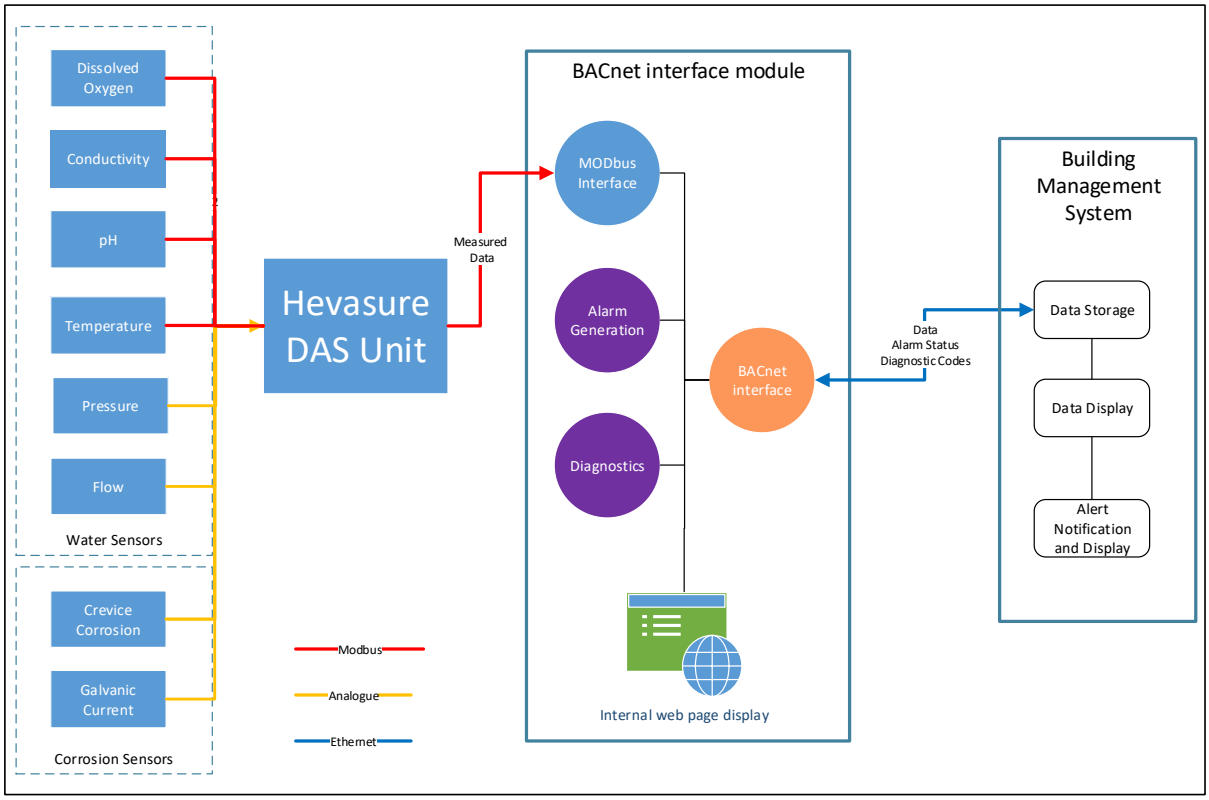
Hevasure Aquila-s Monitoring System

Technical Specification

1. Introduction

Hevasure Monitoring technology enables continuous measurements to be made on important aspects of a heating or chilled water system as well as transmission of that data to a Building Management System (BMS) via a BACnet interface. Alarms with intelligent messaging are issued if parameters exceed critical levels, helping to ensure both engineering integrity and water quality are maintained, significantly reducing the risk of corrosion and preserving HVAC system efficiency. The Aquila-s model has been specifically developed for secure environments such that external transmission of data via the internet is avoided.

The complete monitoring system comprises: hardware (sensors, data acquisition system, BACnet interface module (Commander), manifold, enclosure and fittings). A conceptual map of the data flow and interfaces is shown in Figure 1.



The measured data is processed via the DAS and BACnet interface module where it is analysed against pre-set limits. When these limits are exceeded, alarms are triggered and messages generated dependent on particular combinations. The BACnet interface module converts all data, alarms and messages into BACnet protocol in order that they can be read by the BMS. No data is stored in the Hevasure system.

2. Hevasure Aquila-s Monitoring Station (hardware)

i. Enclosure

The primary hardware is contained within a metal, glass-fronted enclosure which can be wall mounted or free standing and is usually installed in a plant room (Figure 2 & 3).

Figure 2: Hevasure Aquila-s Monitoring Station

Hevasure Monitoring Station
Compact Enclosure Dimensions

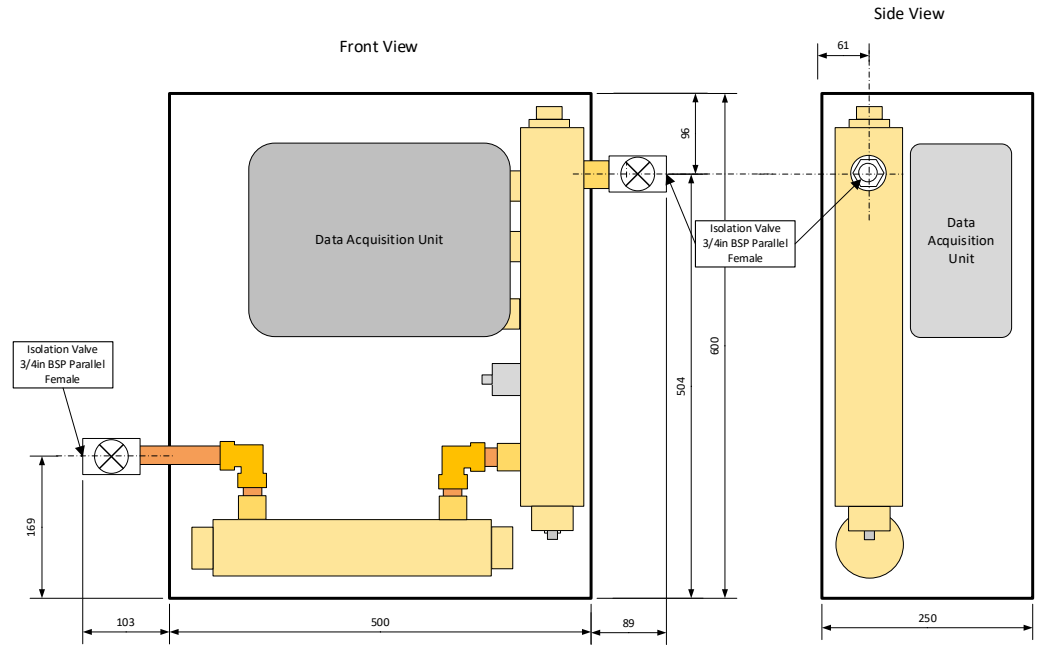


Figure 3. Monitoring Station Enclosure Dimensions

Steel cabinet: Schneider Electrical NSYS3D6525T.

Dimensions (mm): H600 x W500 x D250

Supplied with lockable handle and wall mounting brackets as standard.

CAD drawing available from Schneider Electrical Web Site.

The enclosure is not IP rated it has been modified to allow improved access for routine maintenance operations.

Total weight: 25kg

ii. Materials

Cabinet:	mild steel (painted) with glass front
Manifold & galvanic current housing:	Polypropylene
Plumb fittings:	Brass and copper
Sensors:	various with EPDM rubber seals

iii. Operating Conditions

Max operating temperature (water): 82 C

Max hydraulic pressure: 10 bar

Note: for higher operating temperatures cooling fins can be used on the inlet side of the manifold

iv. Plumbing connections

Connections to the LTHW or CHW system flow and return pipework is via 2 x ¾" BSP

v. Electrical connections

Universal input (100-240Vac) mains supply, hard-wired. Note: A CE-approved 24V 3A DC power supply is contained within the data acquisition system.

vi. Sensors (standard configuration)

1 x dissolved oxygen (Modbus output)
1 x conductivity (Modbus output)
1 x temperature (from conductivity sensor)
1 x pressure sensor (4-20mA)
1 x galvanic current sensor (mA output)
1 x crevice corrosion sensor (resistance)
Optional: 1 x pH sensor (Modbus output)
1 x flow meter (pulse output)

vii. Data Acquisition System

The Hevasure Monitoring system comes with a state-of-the-art data acquisition system, containing numerous digital and analogue inputs. This can be delivered pre-configured for the particular system being monitored.

Sensor inputs: 4 x Modbus
2 x 4-20mA current sink (passive)
2 x 4-20mA current source
8 X Corrosion Resistance sensors (2-wire connection), isolated as a group.
1X Galvanic Current detect, Current from galvanic source detected across 5 ohm resistor. This is isolated
1X Flow (pulse) input

viii. BACnet Interface Module (Commander Unit)

The BACNet interface module is a Commander unit from North BT Ltd, providing data processing and BACnet interface via a standard RJ45 ethernet port.

3. Installation

Installation should only be carried out by a suitably qualified engineer, trained in Health & Safety within a Plant Room environment. Site specific H&S rules apply.

Reference should be made to the document 'Installation of Hevasure Aquila-S Monitoring Station.

4. BACnet Interface

i. BACnet Data Objects

The Aquila-S unit stores data as data objects, which are grouped together in pages which are available as BACnet data objects to be read or written by the Building Management System (BMS). All these data objects are updated in real time, so the Aquila-S unit does not store the data objects (all storage and data management is the responsibility of the BMS).

The BACnet data objects contain all the measured data, calculated data as well as the alarms information required for the BACnet interface. Table 1 defines the groups of data object pages.

Name	Page No	Description
Measured Data	1	Parameter data read from sensors
Calculated Data	2	Parameters calculated from measured data
Alarm Limits	3	High, Low Alarm levels
Warning Limits	4	High, Low Warning levels
Site Inputs	5	Site specific configuration values
Alert Parameters	6	Parameters to trigger BMS alarms
Diagnostic Parameters	7	Parameters to trigger diagnostic messages - Section 5

Table 1 BACnet data object pages

The full list of BACnet data objects are in Section 5.

The alert parameters and the diagnostic parameters are data objects that should be configured to provide alerts and messages within the BMS system to notify the operator that that an issue has

been detected by the Aquila-s unit and that action may need to be taken to prevent long term damage to the water system.

ii. BACnet Alert Parameters

When an alert is triggered in the Aquila-s system, the value of the alert parameter can be configured in the BMS system to generate an alert to notify the operator that an issue has been detected by the Aquila-S unit. The Alert parameter values are configured so the value of the alert parameters correspond to a specific exceedance, Table 2.

Alert Parameter Value	Alert Condition
-2	Low Alarm
-1	Low Warning
0	Normal
1	High Warning
2	High Alarm

Table 2: Alert Parameters Conditions

There parameters can be plotted over time by the BMS system to provide a history of when specific alarm levels have been exceeded.

iii. Diagnostic Parameter Messages

Diagnostic parameters are generated diagnostic values that occur when a specific set of alarm exceedances have occurred which can help the operator identify the source of the alert and potential corrective action. The description defined in tables 3,4 should be displayed to the operator when the diagnostic parameter displays a certain value.

System Code	Potential Cause	Suggestion Action
11	High Dissolved Oxygen in system due to water make-up	Check cause and add inhibitor
12	High Dissolved Oxygen due to Low Pressure	Check Pressurisation Unit
13	High DO due to water make-up	Check cause - possible leak?
14	Low pressure in System	Risk of air entering system
15	Inhibitor level low	Check composition and adjust
16	pH too low risking corrosion	Check composition and adjust
17	pH too high risking corrosion	Check composition and adjust
18	Water make-up detected	Check for possible leak
19	Water make-up detected	Check for leak, add inhibitor

Table 3: System Code Messages

Corrosion Code Value	Potential Cause	Suggestion Action
41	Corrosion occurring	Check system condition
42	Corrosion Occurring	Resolve oxygen ingress
43	Excessive Corrosion Occurring	Damage occurring - high DO
44	Indication of crevice corrosion	Contact support
45	Corrosion Occurring	Contact support

Table 4: Corrosion Code Messages

5. BACnet Data Objects

i. Measured Data

BACnet Object	Name	Units	BACnet Object Type	Description
AI1	P1.O1 Dissolved Oxygen	ppm	Analogue Input	Measured Data - Dissolved Oxygen
AI2	P1.O2 DO Temperature	°C	Analogue Input	Measured Data - DO Temperature
AI3	P1.O3 DO Quality	%	Analogue Input	Measured Data - DO Quality
AI4	P1.O4 Conductivity	µS	Analogue Input	Measured Data - Conductivity
AI5	P1.O5 Temperature	°C	Analogue Input	Measured Data - Temperature
AI6	P1.O6 Conductivity Quality	%	Analogue Input	Measured Data - Conductivity Quality
AI7	P1.O7 pH Sensor		Analogue Input	Measured Data - pH Sensor
AI8	P1.O8 pH Temperature	°C	Analogue Input	Measured Data - pH Temperature
AI9	P1.O9 pH Quality	%	Analogue Input	Measured Data - pH Quality
AI10	P1.O10 Crevice Corrosion 1	Ohms	Analogue Input	Measured Data - Crevice Corrosion 1
AI11	P1.O11 Crevice Corrosion 2	Ohms	Analogue Input	Measured Data - Crevice Corrosion 2
AI12	P1.O12 Galvanic Current	mA	Analogue Input	Measured Data - Galvanic Current
AI13	P1.O13 Pressure (4-20mA)	mA	Analogue Input	Measured Data - Pressure (4-20mA)
AI14	P1.O14 Flow Pulse Count	Count	Analogue Input	Measured Data - Flow Pulse Count

ii. Calculated Data Objects

BACnet Object	Name	Units	BACnet Object Type	Description
AV33	P2.O1 Pressure 1	Bar	Analogue Value	Calculated Data - Pressure 1
AV34	P2.O2 Dosing	%	Analogue Value	Calculated Data - Dosing
AV35	P2.O3 Corrosion rate	mmpy	Analogue Value	Calculated Data - Corrosion rate
AV36	P2.O4 Cumulative DO	PPM	Analogue Value	Calculated Data - Cumulative DO
AV37	P2.O5 Cumulative GC	mV	Analogue Value	Calculated Data - Cumulative GC
AV38	P2.O6 Metal Loss	mm	Analogue Value	Calculated Data - Metal Loss
AV39	P2.O7 Flow Rate	l/h	Analogue Value	Calculated Data - Flow Rate

iii. Alarm Limit Objects

BACnet Object	Name	Units	BACnet Object Type	Description
AV65	P3.O1 Temp Alarm Low	°C	Analogue Value	Input Alarm Values - Temp Alarm Low
AV66	P3.O2 Temp Alarm High	°C	Analogue Value	Input Alarm Values - Temp Alarm High
AV67	P3.O3 DO Alarm	ppm	Analogue Value	Input Alarm Values - DO Alarm
AV68	P3.O4 Cond Alarm Low	µS	Analogue Value	Input Alarm Values - Cond Alarm Low
AV69	P3.O5 Cond Alarm High	µS	Analogue Value	Input Alarm Values - Cond Alarm High
AV70	P3.O6 pH Alarm Low		Analogue Value	Input Alarm Values - pH Alarm Low
AV71	P3.O7 pH Alarm High		Analogue Value	Input Alarm Values - pH Alarm High
AV72	P3.O8 Crevice Corr 1 Alarm	Ohms	Analogue Value	Input Alarm Values - Crevice Corr 1 Alarm
AV73	P3.O9 Crevice Corr 2 Alarm	Ohms	Analogue Value	Input Alarm Values - Crevice Corr 2 Alarm
AV74	P3.O10 GC Alarm	mA	Analogue Value	Input Alarm Values - GC Alarm
AV75	P3.O11 Press. Alarm Low	Bar	Analogue Value	Input Alarm Values - Press. Alarm Low
AV76	P3.O12 Press. Alarm High	Bar	Analogue Value	Input Alarm Values - Press. Alarm High
AV77	P3.O13 Dosing Alarm Low	%	Analogue Value	Input Alarm Values - Dosing Alarm Low
AV78	P3.O14 Dosing Alarm High	%	Analogue Value	Input Alarm Values - Dosing Alarm High
AV79	P3.O15 Corr Rate Alarm	mmpy	Analogue Value	Input Alarm Values - Corr Rate Alarm
AV80	P3.O16 Cum DO Alarm	ppm	Analogue Value	Input Alarm Values - Cum DO Alarm
AV81	P3.O17 Cum Corr Alarm	mV	Analogue Value	Input Alarm Values - Cum Corr Alarm
AV82	P3.O18 Metal Loss Alarm	mm	Analogue Value	Input Alarm Values - Metal Loss Alarm
AV83	P3.O19 Flow Rate Alarm Low	l/h	Analogue Value	Input Alarm Values - Flow Rate Alarm Low
AV84	P3.O20 Flow Rate Alarm Hig	l/h	Analogue Value	Input Alarm Values - Flow Rate Alarm Hig

iv. Warning Limit Objects

BACnet Object	Name	Units	BACnet Object Type	Description
AV97	P4.O1 Temp Warning Low	°C	Analogue Value	Input Warning Values - Temp Warning Low
AV98	P4.O2 Temp Warning High	°C	Analogue Value	Input Warning Values - Temp Warning High
AV99	P4.O3 DO Warning	ppm	Analogue Value	Input Warning Values - DO Warning
AV100	P4.O4 Cond Warning Low	µS	Analogue Value	Input Warning Values - Cond Warning Low
AV101	P4.O5 Cond Warning High	µS	Analogue Value	Input Warning Values - Cond Warning High
AV102	P4.O6 pH Warning Low		Analogue Value	Input Warning Values - pH Warning Low
AV103	P4.O7 pH Warning High		Analogue Value	Input Warning Values - pH Warning High
AV104	P4.O8 C Corr 1 Warning	Ohms	Analogue Value	Input Warning Values - C Corr 1 Warning
AV105	P4.O9 C Corr 2 Warning	Ohms	Analogue Value	Input Warning Values - C Corr 2 Warning
AV106	P4.O10 GC Warning	mA	Analogue Value	Input Warning Values - GC Warning
AV107	P4.O11 Press. Warning Low	Bar	Analogue Value	Input Warning Values - Press. Warning Low
AV108	P4.O12 Press. Warning High	Bar	Analogue Value	Input Warning Values - Press. Warning High
AV109	P4.O13 Dosing Warning Low	%	Analogue Value	Input Warning Values - Dosing Warning Low
AV110	P4.O14 Dosing Warning High	%	Analogue Value	Input Warning Values - Dosing Warning High
AV111	P4.O15 Corr Rate Warning	mmpy	Analogue Value	Input Warning Values - Corr Rate Warning
AV112	P4.O16 Cum Do Warning	ppm	Analogue Value	Input Warning Values - Cum Do Warning
AV113	P4.O17 Cum GC Warning	mV	Analogue Value	Input Warning Values - Cum GC Warning
AV114	P4.O18 Metal Loss Warning	mm	Analogue Value	Input Warning Values - Metal Loss Warning
AV115	P4.O19 Flow R Low Warning	l/h	Analogue Value	Input Warning Values - Flow R Low Warning
AV116	P4.O20 Flow R High Warning	l/h	Analogue Value	Input Warning Values - Flow R High Warning

v. Site Input Objects

BACnet Object	Name	Units	BACnet Object Type	Description
AV129	P5.O1 Pressure: 4mA	Bar	Analogue Value	Site Specific Input - Pressure: 4mA
AV130	P5.O2 Pressure: 20mA	Bar	Analogue Value	Site Specific Input - Pressure: 20mA
AV131	P5.O3 Dosing: mX		Analogue Value	Site Specific Input - Dosing: mX
AV132	P5.O4 Dosing: B		Analogue Value	Site Specific Input - Dosing: B

vi. Alarm Parameter Objects

BACnet Object	Name	Units	BACnet Object Type	Description
AV161	P6.O1 Temperature	N/A	Analogue Value	Alarm Condition - Temperature
AV162	P6.O2 Dissolved Oxygen	N/A	Analogue Value	Alarm Condition - Dissolved Oxygen
AV163	P6.O3 Conductivity	N/A	Analogue Value	Alarm Condition - Conductivity
AV164	P6.O4 pH	N/A	Analogue Value	Alarm Condition - pH
AV165	P6.O5 Crevice Corr 1	N/A	Analogue Value	Alarm Condition - Crevice Corr 1
AV166	P6.O6 Crevice Corr 2	N/A	Analogue Value	Alarm Condition - Crevice Corr 2
AV167	P6.O7 Galvanic Current	N/A	Analogue Value	Alarm Condition - Galvanic Current
AV168	P6.O8 Pressure	N/A	Analogue Value	Alarm Condition - Pressure
AV169	P6.O9 Dosing	N/A	Analogue Value	Alarm Condition - Dosing
AV170	P6.O10 Corrosion Rate	N/A	Analogue Value	Alarm Condition - Corrosion Rate
AV171	P6.O11 Cumulative DO	N/A	Analogue Value	Alarm Condition - Cumulative DO
AV172	P6.O12 Cumulative GC	N/A	Analogue Value	Alarm Condition - Cumulative GC
AV173	P6.O13 Metal Loss	N/A	Analogue Value	Alarm Condition - Metal Loss

vii. Diagnostic Parameters

BACnet Object	Name	Units	BACnet Object Type	Description
AV193	P7.O1 System Code	N/A	Analogue Value	Message Codes - System Code
AV194	P7.O2 Corrosion Code	N/A	Analogue Value	Message Codes - Corrosion Code
AV195	P7.O3 Modbus Comms	N/A	Analogue Value	Message Codes - Modbus Comms

6. INTERNAL WEB PAGE DATA DISPLAY

The Aquila-s unit contains an internal web server that provides a web page where data is displayed along with alerts and messages. This page can be accessed from any browser at the IP address assigned to the Aquila-s unit. This page displays the real time measured and calculated parameter values and could be made available on the BMS system via a HTTP link.

i. Home Page

This page displays the last three alerts that have been raised with descriptive text for the diagnostic alerts. There are also the menu buttons to enable selection of the lower pages where the essential data values are displayed.

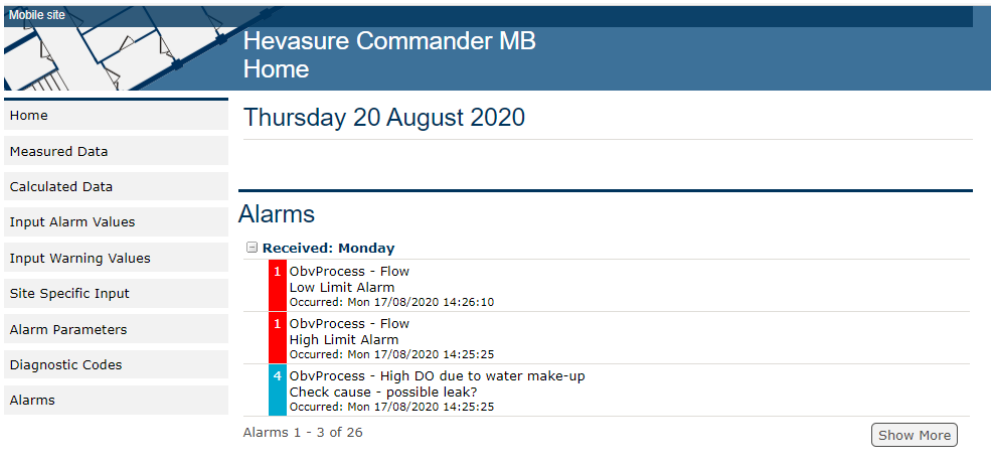


Figure 4

ii. Measured Data Page

The measured data page shows the current values.

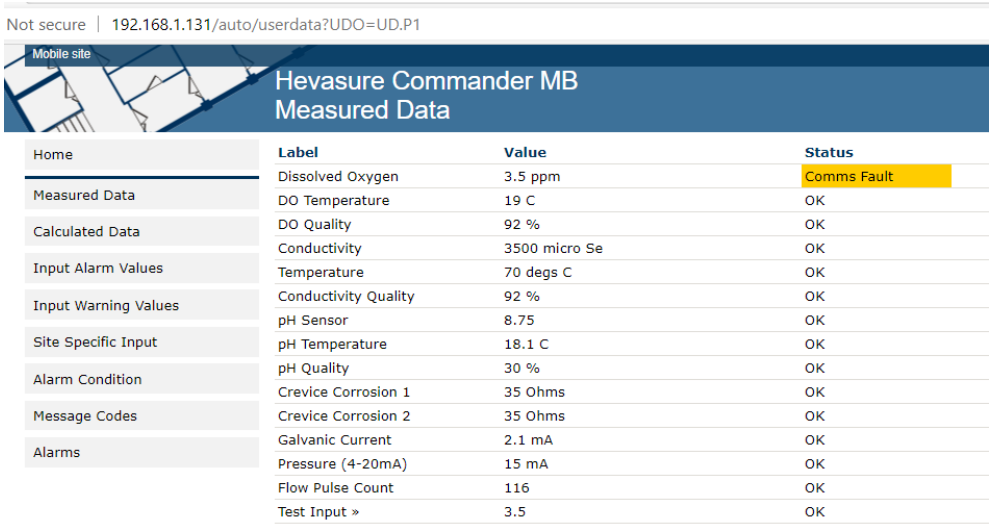


Figure 5

iii. Calculated Data Page

The calculated data page shows the parameters that have been derived from the measured data that reported and can have alert levels specified.

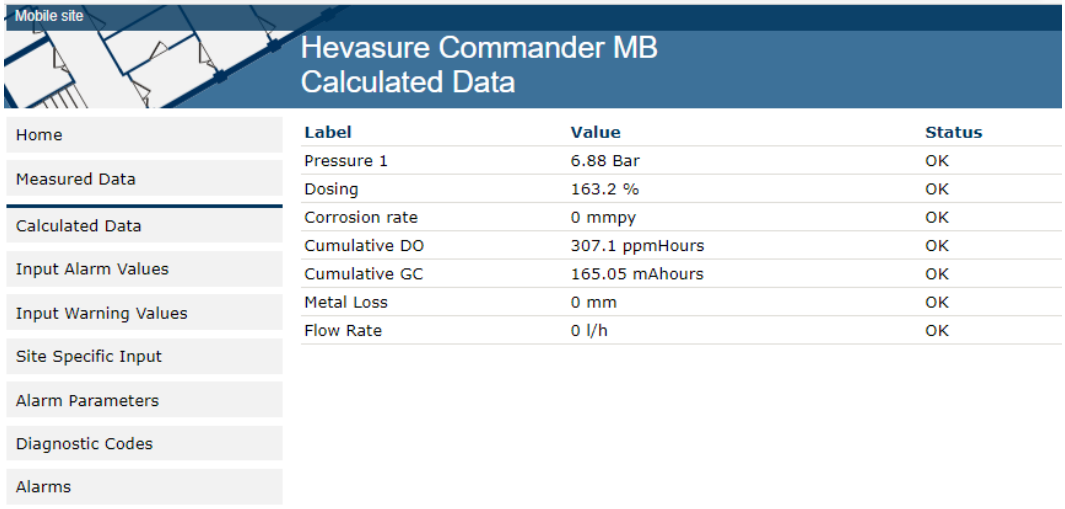


Figure 6

iv. Input Alarm Page

The Input Alarm page and the Input warning Page shows the upper and lower limits configured for a specific parameter. This page can be used to input and update the values.

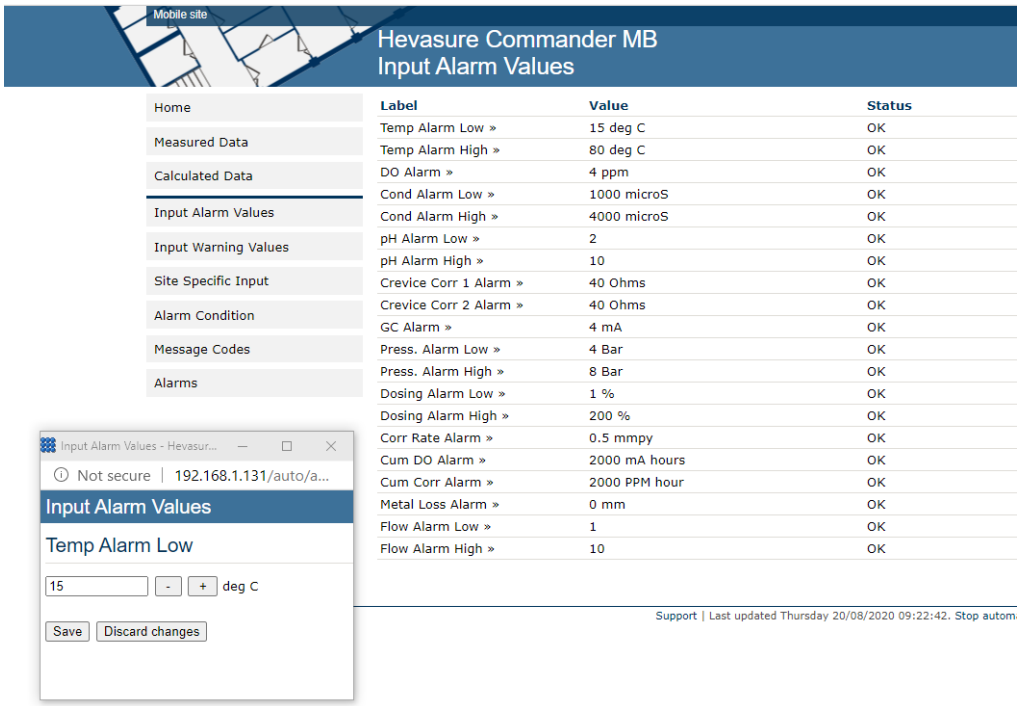


Figure 7

v. Alarm Parameter Page

The Alarm parameter page shows which parameters are currently in an alarm state, and the value of the alarm parameter, Section 4.ii

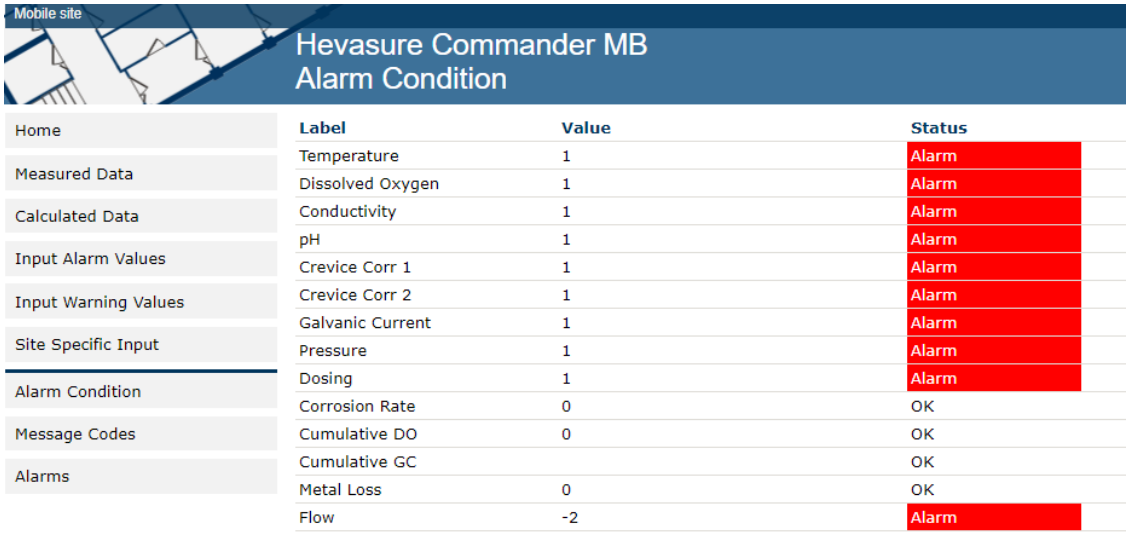


Figure 8

vi. Diagnostic Code Page

The diagnostic code page shows the code values which relate to specific diagnostic messages as defined in Section 4.ii.

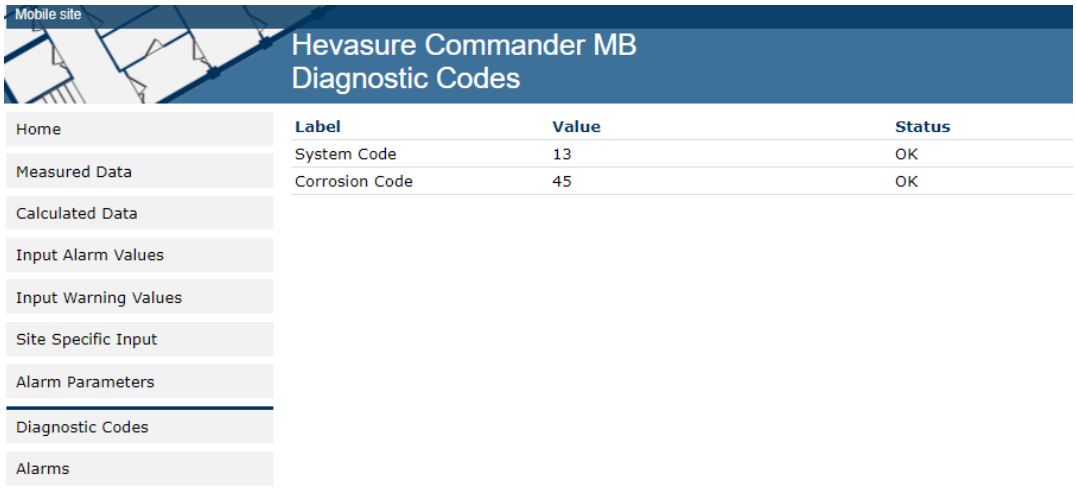


Figure 9

vii. Alarm Page

The alarm page shows a history of the parameter alarms that have occurred as well as the diagnostic messages that have been generated from the parameter alarms.

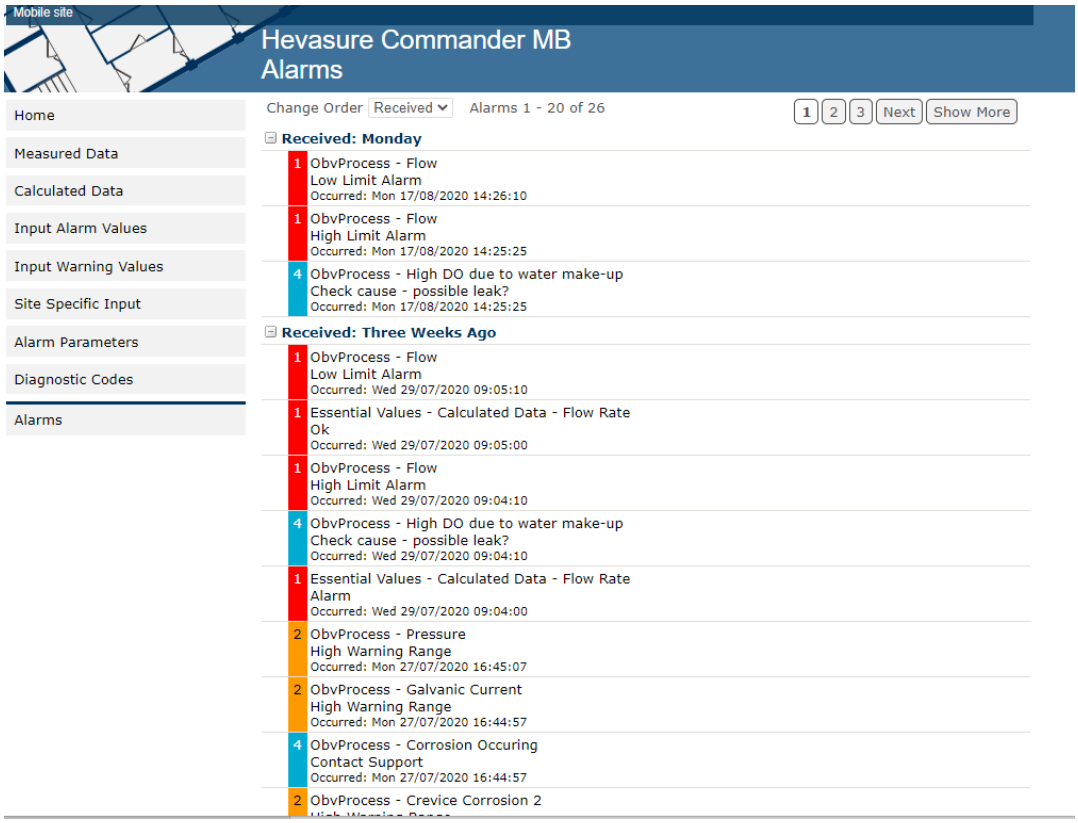


Figure 10

Document Control

V1.0: Issued 11/02/2021

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