6.12 ST[12] on-board monitoring

6.12.1 Scope

6.12.1.1 General

The on-board monitoring service type provides the capability to monitor on-board parameters or groups of parameters and react to the violations of the related monitoring conditions by raising events. The resulting event reports can be sent to ground and caught on-board, e.g. by an event-action subservice.

The on-board monitoring service type defines two standardized subservice types, i.e.:

- the parameter monitoring subservice type;
- the functional monitoring subservice type.

6.12.1.2 Parameter monitoring subservice

The parameter monitoring subservice type provides the capability to monitor on-board parameters with respect to checks defined by the ground system, to report any parameter check transitions to the ground and when monitoring conditions are violated to raise events.

The types of check that can be applied for an on-board parameter depend on the parameter and its type. The subservice type provides the capability to check that a parameter value lies within specified limits or that a parameter has the expected value. It provides optional capability to check that the delta change in a parameter value lies within a pair of threshold values.

For each parameter and associated check, a parameter monitoring definition is specified. This Standard does not introduce any limitation on the number of checks that can be performed on an on-board parameter. A parameter monitoring definition can specify warning limits for an on-board parameter when another definition can specify danger limits for that same parameter. A parameter can be at the same time limit checked and delta checked, using two different parameter monitoring definitions.

The parameter monitoring subservice type provides optional capability to include a conditional check in a parameter monitoring definition. If the conditional check is false, the parameter monitoring check in that definition is not performed. For example, this can be used to disable the monitoring of an on-board parameter when the associated equipment is inactive.

6.12.1.3 Functional monitoring subservice

The functional monitoring subservice type provides the capability to monitor the functional health of on-board elements (e.g. software applications, hardware).

A functional monitoring definition includes a set of one or more parameter monitoring definitions: when a minimum number of these definitions is

contemporaneously violated, that functional monitoring definition is considered violated and the associated event is raised.

The behaviour of the functional monitoring subservice type relies on the parameter monitoring subservice type.

6.12.2 Service layout

6.12.2.1 Subservice

6.12.2.1.1 Parameter monitoring subservice

a. Each on-board monitoring service shall contain exactly one parameter monitoring subservice.

6.12.2.1.2 Functional monitoring subservice

a. Each on-board monitoring service shall contain at most one functional monitoring subservice.

6.12.2.2 Application process

a. For each on-board monitoring service that contains both, a parameter monitoring subservice and a functional monitoring subservice, the two subservice providers of that service shall be hosted by the same application process.

6.12.2.3 Accessibility

6.12.2.3.1 Service

a. Each on-board monitoring service shall be associated to exactly one event reporting subservice.

NOTE 1 This event reporting subservice (refer to clause 6.5) is responsible for catching the events raised by the on-board monitoring service and issuing the corresponding event notifications.

NOTE 2 The events that can be raised by the on-board monitoring service are identified by the combination of the identifier of the application process that hosts the event reporting subservice and an event definition identifier.

b. The event reporting subservice that is associated to the on-board monitoring service shall be declared when specifying that on-board monitoring service.

6.12.3 Parameter monitoring subservice

6.12.3.1 Parameter accessibility

a. The parameter monitoring subservice shall be able to monitor all on-board parameters that are accessible to the application process that hosts the subservice.

6.12.3.2 Check types

6.12.3.2.1 Minimum capability

a. The parameter monitoring subservice shall support the evaluation of the following minimum check types:
   1. Limit-check,
   2. Expected-value-check.

b. When performing a limit-check, the parameter monitoring subservice shall:
   1. check that the value of a parameter lies within a pair of limit values;
   2. declare the check successful when the value of the parameter is less than or equal to the high limit value and greater than or equal to the low limit value.

c. When performing an expected-value-check, the parameter monitoring subservice shall:
   1. check that the value resulting from applying a bit mask to a parameter is equal to the expected value;
   2. declare the check successful when these two values are equal.

6.12.3.2.2 Additional capability

a. The parameter monitoring subservice may support the evaluation of the delta-check type.

b. Whether the parameter monitoring subservice supports the delta-check type shall be declared when specifying that subservice.

c. When performing a delta-check, the parameter monitoring subservice shall:
   1. calculate the delta value between two consecutive values of a parameter;
   2. declare the check successful when the delta value is less than or equal to the high threshold value and greater than or equal to the low threshold value.

      NOTE For item 1, the delta value is the difference between the two values.

6.12.3.3 Parameter monitoring definition

a. The maximum number of parameter monitoring definitions that the parameter monitoring subservice can contemporaneously evaluate at any time shall be declared when specifying that subservice.

NOTE This maximum represents the maximum number of entries in the parameter monitoring definition list. The parameter monitoring definition list is named "PMON list".

b. The parameter monitoring subservice shall provide the capability to process several parameter monitoring definitions for the same on-board parameter.

NOTE For example, with this capability, the monitoring plan can be adapted to specific spacecraft mode conditions using different check validity conditions.

c. Whether the parameter monitoring subservice supports conditional checking of parameter monitoring definitions shall be declared when specifying that subservice.

NOTE This conditional checking depends on a Boolean condition, named "check validity condition". When that Boolean condition is true, the check in the parameter monitoring definition is performed.

d. Whether the parameter monitoring subservice uses a single, subservice-specific monitoring interval for all parameter monitoring definitions or uses a definition-specific monitoring interval for each parameter monitoring definition shall be declared when specifying that subservice.

NOTE The monitoring interval corresponds to the time between two consecutive evaluations of the same parameter monitoring definition.

e. If the parameter monitoring subservice uses a subservice-specific monitoring interval, that monitoring interval shall be declared when specifying that subservice.

f. Monitoring intervals shall be expressed in "on-board parameter minimum sampling interval" units.

NOTE The on-board parameter minimum sampling interval is driven by requirement 5.4.3.2c.

g. Each parameter monitoring definition shall contain:

1. the identifier of the parameter monitoring definition;
2. the identifier of the on-board parameter to monitor;
3. if the parameter monitoring subservice supports the conditional checking of parameter monitoring definitions, a check validity condition that yielding false prevents the check being performed;
4. if the parameter monitoring subservice uses definition-specific monitoring intervals, a monitoring interval;
5. a check definition.

NOTE 1 For item 3, refer to requirements 6.12.3.3c and 6.12.3.3h.

NOTE 2 For item 4, refer to requirement d.

NOTE 3 For item 5, refer to requirement 6.12.3.3j.

h. Each check validity condition shall contain:
   1. the identifier of an on-board parameter to use as a validity parameter;
   2. a bit-mask;
   3. an expected value.

i. When computing the check validity condition, the parameter monitoring subservice shall:
   1. perform a bitwise-and between the bit-mask and the sampled value of the validity parameter;
   2. declare the condition true when the masked value equals the expected value.

j. Each check definition shall contain:
   1. the repetition number that is the number of successive and consistent checks that establishes a new checking status;
   2. the check type that is one of:
      (a) limit-check,
      (b) expected-value-check,
      (c) delta-check;
   3. for a limit-check:
      (a) the low limit;
      (b) if establishment of a new "below low limit" checking status causes the parameter monitoring subservice to raise an event, the event definition identifier corresponding to that event;
      (c) the high limit;
      (d) if establishment of a new "above high limit" checking status causes the parameter monitoring subservice to raise an event, the event definition identifier corresponding to that event;
   4. for an expected-value-check:
      (a) the expected value;
      (b) the mask to apply to the sampled value;
      (c) if establishment of a new "unexpected value" checking status causes the parameter monitoring subservice to raise an event, the event definition identifier corresponding to that event;
   5. for a delta-check:
      (a) the number of consecutive delta values, each one calculated between two consecutive values of the parameter, used to calculate the average value of these consecutive delta values that is compared to the low delta threshold value and to the

high delta threshold value to determine the PMON checking status;

(b) the low delta threshold value;

(c) if establishment of a new "below low threshold" checking status causes the parameter monitoring subservice to raise an event, the event definition identifier corresponding to that event;

(d) the high delta threshold value;

(e) if establishment of a new "above high threshold" checking status causes the parameter monitoring subservice to raise an event, the event definition identifier corresponding to that event.

NOTE The types of check that can be applied to parameters depend on their nature, e.g. parameters of analogue nature can be limit or delta checked, status parameters can be expected value checked.

6.12.3.4 Statuses

a. The parameter monitoring subservice shall maintain a status indicating whether the overall parameter monitoring function is enabled or disabled.

NOTE This status is named "PMON function status".

b. When starting the parameter monitoring subservice, the overall parameter monitoring function status shall be set to "enabled".

c. For each parameter monitoring definition, the parameter monitoring subservice shall maintain a status indicating whether that parameter monitoring definition is enabled or disabled.

NOTE This status is named "PMON status".

d. For each parameter monitoring definition, the parameter monitoring subservice shall maintain a status indicating the established status of the checks performed on the monitored parameter.

NOTE 1 This status is named "PMON checking status".

NOTE 2 For an expected-value-check, the PMON checking status can have any of the following values: "unchecked", "invalid", "expected value" or "unexpected value".

NOTE 3 For a limit-check, the PMON checking status can have any of the following values: "unchecked", "invalid", "within limits", "below low limit" or "above high limit".

NOTE 4 For a delta-check, the PMON checking status can have any of the following values: "unchecked", "invalid", "within threshold", "below low threshold" or "above high threshold".

NOTE 5 The value of the PMON checking status is changed when a number of successive and consistent parameter checks establish a new checking status, see requirement 6.12.3.3j.1. The status values "unchecked" and "invalid" indicate that no checking status is currently established for the parameter.

6.12.3.5 Controlling the parameter monitoring function

6.12.3.5.1 Enable the parameter monitoring function

a. The parameter monitoring subservice shall provide the capability to enable the parameter monitoring function.

NOTE 1 The corresponding requests are of message type "TC[12,15] enable the parameter monitoring function".

NOTE 2 For the capability to disable the parameter monitoring function, refer to clause 6.12.3.5.2.

b. Each request to enable the parameter monitoring function shall contain exactly one instruction to enable the parameter monitoring function.

NOTE The instructions to enable the parameter monitoring function contain no argument.

c. For each valid instruction to enable the parameter monitoring function, the parameter monitoring subservice shall:

1. set the PMON function status to "enabled";
2. for each parameter monitoring definition that is enabled:
   (a) set its PMON checking status to "unchecked";
   (b) reset the repetition counter;
3. start the parameter monitoring process.

NOTE Enabling the parameter monitoring function does not affect the PMON status of the parameter monitoring definitions.

6.12.3.5.2 Disable the parameter monitoring function

a. The parameter monitoring subservice shall provide the capability to disable the parameter monitoring function.

NOTE 1 The corresponding requests are of message type "TC[12,16] disable the parameter monitoring function".

NOTE 2 For the capability to enable the parameter monitoring function, refer to clause 6.12.3.5.1.

b. Each request to disable the parameter monitoring function shall contain exactly one instruction to disable the parameter monitoring function.

NOTE The instructions to disable the parameter monitoring function contain no argument.

c. The parameter monitoring subservice shall reject any instruction to disable the parameter monitoring function if:

1. the on-board monitoring service includes a functional monitoring subservice whose functional monitoring function is enabled.

NOTE See clause 6.12.4.4.1.

d. For each request to disable the parameter monitoring function that is rejected, the parameter monitoring subservice shall generate a failed start of execution notification.

e. For each valid instruction to disable the parameter monitoring function, the parameter monitoring subservice shall:

1. set the PMON function status to "disabled";
2. stop the parameter monitoring process.

NOTE Disabling the parameter monitoring function affects neither the PMON status nor the PMON checking status of the parameter monitoring definitions.

6.12.3.6 Controlling the parameter monitoring definitions

6.12.3.6.1 Enable parameter monitoring definitions

a. The parameter monitoring subservice shall provide the capability to enable parameter monitoring definitions.

NOTE 1 The corresponding requests are of message type "TC[12,1] enable parameter monitoring definitions".

NOTE 2 For the capability to disable parameter monitoring definitions, refer to clause 6.12.3.6.2.

b. Each request to enable parameter monitoring definitions shall contain one or more instructions to enable a parameter monitoring definition.

c. Each instruction to enable a parameter monitoring definition shall contain:

1. the identifier of the parameter monitoring definition.

d. The parameter monitoring subservice shall reject any instruction to enable a parameter monitoring definition if any of the following conditions occurs:

1. that instruction refers to a parameter monitoring definition identifier that is not in the PMON list;
2. that instruction refers to a parameter monitoring definition that is used by a protected functional monitoring definition.

NOTE For item 2, the existence of protected functional monitoring definitions depends on the presence of a functional monitoring subservice with support for protecting functional monitoring definitions. See also clause 6.12.4.6.

e. For each instruction to enable a parameter monitoring definition that it rejects, the parameter monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The parameter monitoring subservice shall process any valid instruction that is contained within a request to enable parameter monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to enable a parameter monitoring definition, the parameter monitoring subservice shall:

1. reset the repetition counter of that parameter monitoring definition;
2. set the PMON status of that parameter monitoring definition to "enabled".

NOTE Enabling the PMON status of the parameter monitoring definition does not affect the PMON checking status of that definition.

6.12.3.6.2 Disable parameter monitoring definitions

a. The parameter monitoring subservice shall provide the capability to disable parameter monitoring definitions.

NOTE 1 The corresponding requests are of message type "TC[12,2] disable parameter monitoring definitions".

NOTE 2 For the capability to enable parameter monitoring definitions, refer to clause 6.12.3.6.1.

b. Each request to disable parameter monitoring definitions shall contain one or more instructions to disable a parameter monitoring definition.

c. Each instruction to disable a parameter monitoring definition shall contain:

1. the identifier of the parameter monitoring definition.

d. The parameter monitoring subservice shall reject any instruction to disable a parameter monitoring definition if any of the following conditions occurs:

1. that instruction refers to a parameter monitoring definition identifier that is not in the PMON list;
2. that instruction refers to a parameter monitoring definition that is used by a protected functional monitoring definition.

NOTE For item 2, the existence of protected functional monitoring definitions depends on the presence of a functional monitoring subservice with support for protecting functional monitoring definitions. See clause 6.12.4.6.

e. For each instruction to disable a parameter monitoring definition that it rejects, the parameter monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The parameter monitoring subservice shall process any valid instruction that is contained within a request to disable parameter monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to disable a parameter monitoring definition, the parameter monitoring subservice shall:

1. set the PMON status of the parameter monitoring definition to "disabled";
2. set the PMON checking status of the parameter monitoring definition to "unchecked".

6.12.3.6.3 Parameter monitoring process

a. If the PMON function status is "disabled", the parameter monitoring subservice shall not perform the parameter monitoring process for any parameter monitoring definitions.

b. If the PMON status of a parameter monitoring definition is disabled, the parameter monitoring subservice shall not perform the parameter monitoring process for that definition.

c. When performing the parameter monitoring process for a parameter monitoring definition, at the end of the monitoring interval, the parameter monitoring subservice shall, in sequence:

1. if the subservice supports the conditional checking of parameter monitoring definitions, compute the check validity condition;
2. if the computed check validity condition yields false:
   (a) set the PMON checking status to "invalid";
   (b) reset the repetition counter of that parameter monitoring definition;
3. if the subservice does not support the conditional checking of parameter monitoring definitions, or if the check validity condition yields true:
   (a) perform the check specified by the check definition, using a newly sampled value of the monitored parameter;
   (b) if the specified "repetition number" of consecutive checks of the monitored parameter have all produced the same checking status output, establish a new PMON checking status;

d. When a new PMON checking status is established, if that status differs from the previous PMON checking status, the parameter monitoring subservice shall:

   (a) record a check transition by adding that transition to the check transition list;
   (b) if an event definition is associated to that transition, raise the corresponding event.

e. When a new PMON checking status is established for an expected-value-check, the parameter monitoring subservice shall set the PMON checking status to:

1. "unexpected value" if the specified "repetition number" of consecutive checks were declared unsuccessful;
2. "expected value", if the specified "repetition number" of consecutive checks were declared successful.

NOTE See requirement 6.12.3.2.1c for the conditions to declare success for an expected-value check.

f. When a new PMON checking status is established for a limit-check, the parameter monitoring subservice shall set the PMON checking status to:

1. "above high limit", if the specified "repetition number" of consecutive checks were declared unsuccessful and the parameter value in each check was greater than the high limit value;
2. "below low limit", if the specified "repetition number" of consecutive checks were declared unsuccessful and the parameter value in each check was less than the low limit value;
3. "within limits", if the specified "repetition number" of consecutive checks were declared successful.

NOTE See requirement 6.12.3.2.1b for the conditions to declare success for a limit check.

g. When a new PMON checking status is established for a delta-check, the parameter monitoring subservice shall set the PMON checking status to:

1. "above high threshold", if the specified "repetition number" of consecutive checks were declared unsuccessful and the delta value in each check was greater than the high threshold value;
2. "below low threshold", if the specified "repetition number" of consecutive checks were declared unsuccessful and the delta value in each check was less than the low threshold value;
3. "within thresholds", if the specified "repetition number" of consecutive checks were declared successful.

NOTE See requirement 6.12.3.2.2c for the conditions to declare success for a delta check.

6.12.3.7 Reporting the check transitions

a. The parameter monitoring subservice shall provide the capability to report the contents of the check transition list.

NOTE The corresponding reports are data reports of message type "TM[12,12] check transition report".

b. When reporting the contents of the check transition list, the parameter monitoring subservice shall:

1. for each check transition in the check transition list, generate a check transition notification containing:
   (a) the identifier of the parameter monitoring definition for which the check transition is recorded;
   (b) the identifier of the monitored parameter;
   (c) the check type;
   (d) for an expected-value-check, the expected-value-check mask;

(e) the parameter value that has caused the transition;

(f) the limit crossed;

(g) the PMON checking status before the transition;

(h) the PMON checking status resulting from the transition;

(i) the transition time;

2. generate a single check transition report containing all the generated check transition notifications;

3. remove all the reported check transitions from the check transition list.

NOTE 1 For item 1(e), it is the sampled value of the monitored parameter that was used for the last check.

NOTE 2 For item 1(f), it is the specified check value of the parameter monitoring definition that was violated.

NOTE 3 For item 1(i), it is the sampling time of the first parameter sample which was used to establish the new checking status.

c. The maximum number of transitions required for issuing a check transition report shall be declared when specifying the parameter monitoring subservice.

d. The parameter monitoring subservice shall report the contents of the check transition list whenever one of the following condition occurs:

1. the maximum number of transitions required for issuing a check transition report is reached;

2. at the maximum transition reporting delay after the occurrence of the first check transition recorded in the check transition list.

e. The maximum transition reporting delay shall be expressed in "on-board parameter minimum sampling interval" units.

NOTE The on-board parameter minimum sampling interval is driven by requirement 5.4.3.2c.

f. The default maximum transition reporting delay shall be declared when specifying the parameter monitoring subservice.

NOTE For changing the maximum transition reporting delay, refer to requirement 6.12.3.8a.

6.12.3.8 Change the maximum transition reporting delay

a. The parameter monitoring subservice capability to change the maximum transition reporting delay shall be declared when specifying that subservice.

NOTE The corresponding requests are of message type "TC[12,3] change the maximum transition reporting delay".

b. Each request to change the maximum transition reporting delay shall contain exactly one instruction to change the maximum transition reporting delay.

c. Each instruction to change the maximum transition reporting delay shall contain:
   1. the maximum transition reporting delay.

d. For each valid instruction to change the maximum transition reporting delay, the parameter monitoring subservice shall:
   1. set the maximum transition reporting delay to the value specified in that instruction.

6.12.3.9 Managing parameter monitoring definitions

6.12.3.9.1 Add parameter monitoring definitions

a. The parameter monitoring subservice capability to add parameter monitoring definitions shall be declared when specifying that subservice.

   NOTE 1 The corresponding requests are of message type "TC[12,5] add parameter monitoring definitions".

   NOTE 2 For the capability to delete all parameter monitoring definitions, refer to clause 6.12.3.9.2.

   NOTE 3 For the capability to delete parameter monitoring definitions, refer to clause 6.12.3.9.3.

b. If the capability to add parameter monitoring definitions is provided by the parameter monitoring subservice, that subservice shall provide at least one of the following capabilities:
   1. the capability to delete all parameter monitoring definitions specified in clause 6.12.3.9.2;
   2. the capability to delete parameter monitoring definitions specified in clause 6.12.3.9.3.

c. Each request to add parameter monitoring definitions shall contain one or more instructions to add a parameter monitoring definition.

d. Each instruction to add a parameter monitoring definition shall contain:
   1. the contents of the parameter monitoring definition.

      NOTE The contents of a parameter monitoring definition are specified in clause 6.12.3.3g.

e. The parameter monitoring subservice shall reject any instruction to add a parameter monitoring definition if any of the following conditions occurs:
   1. that instruction cannot be added since the PMON list is full;
   2. that instruction refers to a parameter monitoring definition identifier that is already in the PMON list;
   3. that instruction refers to a parameter to monitor that is not accessible;
   4. that instruction refers to a validity parameter that is not accessible;
   5. that instruction refers to a limit check for which the high limit is lower than the low limit;
   6. that instruction refers to a delta check for which the high threshold is lower than the low threshold.

f. For each instruction to add a parameter monitoring definition that it rejects, the parameter monitoring subservice shall generate the failed start of execution notification for that instruction.

g. The parameter monitoring subservice shall process any valid instruction that is contained within a request to add parameter monitoring definitions regardless of the presence of faulty instructions.

h. For each valid instruction to add a parameter monitoring definition, the parameter monitoring subservice shall:

1. add a new parameter monitoring definition to the PMON list, using data from that instruction;
2. set the PMON checking status of the new parameter monitoring definition to "unchecked";
3. set the PMON status of the new parameter monitoring definition to "disabled".

6.12.3.9.2 Delete all parameter monitoring definitions

a. The parameter monitoring subservice capability to delete all parameter monitoring definitions shall be declared when specifying that subservice.

NOTE 1 The corresponding requests are of message type "TC[12,4] delete all parameter monitoring definitions".

NOTE 2 For that declaration, refer to requirement 6.12.3.9.1b.

b. Each request to delete all parameter monitoring definitions shall contain exactly one instruction to delete all parameter monitoring definitions.

NOTE The instructions to delete all parameter monitoring definitions contain no argument.

c. The parameter monitoring subservice shall reject any request to delete all parameter monitoring definitions if any of the following conditions occurs:

1. the PMON list contains one or more parameter monitoring definitions that are used by the functional monitoring subservice;
2. the PMON function status is "enabled".

d. For each request to delete all parameter monitoring definitions that is rejected, the parameter monitoring subservice shall generate a failed start of execution notification.

e. For each valid instruction to delete all parameter monitoring definitions, the parameter monitoring subservice shall:

1. delete all entries in the PMON list;
2. delete all entries in the check transition list.

6.12.3.9.3 Delete parameter monitoring definitions

a. The parameter monitoring subservice capability to delete parameter monitoring definitions shall be declared when specifying that subservice.

NOTE 1 The corresponding requests are of message type "TC[12,6] delete parameter monitoring definitions".

NOTE 2 For that declaration, refer to requirement 6.12.3.9.1b.

b. Each request to delete parameter monitoring definitions shall contain one or more instructions to delete a parameter monitoring definition.

c. Each instruction to delete a parameter monitoring definition shall contain:

1. the identifier of the parameter monitoring definition.

d. The parameter monitoring subservice shall reject any instruction to delete a parameter monitoring definition if any of the following conditions occurs:

1. that instruction refers to a parameter monitoring definition identifier that is not in the PMON list;
2. that instruction refers to a parameter monitoring definition whose PMON status is "enabled";
3. that instruction refers to a parameter monitoring definition that is used by a functional monitoring definition.

e. For each instruction to delete a parameter monitoring definition that it rejects, the parameter monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The parameter monitoring subservice shall process any valid instruction that is contained within a request to delete parameter monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to delete a parameter monitoring definition, the parameter monitoring subservice shall:

1. remove the parameter monitoring definition that is referred to by that instruction from the PMON list.

6.12.3.9.4 Modify parameter monitoring definitions

a. The parameter monitoring subservice capability to modify parameter monitoring definitions shall be declared when specifying that subservice.

NOTE 1 The corresponding requests are of message type "TC[12,7] modify parameter monitoring definitions".

NOTE 2 That capability requires the capability for that subservice to add parameter monitoring definitions (refer to clause 6.12.3.9.1).

b. Each request to modify parameter monitoring definitions shall contain one or more instructions to modify a parameter monitoring definition.

c. Each instruction to modify a parameter monitoring definition shall contain:

1. the identifier of the parameter monitoring definition;

2. the identifier of the monitored parameter used by that parameter monitoring definition;
3. the means to modify:
   (a) the repetition number;
   (b) for a limit-check, its low limit, its high limit and the event definition identifier of each associated event;
   (c) for an expected-value-check, its expected-value-check mask, its expected value and the event definition identifier of its associated event;
   (d) for a delta-check, its low delta threshold, its high delta threshold and the event definition identifier of each associated event.

   NOTE In order to modify the other parameter monitoring definition characteristics, e.g. the check type, this Standard promotes the scenario to delete the parameter monitoring definition and create a new one.

d. The parameter monitoring subservice shall reject any instruction to modify a parameter monitoring definition if any of the following conditions occurs:
   1. that instruction refers to a parameter monitoring definition identifier that is not in the PMON list;
   2. that instruction refers to a monitored parameter that is not the one used in that parameter monitoring definition;
   3. that instruction refers to a limit check for which the high limit is lower than the low limit;
   4. that instruction refers to a delta check for which the high threshold is lower than the low threshold;
   5. that instruction refers to a parameter monitoring definition that is used by a protected functional monitoring definition.

      NOTE 1 For item 5, the existence of protected functional monitoring definitions depends on the presence of a functional monitoring subservice with support for protecting functional monitoring definitions. See clause 6.12.4.6.

      NOTE 2 See clause 8.12.2.7 for additional constraints due to the interface specification.

e. For each instruction to modify a parameter monitoring definition that it rejects, the parameter monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The parameter monitoring subservice shall process any valid instruction that is contained within a request to modify parameter monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to modify a parameter monitoring definition, the parameter monitoring subservice shall:

1. modify the parameter monitoring definition that is referred to by that instruction, using data from that instruction;
2. set the PMON checking status of the modified parameter monitoring definition to "unchecked";
3. reset the repetition counter of that parameter monitoring definition.

6.12.3.10 Report parameter monitoring definitions

a. The parameter monitoring subservice capability to report parameter monitoring definitions shall be declared when specifying that subservice.

NOTE 1 The corresponding requests are of message type "TC[12,8] report parameter monitoring definitions". The responses are data reports of message type "TM[12,9] parameter monitoring definition report".

NOTE 2 That capability requires the capability for that subservice to provide at least one of:

- the capability to add parameter monitoring definitions (refer to clause 6.12.3.9.1),;
- the capability to modify parameter monitoring definitions (refer to clause 6.12.3.9.4).

b. Each request to report parameter monitoring definitions shall contain:

1. one or more instructions to report a parameter monitoring definition, or
2. exactly one instruction to report all parameter monitoring definitions.

NOTE The instructions to report all parameter monitoring definitions contain no argument.

c. Each instruction to report a parameter monitoring definition shall contain:

1. the identifier of the parameter monitoring definition.

d. The parameter monitoring subservice shall reject any instruction to report a parameter monitoring definition if:

1. that instruction refers to a parameter monitoring definition identifier that is not in the PMON list.

e. For each instruction to report a parameter monitoring definition that it rejects, the parameter monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The parameter monitoring subservice shall process any valid instruction that is contained within a request to report parameter monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to report a parameter monitoring definition, the parameter monitoring subservice shall generate a single parameter monitoring definition notification that includes:

1. the parameter monitoring definition that is referred to by that instruction;
2. the PMON status of that parameter monitoring definition.

NOTE The parameter monitoring definition is specified in requirement 6.12.3.3g.

h. For each valid instruction to report all parameter monitoring definitions, the parameter monitoring subservice shall generate, for each parameter monitoring definition maintained by that subservice, a single parameter monitoring definition notification.

i. For each valid request to report parameter monitoring definitions, the parameter monitoring subservice shall generate a single parameter monitoring definition report that contains:

1. if changing the maximum transition reporting delay is supported, the current value of that delay;
2. all related parameter monitoring definition notifications.

NOTE For item 1, refer to requirement 6.12.3.8a.

6.12.3.11 Report the status of each parameter monitoring definition

a. The parameter monitoring subservice capability to report the status of each parameter monitoring definition shall be declared when specifying that subservice.

NOTE 1 The corresponding requests are of message type "TC[12,13] report the status of each parameter monitoring definition". The responses are data reports of message type "TM[12,14] parameter monitoring definition status report".

NOTE 2 That capability requires the capability for that subservice to enable parameter monitoring definitions, refer to clause 6.12.3.6.1.

b. Each request to report the status of each parameter monitoring definition shall contain exactly one instruction to report the status of each parameter monitoring definition.

NOTE The instructions to report the status of each parameter monitoring definition contain no argument.

c. For each valid instruction to report the status of each parameter monitoring definition, the parameter monitoring subservice shall:

1. generate, for each parameter monitoring definition in the PMON list, a single parameter monitoring definition status notification that includes:
   (a) the identifier of the parameter monitoring definition;
   (b) its PMON status.

d. For each valid request to report the status of each parameter monitoring definition, the parameter monitoring subservice shall generate a single parameter monitoring definition status report that includes all related parameter monitoring definition status notifications.

6.12.3.12 Report the out-of-limits

a. The parameter monitoring subservice capability to report the out-of-limits shall be declared when specifying that subservice.

NOTE The corresponding requests are of message type "TC[12,10] report the out-of-limits". The responses are data reports of message type "TM[12,11] out-of-limits report".

b. Each request to report the out-of-limits shall contain exactly one instruction to report the out-of-limits.

NOTE The instructions to report the out-of-limits contain no argument.

c. For an expected-value-check, only the following transitions shall be reported in the out-of-limits report:

1. "unchecked" to "unexpected value";
2. "invalid" to "unexpected value";
3. "expected value" to "unexpected value".

d. For a limit-check, only the following transitions shall be reported in the out-of-limits report:

1. "unchecked" to "below low limit";
2. "unchecked" to "above high limit";
3. "invalid" to "below low limit";
4. "invalid" to "above high limit";
5. "within limits" to "below low limit";
6. "within limits" to "above high limit";
7. "below low limit" to "above high limit";
8. "above high limit" to "below low limit".

e. For a delta-check, only the following transitions shall be reported in the out-of-limits report:

1. "unchecked" to "below low threshold";
2. "unchecked" to "above high threshold";
3. "invalid" to "below low threshold";
4. "invalid" to "above high threshold";
5. "within threshold" to "below high threshold";
6. "within threshold" to "above high threshold";
7. "below low threshold" to "above high threshold";
8. "above high threshold" to "below low threshold".

f. For each valid instruction to report the out-of-limits, the parameter monitoring subservice shall generate:

1. for each check transition to report, a single out-of-limit notification that includes:

(a) the identifier of the parameter monitoring definition for which the check transition is recorded;

(b) the identifier of the monitored parameter;

(c) the check type;

(d) for an expected-value-check, the expected-value-check mask;

(e) the parameter value that has caused the transition;

(f) the limit crossed;

(g) the PMON checking status before the transition;

(h) the PMON checking status resulting from the transition;

(i) the transition time.

NOTE 1 For item 1(e), it is the sampled value of the monitored parameter that was used for the last check.

NOTE 2 For item 1(f), it is the specified check value of the parameter monitoring definition that was violated.

NOTE 3 For item 1(i), it is the sampling time of the first parameter sample that was used to establish the new checking status.

g. For each valid request to report the out-of-limits, the parameter monitoring subservice shall generate a single out-of-limits report that includes all related out-of-limit notifications.

NOTE Following the generation of an out-of-limits report, the reported transitions are not removed from the check transition list. The transitions are removed when they are reported in a check transition report, see clause 6.12.3.7.

6.12.3.13 Subservice observables

a. The following observables shall be defined for the parameter monitoring subservice:

1. the number of remaining available entries in the parameter monitoring definition list;

2. the number of enabled parameter monitoring definitions;

3. the PMON function status.

6.12.4 Functional monitoring subservice

6.12.4.1 Accessibility

6.12.4.1.1 Parameter monitoring definition

a. The functional monitoring subservice shall be able to observe, at any time, the PMON checking status of each parameter monitoring definition of the parameter monitoring subservice of the parent on-board monitoring service.

6.12.4.2 Functional monitoring definition

6.12.4.2.1 General

a. The maximum number of functional monitoring definitions that the functional monitoring subservice can contemporaneously evaluate at any time shall be declared when specifying that subservice.

NOTE This maximum is the maximum number of entries in the functional monitoring definition list. The functional monitoring definition list is named "FMON list".

b. The maximum number of parameter monitoring definitions that a functional monitoring definition can refer to shall be declared when specifying the functional monitoring subservice.

NOTE This Standard does not limit the number of times a parameter monitoring definition can be called by a functional monitoring definition.

c. Whether the functional monitoring subservice supports conditional checking of functional monitoring definitions shall be declared when specifying that subservice.

d. Whether the functional monitoring subservice supports specifying, for each functional monitoring definition, the minimum number of contemporaneously violated parameter monitoring definitions that establishes a functional monitoring checking failure shall be declared when specifying that subservice.

NOTE 1 This minimum number is named "minimum PMON failing number".

NOTE 2 A minimum PMON failing number that equals 1 means that a functional monitoring definition fails as soon as one of its parameter monitoring definitions fails. This is equivalent to a logical OR of the PMON conditions.

NOTE 3 If a functional monitoring definition has a minimum PMON failing number that is equal to the number of its parameter monitoring definitions, then the functional monitoring definition fails when all its parameter monitoring definitions fail. This is equivalent to a logical AND of the PMON conditions.

e. If the functional monitoring subservice does not support specifying, for each functional monitoring definition, the minimum PMON failing number, the subservice shall use a value of 1 as the minimum PMON failing number for all functional monitoring definitions.

f. Each functional monitoring definition shall contain:

1. its identifier;
2. if the functional monitoring subservice supports the conditional checking of functional monitoring definitions, a check validity condition that yielding false prevents the check being performed;
3. the event definition identifier of the event to raise;
4. if the subservice supports specifying the minimum PMON failing number, a minimum PMON failing number;
5. a set of one or more parameter monitoring definition identifiers.

NOTE 1 For item 2, refer to requirement 6.12.4.2.1c.

NOTE 2 For item 4, refer to requirement 6.12.4.2.1d.

6.12.4.3 Statuses

a. The functional monitoring subservice shall maintain a status indicating whether the overall functional monitoring function is enabled or disabled.

NOTE This status is named "FMON function status".

b. For each functional monitoring definition, the functional monitoring subservice shall maintain a status indicating whether that functional monitoring definition is enabled or disabled.

NOTE This status is named "FMON status".

c. For each functional monitoring definition, the functional monitoring subservice shall maintain a status indicating the result of the check performed.

NOTE 1 This status is named "FMON checking status".

NOTE 2 The FMON checking status can have any of the following values: "unchecked", "invalid", "running" or "failed".

d. If the functional monitoring subservice supports the capability for protecting functional monitoring definitions, the functional monitoring subservice shall maintain, for each functional monitoring definition, a status indicating whether that functional monitoring definition is protected or unprotected.

NOTE 1 For that capability, refer to requirement 6.12.4.6.1a.

NOTE 2 This status is named "FMON protection status".

NOTE 3 When a functional monitoring definition is protected, it cannot be deleted. The parameter monitoring definitions used by a protected functional monitoring definition cannot be enabled, disabled or modified

NOTE 4 If the subservice does not support that capability, all functional monitoring definitions are implicitly unprotected.

6.12.4.4 Controlling the functional monitoring function

6.12.4.4.1 Enable the functional monitoring function

a. The functional monitoring subservice shall provide the capability to enable the functional monitoring function.

NOTE 1 The corresponding requests are of message type "TC[12,17] enable the functional monitoring function".

NOTE 2 For the capability to disable the functional monitoring function, refer to clause 6.12.4.4.2.

b. Each request to enable the functional monitoring function shall contain exactly one instruction to enable the functional monitoring function.

NOTE The instructions to enable the functional monitoring function contain no argument.

c. The functional monitoring subservice shall reject any request to enable the functional monitoring function if:

1. the parameter monitoring function of the associated parameter monitoring subservice is disabled.

NOTE See clause 6.12.3.5.1.

d. For each request to enable the functional monitoring function that is rejected, the functional monitoring subservice shall generate a failed start of execution notification.

e. For each valid instruction to enable the functional monitoring function, the functional monitoring subservice shall:

1. set the FMON function status to "enabled";
2. for each functional monitoring definition that is enabled:
   (a) set its FMON checking status to "unchecked";
3. start immediately the monitoring of the enabled functional monitoring definitions.

NOTE Enabling the functional monitoring function has no impact on the FMON and FMON protection statuses of the functional monitoring definitions.

6.12.4.4.2 Disable the functional monitoring function

a. The functional monitoring subservice shall provide the capability to disable the functional monitoring function.

NOTE 1 The corresponding requests are of message type "TC[12,18] disable the functional monitoring function".

NOTE 2 For the capability to enable the functional monitoring function, refer to clause 6.12.4.4.1.

b. Each request to disable the functional monitoring function shall contain exactly one instruction to disable the functional monitoring function.

NOTE The instructions to disable the functional monitoring function contain no argument.

c. For each valid instruction to disable the functional monitoring function, the functional monitoring subservice shall:

1. set the FMON function status to "disabled".
2. stop immediately the monitoring of the functional monitoring definitions.

NOTE Disabling the functional monitoring function has no impact on the FMON, FMON protection and FMON checking statuses of the functional monitoring definitions.

6.12.4.5 Controlling the functional monitoring definitions

6.12.4.5.1 Monitoring transitions

a. For each functional monitoring definition, whenever a new PMON checking status has been established for one of its parameter monitoring definitions, the functional monitoring subservice shall perform the following:

1. If the FMON function status is "enabled" and the FMON status is "enabled" and the current FMON checking status is not "failed":
   (a) the check validity condition, if any, is computed;
   (b) If the computed check validity condition yields false, the FMON checking status is set to "invalid".
2. If the FMON function status is "enabled", the FMON status is "enabled" and the current FMON checking status is neither "failed" nor "invalid":
   (a) check if the number of related parameter monitoring definitions that are contemporaneously in violation equals or exceeds the minimum PMON failing number;
   (b) if the check yields true, the FMON checking status is set to "failed" and the associated event is raised;
   (c) if the check yields false, the FMON checking status is set to "running".

6.12.4.5.2 Enable functional monitoring definitions

a. The functional monitoring subservice shall provide the capability to enable functional monitoring definitions.

NOTE 1 The corresponding requests are of message type "TC[12,19] enable functional monitoring definitions".

NOTE 2 For the capability to disable functional monitoring definitions, refer to clause 6.12.4.5.3.

b. Each request to enable functional monitoring definitions shall contain one or more instructions to enable a functional monitoring definition.

c. Each instruction to enable a functional monitoring definition shall contain:

1. the identifier of the functional monitoring definition.

d. The functional monitoring subservice shall reject any instruction to enable a functional monitoring definition if:

1. that instruction refers to a functional monitoring definition identifier that is not in the FMON list.

e. For each instruction to enable a functional monitoring definition that it rejects, the functional monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The functional monitoring subservice shall process any valid instruction that is contained within a request to enable functional monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to enable a functional monitoring definition, the functional monitoring subservice shall:

1. set the FMON status of the functional monitoring definition to "enabled".

NOTE Enabling the FMON status of the functional monitoring definition does not affect the FMON checking status of that definition.

6.12.4.5.3 Disable functional monitoring definitions

a. The functional monitoring subservice shall provide the capability to disable functional monitoring definitions.

NOTE 1 The corresponding requests are of message type "TC[12,20] disable functional monitoring definitions".

NOTE 2 For the capability to enable functional monitoring definitions, refer to clause 6.12.4.5.2.

b. Each request to disable functional monitoring definitions shall contain one or more instructions to disable a functional monitoring definition.

c. Each instruction to disable a functional monitoring definition shall contain:

1. the identifier of the functional monitoring definition.

d. The functional monitoring subservice shall reject any instruction to disable a functional monitoring definition if:

1. that instruction refers to a functional monitoring definition identifier that is not in the FMON list.

e. For each instruction to disable a functional monitoring definition that it rejects, the functional monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The functional monitoring subservice shall process any valid instruction that is contained within a request to disable functional monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to disable a functional monitoring definition, the functional monitoring subservice shall:

1. set the FMON status of the functional monitoring definition to "disabled";
2. set the FMON checking status of the functional monitoring definition to "unchecked".

6.12.4.6 Protecting functional monitoring definitions

6.12.4.6.1 Protect functional monitoring definitions

a. The functional monitoring subservice capability to protect functional monitoring definitions shall be declared when specifying that subservice.

NOTE 1 The corresponding requests are of message type "TC[12,21] protect functional monitoring definitions".

NOTE 2 For the capability to unprotect functional monitoring definitions, refer to clause 6.12.4.6.2.

b. Each request to protect functional monitoring definitions shall contain one or more instructions to protect a functional monitoring definition.

c. Each instruction to protect a functional monitoring definition shall contain:

1. the identifier of the functional monitoring definition.

d. The functional monitoring subservice shall reject any instruction to protect a functional monitoring definition if:

1. that instruction refers to a functional monitoring definition identifier that is not in the FMON list.

e. For each instruction to protect a functional monitoring definition that it rejects, the functional monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The functional monitoring subservice shall process any valid instruction that is contained within a request to protect functional monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to protect a functional monitoring definition, the functional monitoring subservice shall:

1. set the FMON protection status of the functional monitoring definition to "protected".

NOTE When a functional monitoring definition is protected, it cannot be deleted and it prevents the enabling, disabling or modifying of any parameter monitoring definition that is used in that functional monitoring definition. See clauses 6.12.4.7.2, 6.12.3.6.1, 6.12.3.6.2 and 6.12.3.9.4.

6.12.4.6.2 Unprotect functional monitoring definitions

a. The functional monitoring subservice capability to unprotect functional monitoring definitions shall be provided if the capability to protect functional monitoring definitions is provided by that subservice.

NOTE 1 The corresponding requests are of message type "TC[12,22] unprotect functional monitoring definitions".

NOTE 2 For the capability to protect functional monitoring definitions, refer to clause 6.12.4.6.1.

b. Each request to unprotect functional monitoring definitions shall contain one or more instructions to unprotect a functional monitoring definition.

c. Each instruction to unprotect a functional monitoring definition shall contain:

1. the identifier of the functional monitoring definition.

d. The functional monitoring subservice shall reject any instruction to unprotect a functional monitoring definition if:

1. that instruction refers to a functional monitoring definition identifier that is not in the FMON list.

e. For each instruction to unprotect a functional monitoring definition that it rejects, the functional monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The functional monitoring subservice shall process any valid instruction that is contained within a request to unprotect functional monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to unprotect a functional monitoring definition, the functional monitoring subservice shall:

1. set the FMON protection status of the functional monitoring definition to "unprotected".

6.12.4.7 Modifying functional monitoring definitions

6.12.4.7.1 Add functional monitoring definitions

a. The functional monitoring subservice capability to add functional monitoring definitions shall be declared when specifying that subservice.

NOTE 1 The corresponding requests are of message type "TC[12,23] add functional monitoring definitions".

NOTE 2 For the capability to delete functional monitoring definitions, refer to clause 6.12.4.7.2.

b. Each request to add functional monitoring definitions shall contain one or more instructions to add a functional monitoring definition.

c. Each instruction to add a functional monitoring definition shall contain:

1. the contents of the functional monitoring definition.

NOTE The contents of a functional monitoring definition are specified in requirement 6.12.4.2.1f.

d. The functional monitoring subservice shall reject any request to add functional monitoring definitions if any of the following conditions occurs:
   1. that request contains an instruction that refers to a functional monitoring definition identifier that is already in the FMON list;
   2. that request contains more than one instruction for the same functional monitoring definition.

e. The functional monitoring subservice shall reject any instruction to add a functional monitoring definition if any of the following conditions occurs:
   1. that instruction cannot be added since the FMON list is full;
   2. that instruction refers to a parameter monitoring definition identifier that is not in the PMON list;
   3. that instruction refers to a validity parameter that is not accessible.

f. For each request to add functional monitoring definitions that it rejects, the functional monitoring subservice shall generate the failed start of execution notification for that request.

g. For each instruction to add a functional monitoring definition that it rejects, the functional monitoring subservice shall generate the failed start of execution notification for that instruction.

h. The functional monitoring subservice shall process any valid instruction that is contained within a request to add functional monitoring definitions regardless of the presence of faulty instructions.

i. For each valid instruction to add a functional monitoring definition, the functional monitoring subservice shall:
   1. add a new functional monitoring definition to the FMON list, using data from that instruction;
   2. set the FMON checking status of the new functional monitoring definition to "unchecked";
   3. set the FMON status of the new functional monitoring definition to "disabled";
   4. if the functional monitoring subservice supports the capability for protecting functional monitoring definitions, set the FMON protection status of the new functional monitoring definition to "protected".

      NOTE For the capability in item 4 refer to requirement 6.12.4.6.1a.

6.12.4.7.2 Delete functional monitoring definitions

a. The functional monitoring subservice shall provide the capability to delete functional monitoring definitions if the capability to add functional monitoring definitions is provided by that subservice.

   NOTE 1 The corresponding requests are of message type "TC[12,24] delete functional monitoring definitions".

NOTE 2 For the capability to add functional monitoring definitions, refer to clause 6.12.4.7.1.

b. Each request to delete functional monitoring definitions shall contain one or more instructions to delete a functional monitoring definition.

c. Each instruction to delete a functional monitoring definition shall contain:

1. the identifier of the functional monitoring definition.

d. The functional monitoring subservice shall reject any instruction to delete a functional monitoring definition if any of the following conditions occurs:

1. that instruction refers to a functional monitoring definition identifier that is not in the FMON list;
2. that instruction refers to a functional monitoring definition whose FMON status is "enabled";
3. that instruction refers to a functional monitoring definition whose FMON protection status is "protected".

e. For each instruction to delete a functional monitoring definition that it rejects, the functional monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The functional monitoring subservice shall process any valid instruction that is contained within a request to delete functional monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to delete a functional monitoring definition, the functional monitoring subservice shall:

1. remove the functional monitoring definition that is referred to by that instruction from the FMON list.

6.12.4.8 Report functional monitoring definitions

a. The functional monitoring subservice capability to report functional monitoring definitions shall be declared when specifying that subservice.

NOTE 1 The corresponding requests are of message type "TC[12,25] report functional monitoring definitions". The responses are data reports of message type "TM[12,26] functional monitoring definition report".

NOTE 2 That capability requires the capability for that subservice to add functional monitoring definitions. refer to clause 6.12.4.7.1.

b. Each request to report functional monitoring definitions shall contain:

1. one or more instructions to report a functional monitoring definition, or
2. exactly one instruction to report all functional monitoring definitions.

NOTE The instructions to report all functional monitoring definitions contain no argument.

c. Each instruction to report a functional monitoring definition shall contain:

1. the identifier of the functional monitoring definition.

d. The functional monitoring subservice shall reject any instruction to report a functional monitoring definition if:

1. that instruction refers to a functional monitoring definition identifier that is not in the FMON list.

e. For each instruction to report a functional monitoring definition that it rejects, the functional monitoring subservice shall generate the failed start of execution notification for that instruction.

f. The functional monitoring subservice shall process any valid instruction that is contained within a request to report functional monitoring definitions regardless of the presence of faulty instructions.

g. For each valid instruction to report a functional monitoring definition, the functional monitoring subservice shall

1. generate a single functional monitoring definition notification that includes:

(a) the content of the functional monitoring definition that is referred to by that instruction;

(b) if the functional monitoring subservice supports the capability for protecting functional monitoring definitions, the FMON protection status of that functional monitoring definition;

(c) the FMON status of that functional monitoring definition.

NOTE 1 For item 1(a), the content of a functional monitoring definition is specified in requirement 6.12.4.2.1f.

NOTE 2 For item 1(b), refer to requirement 6.12.4.6.1a.

h. For each valid instruction to report all functional monitoring definitions, the functional monitoring subservice shall:

1. for each functional monitoring definition maintained by that subservice, generate a single functional monitoring definition notification that includes:

(a) the contents of that functional monitoring definition;

(b) if the functional monitoring subservice supports the capability for protecting functional monitoring definitions, the FMON protection status of that functional monitoring definition;

(c) the FMON status of that functional monitoring definition.

NOTE 1 The contents of a functional monitoring definition are specified in requirement 6.12.4.2.1f.

NOTE 2 For the capability for protecting functional monitoring definitions, refer to requirement 6.12.4.6.1a.

i. For each valid request to report functional monitoring definitions, the functional monitoring subservice shall generate a single functional monitoring definition report that contains all related functional monitoring definition notifications.

6.12.4.9 Report the status of each functional monitoring definition

a. The functional monitoring subservice capability to report the status of each functional monitoring definition shall be declared when specifying that subservice.

NOTE The corresponding requests are of message type "TC[12,27] report the status of each functional monitoring definition". The responses are data reports of message type "TM[12,28] functional monitoring definition status report".

b. Each request to report the status of each functional monitoring definition shall contain exactly one instruction to report the status of each functional monitoring definition.

NOTE The instructions to report the status of each functional monitoring definition contain no argument.

c. For each valid instruction to report the status of each functional monitoring definition, the functional monitoring subservice shall:

1. generate, for each functional monitoring definition in the FMON list, a single functional monitoring definition status notification that includes:
   (a) the identifier of that functional monitoring definition;
   (b) if the functional monitoring subservice supports the capability for protecting functional monitoring definitions, its FMON protection status;
   (c) its FMON status;
   (d) its FMON checking status.

   NOTE For item 1(b), refer to requirement 6.12.4.6.1a.

d. For each valid request to report the status of each functional monitoring definition, the functional monitoring subservice shall generate a single functional monitoring definition status report that includes all related functional monitoring definition status notifications.

6.12.4.10 Subservice observables

a. The following observables shall be defined for the functional monitoring subservice:

1. the number of remaining available entries in the functional monitoring definition list;
2. the number of enabled functional monitoring definitions;
3. the FMON function status.