of valid Monitor Types)

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

Configuration Option			
Name	**description**		
{station(s)}	Optional configuration options for soh-control.monitor-types-for-rollup-station that are specific to a Station		
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)

3.2.11 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. A default.json file is required; all other files are optional overrides.

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

Configuration Option	
Name	**description**
default	The default configuration option for soh-control.monitor-types-for-rollup-channel

constraintType	criterion	operator	description
DEFAULT	—	—	defines the constraint as default
parameters		**type**	**description**
sohMonitorTypesForRollup		string list	list of monitor types for roll up (see Appendix A for a list of valid Monitor Types)

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

Configuration Option			
Name	**description**		
{station(s)}	Optional configuration options for soh-control.monitor-types-for-rollup-channel that are specific to one or more Stations		
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)

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

Configuration Option			
Name	**description**		
{channel(s)}	Optional configuration options for soh-control.monitor-types-for-rollup-channel that are specific to one or more Channels on a single Station		
constraintType	**criterion**	**operator**	**description**
STRING	StationName	EQ	name of station to which this applies
STRING	ChannelName	ANY	name(s) of Channels to which this configuration option applies
parameters		**type**	**description**
sohMonitorTypesForRollup		string list	list of monitor types for roll up (see Appendix A for a list of valid Monitor Types)

3.2.12 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 will include 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.

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

Configuration Option			
Name	**description**		
default	The default configuration option for soh-control.channel-capability-rollup		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
parameters		**type**	**description**
sohMonitorsToChannelRollupOperator		Complex Channel Capability Rollup structure	Complex structure which describes how to calculate the Channel Capability Status. Structure is described below

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

Configuration Option			
Name	**description**		
{station group}	Optional configuration options for soh-control.channel-capability-rollup that are specific to Station Group(s)		
constraintType	**criterion**	**operator**	**description**
STRING	StationGroupName	ANY	name(s) of station groups 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.

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

parameters	**type**	**description**
operatatorType	string	Type of operation that the rollup calculation will perform. Valid values are: • **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 status 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.
sohMonitorTypeOperands	string list	Provides a list of Monitor Types to include in the Channel Capability Rollup. The sohMonitorTypeOperands is optional; if it is provided, then the rollupOperatorOperands should not be provided. If neither is provided, then ALL Monitor Types are included.

parameters	type	description
rollupOperatatorOperands	Complex Channel Capability Rollup structure	Provides two or more sub rollups to include in the Station Capability Rollup. The rollupOperatorOperands is optional; if it is provided, then the channelOperands should not be provided. if neither is provided, then ALL Stations in the Station Group are included. Each sub rollup includes: 1) operatorType (plus goodThreshold and marginalThreshold if the operatorType is MIN_GOOD_OF) 2) sohMonitorTypeOperands giving list of Stations

3.2.13 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.

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

Configuration Option			
Name	**description**		
default	The default configuration option for soh-control.station-capability-rollup		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
parameters		**type**	**description**
channelsToStationRollupOperator		Complex Station Capabilit	Complex structure which describes how to calculate the Station Capability

		y Rollup structure	Status. Structure is described below.

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

Configuration Option			
Name	**description**		
{station group}	Optional configuration option for soh-control.station-capability-rollup which is specific to a Station Group Name. If used, the configuration options for soh-control.station-capability-rollup which are specific to only a Station.		
constraintType	**criterion**	**operator**	**description**
STRING	StationGroupName	ANY	name(s) of station groups to which this 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.

Configuration Option			
Name	**description**		
{station}	Optional configuration option for soh-control.station-capability-rollup which is specific to a Station. If used, configuration options for soh-control.station-capability-rollup which are only specific to a Station Group should not be used.		
constraintType	**criterion**	**operator**	**description**
STRING	StationName	ANY	name(s) of stations to which this 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.

Configuration Option			
Name	**description**		
{station group station}	Optional configuration option for soh-control.station-capability-rollup which is specific to a Station Group Name and Station		
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**
channelsToStationRollupOperator		Complex Station Capability Rollup structure	Complex structure which describes how to calculate the Station Capability Status. Structure is described below.

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

parameters	**type**	**description**
operatatorType	string	Type of operation that the rollup calculation will perform. Valid values are: • **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.

parameters	type	description
channelOperands	string list	Provides a list of Channel Names to include in the Station Capability Rollup. The channelOperands is optional. If it is provided, then the rollupOperatorOperands should not be provided. If neither is provided, then 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.
rollupOperatatorOperands	Complex Station Capability Rollup structure	Provides two or more sub rollups to include in the Station Capability Rollup. The rollupOperatorOperands is optional. If it is provided, then the channelOperands should not be provided. If neither is provided, then 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: 1) operatorType (plus goodThreshold and marginalThreshold if the operatorType is MIN_GOOD_OF) 2) channelOperands giving list of Stations

3.2.14 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 will include 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

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

Configuration Option			
Name	**description**		
default	The default configuration option for soh-control.station-group-capability-rollup		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
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.

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

Configuration Option			
Name	**description**		
{station group name}	A configuration option for soh-control.station-group-capability-rollup that is specific to a Station Group		
constraintType	**criterion**	**operator**	**description**
STRING	StationGroupName	ANY	name(s) of station groups to which this applies
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.

The complex Station Group Capability Rollup structure is defined below:

parameters	type	description
operatatorType	string	Type of operation that the rollup calculation will perform. Valid values are: • **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 GOOD Station Capability Status required to make the Station Group Capability Status GOOD. The goodThreshold 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 it is provided, then the rollupOperatorOperands should not be provided. If neither is provided, then 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.

parameters	type	description
rollupOperatatorOperands	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 it is provided, then the stationOperands should not be provided. If neither is provided, then 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: 1) operatorType (plus goodThreshold and marginalThreshold if the operatorType is MIN_GOOD_OF) 2) stationOperands giving list of Stations

3.2.15 Global Monitoring Org

Global monitoring org is a string defining how to assign the monitoringOrganization attribute for the bridged SignalDetection and SignalDetectionHypothesis objects. This configuration is shared by several Bridge components. SignalDetectionBridgeConfiguration should access it as a Global Configuration Reference.

config/processing/global.monitoring-org/default.json

Configuration Option				
	Name	**description**		
	monitoring-org-default	A configuration option defining global monitoring organization default		
	constraintType	**criterion**	**operator**	**description**
	STRING	1) —	—	defines the constraint as default
	parameters	**type**		**description**
	monitoringOrganization	String		Name of organization that is monitoring

3.3 Interactive Analysis Processing Config

3.3.1 Operational Time Period

Defines the window of time data is accessible. The time window is defined based on the duration from the current time.

config/processing/global.operatoional-time-period/default.json

Configuration Option			
Name	**description**		
default	The default configuration option for simulator.bridged-data-source-config		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
parameters	**type**		**description**
operationalPeriodStart	Duration		Duration prior to current time which defines the start of the operational time period.
operationalPeriodEnd	Duration		Duration prior to current time which defined the end of the operational time period.

config/processing/global.operatoional-time-period/overrides.json

This file is for test purposes on GMS code only and is obsolete.

3.3.2 Station Groups

The station-definition-manager.station-group-names configuration defines which Station Groups are used for IAN. These Station Groups must match those defined in the bridged data.

The station-definition-manager.station-group-names configuration does not define the Station Groups by listing the Station which they include. The Stations which are included in the Station Group must be defined in the bridged data.

The station-definition-manager.station-group-names configuration contains a single default.json file which lists the Station Groups displayed on the UI.

config/processing/ station-definition-manager.station-group-names/default.json

Configuration Option			
Name	**description**		
default	The one and only configuration option for the soh-control.station-group-names configuration object.		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
parameters	**type**	**description**	
stationGroupNames	String list	List of names of station groups used in IAN processing	

3.3.3 Simulator Bridged Data Source Config

Configuration which identifies which schemas to use for the simulator for test purposes.

config/processing/simulator.bridged-data-source-config/default.json

Configuration Option			
Name	**description**		
default	The default configuration option for simulator.bridged-data-source-config		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
parameters	**type**		**description**
default_schema	String		Database schema where seed data exists for the simulator. This data is read only.
simulation_schema	String		Database schema where the replicated seed data exists. This is an empty schema at start time.
calib_delta	Integer		Number of groups in which calibration data will be updated over the calibration update period found in the simulation spec. Expected to be moved to the simulation spec for PI16.

3.3.4 IAN Display Parameters

These settings allow the user to configure the UI. For example, what station group to use by default.

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

Configuration Option			
Name	**description**		
default	The default configuration option for ui.analyst-settings		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
parameters	**type**		**description**
defaultNetwork	String		This is obsolete.
currentIntervalEndTime	Date Time/String		Used by IAN Map and Waveform Display to set the end time of the interval which is used by default. To use the latest data use "UseCurrentTime"
maximumOpenAnythingDuration			
currentIntervalDuration	Duration		Used by IAN Map and Waveform Display along with the currentIntervalEndTime to set the interval which is used by default.
waveformViewablePaddingDuration	Duration		Additional padding that is added to either side of the Waveform Display.
defaultInteractiveAnalysisStationGroup	String		Default Station Group which dictates which Stations get populated on the Waveform Display and Map Display.
fixedAmplitudeScaleValues	Floating Point		
defaultFilters	Complex Structure		Use to apply filters to waveforms. Legacy structure which is not currently used

3.3.5 Workflow Manager Bridge Polling Period

The frequency which the workflow manager polls for new interval data from the interval bridge. Under the data bridge architecture, the WorkflowManager initializes a single timer to periodically call operation updateWorkflowIntervals. The timer period is defined via processing configuration as the *bridgePollingPeriod*.

config/processing/workflow-manager.bridge-polling-period/default.json

Configuration Option			
Name	**description**		
default	The default configuration option for workflow manager bridge polling period		
constraintType	**criterion**	**operator**	**description**
DEFAULT	—	—	defines the constraint as default
parameters	**type**		**description**
bridgePollingPeriod	String		Text String of the bridge polling period using ISO-8601 duration

3.3.6 Workflow Manager Stage Definition

Definitions for each named stage, detailing the sequences, steps and activities of that stage.

config/processing/workflow-manager.stage-definition /al1.json

Configuration Option				
	Name	**description**		
	String	Analyst 1 default stage definition		
	constraintType	**criterion**	**operator**	**description**
	String	String	String/ Bool	
	parameters	**type**		**description**
	name	String		Text String to describe analyst 1
	duration	String		Text String of the al1 duration using ISO-8601 duration
	mode	String		Text string for the mode defaulted to INTERACTIVE
	activities	Complex Structure		Structure is a collection of analysis activities that the analyst would perform as a part of completing the stage.

config/processing/workflow-manager.stage-definition /al2.json

Configuration Option				
	Name	**description**		
	String	Analyst 2 default stage definition		
	constraintType	**criterion**	**operator**	**description**
	String	String	String/ Bool	
	parameters	**type**		**description**
	name	String		Text String to describe analyst 2
	duration	String		Text String of the al2 duration using ISO-8601 duration
	mode	String		Text string for the mode defaulted to INTERACTIVE
	activities	Complex Structure		Structure is a collection of analysis activities that the analyst would perform as a part of completing the stage.

config/processing/workflow-manager.stage-definition /auto-network.json

Configuration Option				
	Name	**description**		
	String	Automatic processing to build events before analyst begins analysis		
	constraintType	**criterion**	**operator**	**description**
	String	String	String/ Bool	Configuration constraint to allow selection by stage name
	parameters	**type**		**description**
	name	String		Text String to describe auto network
	duration	String		Text String of the auto network duration using ISO-8601 duration
	mode	String		Always set to automatic
	sequences	Complex Structure		Collection of processing sequences and steps the automated stage performs.

config/processing/workflow-manager.stage-definition /auto-post-al1.json

Configuration Option				
	Name	**description**		
	String	Automatic processing to build events before analyst begins analysis		
	constraintType	**criterion**	**operator**	**description**
	String	String	String/ Bool	Configuration constraint to allow selection by stage name
	parameters	**type**		**description**
	name	String		Text String to describe auto post al1
	duration	String		Text String of the auto post al1 duration using ISO-8601 duration
	mode	String		Always set to automatic
	sequences	Complex Structure		Collection of processing sequences and steps the automated stage performs.

3.3.7 Workflow Manager Workflow Definition

The ordered list of processing stages used to generate the workflow.

config/processing/workflow-manager.stage-definition /workflow-manager.workflow-definition.json

Configuration Option				
	Name	**description**		
	String	The default configuration option for workflow manager stage definitions workflow definition		
	constraintType	**criterion**	**operator**	**description**
	String	-	-	defines the constraint as default
	parameters	**type**		**description**
	name	String		Text String to describe organization name.
	stageNames	String		Text String to describe workflow definition stage names.

3.3.8 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.

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

Configuration Option				
	Name	**description**		
	default	The default configuration option for acei-merge-processor.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.

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

Configuration Option		
	Name	**description**
	{station name(s)}	A configuration option for acei-merge-processor-tolerance that applies to specific Stations

	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.
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	IN	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.

3.3.9 Global Stage Accounts

A mapping of a workflow definition id to a database account that is used to retrieve data for that stage. Used in signal detection manager so that when queried the service for data on detections from a certain stage, it is known which database account to look.

config/processing/global.stage-accounts/default.json

Configuration Option				
	Name	**description**		
	stage-accounts-default	A configuration option for global stage accounts default		
	constraintType	**criterion**	**operator**	**description**
	STRING	—	—	defines the constraint as default
	parameters	**type**		**description**
	databaseAccountsByStage	Complex Structure		Complex structure containing workFlowDefinitionID name of the analyst and databaseAccount address for that name.
	previousDatabaseAccountsByStage	Complex Structure		Complex structure containing workFlowDefinitionID name of the analyst and

			databaseAccount address for that name.

3.3.10 Signal Detection Waveform Lead Lag

Signal detection waveform lead lag is a string that measuredWaveformLeadDuration and measuredWaveformLagDuration - offsets before and after the SignalDetection's ARRIVAL_TIME used to define the maximum duration between a FeatureMeasurement.ChannelSegment's startTime and endTime. Durations that are added / subtracted from endpoints that are queried for signal detection to allow incorporate of data on the edges of the query. If queries for data between A and B, and lead = C, lag = D, then the actual query looks for data between A - C and B + D.

config/processing/ signal-detection.waveform-lead-lag/default.json

Configuration Option			
Name	**description**		
waveform-lead-lag-default	A configuration option for signal detection waveform lead and lag default		
constraintType	**criterion**	**operator**	**description**
STRING	—	—	defines the constraint as default
parameters	**type**		**description**
measuredWaveformLeadDuration	String		ISO 8601 string value for measure waveform lead duration
measuredWaveformLagDuration	String		ISO 8601 string value for measure waveform lead duration

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 files and thus does not have constraints.

config/user-preferences/defaultUserPreferences.json

parameter name	**type**	**description**
defaultLayoutName	string	Name of the default Layout
sohLayoutName	string	Name of the default Layout
userID	string	Value is defaultUser

workspaceLayouts	Complex Workspace Layout Structure List	List of one or more Complex Structure detailing out 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-in to 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 variables names are restricted to only alphanumeric characters and an underscore. By convention, environment variable names are specified with upper-case characters. System configuration names must be translated into a 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 `--env` argument to **gmskube**. Any number of overrides can be specified, just by specifying multiple `--env` arguments. To override `cd11-rsdf-processor.retry-backoff-ms` to 2 seconds, the following would be specified in the deployment command:

```
$ gmskube install -env 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**

2) 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 – any directories not found in the overrides will fall back to default values in the default configuration.

```
%gmskube install --tag develop --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, matching 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.

5.2.2 Generating Station Reference and Station Processing from CSS

To update station reference and station processing configuration, you should first edit the myriad of CSS specification files found in your 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 your alternate configuration to be read. Note that this configuration is not updated on a **gmskube reconfig**.

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 amount of time required to process the SOH calculations. Determining the actual value would require benchmarking the system and would depend on the number of stations and channels being processes. 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. For PI12, this is 24 hours.

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 – Several of the calculations below specify 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, and 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 to be 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 0 will mean, that there is no quiet interval following acknowledgement.

Acknowledgement Quiet Duration >= MAX(Calculation Interval)
This is a loose recommendation. Setting the Acknowledgment Quiet Duration to be greater than the Calculation Interval will give enough time for all data in the current calculation window to be filtered through during the quiet interval. Since there is only one acknowledgement interval, and the Calculation Interval is per Channel Monitor, it may be desirable 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 >= 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 >> Reprocessing Interval
All SOH Historical Durations should be a magnitude longer than the Reprocessing Interval. If the SOH Historical Duration is 50 times longer than the Reprocessing Interval, then it will display 50 points on the graph.

SOH Historical Duration >> Calculation Interval

All SOH Historical Durations should be significantly greater than the shortest Calculation Interval, and the largest SOH Historical Duration should be significantly longer than the longest Calculation Interval. 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 <= 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 >= 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

3)

Calculation Interval >= 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 will mean that 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 0 for the Back Off Duration is not recommended for the Missing Data Monitor.

Back Off Duration >= 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 >= 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 then data which is not expected to be received while operating under normal condition will be treated as missing (this would include data which has not been received due to normal latency and data which had not been received because it part of a packet being currently created on the system). This is less important for the Latency and Environmental Monitors; however, if this condition is not met it means the amount of data used in the calculation will be less that 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 >= Maximum Normal Latency + Packet Length

Do this to keep 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 >= 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 >= 1/(Packet Length*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 is 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 >= 0%
Setting the Good Threshold to 0 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. In some situations, this might be needed.

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 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. Thus, is it 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, then 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 >= Good Threshold + [(Packet Length/Calculation Interval) * 100]
In this equation, the Packet Length/Calculation Interval is equal to 1 packet on the equation. This could have also been expressed as 1/(Calculation Interval/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 could 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 was set to 100, then 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 >= Good Threshold + [(Packet Length/Calculation Interval) * 100]
In this equation the Packet Length/Calculation Interval is equal of 1 packet on the equation. This could have also been expressed as 1/(Calculation Interval/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 would could 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 in understanding, 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 minuets
- Available Quiet Interval: 5 minutes, 15 minutes, 1 hour, 24 hours, 7 days
- SOH Station Stale Duration: 5 minutes
- SOH Historical Durations: 6 hours, 12 hours, 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 Type.

Monitor Type	SOH Value Type
MISSING	PERCENT
LAG	DURATION
TIMELINESS	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_CLOCK_DIFFERENTIAL_IN_MICROSECONDS*	DURATION
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_LAST_GPS_SYNC_TIME*	DURATION
ENV_MAIN_POWER_FAILURE	PERCENT
ENV_STATION_POWER_VOLATAGE*	DURATION
ENV_VAULT_DOOR_OPENED	PERCENT
ENV_ZEROED_DATA	PERCENT

*Note that there are three Environmental Monitor Types with a SOH Value Type DURATION. These Monitor Type are not currently being calculated.