

Date: **Feb 2025**Distribution: **Public**Reference: **380**

# Perception Server

## v2.4.8 - Feb 2025

### Key new features

#### **Enhanced Support of GE Vernova's Kelman DGA 900 Plus, BMT 430 and DGA 900 TapTrans Plus**

- Kelman DGA900 Plus, BMT430 and DGA900 Tap Trans Plus now supports External Partial Discharge (PD) Discrimination.
- External PD added in Status, Data table and Trend Chart Worksheets.
- Internal and External Bushing indication added in PRPD Worksheet.
- Introduction of 4 quadrants in PRPD Worksheet to represent the Cycle shift value with color coding.
- Added Subcategory for Internal and External PD selection in Partial Discharge worksheet.
- Introduced External Partial Discharge tab in Dashboard worksheet.

#### **Enhanced Support of GE Vernova's Kelman DGA 900 TapTrans Plus**

- Support has been added for the Kelman DGA 900 TapTrans Plus for 9 Bushings Monitoring.
- The following worksheets workbooks have been added: Properties, Data Table, Status, Trend Chart, Bushing Monitor, Partial Discharge, PRPD, Inter-Phase Angle and Web Browser.
- Kelman DGA 900 TapTrans Plus with Bushings Monitoring data can be exported and imported.
- Added Bushings Monitoring Alarms and Top oil Sensor in Status and Data Table Worksheet.
- Added Bushings Algorithm to support the Kelman DGA 900 Tap Trans Plus.

#### **Duval Diagnostics for Ester oils added for GE Vernova's Kelman DGA 900 TapTrans Plus, DGA 900 Plus, DGA 900, MultiTrans PLUS, Transfix 1.6, TapTrans, MultiTrans**

- New Duval Triangle and Pentagons for ester oils in Duval Worksheet.
- Introduced a selection drop down for triangles and pentagon in Duval worksheet.
- Introduced a selection drop down for Liquid Type - Mineral and Ester Oils.
- The existing Mineral Oil Triangles are renamed as below:
  - Classic as Triangle 1 Mineral Oils
  - 4-Low Temperature Faults as Triangle 4 LTF Mineral Oils
  - 5-Low Temperature Faults as Triangle 5 LTF Mineral Oils
  - LTC as LTC Triangle 2
  - LTC Triangle 2 MR (This is only available for Oil source 2 or Diverter).

- Below are the new Triangles added for Ester Liquids
  - Natural Ester Triangle 3 FR3
  - Synthetic Ester Triangle 3 Midel 7131
  - Natural Ester Triangle 3 Sunflower
  - Natural Ester Triangle 6 LTF FR3 Oils
  - Natural Ester Triangle 7 LTF FR3 Oils
- The existing Mineral oil Pentagons are renamed as below
  - Pentagon 1 as Mineral Oil -Pentagon 1
  - Pentagon 2 as Mineral Oil -Pentagon 2
- Below are the new Pentagons added for Ester Liquids
  - Natural Ester Pentagon 3 soybean
  - Natural Ester Pentagon 3 Rapeseed
  - Natural Ester Pentagon 3 Sunflower
  - Synthetic Ester Pentagon 3 Synthetic
- As per IEEE C57.104 standard Gas Color coding has been modified in Trend Chart and TDCG Worksheet.

### **Notable bug fixes**

- Hydran – Increased CT limit range.

## **v2.4.7 - Sep 2024**

### **Key new features**

#### **Enhanced Support of GE Vernova's Kelman DGA 900 Tap Trans**

- Kelman DGA900 TapTrans now supports Models - Cooling, Thermal and OLTC
- Kelman DGA900 TapTrans Thermal and Cooling Oil Source data varies as per the DGA input source.
- Kelman DGA900 Taptrans with Models data can be exported and imported.
- Added Cooling, Thermal and OLTC related data in Status and Data Table Worksheet.
- Added Models in Workflow association to support the DGA900 TapTrans.

Perception - License activation mechanism is modified, updated the manual activation screen so it provides contact details the user will use to send us the license key for activation.

### **Notable bug fixes**

- Kama Solutions - No Green tick denoting healthy perception data is resolved.

## **v2.4.6 - Jun 2024**

### **Key new features**

#### **Enhanced Support of GE Vernova's Kelman DGA 900 PLUS**

- Kelman DGA900 PLUS now supports BMT430 data points

- Kelman DGA900 PLUS with Bushing Monitoring data can be exported and imported
- Added Bushing Monitoring Alarms and Top oil Sensor in Status and Data Table worksheet
- Added Bushing Algorithm to support the DGA900 PLUS
- Added Polar Plot Amplitude PD gauges under Dashboard → Partial Discharge

### **Notable bug fixes**

- Perception - tmw.scl.dll issue from client side is resolved.
- Fixed PRPD Plot not displaying in BMT430 Asset defect → PRPD Worksheet.
- Fixed Import/Export functionality for PRPD Plot BMT430 and DGA900 PLUS
- Fixed Service log retrieval and send in Perception service notification email
- Fixed Display TDHC data in Data table and Status worksheets.

## **v2.4.5 - Mar 2024**

### **Key new features**

#### **Support of GE's Kelman BMT430 with Bushing Monitoring (BETA)**

- Support has been added for the Kelman BMT430 with 9 Bushing Monitoring.
- The following worksheets workbooks have been added: Properties, Data Table, Status, Trend Chart, Bushing Monitor, Partial Discharge, PRPD, Inter-Phase Angle and Web Browser.
- Kelman BMT430 with Bushing Monitoring data can be exported and imported.
- Added Bushing Monitoring Alarms and Top oil Sensor in Status and Data Table Worksheet.
- Added Bushing Algorithm to support the BMT430.
- Added Polar Plot Amplitude PD gauges under Dashboard → Partial Discharge.

#### **TFC Support of GE's Kelman DGA 900 TAPTRANS**

- TFC Support has been added for the Kelman DGA 900 TAPTRANS.
- TFC Monitoring, TFC Event and Inrush Events are Shown in Data Table and Status Worksheets.
- TFC Support data can be exported and imported.

### **Notable bug fixes**

- OLTC Motor Torque – Fixed oltc motor torque bottom graph needs y axis extended to show all plots.
- Status Worksheet – Fixed Invalid DINs in Status Worksheet.
- Fixed Removed Integrated alarm point in BMT 430 from Status Worksheet.
- Fixed Remove Bushing profiles , Bushing name , phase a , b ,c name , Bushing Ref from Status Worksheet.
- Fixed Primary secondary tertiary should be in sequence for BMT 430 in Status Worksheet.
- Fixed Bushing Monitors should not be under the same Transformer Bank/Transformer in Asset Explorer.
- Fixed REQ-FS-0207 - GS-03086900 – Voltage value shows wrongly in Status Worksheet raised by customer.
- Fixed Import/Export functionality for OLTC Motor Torque Top and Bottom half graph data.

# v2.4.4 - Nov 2023

## Key new features

### Enhanced OLTC Models support.

For Kelman DGA 900 PLUS monitors with OLTC models support has been upgraded.

- OLTC Temperature model now display a common trend chart with single vertical axis.
- OLTC Tap Position model now displaying "Tap Position Counts" table , "Position Counter" bar graph, "Cumulative Time" bar graph and a trend chart below the bar graphs: "OLTC number of operations" with two trends: "Operations per Hour" and "Operations per Day", with a common vertical axis. The date range is used, the trend chart will be updated as usual. However, the bar graphs will show and incremental bar graph (values at the end date minus values at the start date). The table will also reflect these values.
- OLTC Motor Torque now has two halves namely Top Half and Bottom half.
  - Top Half - A trend chart will be shown displaying the "Final Tap Position" data for all the records within the date range. Right clicking on it will open a standard menu, including the "Add/Remove Measurements Points". It will not be possible to remove the "Final Tap Position" data from the chart. No additional vertical axis to be shown for additional data. Additional data range default given by max and min value displayed. Changeable by menu below or by double-clicking on the legend item as per standard. Zooming in and out as per the trend chart standard. Clicking on a single data point will display the information associated to this record in the bottom half. The data point will then be highlighted.
  - Bottom Half - If a single sequence is selected from the top half, the bottom half will show a torque profile chart (Power Reference, Power and Position vs time). Left axis to be that of Power in W, and the right axis to be that of Position (no units). Default axis range for power is from 0 to max of Power Reference and Power. Default axis range for Position is from 1 to number of OLTC positions. On the right of the bottom half there will be a Reference table. The Table will display the reference and record torque parameters

### 859 Relay support.

Support has been added for the new 859 Relay device.

- 869 Asset type has been modified to 869/859 Relay. Upon downloading relay , perception can identify the relay type and updates in the application.
- 859 relay has the same number of worksheets as 869 relay.
- 869 Motor Ranking has been updated to 869/859 Motor Ranking under workflows in Motor Properties worksheet.

### Support for TLS 1.2

- Support for TLS 1.2 has been added for the SMTP email facility.

### Upgrade procedure

- Software upgrade is performed automatically by the installers.
- No database upgrade required.

## v2.4.3 - Mar 2023

### Key new features

#### Enhanced Kelman DGA 900 PLUS support

For Kelman DGA 900 PLUS monitors with bushing monitoring support for 9 bushing configurations has been implemented.

When a Kelman DGA 900 PLUS is monitoring 9 bushings the data for the 3<sup>rd</sup> set of bushings will be analysed along with the 1<sup>st</sup> and 2<sup>nd</sup> bushing sets using the “Bushing Standard” workflow.

#### Upgrade procedure

- Software upgrade is performed automatically by the installers.
- No database upgrade required.

## v2.4.2 - Dec 2022

### Key content

- Minor enhancements and bug fixes.

## v2.4.1 – June 2021

### Key new features

#### Support of GE's Kelman DGA 900 MULTITRANS

Support has been added for the new Kelman DGA 900 MULTITRANS device.

The Kelman DGA 900 MULTITRANS supports multiple oil sources, typically from the main tanks of single phase transformers used in a transformer bank.

The following worksheets are available for the Kelman DGA 900 MULTITRANS: Properties, Data Table, Status, TDCG, Trend Chart, Key Gas, Gas Ratios, Ratios, ETRA and Duval's.

Users can download data and alarms from the Kelman DGA 900 MULTITRANS via Network media and HTTP/HTTPS protocol.

If Bushing Monitoring is enabled on the Kelman DGA 900 MULTITRANS the following additional functions are available:

- Bushing Monitoring, Partial Discharge, PRPD and Inter-Phase Angle worksheets

Kelman DGA 900 MULTITRANS data can be exported and imported.

### **Support of GE's Kelman DGA 900 TAPTRANS**

Support has been added for the new Kelman DGA 900 TAPTRANS device.

The DGA 900 TAPTRANS supports multiple oil sources, typically from the main tank, selector tank and divertor tank of a transformer.

The following worksheets are available for the Kelman DGA 900 TAPTRANS: Properties, Data Table, Status, TDCG, Trend Chart, Key Gas, Gas Ratios, Ratios, ETRA and Duval's.

Users can download data and alarms from the Kelman DGA 900 TAPTRANS via Network media and HTTP/HTTPS protocol.

If Bushing Monitoring is enabled on the Kelman DGA 900 TAPTRANS the following additional functions are available:

- Bushing Monitoring, Partial Discharge, PRPD and Inter-Phase Angle worksheets

Kelman DGA 900 TAPTRANS data can be exported and imported.

## **v2.4.0 – March 2021**

### **Key new features**

#### **Kelman DGA 900 ROC Workbook**

The rate of change (ROC) workbook has been added for the Kelman DGA 900. The ROC workbook displays a rate of change trend chart based on either the ROC values set and downloaded from the Kelman DGA 900 or values manually entered on the ROC workbook.

The ROC calculation used when the values are set manually calculates ROC as PPM per Day.

#### **Kelman DGA 900 PLUS with Models Tap Position**

A bar graph has been added to the OLTC Tap Position workbook of the Kelman DGA 900 Plus with models. The bar graphs visualise the number of times the OLTC has been in a certain tap position for Permanent Count, Resettable Count and Maintenance Count.

### **CBWatch3 Time Zone**

Perception can now determine the time zone set in the CBWatch3 when downloading data to ensure the consistency of the timestamps on both the CBWatch3 and Perception.

### **INTELLIX BMT 330 Enhancement**

The time-line slide bar on the Bushing Monitoring & Partial Discharge workbooks has been enhanced to show the selected date range.

## **v2.2.2**

### **Key new features**

#### **Support of GE's Kelman DGA 900 PLUS with Bushing Monitoring**

Support has been added for the Kelman DGA 900 PLUS with Bushing Monitoring.

The following worksheets additional workbooks have been added: Bushing Monitoring, Partial Discharge, PRPD and Inter-Phase Angle .

Kelman DGA 900 PLUS with Bushing Monitoring data can be exported and imported

#### **Hydran M2-X Firmware Version Identification**

An enhancement has been made the Hydran M2-X firmware version identification to support the display of firmware versions followed by a letter, for example 5.05b.

The firmware version field in the Hydran M2-X properties page will now contain the letter as well as the firmware numbers.

#### **Operating System Support**

The Perception applications are now supported on the following Microsoft® Operating Systems:

- Windows Vista
- Windows 7
- Windows 8
- Windows 8.1
- Windows 10
- Windows Server 2003

- Windows Server 2008
- Windows Server 2012
- Windows Server 2016
- Windows Server 2019
- SQL Server 2008 R2
- SQL Server 2012
- SQL Server 2014
- SQL Server 2016
- SQL Server 2017
- SQL Server 2019

## v2.2.1

### Key new features

#### **Support of GE's Kelman DGA 900 PLUS**

Support has been added for the new Kelman DGA 900 PLUS device.

The following worksheets are available for the Kelman DGA 900 PLUS: Properties, Data Table, Status, TDCG, Trend

Chart, Key Gas, Gas Ratios, Ratios, ETRA, Duval's and Models.

As per the enhanced capability of the Kelman DGA 900 PLUS, users can view models developed using standards such as IEEE C57.91 (2011) which provides the following information:

- Dynamic loading
- Insulation aging
- Moisture in oil
- Moisture in winding insulating barrier
- MVA
- Cooling efficiency
- Cooling condition
- OLTC temperature
- OLTC tap position
- OLTC motor torque
- Winding Hot Spot Temperature (WHST)

Users can download data and alarms from the Kelman DGA 900 PLUS via Network media and HTTP/HTTPS protocol

DGA Standard and Simplified DGA workflow support is also available for the

DGA 900 PLUS Kelman DGA 900 PLUS data can be exported and imported

#### **Support of GE's 869 Motor Protection Relay**

Support has been added for GE's 869 motor protection relay running firmware version 2.00 or later.

869 motor protection relay assets have the following workbooks available for capturing and visualising data; Properties, Data Table, Status, Trend Chart.

Perception currently supports the download, visualisation and alarm notification of specific data, namely:

#### Breaker

BKR1 Closed (BKR1 Closed) (Alarm Support)  
BKR1 Hlth PKP (Alarm Support)  
BKR1 Opened (BKR1 Opened) (Alarm Support)  
Arcing Current Total (Alarm Support)  
Arcing Current Per Phase (Alarm Support)  
Breaker Close Time (Alarm Support)  
Breaker Avg. of Close Time (Alarm Support)  
Breaker Avg. of 5 Close Time (Alarm Support)  
Arc Energy Per Phase (Alarm Support)  
Arc Time Per Phase (Alarm Support)  
Spring Charge Time (Alarm Support)  
Total Breaker Trips  
Trip Time (Alarm Support)  
Trips Since Last Reset Alarm Counter  
Avg. of Charge Time (Alarm Support)  
Avg. of 5 Charge Time (Alarm Support)  
Avg. of Arc Energy Per Phase (Alarm Support)  
Avg. of 5 Arc Energy Per Phase (Alarm Support)  
Avg. of Arc Time Per Phase (Alarm Support)  
Avg. of 5 Arc Time Per Phase (Alarm Support)  
Avg. of Trip Time (Alarm Support)  
Avg. of 5 Trip Time (Alarm Support)  
Current Trip PKP/OP Events IOC/TOC/NOC/OC/Cur  
Voltage Trip PKP/OP Events OV/UV  
Frequency Trip PKP/OP  
Events Overfreq/Underfreq  
Motor Trip PKP/OP  
Breaker Trip PKP/OP

#### Motor

Motor Overload  
Motor Running  
Motor Starting  
Motor Stopped

#### Motor Load

Average Run Time  
(Days) Average Run  
Time (Min) Learned  
Average kvar Learned  
Average kW Learned  
Average Load Learned  
Average PF

#### Motor Start Characteristics

Last Acceleration Time  
Last Start TCU  
Last Starting Current  
Learned Acceleration

Time Learned Start  
Current Learned Start  
TCU

Motor

Thermal

RTD1 Max  
RTD10 Max  
RTD11 Max  
RTD12 Max  
RTD2 Max  
RTD3 Max  
RTD4 Max  
RTD5 Max  
RTD6 Max  
RTD7 Max  
RTD8 Max  
RTD9 Max

Motor Start Statistics

Start Acceleration  
Time Start Effective  
Current Start Peak  
Current  
Bearing Sub-System  
Energy at Peak Mag @k=1  
Energy at Peak Mag @k=2  
Energy at Peak Mag @k=3  
Max Change in Energy @k=1 (Alarm Support)  
Max Change in Energy @k=2 (Alarm Support)  
Max Change in Energy @k=3 (Alarm Support)  
Max Change in Freq @k=1  
Max Change in Freq @k=2  
Max Change in Freq @k=3  
Max Change in Mag @k=1 (Alarm Support)  
Max Change in Mag @k=2 (Alarm Support)  
Max Change in Mag @k=3 (Alarm Support)  
Norm Peak Freq @k=1  
Norm Peak Freq @k=2  
Norm Peak Freq @k=3  
Norm Peak Magnitude @k=1  
Norm Peak Magnitude @k=2  
Norm Peak Magnitude @k=3

Load Sub System

Load Load Bin J1 I AVG Speed  
Thermal Capacity Used

Mechanical Sub-System

Energy at Peak Mag @k=1  
Energy at Peak Mag @k=2  
Energy at Peak Mag @k=3  
Max Change in Energy @k=1 (Alarm Support)  
Max Change in Energy @k=2 (Alarm Support)  
Max Change in Energy @k=3 (Alarm Support)  
Max Change in Freq @k=1  
Max Change in Freq @k=2  
Max Change in Freq @k=3

Max Change in Mag @k=1 (Alarm Support)  
Max Change in Mag @k=2 (Alarm Support)  
Max Change in Mag @k=3 (Alarm Support)  
Norm Peak Freq @k=1  
Norm Peak Freq @k=2  
Norm Peak Freq @k=3  
Norm Peak Magnitude @k=1  
Norm Peak Magnitude @k=2  
Norm Peak Magnitude @k=3

#### Rotor Sub-System

Component Frequency(BRB)  
Component Level(BRB)  
(Alarm Support) Motor load at BRB  
Calculation(xFLA)

#### Stator Sub-System

Energy at Peak Mag  
Max Change in Energy (Alarm Support)  
Max change in Freq  
Max Change in Mag (Alarm Support)  
Norm Peak Freq  
Norm Peak Magnitude  
Operating Quantity(SITF) (Alarm Support)

#### Supply Sub-System

Current  
Unbalance  
Frequency  
J1 Phase A  
THD J1  
Phase B THD  
J1 Phase C  
THD J2 V  
AVG L-L

#### Other

Reset  
OP(PB)

The communication method currently supported is via Network media and MODBUS protocol for data download. To enable 869 motor protection relay support please contact your GE sales representative.

### **Plant and Motor Assets**

As part of the 869 motor protection relay integration 2 additional asset types have been added to Perception. A new motor asset is now available which can be used as the parent of the 869 motor protection relay in the asset explorer. As well as data downloaded from the 869 motor protection relay, motor data can also be imported using the CSV file import mechanism.

Motor assets have the following workbooks available for capturing and visualising data; Properties, Wallboard, Data Table, Status, Trend Chart.

The motor properties page can be used to capture specific information about the motor being monitored. The motor asset is enabled as part of the 869 protection relay support.

A new plant asset is now available which can be used as the parent for transformer and motor assets. The plant asset is used to represent an industrial plant where a motor or transformer being monitored resides.

Plant assets have a wallboard workbook.

### **CBWatch3 Data Download Enhancement**

Support has been added for the download and visualisation of operational and other data from the CBWatch3 running firmware version 4.1.0 or higher, specifically:

#### **Opening Data**

##### Last Opening Operation Data

Last operation date and time  
Opening operation counter  
52a contact switching time  
Opening reaction time (t1)  
Opening contact separation time (ts)  
52b contact switching time  
Opening operation time  
(t2) Opening travel time  
(t2-t1) Opening contact  
separation speed  
Overtravel  
Coil circuit DC voltage source 1  
Coil circuit DC voltage  
source 2 \* Outside  
ambient temperature  
Arching Contact Wear  
Interrupted current  
(RMS)  
Arcing time  
Cumulated contact  
electrical wear  
Coil Current  
Mean coil current -  
Open 1  
Mean coil current -  
Open 2  
Coil actuation charge -  
Open 1  
Coil actuation charge -  
Open 2  
Coil resistance - Open 1  
\*  
Coil resistance - Open 2  
\*

#### **Closing Data**

##### Last Closing Operation Data

Last operation date and time

Time elapsed since previous opening operation  
Closing operation counter  
52b contact switching time  
Closing reaction time (t1)  
52a contact  
switching time  
Closing operation  
time (t2) Closing  
travel time (t2-t1)  
Closing contact  
touching speed  
Overtravel  
Coil circuit DC voltage  
source 1 \* Outside  
ambient temperature  
Coil Current  
Mean coil current - Closing  
Coil actuation charge - Closing  
Coil resistance - Closing \*

#### Spring Rewind Operation

Spring rewind time  
Cumulative spring rewind motor time  
Number of spring rewinds  
Mean rewind motor current  
Max rewind motor inrush current

#### **Pump Data**

Last Pump  
Operation Data Last  
pump start date and  
time Last pump  
stop date and time  
Pump status (on/off) - NOT  
DISPLAYED\*\* Last pump run  
time  
Maximum pump motor inrush current  
Number of pump starts/24h  
Number of CB operations /24h  
Pump starts without CB  
operation /24h \* Pump run  
time /24h  
Cumulative pump run time

#### **Continuous Measurements**

Gas  
Gas pressure measured  
Gas temperature measured  
Gas moisture level measured  
Gas density  
Gas pressure at 20°C  
Gas liquefaction pressure at 20°C  
Short-term gas pressure leak rate  
Long-term gas pressure leak rate  
Long-term gas mass leak rate \*  
Long term gas % leak rate \*  
Gas short-term extrapolated pressure at 20°C

Gas long-term extrapolated pressure at 20°C

Position 52a/52b Contacts

Previous operation type

52a (ON=CB Closed, OFF=CB Open)

52b (OFF=CB Closed, ON=CB Open, )

CB contact position

DC Voltage Sources

Coil circuit DC voltage source 1

Coil circuit DC voltage source 2

**Temperature Sensors**

Outside ambient temperature

Temperature 1 - User specified

Temperature 2 - User specified

Temperature 3 - User specified

Temperature 4 - User specified

Temperature 5 - User specified

Temperature 6 - User specified

Temperature 7 - User specified

Temperature 8 - User specified

Delta to ambient temperature

**Other**

Additional Channels

Gen 1 - User specified

Gen 2 - User specified

Gen 3 - User specified

Gen 4 - User specified

The data is currently downloaded from the CBWatch3 modbus registers, hence when an event occurs these registers are overwritten with the new values.

Perception applies special logic for the download of Open, Close and Pump values which are only updated and hence downloaded if an event has occurred on the CBWatch3. Continues and Risk Index data will only be downloaded if at least 4 hours has passed since last stored measurement. This allows user to configure a frequent download schedule for the CBWatch3 without the risk of creating duplicate data thus creating a more accurate historical record of data in Perception.

The data can be visualised in the trend chart, data table and status worksheets in Perception.

**MS 3000 Download Performance Enhancement**

Support has been added for the MS 3000 Overflow Tag which improves the performance of downloading data from the MS 3000 in Perception.

**MS 3000 Service Notifications**

Notification of service state indicators for MS 3000 master and slave devices are now supported. This includes indication on the asset tree, MS 3000 properties page and email notifications.

### **8 Series Relay and MS3000 Event Plotting**

Event types such as overvoltage or trips captured on the 8 Series Relay or MS3000 can now be plotted as measurement points on trend charts.

### **Relative Saturation measurement download from Transfix and Kelman DGA 900**

The relative saturation measurement is now downloaded from the Transfix and Kelman DGA 900 family of devices. The download of relative saturation data is from the point of its introduction in Perception, hence the historical relative saturation data is not downloaded for existing devices. To receive historical relative saturation data an existing device needs to be recreated in Perception to allow for a full download of data from the device. Please consider any impact that may occur regarding algorithm association and results when recreating assets in Perception.

### **Transfix and Kelman DGA 900 error codes description**

Along with the error codes, a description of the error is now displayed in the data table tool tip should a Transfix or Kelman DGA 900 family device have an active service alarm when data is downloaded.

### **Accessing the Perception User Manuals from within the Perception software**

The user manuals for the Perception software can now be launched from the help menu of the Perception Desktop and Perception Server Configuration Tool. A separate troubleshooting guide for Perception is also now provided giving users instant access and information on how to correct issues GE are aware of that may arise.

## **v2.2.0**

### **Key new features**

#### **Support of MS3000 onboard Risk Indexing**

Support has been added for the download of the onboard Risk Index results from MS 3000 monitoring devices running master template 3.6.4.22p0\_3.2.2.13p0\_4.5p0 or later.

Perception now downloads and visualises the Risk Index results along with the other data stored on the MS 3000. The Risk Index results are calculated directly on the MS 3000 monitor running master template 3.6.4.22p0\_3.2.2.13p0\_4.5p0 or later.

Perception can be configured to use and display only the Risk Indexes downloaded from the MS 3000, or only the Risk Index calculated in Perception or a combination of both. When both Risk Index options are configured Perception automatically selects and displays in the most critical Risk Index result and information regardless of its origin.

Risk Index data downloaded from the MS 3000 can be exported and imported via the existing mechanism in Perception.

### **Support of GE's 845 Relay**

Support has been added for GE's 845 transformer protection relay running firmware version 1.7 or later. Perception currently supports the download and visualisation of the specific data, namely:

- Arcing Current (Per Phase) with alarm notification
- Arcing Current Total with alarm notification
- Total Breaker Trips
- Trips Since Last Reset
- Alarm Counter
- Last Trip Time with alarm notification
- Avg. of 5 Trip Time with alarm notification
- Avg. of Trip Time with alarm notification
- Last Close Time with alarm notification
- Avg. of 5 Close Time with alarm notification
- Avg. of Close Time with alarm notification
- Last Arc Time (Per Phase) with alarm notification
- Avg. of 5 Arc Time (Per Phase) with alarm notification
- Avg. of Arc Time (Per Phase) with alarm notification
- Last Spring Charge Time with alarm notification
- Avg. of 5 Charge Time with alarm notification
- Avg. of Charge Time with alarm notification
- Last Arc Energy (Per Phase) with alarm notification
- Avg. of 5 Arc Energy (Per Phase) with alarm notification
- Avg. of Arc Energy (Per Phase) with alarm notification
- Xfmr Phase A Energization peak inrush current (Per Phase)
- Xfmr Phase A Minimum Voltage during energization (Per Phase)
- Xfmr Phase A Energization 2nd harmonic inrush current (Per Phase)
- Breaker Total Arcing Current (Per Breaker)
- Aging Factor with alarm notification
- Xfmr Loss of Life with alarm notification
- Winding Hottest Spot Temperature with alarm notification
- Top Oil Temperature
- Ambient Temperature
- Frequency
- Real Power (Per Phase)
- Reactive Power (Per Phase)
- Total Real Power
- Total Reactive Power
- Total Apparent Power
- Power Factor
- Real Demand (kW)
- Reactive Demand
- Apparent Demand
- Frequency Rate of Change
- Volts per Hertz 1
- Volts per Hertz 2
- 2nd Harmonic (Per Phase & Per Winding)

- 5th Harmonic (Per Phase & Per Winding)
- Total Harmonic Distortion (Per Phase & Per Winding)
- Harmonic Derating Factor (Per Winding) with alarm notification
- Average Phase Current (Per Winding)
- Transformer overload (Per Winding)
- Demand (Per Phase & Per Winding)
- DGA (If GE online DGA monitor connected to 845)
- Ph IOC 1 Trip PKP
- Ph IOC 1 Trip PKP (Per Phase)
- Breaker Hlth Trip PKP (Per Breaker)
- Peak Inrush Current (Per Phase)
- 2nd harmonic inrush current (Per Phase)
- 5th harmonic inrush current (Per Phase)
- Peak Inrush Current
- 2nd harmonic inrush current
- 5th harmonic inrush current
- Frequency
- RMS Current (Per Phase)
- Energization Winding Source
- Ground Current
- Total Harmonic Distortion (Per Phase)
- Xfmr Status
- Winding Hot-spot Temperature
- Top Oil Temperature
- Aging Factor
- Loss of Life
- Minimum Voltage (Per Phase)
- 3-Phase Real Power
- 3-Phase Reactive Power
- Power Factor
- Phase to Phase AB RMS Voltage
- Phase to Phase BC RMS Voltage
- Phase to Phase CA RMS Voltage
- Volts per Hertz 1
- Volts per Hertz 2
- Xfmr Energization Peak inrush current historical max
- Xfmr Energization 2nd harmonic inrush current historical max
- 2nd Harmonic historical max (Per Winding)
- 5th Harmonic historical max (Per Winding)
- Total Harmonic Distortion historical max (Per Winding)
- Harmonic Derating Factor historical max (Per Winding)
- Average Phase Current historical max (Per Winding)
- Transformer overload historical max (Per Winding)
- Total Arcing Current historical max (Per Breaker)
- Xfmr Minimum Voltage during energization historical max
- Total Real Power historical max
- Aging Factor historical max
- Top Oil Temperature historical max
- Winding Hottest Spot Temperature historical max

The communication method currently supported is via Network media and MODBUS protocol for data download.

The 845 relay can be added as a child of the transformer allowing users to compare the results of DGA and Lab

Data against relay measurements and events using the transformer

worksheets. To enable 845 relay support please contact your GE sales

representative. **Kelman DGA 900 HTTP/HTTPS Network Port**

### **Assignment**

The HTTP/HTTPS network port used by the Kelman DGA 900 can now be defined in the properties page of the Kelman DGA 900 in Perception. By ticking the “Define network port” tick box the user can now specify the port (0 to 65535) to be used when connecting to the Kelman DGA 900.

### **Multiple Intellix BMT 300/330 monitors for one transformer**

Multiple Intellix BMT 300/330 monitors can now be added as the children of a single transformer in the Perception asset explorer.

By using the transformer asset worksheets in Perception users can now visualize the monitoring data for multiple sets of bushings provided by multiple Intellix BMT 300/330 monitors on a single worksheet such as the bushing monitor worksheet.

### **Multi-language Support**

The Perception software now supports the following regional languages:

- English
- French
- Spanish
- Brazilian Portuguese
- Russian
- German
- Simplified Chinese

Perception automatically detects the current regional language mode of the host Windows operating system and displays the Perception text in the native regional language. If the regional language is not supported Perception reverts to the English language.

The Perception user manuals are also available in these supported languages.

## **v2.0.2**

### **Key new features**

#### **Transformer Report Facility**

The transformer report facility in Perception Desktop when connected to Perception Server has been significantly enhanced.

The most significant change to this feature is the format of the report when it is generated. Reports are now generated in a multi-page Microsoft® Word document format instead of an single image file. This new format provides users with the ability to further update and edit the report using

Microsoft® Word after it has been generated. The report now spans across multiple pages with each page dedicated to a specific set of data or data view with comment boxes to allow the users to add descriptions against the information being displayed.

The capability to generate reports in a Microsoft® Word format is built into Perception, meaning there is no reliance on Microsoft® Word or Office being installed on the PC running Perception Desktop in order to generate the reports. However, Microsoft® Word is required when it comes to opening and editing the generated report.

We have also updated the report content to include BMT, Fleet Ranking and CO<sub>2</sub>/CO ratio information in the report. When selected new sections are added into the report detailing the critical BMT and Fleet Ranking information for the transformer. The CO<sub>2</sub>/CO ratio section displays a trend chart pre-populated with CO<sub>2</sub>/CO ratio along with moisture, oil temperature and Ambient temperature if available.

A new gases option has also been added in the report wizard which allows the user to select or deselect specific gases to be used in the report.

### **Hydran Download Performance**

Data download performance has been significantly improved for the Hydran product line when using Modbus and DNP3 protocols. Data download speeds are now on average 2-3 times faster than with previous versions of Perception.

As well as faster download speeds, Perception now also has better data processing during downloads. Whilst data is being downloaded from a Hydran, Perception new data processing capability improves performance and recovery should a communication interruption occur.

### **SSL & TLS Support For SMTP**

Support has been added to the Perception Server email service integration for secure SMTP connections using explicit SSL & TLS over ports 25/587.

### **Perception Desktop Idle Timeout**

An idle timeout feature has been added to Perception Desktop which automatically disconnects a user from Perception Server if they have not interacted with Perception Desktop for several minutes. By default, the idle timeout is set to 5 minutes however this can be changed in the Perception Server Configuration Tool.

### **Ability to plot CO<sub>2</sub>/CO ratio in the trend chart**

Users can now plot a CO<sub>2</sub>/CO ratio in the Perception Desktop trend chart worksheets. This enables users to trend the CO<sub>2</sub>/CO ratio against other data points visualised in the trend charts in order to compare and identify correlations.

**v2.0.1**

## **Key new features**

### **Active Directory Integration**

Perception Server now integrates directly with Microsoft® Active Directory enabling organisations to manage Perception user access control from Active Directory.

### **Service Email Enhancement**

When a service alarm is triggered on a Hydran M2, M2-X or 201ti the service log files are now automatically downloaded from the device and included as an attachment in the service notification email.

### **Disable Data Download**

Perception Server can now be configured not to download the measurement data from the GE online monitors when they connect to the unit. This feature was created to help users reduce the amount of duplicate information in organisations where there may be other applications such as data historians used to store the measurement data from the online monitors.

When enabled, upon a manual or automatic download command Perception will connect to the unit and only download information about the operation and display as well as send notifications for service requirements there may be for the online monitor.

### **Wallboard Improvement**

The wallboard feature in Perception has been further enhanced to improve the overall user experience and notification capabilities.

The asset text displayed on the wallboard now dynamically adapts based on the resolution of the image and screen displaying the wallboard making it much clearer and easier to read. A new text box opacity feature has also been added that enables a user to display a white background in the text box with a selectable transparency level.

A navigation feature has been added to the wallboard that allows users to navigate to an asset in the asset explorer by clicking on the node asset in the wallboard.

Asset alarm change notifications are now more obvious with the introduction of a pulse effect for the asset node when an alarm occurs. The pulse effect remains until a user acknowledges the alarm within the wallboard of the direct parent of the transformer asset.

### **First Measurement After Restart**

Perception can now distinguish, and highlight in a teal colour, on the data table the first measurement taken by an online monitor after a restart. Previously such measurements were marked as uncertain quality and highlighted in pink and it was not immediately identifiable as to the reason for the uncertain quality mark.

### **Plotting of Zero Values on Charts**

A new option has been added to the trend chart appearance context menu called "Connect gaps". This option enables users to exclude zero value measurements from data charts when it has been determined that the measurement is bad quality or in the case of BMT data it was determined that transformer was powered down\de-energised at the time the sample was taken.

By doing this it makes it much easier for users to follow a trend line in a chart by removing the invalid data.

## **Display of Monitor Firmware Version**

Perception now downloads and displays the firmware version information for online monitor in the device properties page. This feature is currently supported for the Transfix Family, DGA900 BMT Family & Hydran Family.

# v2.0.0

## **Key new features**

### **Support of GE CB Watch 3 monitor**

Support has been added for the GE CB Watch 3 monitoring devices running firmware version 4.1 or later. Perception currently supports the download and visualisation of the Risk Index Results, Current Position, Number of Operations, Date Last Operated and Alarm States. The Risk Index results are calculated directly on the CB Watch 3 monitor running firmware version 4.1 or later.

Perception also provides access to the web interface of the CB Watch 3 via the Web Browser worksheet, where users can view the additional data stored on the CB Watch 3 monitor.

The communication method currently supported is via Network media and MODBUS protocol for data download and HTTP/HTTPS for connection to the web interface.

To compliment the support of the CB Watch 3 monitor, a new Circuit Breaker asset type has been added to

Perception along with a dashboard created specifically for viewing the critical data downloaded for the CB Watch

3.

CB Watch 3 support is available for the Perception Workflow Risk Indexing and Ranking mechanism. A new algorithm called CB Watch has been created under the Workflows drop down list within the Circuit Breaker properties. When selected Perception uses the Risk Index results received from the CB Watch 3 to present a Risk Index overview and rank position within the asset ranking table.

CB Watch 3 data can be exported and imported via the existing mechanism in Perception.

### **Asset Explorer Search**

Users can now search by asset name and automatically filter for devices in the Perception Asset Explorer.

This is performed by entering the text in the search field at the top of the asset explorer. As the user starts typing the asset tree dynamically filters to show only assets with the specified text in their name. This allows users to navigate directly to a specific asset, or group of assets under an area.

When searching for a group of assets under an area, initially the user will not see assets listed under the area when the search is performed. However, by clicking the X in the search field the

user will be automatically taken to the location of the area in the asset explorer and the assets listed below will be visible.

### **Auto-Download enhancement**

An option called “Based on device sample rate” has been added to the Auto-Download section of the properties page for the DGA 900 and Transfix family of devices.

This new option enables Perception to mimic the measurement schedule of the online monitor hence ensuring new measurements are downloaded from the device as soon as they are available.

This option is particularly useful in the event that the online monitor goes into alarm mode and starts to sample more regularly. In the past Perception would have not been aware that more regular samples were being taken and would continue to download data based on the scheduled download time.

When the option is enabled the standard schedule settings will be ignored and next download time will be assigned based on device measurement scheduler.

Users may notice that there is a time difference of one hour between the download time and measurement schedule time. This difference is required as it can take up to 1 hour for a measurement sample to complete fully.

### **Worksheet templates**

Users now have the ability to export & import worksheet settings as a template.

By right clicking on the worksheet tab the user has the option to import or export the worksheet template.

The template contains the customized features of the worksheet. For example, the selected measurement points, appearance settings, date range, selected charts etc. These settings are all stored in the template xml file and when imported the settings are then applied to another instance of Perception Desktop for the selected worksheet or another worksheet in the same Perception instance.

This feature can also be used to auto populate the properties page of a Transformer. Exported Transformer properties templates contain all but the serial number details of the Transformer. This export can then be imported into other Transformers making it easier to update the properties for Transformers of the same design and properties.

### **Export**

The Export functionality in Perception has been enhanced to now include the Risk Index information in the CSV format.

Thus, allowing users to share the risk index and rank information for an asset in Perception with data historians or 3<sup>rd</sup> party applications.

The export can be done in automatic by enabling the option in the Perception Server Configuration tool. When enabled a CSV file will automatically be created after the execution of the workflows as defined in the workflow scheduler or executed manually using the option in the scheduler window.

## ROC Workbook

The ROC calculation used in the Perception ROC workbook has been updated to calculate ROC as PPM/Day rather than PPM/Hour to align with the ROC method performed in the DGA 900 and Kelman family monitors.

# V1.22.3

## Key new features

### Intellix BMT 330 Dashboard

A new dashboard has been created for the Intellix BMT 330 to help users better understand the information provided on the condition of their monitored bushings.

The dashboard presents the following

information: Transformer details

Populated from the Transformer properties page and downloaded from the Intellix BMT 330

- Primary Voltage
- Secondary Voltage
- Frequency
- Inter-phase angle ( $\angle$ ) A-B
- Inter-phase angle ( $\angle$ ) A-C
- Top Oil Temp per phase
- Ambient temperature
- Ambient humidity

Gauges

- C1 % change
- Angle AB Reference change
- Angle AC Reference change

Capacitance values for each phase\bushing

- Nameplate C1 (pF)
- Expected Amplitude (mA)
- Measured Amplitude (mA)
- Estimated C1 (Pf), based on measured bushing leakage current amplitude and inter-bushing phase.

Insulation values for each phase\bushing

- Nameplate  $\tan \delta$ /PF (%)
- Expected Angle ( $^{\circ}$ )
- Measured Angle ( $^{\circ}$ )
- Estimated  $\tan \delta$ /PF (%), based the bushing nominal operating voltage and inter-phase angles.

Support has also been added for Modbus over TCP removing the need for a virtual serial to ethernet software adaptor.

## Ratio alarm enhancement

Ratio alarm classification as defined in the Transfix, TapTrans, MultiTrans or MiniTrans is now supported in Perception.

For example, when a ratio alarm is set to “Alarm Indicator – Caution” in the monitor, in Perception the ratio alarm when triggered will be highlighted yellow. If a ratio alarm is set to “Alarm Indicator – Alarm” in the monitor, in Perception the ratio alarm when triggered will be highlighted red.

### **Email notification segregation**

Email notifications can now be segregated to 3 different groups, allowing the user to define the recipients of the emails based on the notification type:

- Alarm – Notification that an alarm level breach has occurred on the online monitor.
- Communication – Notification that Perception was unable to communicate with the online monitor
- Service – Notification that the online monitor requires service attention.

### **Service email enhancement**

When a service alarm is triggered on a Transfix, TapTrans, MultiTrans or MiniTrans the service log files are automatically downloaded from the device and included as an attachment in the service notification email.

### **Diagnostics**

The Ratio workbook is available for Transformer assets. This will allow data imported in CSV file format for a Transformer to make use of the Ratio visualization capabilities in Perception.

### **Localization**

Simplified Chinese language support has been updated.

### **Manual Workflow Execution**

The workflow scheduler can now be executed manually via a button in the Tools > Workflow Scheduler configuration form. This allows users to instantly perform a data evaluation should the need arise.

## **V1.22.2**

### **Key new features**

#### **Enhanced Support of Kelman DGA 900**

Ratio formulas and limits are now downloaded from the Kelman

DGA 900. Support for the new firmware version – FW V 1.30.

#### **Support of Hydran M2 and Intellix MO150**

Hydran M2 and Intellix MO150 devices with floating point variation enabled for DNP3 communication is now supported in Perception.

### **Transport X<sup>2</sup>**

Improved regionalised recognition on import of data from the Transport X<sup>2</sup> based on the region local setting of the PC hosting Perception.

## **V1.22.1**

### **Key new feature**

#### **Support of Hydran M2**

Extended support of Hydran M2 firmware up to 5.05 version. Support for the new Hydran M2 H2 device.

#### **Support of DGA900**

HTTPS protocol is supported

#### **Support of Transport X<sup>2</sup>**

A new asset has been defined for Transport X<sup>2</sup> device. Once the unit is connected over USB cable to the machine with Perception Desktop the asset is detected and represented in the asset tree for further actions. The following features are available: download transformer measurements stored on the device, export stored data to CSV file, retrieve service logs.

#### **Support of Hydran M2**

Extended support of Hydran M2 firmware up to v5.04.

## **V1.22.0**

### **Key new features**

#### **Support of MS 3000**

Extended support has been added for the MS 3000 device. The following features are available: downloading of measurement data and access to remote HMI over secured HTTPS (default option), fleet ranking workflows based on downloaded data; information representation on transformer dashboard.

#### **Service emails**

Additional information about measurement/service errors and flags is now provided in notification emails.

## V1.20.1

### Key new features

#### Support of Kelman DGA 900

Support has been added for the new Kelman DGA 900 device. The following worksheets are available Properties, Data Table, Status, TDCG, Trend Chart, Key Gas, Gas Ratios, Ratios, ETRA and Duval's.

Users can download data and alarms from the Kelman DGA 900 via Network media and HTTP protocol

DGA Standard and Simplified DGA workflow support is also available for the DGA 900

Kelman DGA 900 data can be exported and imported

## V1.20.0

### Key new features

#### DGA 500

Added support of ranking workflows, export/import.

#### Hydran M2, 201Ti & Intellix MO 150

Execution of "Install new sensor" command is now available using Perception. View of real time alarms was extended – user could see even disabled alarms and modify the view with options. Also, the following technical logs could be downloaded now from the device: Short Term, Long Term, Alarms, Events, Service, Digital, DGA. Extended support of MO 150 firmware up to v3.05c.

#### MS 3000

Basic support has been added for the MS 3000 device. The following features are available: downloading of measurement data over HTTP, representation on common and DGA diagnostic worktabs, remote HMI view.

#### Support of Non-Mineral Oil

Certain diagnostics and workflows are disabled as not applicable when non-mineral oil is specified in transformer properties.

#### Transfix Rate of Change Calculation

Perception now calculates RoC values and alarming for each of the available gas concentration historical values.

#### Languages

Perception 1.20 is available in German, Chinese and Russian languages.

# V1.18.3

## Key new features

### Support of DGA 500

Support has been added for the new DGA 500 device. The following worksheets are available Properties, Data Table, Trend Chart, Status, TDCG and Duval's (Classic and LTC Triangles).

# V1.18.2

## Key new features

### Support of Intellix BMT 330

Support has been added for the new Intellix BMT 330 device.

### Support Phase Angle alarms for BMT 330

Phase Angle alarms have been implemented in the new Intellix BMT 330.

Users can now view these alarms in the Perception application in the Data Table, Status and Inter-Phase Angle worksheets.

### PRPD worksheet

A new Phase Resolved Partial Discharge worksheet is available for the Intellix BMT 330 device. The worksheet displays the PRPD data downloaded from the device on 2 different charts. A 2-D Chart where the x-axis displays the phase angle of the grid voltage for the phase and the y-axis displays the Apparent Charge of each PD event. The 2<sup>nd</sup> Chart is a Histogram which shows the density of PD events.

### Inter-Phase Angle worksheet

A new Inter-Phase Angle worksheet exists for the Intellix BMT 330 device. The worksheet displays the calculated Angle A-B and Angle A-C measurements against the Expected Angle A-B and Expected Angle A-C values. The worksheet also displays the Phase Angle Caution and Alarm limits as configured on the device.

### Updates to Bushing Monitor and Partial Discharge worksheets

Users can now position the mouse over data points on the Polar Plots and a tooltip will display showing the actual values of this point. A range selector has been added to the Polar Plot timelines, allowing the user to filter through the data points displayed. The worksheets have been updated to improve performance when viewing large data sets. The zoom feature has also been updated to allow the movement of the zoomed graph focus point. For more information please see the Perception Desktop user manual for more details.

### Transformer Bank (Phase Association, Annotations, Workflow Association)

A new Transformer Bank asset has been added to the Perception application. The Transformer Bank asset has been created to facilitate the addition of single phase transformers and subsequent monitoring in Perception. The Transformer Bank properties worksheet allows the user to configure phase and tank associations. Each phase and tank configuration will automatically create an annotation at the association date in the Data Table and Trend Chart worksheets. Users can associate the BMT Standard workflow to their Transformer Bank and the Transformer Bank will appear in the Ranking Tab, its condition will be based on the combined risk indexes and conditions of its children and the Intellix BMT 330. For more information please see the Perception Desktop user manual

### **Min and Max range limits for Dynamic Load model and CT Ratio's**

The min and max range limits for the Dynamic Loading Model and CT Ratios within the MO150 has been increased to allow for a wider data range. The range limit for Rated Continuous Current on HV Bushing (A) has increased to 1 - 100,000. The range limit for Rated Continuous Current on LV Bushing (A) in Dynamic Load model has increased to 1 - 1,000,000. The range limit for CT Ratios has increased to 1 to 50,000.

## **V1.18.1**

### **Key new features**

#### **Duval's Pentagon 1 and Duval's Pentagon 2**

Duval's Pentagons 1 & 2 are now available in Perception from the Duval's worksheet. The Pentagon diagnostics use five key gases namely: H<sub>2</sub>, CH<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>4</sub> and C<sub>2</sub>H<sub>2</sub>, in a single graphical representation used for the interpretation of DGA results in mineral oil-filled transformers. Pentagons 1 and 2 permit distinguishing between thermal faults of lesser concern for the transformers, e.g., T3-H and S faults in oil and O, overheating to more serious and potentially dangerous faults e.g. carbonization of paper. The Pentagon diagnostics are also available for use in the Transformer Status Report feature.

#### **Support for HydranM2 FW 5.03**

Users can now download from HydranM2 devices running latest FW 5.03

## **V1.18.0**

### **Key new features**

#### **Additional Models Display and Enhancements**

The following model readings have been added to Perception Desktop for HydranM2 and MO150 devices

- Cooling Banks Status

- Cooling Control Model (MO150 only)
- Cooling Efficiency Model
- OLTC Tap Position Model
- OLTC Differential Temperature Model

## Manual Override & Input of Ambient Air Temperature and Top Oil Temperature

This feature is available only for the MO150 device with FW version 3.06.

The user can now choose to enable Simulation Mode for Ambient Air Temperature and Top Oil Temperature

If simulation mode is enabled, the manually entered values are used in the DLG Model calculation. Otherwise the measurement values taken from the device will be used.

## Allow usage of measured voltage in the Apparent Power Model

This feature is available only for MO150 device with FW version 3.06.

The user can now assign 3 new types to the Output Models of an Analog input

- Rated Voltage on HV side
- Rated Voltage on LV side
- Rated Voltage on tertiary side

When a new voltage output is assigned to an Analog input the Apparent power model is calculated based on this voltage instead of the one manually configured on the device and displayed in the appropriate worksheets in Perception.

## **Renaming of Measurement points**

Users can now rename downloaded or imported measurement points in Perception via the Status worksheet. The renamed measurement point will be shown in all instances of the application. User can also choose to reset the renamed point back to its original display name.

## **Support for Hydran20Ti legacy FW 2.20**

Users can now download from Hydran201Ti devices running legacy FW 2.20

## **Support for HydranM2 and MO150 latest FW**

Users can now download from HydranM2 FW  $\leq 5.02$  and MO150 FW  $\leq 3.06$

## **German Language Support**

Perception 1.18 is available in the German language

## **Support Import and Export of alarms for all devices including Transport X**

Users can now import alarm information from Transport X unit using FW v1.12.6.567

Users can also import and export alarm information for all device types

# **V1.16.0**

## **Key new features**

### **Perception Web**

Perception Server now includes a web interface option to allow end users to view critical transformer and fleet data held in Perception using an internet browser application from a PC, Smart Phone or Tablet.

The web interface provides access to the following:

- Fleet Overview
  - o Summary count of the number of transformers in the fleet, the assets that are ranked and the alarms that have been triggered.
  - o Risk index distribution of the fleet.
  - o Fleet ranking table.
  - o Latest events list containing details of crucial events that occurs for an asset within the fleet.
  - o Average fleet risk index history providing a timeline of the overall health risk index of the transformer fleet.
- Transformer Dashboards
  - o Critical transformer information, such as current risk index and history, fleet ranking position, alarms, load current and PU percentage, ambient environment information and critical measurement data taken by the online monitors.
- Asset Wallboards
  - o Area's, Substation's and Transformer's wallboards as preconfigured in Perception Server via the Perception Desktop application.
- Asset Hierarchy
  - o Visualise representation of the network of areas, substations, transformers and online monitors as preconfigured in Perception Server via the Perception Desktop application.
  - o Click through on an Area or Substation asset to show associated Wallboard.
  - o Click through on transformer asset to show associated Wallboard or Transformer Dashboard.

### **Fleet Ranking Enhancements**

We have improved our transformer risk and fleet ranking analysis by building on our existing workflow algorithms as well as introducing new workflows.

#### OLTC analysis via TapTrans.

A DGA Standard OLTC workflow has been created to perform analysis on OLTC data captured by the TapTrans monitor using expert knowledge along with technics taken from the IEEE C57.104 standard.

#### New Simplified DGA and Simplified DGA OLTC Workflows

A new Simplified DGA workflow has been added. The data analysis in the Simplified DGA algorithm is based solely on the Caution and Alarm status of the monitors.

#### MiniTrans, HydranM2 & Hydran201Ti Support

The DGA Standard workflow now also supports the following monitoring devices MiniTrans, HydranM2 and Hydran201Ti.

#### DGA Standard Moisture Analysis Enhancements.

The DGA Standard workflow has been updated with improvements to H2O levels in Oil and Gas Sensitivity.

## BMT Standard Workflow

The BMT standard workflow has been updated to support the latest BMT 300 FW Version 1.2

## Workflow Sensitivity

Each workflow association now has its own sensitivity value which can be used to adjust the sensitivity of the parameters during data analysis.

## Enhanced Transformer Criticality

A new Criticality Details section in Transformer Properties worksheet has been added. The Criticality Details are used in Fleet Ranking algorithms to give a more accurate assessment of the risk condition of the transformer based on the unique critical factors of each transformer.

## **Import and Export Enhancements**

The import and export CSV file functions have been further enhanced. Export and Import of asset Properties

There is now the option to Export Properties, Measurements or All Data held for an asset.

## Export and Import asset tree hierarchy

When data on an asset is exported information about the Parent/Child structure of the asset within the asset tree is exported. When this data is then imported the asset placed correctly in the asset tree hierarchy or the hierarchy is built for the asset.

## Import & Export Measurement Diagnostics and Quality Status

Measurement diagnostics and quality status information is now included in data export and imports.

## **NERC-CIP Compliance**

In order to ensure Perception helps organisation meet NERC-CIP compliance we have improved the even logging within Perception.

Events are logged in an audit log for auditing purposes, namely:

- Adding Nodes
- Deleting Nodes
- Add/Delete References (Drag & Drop nodes)
- Import events
- Export events
- Import export mapping changes (Add/Update/Delete events)
- Server start stop events
- Workflow configuration in Transformer properties(adding, updating, removing them)
- Uploading workflows event on the server & Deleting workflows event.
- Uploading wallboards
- Save wallboard configuration event like when moving node position on the wallboard.
- Write events for the configuration changes.
- Device setup event when launching setup.
- Login Logout events.

- Perception Server Config tool changes.

## **Rate of Change visualization for Caution and Alarm**

Perception now differentiates and visualises rate of change alerts for caution (high) and alarm (High-High). The ROC alarms are visualized in Status worksheet, Asset Explorer, & Alarm Email Notifications. The latest Transfix Host 1.15.1 firmware is required.

## **Wallboard Enhancements**

### Centralised Wallboards

Wallboards are now centralised and can be viewed across the entire Perception Fleet.

When a wallboard is configured for an asset, the wallboard is available and can be viewed from any Perception Desktop client that is connected to the same Perception Server instance.

### Restrictions on Wallboard manipulation and changes

Wallboard manipulations are now controlled under the Perception Access Control policy. Only users assigned with an Architect role can change the wallboard layout and settings. Observers and Supervisors have can still view the wallboard but they cannot make any changes to the wallboard.

## **Transformer Dashboard Updates**

Dissolved gas analysis data taken by the Hydran 201T1 & Hydran M2 data is now displayed in the transformer dashboard.

## **Operating System Support**

The following operating systems are now supported for Perception Fleet (Server and Desktop applications). Windows 8 32-bit and 64-bit

Windows Server  
2012

## **Perception 1.14 Release Notes**

New Functionality:

### **Flexible Modbus Slave address of the Transfix**

Modbus Slave address of the Transfix is not hardcoded to 1 now when Modbus over TCP connection is used. Address parameter was added to appropriate device provider in Perception.

### **Hydran M2 support**

Hydran M2 devices with firmware version 5.01 can now be added to the Perception application.

## **Intellix MO150 support**

MO150 devices with firmware version 3.05 can now be added to the Perception application.

## **Hydran native protocol support for Hydran201Ti and HydranM2**

Perception application can now connect to Hydran201Ti and HydranM2 devices over Hydran native protocol. Supported firmware versions are: 4.1 for the Hydran201Ti and 1.08/2.0 for the HydranM2.

## **Fleet Ranking**

A new level of interpretation of the health of the transformer fleet has been added to Perception Server. It uses established IEEE/CIGRE/IEC standards to create algorithms to properly rank assets according to their risk of failure, based on key performance indicators acquired through DGA and bushing/PD monitoring. The ranked order of assets is displayed in Perception as a list, with the most critical asset listed at the top.

Perception also allows the algorithms to be modified, or new algorithms created using a new workflow designer. The workflow designer allows a user with appropriate privileges to edit existing, and design new algorithms using a drag and drop integrated design environment (IDE). The IDE presents existing algorithms and data points as selectable objects. Finally, the designer allows the user to compile and deploy the algorithms to Perception Server.

Dashboard screens have also been added to enhance the understanding of the user by collating key information about the fleet into a single screen. Further detail can be gleaned by using the previously available diagnostics.

## **Enhanced and programmable CSV import/export**

To further enhance Perception's ability to integrate with 3rd party systems (e.g. SCADA, EMS, DMS and Historians), the CSV import/export functionality has been completely reworked. Now, import/export can be configured using mapping tables. This allows any CSV file from any system to be mapped into the Perception database by tying up the CSV fields to the appropriate Perception fields.

Perception ships with the CSV mapping tables pre-configured for TransConnect, TOA4 and Perception format.

## **Expert Analysis Email**

In addition to the existing email that is sent to warn about alarms, Perception has been enhanced to allow a further email to be generated, called the Expert Analysis Email. This new email contains a snapshot of the transformer conditions, enabling the recipient to have a reasonable idea of the state of the transformer.

# **V1.12.0**

## **Key new features**

### **BMT300 and Hydran201Ti support**

BMT300 and Hydran201Ti (over Modbus) devices can now be added to the Perception application. Supported firmware versions are: 3.2.3 for the BMT and 4.1 for the Hydran.

### **Additional Diagnostics**

The following additional diagnostics have been added to Perception Server.

### **New Duval's Triangles**

Two new Duval's triangles have been added to the Duval Triangle diagnostics. These are the '4 - Low Temperature Faults' and the '5 - Low Temperature Faults'.

When DGA results are close to the boundary between zones PD and T1, it may sometimes be difficult to distinguish between these two types of faults. Also, some types of oils on the market tend to be "stray gassing", i.e., to unexpectedly form gases at relatively low temperatures such as 80 to 200°C. Stray gases may appear in the PD, T1, or T2 zones, and therefore may interfere with the identification of these faults in transformers. The Duval

Triangles 4 and 5 for low-temperature faults in transformers have been developed to remove these uncertainties. They should be applied only to faults identified by the Classic Duval Triangle as possible faults PD, T1, or T2, and should be viewed only as a complement of information for the Classic Duval Triangle.

### **Rogers, Doernenburg and IEEE® C57.104 Transformer Conditions Ratio Table**

A table containing Rogers, Doernenburg and IEEE® C57.104 Transformer Conditions ratios has been added to the

Gas Ratio workbook. The table gives users a simplified view all 3 ratios at the same time.

Rogers ratio was developed from Halstead's thermal equilibrium and Doernenburg ratios together with information gained from failed units. It was refined to three ratios which, when compared can be used to diagnose six possible faults.

Rogers ratio method has the advantage that it is quantitative and is independent of oil volume and can therefore be used as a diagnostic tool on any oil filled transformer.

IEEE® C57.104 Transformer Conditions evaluates the transformers condition using individual gases and TDCG concentrations.

### **Japanese ETRA Standard**

The Japanese ETRA diagnostic is taken from "Supervision and Maintenance by DGA" published in 1999 by the

Electric Technology Research Association in Japan.

By comparing ratios of C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub> & C<sub>2</sub>H<sub>6</sub> present in the oil, 5 levels of fault warnings can be determined, "Low Temperature", "Medium Temperature", "High Temperature", "Discharge + Overheating" and "Discharges". Perception Desktop displays a graphical representation of the diagnostic chart to show measurement information in relation to fault conditions and trending patterns.

### **Model Display**

The Models Display utilises the information taken by the Intellix MO150 and Hydran M2 systems, which are designed to collect, process, analyse and interpret critical operations on data obtained

from various sensors. It incorporates on-board intelligence, which utilizes the monitored transformer's characteristics along with real-time measurements to automatically compute on-line state-of-the-art mathematical transformer models based on IEEE® or IEC® standards.

The models presented in Perception

Desktop are: MO150

- Dynamic Loading Guide
- MVA model which computes apparent power on primary, secondary or tertiary winding
- Winding hot-spot temperature model which computes the hot-spot temperature of each winding where load current is measured
- Moisture in the thin conductor insulation and in the barrier insulation which computes the moisture content of each
- Insulation aging which computes aging acceleration factor from IEEE or IEC guidelines

Hydran M2

- Dynamic Loading Guide
- Hydran Readings
- MVA model which computes apparent power on primary, secondary or tertiary winding
- Winding hot-spot temperature model which computes the hot-spot temperature of each winding where load current is measured
- Temperature Model
- Moisture in the thin conductor insulation and in the barrier insulation which computes the moisture content of each
- Insulation aging which computes aging acceleration factor from IEEE or IEC guidelines

### **Graph Annotation**

Annotations can be added to the trend charts providing the facility to tag events within the trend chart and enter event details. When the annotations are set to hidden, a flag at the bottom of the trend chart indicates that there is a hidden annotation at that particular section of the trend chart.

Annotations can be used to flag and explain particular events presented in the trend chart. They can also be used to flag events which indicate further detailed monitoring of the transformer measurements is required from a recorded point.

### **Rate of Change Alarm Visualisation**

Rate of change alarm information is displayed in the status page of Transfix devices. If a Rate of Change alarm is triggered on a Transfix device, the status page will contain a "ROC" indication. The user can then view the measurement data within the trend chart to identify the offending gas.

### **Ratio Alarm Visualisation**

Ratio alarms set on the Transfix device are displayed on a trend chart in the Ratio workbook along with the ratio alarm limit values. There is also the facility to create custom ratio calculations within Perception Desktop using the data received from the Transfix.

### **Download & Email Logs**

Enables the user to conveniently download and e-mail log information from Transfix devices when a query arises with the device.

# V1.10.0

**Key new features**

**Perception Server**

Perception Server is a dedicated enterprise server application that utilises Perception Desktop as an interface. Operations performed in Perception Desktop are executed via Perception Server. The advantages of using dedicated server architecture are:

- Ability for multiple clients and a single central server which hosting Perception data.
- Download data from devices without user intervention or the need for Perception Desktop to be running using the auto download scheduling feature controlled by the Perception Server.
- Background Downloading - downloads initiated within Perception Desktop Application continue to run even if the Perception Desktop Application or client PC is shut down.
- Security and Access control.

The Perception Server application is configured using the Perception Server Config Tool. Perception Server Config

Tool allows the Perception Server administrator to setup and configure:

- Perception Server access control security
- Database settings
- Alarm e-mail notification settings
- Enable available modems on the server
- Activate the Perception Server

license. Please see user manual for

more details.

The Perception Desktop application is used to:

- Add devices to the Perception Server
- Initiate downloads
- View data downloaded from the device
- Schedule auto-downloads
- Enable e-mail notifications for devices
- Monitor the device condition and service alarm information.

### **Enhanced Security**

The Perception Applications now use integrated OPC security protocol. This security feature ensures that only trusted Perception Desktop connections are permitted to connect to the Perception Server. Please see user manual for details.

### **Microsoft SQL Server Database**

Perception Server uses Microsoft SQL Server to store data it receives from devices and then presents in Perception Desktop. By using Microsoft SQL Server we are able to provide customers enhanced data security with robust data backup facilities offered within Microsoft SQL Server.

### **Access and Permission Control**

Added the ability to create user logon credentials on the Perception Server via the Perception Server Configuration Tool. This gives the Perception Applications an extra layer of security. The Perception Server administrator can Add, Edit, Delete and Set Permission levels to the logon

credentials. There are currently 2 permission levels, Observer or Supervisor. For more information on Access and Permission Control please see the user manual.

### **Intellix MO150, HydranM2 and Transfix 1.0/1.5 support**

Intellix MO150, HydranM2 and Transfix 1.0/1.5 devices can now be added to the Perception application, for more information please see the user manual.

### **Wallboard**

The Wallboard feature provides customers with a graphical overview of their power utilities condition; using information gathered from their GE Energy transformer monitoring devices within Perception Desktop.

Wallboard is configured by simply providing a base image for the wallboard e.g. a map image or aerial image of a utility. Once the image is configured the assets within the asset explorer of Perception Desktop are automatically added to the wallboard image replicating the Perception Desktop asset explorer structure.

The child assets of a parent with wallboard configured are represented by coloured circles on the wallboard image. These circles can be moved around the image in order to position them in the appropriate location as per the wallboards representation. The colour of the circles is representative of the condition of the transformer monitoring device held under that asset in the asset explorer. If any of the transformer monitoring devices under the child asset triggers an alarm the colour of the circle will change alerting the user.

A dialog box containing details of the condition of all transformer monitoring device under the child assets can also be displayed on the wallboard for each child asset.

There are 3 levels of wallboard available; Area Wallboards, Substation Wallboards and

Transformer Wallboards. For more information please refer to the Perception Desktop User Manual.

### **TOA4 Export**

Users now have the option to create TOA4 files from the data downloaded from devices as well as have the data captured in Perception. This option is enabled via the Perception Server Config Tool.

The TOA4 export files are created on the Perception Server.

For more information please refer to the Perception Server User Manual.

### **Direct Downloading From Devices**

When a device is added to Perception Desktop, there is now the option to download directly from the device without Transconnect, Transcom or Intellix Multi Host application launching.

The Transconnect, Transcom or Intellix Multi Host applications can now be launched by selecting the "Setup" context menu option for the devices.

Downloads initiated from within Perception Desktop will continue until download is complete on the Perception Server even if the Perception Desktop instance which initiated the download is closed.

### **Transformer Status Report**

The transformer report facility allows a user to generate a one page report containing the key information about a transformer based on DGA at any given time.

The report can be customised to contain trend charts, specific date ranges, customer entered text, and diagnostic summaries.

### **Launching External Applications**

Via the Tools menu option users can now launch external tools from Perception. The list of tools is fully user customizable; launch arguments can also be specified.

### **Alarm Enhancements**

The user now has the ability to set a low or low-low alarm setting on the device with peripherals which support this option.

### **E-Mail Notification Enhancements**

Email addresses can now be entered in the device properties worksheet which will receive any Alarm, Service and Communication issue notification e-mails when the Perception Server downloads from the device.

### **Device Condition Visibility in Asset Explorer**

When a device has a Condition or Service alarm or a bad\uncertain sample is taken, the alarm is now visible as an icon on the device within the asset explorer. Please see the user manual for more details.

### **Significant Sample Measurement Highlighting**

Measurements which are uncertain, trigger the limit alarms, or are bad samples are now highlighted in the data table worksheet and status worksheet. The tool tip in the data table also provides more detail on the condition of the sample. In the status worksheet the condition alarm limit values are also now displayed for each element. Please see user manual for more details.

### **Status View Sort by Columns**

Data in the status view worksheet can now be sorted by clicking on the various column headers to arrange the data accordingly.

### **Measurement and Sample Validation**

Duval's Triangle, Gas Ratios and Key Gas have been enhanced to display a banner if the measurements or the configuration of the device alarms are not adequate to use the graphs accurately.

### **Tank Identification data displays**

When adding measurement points from different tanks within a device or different devices under a transformer, the measurement points now contain source information in the measurement point column header.

### **Persistent Worksheet Content and Layouts**

When changes are made to the content of the Perception Desktop worksheets, the changes persist when the Perception Desktop application is closed and reopened.

### **Improved support for negative measurement values**

There is now enhanced handling of measurement values to support negative values received from the devices.

### **Greater Communication Options and Protocols**

Serial support has been added to the connection methods. DNP3 and Modbus connection protocols have been added. This allows the user to choose the connection protocol they prefer. Please see user manual for more details.

### **Device Properties**

The device properties have been improved to provide:

- User device identity information
- Communication configuration options
- Download progress information
- Auto-download configuration options
- Notification e-mail setup
- Device responses
- Last download time.

### **License Upgrade**

The Perception Applications now have the ability to increase the default device limits set when the original license was purchased. By contacting the GE Energy Perception Support team, the user can purchase an upgrade to a higher device limit and reactivate the license on the Perception application for the new device limit to take effect. Please see the user manual for more details.

### **TOA4 Import**

Enhanced support of TOA4 file importing to include transformer nameplate details and other TOA4 regulations.

### **Enhanced Transformer Monitoring and Configuration**

Enhanced Transformer Monitoring and Configuration in the Perception Desktop application giving the user greater flexibility and more configurable options. Please see user manual for more details.

### **Data Table Export**

An export option has been added to the context menu of the data table. The export will only export the measurements currently added and visible on the data table. This will include the ability to export analog, digital and TIM2 peripheral data. Please see the user manual for details.

### Operating System Support

The Perception Applications are now supported on the following Operating Systems:

- Windows Server 2008 & R2 x64 & x86
- Windows Server 2012 x64 & x86
- Windows 7 x64 & x86
- Windows 8 x64 & x86

### Third Party Application Support

Microsoft SQL Server 2008 R2 Standard, Enterprise or Express and Microsoft SQL Server 2012 Standard, Enterprise or Express is supported as the database host for Perception Server.

----

For questions or further product support, please contact the GE support team 24/7 using:

| Region                            | E-mail                 | Telephone        |
|-----------------------------------|------------------------|------------------|
| Global Contact Centre             | GA.support@GE.com      | +44 1785 250070  |
| Central, East Asia, Pacific       | GA.supportCEAP@GE.com  | +61 414 730 964  |
| India                             | GA.supportIND@GE.com   | +91 44 2264 8000 |
| Middle East, North Africa, Turkey | GA.supportMENAT@GE.co  | +971 42929467    |
| Europe, Russia, CIS, Sub-Saharan  | GA.supportERCIS@GE.com | +34 94 4858854   |
| North America                     | GA.supportNAM@GE.com   | +1 877 605 6777  |
| Latin America                     | GA.supportLAM@GE.com   | +55 48 2108 0300 |

GE Vernova, the GE Vernova monogram and any items marked with an \* are trademarks of the GE Vernova Company.  
Copyright 2024, GE Vernova Company. All Rights Reserved.