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USER MANUAL

FOXMAN-UN

Network Monitoring

Health Monitoring Feature

Hitachi Energy

Document ID	1MRC000115	
Document edition	FOXMAN-UN System Release:	R18
	Revision:	A
	Date:	2025-10-13

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Contents

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1 Preface

This document gives an overview on the FOXMAN-UN R18 Health Monitoring feature, the way it is configured and the way it is used during operation.

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2 Feature Description

2.1 Purpose and Applicability

Health Monitoring monitors the physical health of the network elements and visualizes the metrics in the Network Monitoring application of FOXMAN-UN. The main purpose is to detect real or potential issues of the network elements.

Health Monitoring supports FOX61x network elements, their pluggable units, and their Ethernet and SDH ports.

2.2 Health Metrics

FOXMAN-UN collects the following health metrics from the network elements (NEs, units, ports):

- NE Uptime
- NE Temperature
- CPU Load
- Memory Usage
- RX Throughput (*)
- TX Throughput (*)
- RX Errors (*)
- TX Errors (*)
- SFP Input Power
- SFP Output Power
- SFP Temperature

The metrics marked with (*) are based on 15min interval counters collected via PM Collector and are supported for Ethernet ports only (i.e., not supported for SDH ports). The other metrics are polled every 3 minutes, using SNMP version 3.

FOXMAN-UN stores the collected metrics in InfluxDB, in a bucket called ‘network_pm_raw’.

2.3 Health Monitors

Health monitors compare the metrics with configurable multi-level thresholds and visualize the performance state on the map of the Network Monitoring application.

2.4 Performance State and Validity

2.4.1 Performance State

The performance state is evaluated by comparing a metric with configurable multi-level thresholds and can take the following values:

- Ok: Metric is within the expected (healthy) range
- Fair: Metric has exceeded the ‘fair’ threshold
- Poor: Metric has exceeded the ‘poor’ threshold
- Bad: Metric has exceeded the ‘bad’ threshold
- Unmonitored: Metric has no threshold assigned
- Unavailable: Metric is outdated and not compared against any threshold

The performance state is evaluated for both current and historical metrics. For historical metrics, the application displays the **worst** performance state aggregated over time.

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2.4.2 Validity

The validity indicates the age of a metric and can take the following values:

- Current: Time stamp of metric dates back less than 1 hour;
- Outdated: Time stamp of metric dates back more than 1 hour but less than 24 hours;
- No Data: Metric is missing or time stamp of metric dates back more than 24 hours.

Note:

Performance states ‘Ok’, ‘Fair’, ‘Poor’, ‘Bad’ and related colors on the map are continuously evaluated based on the most current metrics. This can be seen as a real-time health status without retention of historical states. Also note that exceeded thresholds do not result in any alarms.

2.4.3 Performance State and Validity of Individual Metrics

Each individual metric has both a performance state and a validity.

2.4.4 Performance State and Validity Aggregation on Entity Level

Metrics are aggregated on entities such as NEs, sections, health monitors and the health monitoring session. Each such entity has an aggregated (worst-case) performance state and validity, based on the underlying metrics. Aggregated state and validity are determined by applying the following precedence of state and validity of the individual metrics:

- Performance State: Bad > Poor > Fair > Ok > Unmonitored > Unavailable;
- Validity: Outdated > Current > No Data.

Examples of (aggregated performance state, aggregated validity):

- (Ok, Current) indicates: All metrics are ‘Ok’ and ‘Current’.
- (Ok, Outdated) indicates: All metrics are ‘Ok’, one or multiple metrics are ‘Outdated’.
- (Poor, Current) indicates: Worst metric state is 'Poor', all metrics are 'Current'.
- (Fair, Outdated) indicates: Worst metric state is 'Fair', one or multiple metrics are ‘Outdated’.
- (Unmonitored, Current) indicates: All metrics without any threshold, all metrics are 'Current'.
- (Unavailable, Outdated) indicates: Performance state not evaluated as all metrics are ‘Outdated’.
- (Unavailable, No Data) indicates: Performance state not evaluated as all metrics are missing.

2.4.5 Performance State Aggregation over Time

Performance states are aggregated and displayed in the form of bar charts over time to provide historical insights. Time intervals are selectable: 24 hours, 7 days, or 30 days.

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3 Configuration

3.1 Configuring Health Monitoring

3.1.1 Default Configuration

Health Monitoring is disabled by default. You can start and stop Health Monitoring on a per-NE basis.

3.1.2 Starting Health Monitoring

You can start Health Monitoring by proceeding as follows:

1. Open the Network Monitoring application.
2. Go to ‘NE’ tab.
3. In the left panel select one or multiple NEs[1].
4. Right click on the selection to open the menu.
5. Under menu item ‘Health Monitor’ select ‘Start’.
6. Wait for message “Selected NE added to Health Monitoring successfully” (this may take up to a few minutes depending on the number of NEs).

During this process FOXMAN-UN automatically executes the following tasks for the related NEs:

- Enable SNMP on the NE (if not yet enabled).
- Add SNMPv3 user and passwords on the NE.
- Modify or create PM Collection job ‘HEALTH_MONITOR’.
- Change health monitoring status: Not Started/Stopped -> Starting -> Running.

Important note: Do not proceed with other NEs before step 6 is concluded.

3.1.3 Stopping Health Monitoring

You can stop Health Monitoring by proceeding as follows:

1. Open the Network Monitoring application.
2. Go to ‘NE’ tab.
3. In the left panel select one or multiple NEs[1].
4. Right click on the selection to open the menu.
5. Under menu item ‘Health Monitor’ select ‘Stop’.
6. Wait for message “Selected NE removed from Health Monitoring successfully” (this may take up to a few minutes depending on the numbers of NEs).

During this process FOXMAN-UN automatically executes the following tasks for the related NEs:

- Remove SNMPv3 user and passwords on the NE (but keep SNMP enabled).
- Modify or delete PM Collection job ‘HEALTH_MONITOR’.
- Change health monitoring status: Running -> Stopping -> Stopped.

Important note: Do not proceed with other NEs before step 6 is concluded.

[1] If someone is logged in to the node from FOXCST as Session Manger, adding this node to health monitoring will fail. Any user must close existing FOXCST with Session Manager privilege on a node before starting Health Monitoring.

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3.2 Configuring Thresholds

3.2.1 Factory Default for Thresholds

The FOXMAN-UN installation comes with the factory default for thresholds as listed below. Note that NE type FOX610 and the core unit CESM3 have specific thresholds for some metrics.

- NE Temperature (Celsius):

Bad ≥ 60	Poor ≥ 55	Fair ≥ 50

  − Specific to NE type FOX610:

Bad ≥ 95	Poor ≥ 90	Fair ≥ 85

- CPU Load (Percent):

Bad ≥ 99	Poor ≥ 90	Fair ≥ 85

  − Specific to CESM3 units:

Bad ≥ 30	Poor ≥ 25	Fair ≥ 20

- Memory Usage (Percent):

Bad ≥ 95	Poor ≥ 90	Fair ≥ 85

  − Specific to CESM3 units:

Bad ≥ 50	Poor ≥ 40	Fair ≥ 30

- RX Throughput (Percent):

Bad ≥ 90.00	Poor ≥ 85.00	Fair ≥ 80.00

- TX Throughput (Percent):

Bad ≥ 90.00	Poor ≥ 85.00	Fair ≥ 80.00

- RX Errors (Packets in 15min interval):

Bad ≥ 10	Poor ≥ 1	

- TX Errors (Packets in 15min interval):

Bad ≥ 10	Poor ≥ 1	

- SFP Temperature (Celsius):

Bad ≥ 85	Poor ≥ 80	Fair ≥ 75

System Release R18 adds default thresholds for SFP Input Power (received optical level), on a per-SFP part number basis. Thresholds for the most widely used Ethernet and SDH SFPs are provided. You can configure thresholds for additional SFP devices, if needed.

You can change those thresholds according to your specific requirements. To access the user interface for threshold configuration, proceed as follows:

1 Open the Network Monitoring application.

2 Go to ‘Monitoring Session’ tab.

3 In the left panel select the Health Monitoring session (there is only a single session present).

4 Select ‘Threshold Configuration’ in the ribbon above the map.

3.2.2 Changing Global Default Thresholds

In the upper part of the threshold configuration view, one can see the default thresholds. Each threshold acts as the global threshold for all metrics of the given type.

To change a global default threshold, proceed as follows:

1 Select the threshold (metric type).

2 Press ‘Edit’.

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3 Change or enter values in the fields marked with the performance levels (‘Bad’, ‘Poor’, ‘Fair’). Remarks:

  a Fields may be left empty.

  b Change to ‘Decreasing’ order if a lower value indicates worse performance. This is typically used for negative values as applicable to metrics ‘SFP Input Power’ and ‘SFP Output Power’.

4 Leave the editor by pressing ‘Apply’.

5 Press ‘Save and Apply’ in the top right corner of the threshold configuration view.

3.2.3 Overriding Default Thresholds

In the lower part of the threshold configuration view, one can see the threshold overrides. You can use overrides to configure specific thresholds based on filter criteria. If the filter criteria are met, these thresholds will be used (rather than the default thresholds) to evaluate the performance state.

To add a threshold override, proceed as follows:

1 Press ‘New Override’.

2 In the ‘Health Monitor’ dropdown list, select the metric type.

3 Use the ‘Add Attribute’ button to add a filter.

4 In the value field, enter the filter value and press ‘Enter’; the tag will appear in the attribute value field.

5 Repeat steps 3) and 4) to add more filters as required.

6 Enter values in the fields marked with the performance levels (‘Bad’, ‘Poor’, ‘Fair’). Remarks:

  a Fields may be left empty.

  b Change to ‘Decreasing’ order if a lower value indicates worse performance. This is typically used for negative values as applicable to metrics ‘SFP Input Power’ and ‘SFP Output Power’.

7 Leave the editor by pressing ‘Apply’.

8 Press ‘Save and Apply’ in the top right corner of the threshold configuration view.

You can also remove or edit existing overrides.

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Please note:

If, for a specific metric, more than 1 override is configured, the more general definition is applied, and if two with the same level of details are specified, the more recent one is applied.

→ Avoid overlapping or contradictory threshold override configurations.

3.3 Changing SNMPv3 Passwords

If you need to change the SNMPv3 passwords, proceed as follows:

1 Stop Health Monitoring for all NEs (see section 3.1.3).

2 Establish an SSH connection to the FOXMAN-UN server.

3 Edit file /opt/nem/var/tmp/.telegraf_snmpv3_auth with sudo rights (e.g. sudo vim /opt/nem/var/tmp/.telegraf_snmpv3_auth), change passwords and save the file.

4 Restart FOXMAN-UN by executing command ‘nemstop’, followed by command ‘nemstart’.

5 Start Health Monitoring for the NEs again (see section 3.1.2).

Note:

All NEs must have the same SNMPv3 passwords.

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4 Operation

Once Health Monitoring has started collecting metrics from the network, there are different views that visualize the health status and the metrics.

4.1 Overall Status on Homepage

When selecting the ‘Performance Monitoring’ group of applications from the left panel of the homepage, two widgets associated with network monitoring are displayed on top.

The widget on the left, ‘Health Monitors’, gives an overview of the current performance state of the up to 11 health monitors. If there are any exceeded metrics, it displays the number of exceeded metrics per health monitor.

The widget on the right, ‘Network Elements’, gives an overview of the current performance state of the network elements that are configured for Health Monitoring. If there are any exceeded metrics, it displays the number of exceeded metrics per network element.

Both widgets provide a link to open the Network Monitoring application.

Two more widgets related to network performance are show below, ‘Clock Synchronization’ and ‘DCN Connection’.

4.2 Network Monitoring Application

4.2.1 Overview Tab

The overview tab is the dashboard for a quick overview of the network performance status and history. It provides **charts** over a time span (last 24 hours, last 7 days, last 30 days) selectable via the Global Time selector. The dashboard provides two views, which can be selected at the top right corner:

- Network: Overview of the current and historical state of the network
- Health Monitors: Performance state and statistical data per health monitor (i.e. per metric type)

Network Dashboard

On the top of the network dashboard, a set of donut charts reflects the **current** network state:

- Metrics Performance State: Current performance state distribution of all collected metrics (Note: The link at the top right corner opens the detailed list of exceeded metrics).
- NE Performance State: Current performance state distribution of all NEs.
- Section Performance State: Current performance state distribution of all sections.
- Health Monitors Performance State: Current performance state distribution of all health monitors.
- Metrics Validity: Current validity distribution of all metrics.
- NE Monitoring Status: Current monitoring status distribution of all NEs (Not Started, Running, Stopped, etc.).

Below the donut charts, two bar charts reflect the **historical** network state:

- Metrics Performance State History: Worst metric performance state distribution over last 24h / 7d / 30d.
- NE Performance State History: Worst NE performance state distribution over last 24h / 7d / 30d.

And finally, at the bottom right, there is a horizontal bar chart indicating the

- Current Worst Performing NE: Worst performing NEs with number and state of exceeded metrics.

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Health Monitors Dashboard

The network monitors dashboard provides two views, which can be selected by tabs on the title bar:

- **Performance State**: Current and historical performance state per health monitor

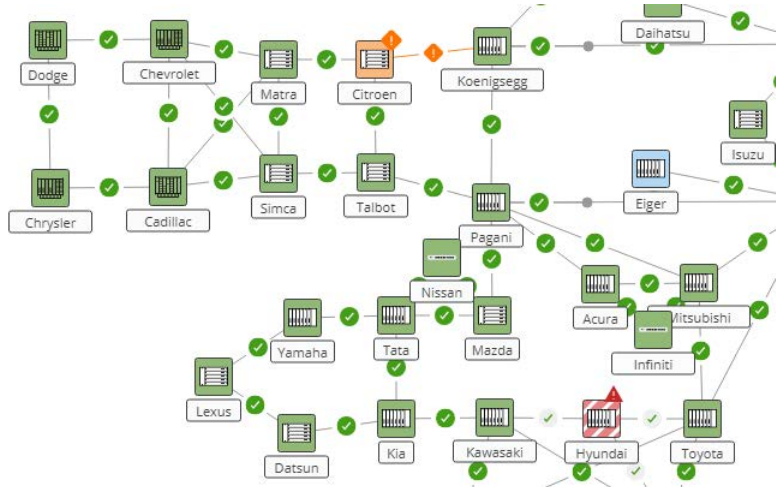
  This view breaks down the current metrics distribution and worst historical performance state to the individual health monitors (i.e., metric types). Time intervals are selectable: 24 hours, 7 days, or 30 days.
- **Values**: Statistical key figures per health monitor over time

  Statistical key figures for metrics of the same type are calculated and displayed over time to provide statistical insights in the form of line charts. The line charts contain the trends for minimum value, maximum value, average and 20th/80th percentiles. Time intervals are selectable: 24 hours, 7 days, or 30 days.

4.2.2 Map

The network monitoring map is displayed in all tabs except the ‘Overview’ tab. It shows the network elements and the sections according to their aggregated performance state and validity. See example in the screenshot below.

- The performance state defines the color:
  - Ok = green,
  - Fair = blue,
  - Poor = orange,
  - Bad = red,
  - Unmonitored, Unavailable = white.
- The validity defines the pattern:
  - Current = solid,
  - Outdated = striped/dashed,
  - No Data = empty.



Under ‘View Options’ in the top right corner of the map you can also enable alarm coloring. In this case, the colors indicating performance state are overlaid with the colors indicating alarm severity.

You can click on an NE or a section on the map to see the details on the right panel. You get the same view when you are in tab ‘Section’ or ‘NE’ and select the entity in the left panel. See the detailed description of the tabs in the sections below.

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4.2.3 Health Monitor Tab

Select the ‘Health Monitor’ tab to see a list of all health monitors and their aggregated performance state and validity, together with the network map. You can resize the left panel to medium or large size to see more attributes of the health monitors.

Each health monitor aggregates the metrics of the related type. When you select a specific health monitor you have the following choice for viewing the metrics:

- View all metrics by clicking on the metrics symbol in the ribbon or in the right panel, or from the right-click menu of the selected health monitor.
- The network elements with available metrics are marked with the related performance state color on the network graph or on a customized map.

The metrics table can be filtered and sorted for deeper analysis.

4.2.4 Monitoring Session Tab

Select the ‘Monitoring Session’ tab to see the single health monitoring session and its aggregated performance state and validity. You can resize the left panel to medium or large size to see more attributes of the monitoring session.

The monitoring session represents the highest aggregation point for metrics, i.e., it aggregates all the metrics collected for Health Monitoring. When you select the monitoring session you have the following choice for viewing the metrics:

- View all metrics by clicking on the metrics symbol in the ribbon or in the right panel, or from the right-click menu of the selected monitoring session.

The metrics table can be filtered and sorted for deeper analysis.

4.2.5 Section Tab

Select the ‘Section’ tab to see a list of all sections and their aggregated performance state and validity. You can resize the left panel to medium or large size to see more attributes of the sections.

Each section aggregates the metrics of ports, units, and NEs of both section endpoints (A-end and Z-end). When you select one specific section, you have the following choice for viewing the metrics:

- View all metrics by clicking on the metrics symbol in the ribbon or in the right panel, or from the right-click menu of the selected section.
- View only the metrics which exceeded any thresholds by clicking on ‘Port Metrics’, ‘Unit Metrics’, and ‘NE Metrics’ in the right panel under ‘Related Metrics’ with a performance state of ‘Fair’, ‘Poor’, or ‘Bad’. (Note that only the port metrics are used to determine the section color on the map.)

The metrics table can be filtered and sorted for deeper analysis.

4.2.6 NE Tab

Select the ‘NE’ tab to see a list of all network elements and their aggregated performance state and validity. You can resize the left panel to medium or large size to see more attributes of the NEs (in particular, the ‘Performance State’ indicating whether or not Health Monitoring is running on an NE).

Each NE aggregates its metrics on NE, unit, and port level. When you select a specific NE, you have the following choice for viewing the metrics:

- View all metrics by clicking on the metrics symbol in the ribbon or in the right panel, or from the right-click menu of the selected NE.

The metrics table can be filtered and sorted for deeper analysis.

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4.2.7 Metrics

The metrics window can be opened from different locations, e.g. for a specific health monitor, a specific NE, etc. Metrics are shown as Details or as Summary.Details

Details

Details are displayed in tabular form as

- Current State (showing the most current value and performance state of each metric), or as
- Worst Historical State (showing the worst performance state in the last 24h / 7d / 30d for each metric).

If the option “Show Line Chart” is set, a line graph for the selected metric is displayed. Up to 5 metrics of the same type can be displayed on the line chart.

Table

The table provides the following columns in the ‘Basic’ view (default):

- Name,
- Time,
- Value,
- Unit,
- NE,
- Location,
- SFP Type,
- SFP Part Number,
- Performance State,
- Validity,
- Expected Range.

As usual, columns can be shown or hidden via the table columns icon at the bottom right of the table view.

Line Chart

Using the line chart, you can examine the trend of a metric over time. In detail, you can

- display the line graph of a metric over a configurable time window (last 24h / 7d / 30d),
- see the thresholds assigned to the metric,
- mark the period for which the metric has a ‘Bad’ performance state,
- hover over the graph to see the metric value at the given time,
- zoom-in and slide the zoomed window along the time axis,
- display up to 5 metrics of the same type to compare their trends, and
- save the chart as image (PNG file).

Summary

The summary shows donut charts and bar charts for the relevant set of metrics. For example, if the metrics window is opened for a specific health monitor, the charts reflect the metrics of the given metric type. The diagrams include:

- Number of available metrics,
- Current metric performance state distribution,
- Metrics validity,
- Worst metric performance state distribution over last 24h / 7d / 30d (not available for sections).

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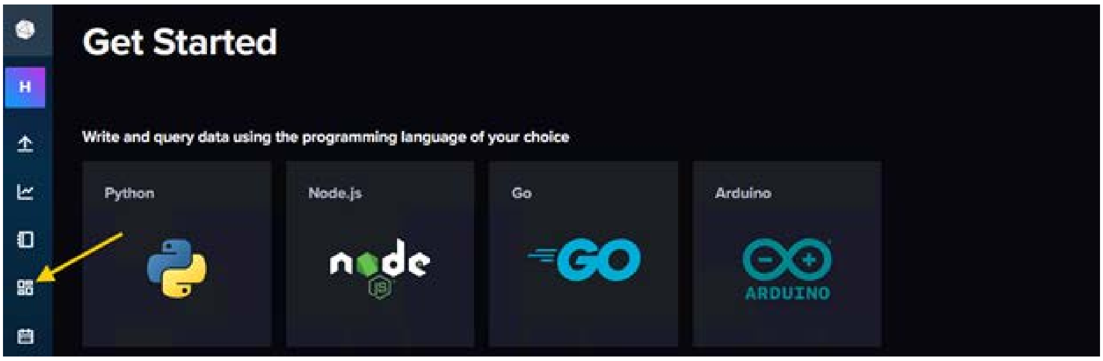
4.2.8 Export of Metrics

You can export metrics to a CSV file by proceeding as follows:

1 Select the ‘Health Monitor’ tab and click on ‘Open Metrics Database’ in the ribbon. This opens the InfluxDB user interface.

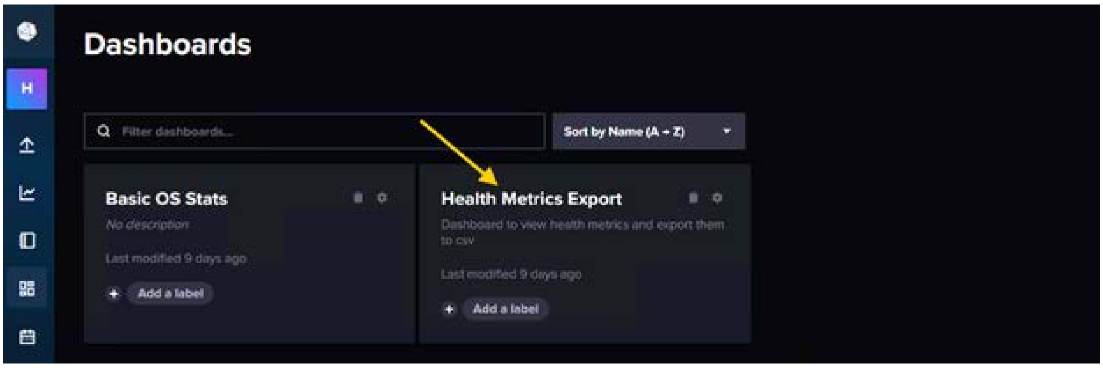
2 Change to ‘Dashboards’ view



Get Started

Write and query data using the programming language of your choice

3 Open dashboard ‘Health Metrics Export’



Dashboards

Basic OS Stats

No description

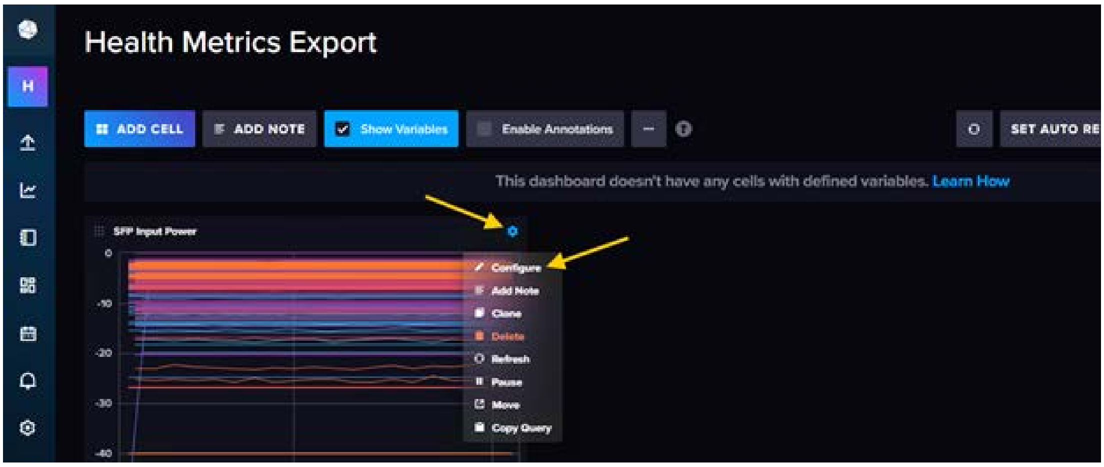
Last modified 9 days ago

Health Metrics Export

Dashboard to view health metrics and export them to csv

Last modified 9 days ago

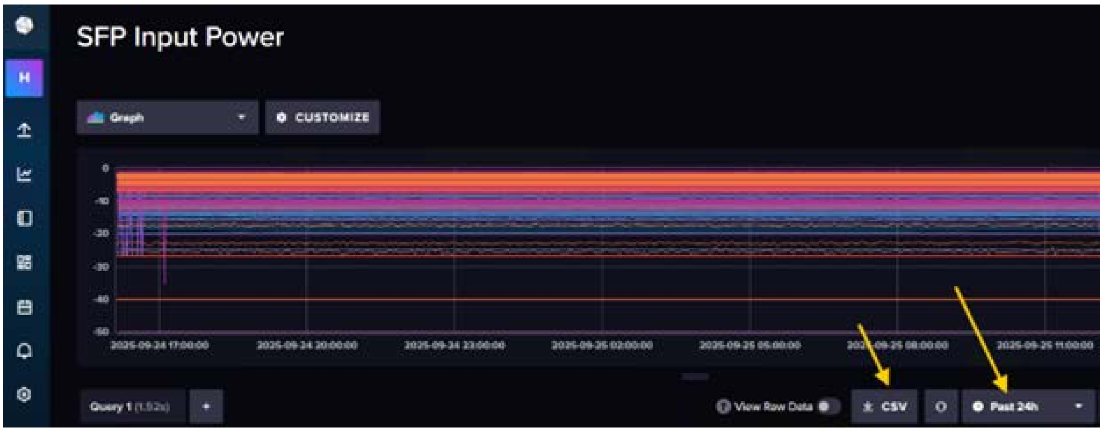
4 For a given metric type, open settings and select ‘Configure’



Health Metrics Export

This dashboard doesn't have any cells with defined variables. Learn How

5 Select time range (e.g. “Past 24h”) and download CSV file



5 Annex

5.1 Troubleshooting

5.1.1 Situation: No or not all Metrics Collected for an NE

Description:

On the map, the NE has a white color, and the metrics table is empty. Or metrics for some units or ports of an NE are missing.

Solution/workaround:

There are multiple reasons why metrics are not being collected from an NE. Proceed as follows to resolve this issue:

1. Check that the NE is manageable
2. Check the health monitoring status in the right panel when NE is selected:
   a. If the status is ‘Not Started’ or ‘Stopped’, then start Health Monitoring.
   b. If the status is ‘Running’, then stop Health Monitoring and start it again.

5.1.2 Situation: Outdated Metrics

Description:

There are metrics with ‘Outdated’ validity (indicating that the metrics are older than 1 hour).

Solution/workaround:

Outdated metrics are a normal situation if Health Monitoring has been stopped on an NE, or if a unit or an SFP has been physically removed or unassigned from the NE. It can also happen after unit software upgrade. After 24 hours the outdated metrics will be automatically cleared from the metrics table.

5.1.3 Situation: Health Monitoring Status Indicates Error

Description:

When starting Health Monitoring on an NE, health monitoring status shows 'SNMPV3_Error'.

Solution/workaround:

A possible cause for this error is that FOXMAN-UN cannot connect to the NE as another system, e.g., FOXCST, is connected to the same NE as 'Session Manager'. Resolution: Log out with the other system (e.g., FOXCST), then stop Health Monitoring and start it again.

5.2 Upgrade from Previous Release

Health Monitoring is supported as of FOXMAN-UN R17A.

Health Monitoring is supported for networks running system releases R16B and up. However, the following restrictions apply:

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Networks running system release R16B:

- SENC1 units don’t support metrics “SFP Input Power”, “SFP Output Power”, SFP Temperature”.
- SENC1 units don’t support metrics “RX Errors”, “TX Errors”, “RX Throughput”, “TX Throughput”.
- SAMOx units don’t support metrics “SFP Input Power”, “SFP Output Power”, SFP Temperature”.

Networks running system release R17A:

- SENC1 units don’t support metrics “RX Errors”, “TX Errors”, “RX Throughput”, “TX Throughput”.
- SAMOx units don’t support metrics “SFP Input Power”, “SFP Output Power”, SFP Temperature”.

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Please note:
When upgrading FOXMAN-UN from a previous system release to R18, existing PM Collector jobs may collect counters that will also be collected by the dedicated ‘HEALTH_MONITOR’ job once Health Monitoring is started on NEs. In general, this is not a problem; however, to save performance and DCN bandwidth, it is recommended to delete obsolete PM jobs.

If Health Monitoring is active on FOXMAN-UN R17A before upgrading to R18, it is recommended to stop Health Monitoring and restart it on the relevant NEs after upgrading to R18. This ensures that newly supported units introduced in R18 are properly included in the monitoring process.

5.3 Other Operational Considerations

5.3.1 DCN and Scalability

Network monitoring places additional load on the Data Communication Network (DCN). Monitoring 200 NEs typically requires around 1 Mbit/s of DCN bandwidth.

To support more than 200 NEs, it is recommended to optimize the DCN design in the network core to prevent bottlenecks. For example, using a VPLS between ABR nodes, connected to an EROP1 router unit at the gateway nodes to the FOXMAN-UN, can improve network scalability and performance.

For large networks, a good practice is to start Health Monitoring with 50 NEs, and then gradually increase the number as needed.

5.3.2 Metrics Collection in Main-Standby Setup

In a redundant FOXMAN-UN setup, the InfluxDB Telegraf agent is not running on the standby server (i.e., Telegraf is stopped when FOXMAN-UN is stopped). Consequently, no InfluxDB data collection will happen on the standby server, including any server internal data collection.

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Please note:
The FOXMAN-UN database backup file includes Health Monitoring configuration data but does not include the metrics data by default.

→ When creating and restoring a backup using the command line commands ‘edbackup’ and ‘edbrestore’, the -x option includes metrics data stored in InfluxDB. However, this option should not be used in productive environments.

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5.3.3 Remote Executor Scripts

Health Monitoring related Remote Executor scripts (‘Configure Healthmonitoring’ and ‘Stop Healthmonitoring’) are for internal use only. Do not execute them from Remote Executor.

5.3.4 NE Uptime Rollover

The ‘NE Uptime’ metric resets after approximately 497 days (the maximum value is 497 02:27:52). Once this limit is reached, the metric automatically rolls over and starts again from zero.

5.4 Known Limitations

5.4.1 SENC1 Units Don’t Provide all Health Metrics

SENC1 units don’t provide the same full set of health metrics as other Ethernet units. They don’t provide

- CPU Load,
- Memory Usage.

5.4.2 40G QSFPs Don’t Provide Health Metrics

40G QSFPs (e.g. type 40GbaseLR4) as supported by EPEX1 port-5 don’t provide the SFP metrics

- SFP Input Power,
- SFP Output Power,
- SFP Temperature.

5.4.3 Only Partial Support of ‘Use 40G with 4 SFPs’ Mode

EPEX1 supports the configuration of mode ‘Use 40G with 4 SFPs’ where SFPs are plugged in ports 1 to 4 and the logical 40G port is modeled as port-5. This configuration is only partially supported by Health Monitoring. The issue is that SFP metrics are stored under ports 1-4 in InfluxDB while the FOXMAN-UN uses port-5 as the section end point.

5.5 Associated Documents

[1KHW002499]	Release Note “FOXMAN-UN”

5.6 Document history

Table 1: Document History

Document ID	FOXMAN-UN Release	Rev	Date	Changes since previous version
1MRC000115-FR17A	R17A	A	Sept 2024	First version for release R17A.
1MRC000115-FR18	R18	A	Sept 2025	Reworked for release R18.

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