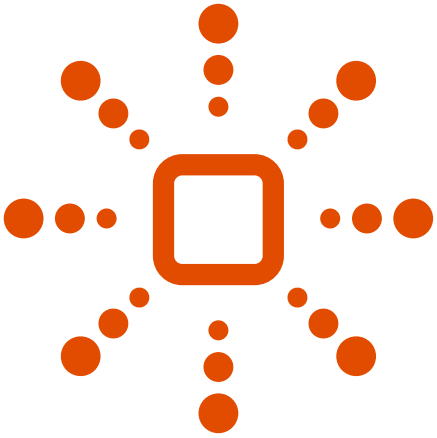
Borough Smart



Elexon Test Evidence v1.0

Introduction

Borough Smart is a generic device/asset control and monitoring platform. Discrete applications hosted by the platform, deliver device specific control and monitoring aspects. Generic features such as security and audit are core features of the platform that are utilised by all application verticals.

There are two apps introduced in this document:

- CMS Lighting – Control, Monitoring of lighting assets.
- Elexon – Manages the completeness, accuracy and timeliness of operational event logs and associated data.

Operators are assigned role(s) granting them access to apps. Specific roles determine the extent of app features available to them.

Device firmware is designed to complement application features. In this context CMS units collate operational events and state in relation to dimming profiles, stored in device memory. Periodically event and state information is uploaded to the application server, enabling information to be centrally aggregated and communicated by the Elexon management app.

The system can utilise numerous persistence mechanism(s) and be hosted on any cloud platform or on-premise.

Test Evidence

Test Group 1 – System Requirements

Test Group 1	**System Configuration** The CMS Test Agent should confirm the software versioning and operating platforms that will be subject to approval.	Evidence that the software and operating platform is subject to version control

Test 1.1 – CMS Software Version

Test Group 1	**Configuration Control**	
Test 1.1	CMS software version	Non-functional
Test 1.2	CMS operating platform and version	Non-functional

CMS_1_02-11-2022_1_Test 1.1

Borough Smart utilises optimised DevOps toolchains where all software modules, either proprietary or shared are versioned using the Semantic Versioning scheme. All module artefacts (including open-source dependencies) are backed up multiple times across a number of mirrored repositories, including cloud and physical storage drives.

Borough Smart Apps and associated device software is developed collaboratively using Git version control integrated with Jira for planning and tracking feature releases and issues.

Code developed for the system cannot be committed without an associated Jira ticket and approved Pull Request, created as part of the code review process. All features and issues have associated Jira epics and issues. Release notes generated for a given module consist of a list of all epics and issues delivered in that release/version.

Secured Jira access is provided to all Borough Smart customers for their installation. This provides access to ticket management and release notes.

Semantic versions are visible throughout the platform at the following component levels:

- Dashboard – v#.#.#
- App – v#.#.#
- Device – v#.#.#

Test 1.2 – CMS Operating Platform and Version

CMS_1_02-11-2022_1_Test 1.2

Example device data shown below includes the version of the device firmware and associated payload firmware.

	cms_unit_reference character varying (255)	unit_version character varying (255)	event_lpp_version character varying (255)	nema_lpp_version character varying (255)
1	elexon000001	v2.2.0	v1.0.0	v2.0.0
2	elexon000002	v2.2.0	v1.0.0	v2.0.0
3	elexon000003	v2.2.0	v1.0.0	v2.0.0
4	elexon000004	v2.2.0	v1.0.0	v2.0.0
5	elexon000005	v2.2.0	v1.0.0	v2.0.0

Re-approval will be sought when there are material changes to platform features that are subject to Elexon test criteria.

Test Group 2 – System Security

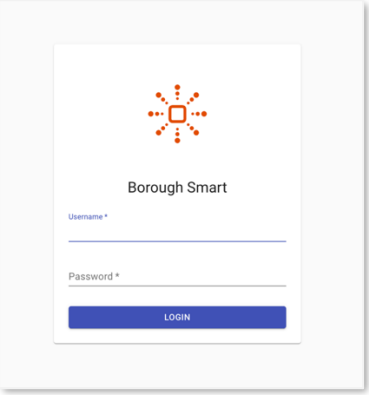
Test Group 2	**Security** The CMS System test agent should confirm the procedures which provide secure access to data. Operators should only be able to access data which is relevant to them. Secure access procedures should be demonstrated for Customers and Meter Administrators	Evidence that data is secure and that only relevant data can be accessed by the appropriate participant.

Test Group 2	**System Security**	
Test 2.1	Customers	4.5.2.3 (i)
Test 2.2	MA	Functional

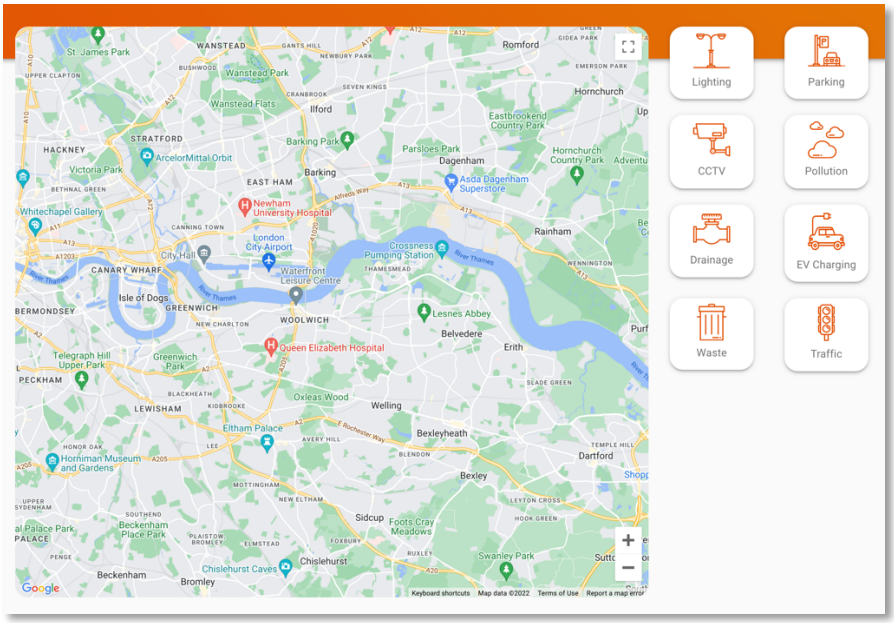
CMS_2_02-11-2022_1_Test 2.1

Each Borough Smart instance is hosted within secure Virtual Private Networks (VPNs). Operators are granted access to VPN instances.

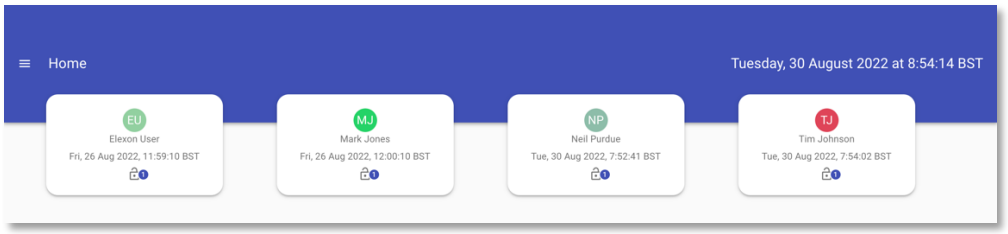
Once an operator has established a secure connection with the VPN they access the system dashboard via the login screen:



Once authenticated the operator can only navigate apps relevant to their role(s):

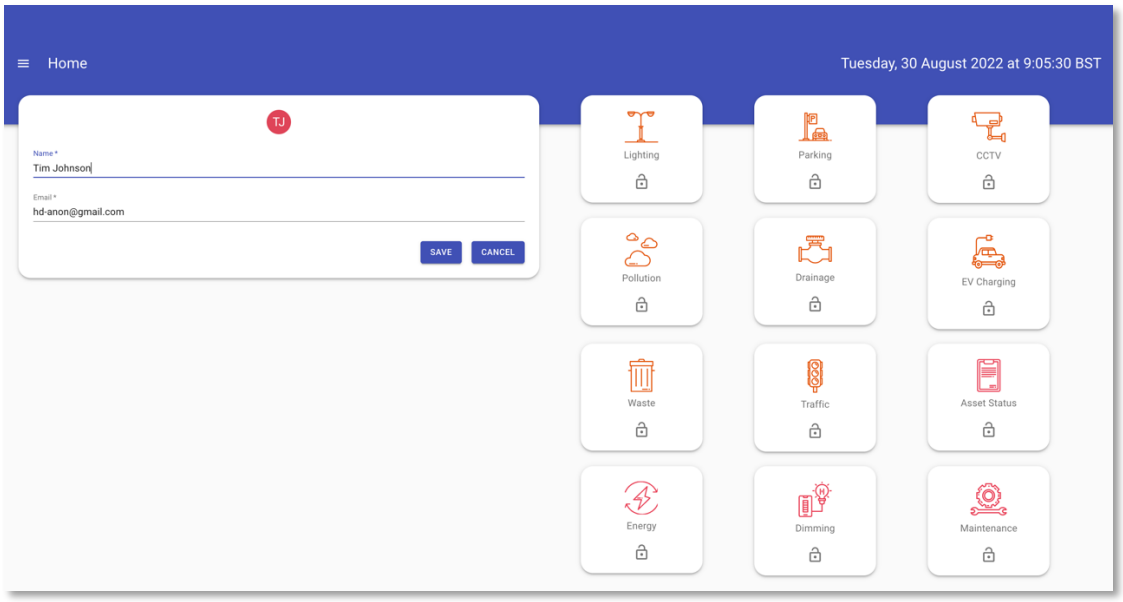


System administrators are able to create, remove, update and delete operators.



CMS_2_02-11-2022_1_Test 2.2

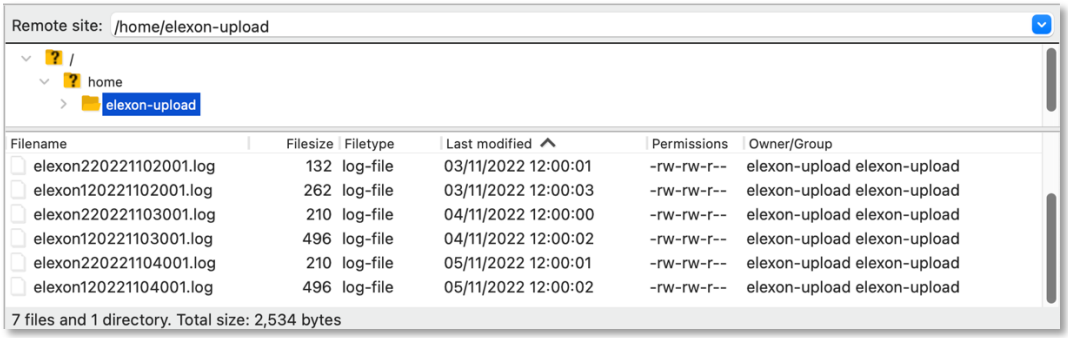
Operators can access and manage their personal profile, active and inactive apps are displayed and operators can request access to locked features.



Administrators are able to manage the profiles of all operators in the system granting and revoking role memberships.

All user activity within the system is audited, all user information is encrypted.

Secure SFTP servers are hosted within the VPN. System administrators can grant and revoke access to SFTP endpoints. FileZilla and other SFTP tools can be utilised to download operational event logs:



Test Group 3 – Synchronisation to UTC

Test Group 3	**Synchronisation to UTC** The CMS System test agent should confirm that the CMS System is synchronised to UTC, either by connection to internet time servers or a radio clock, and are accurate to within ± 20 seconds per month.	Evidence that the CMS System is synchronised to UTC within ± 20 seconds per month.

Test Group 3	**Synchronisation to UTC**	4.5.2.3 (k)

CMS_3_02-11-2022_1_Test 3

Test 3.1 - Server Time Synchronisation

All servers in the architecture are SNTP synchronised:

```
                      Local time: Sat 2021-10-23 18:08:35 BST
                  Universal time: Sat 2021-10-23 17:08:35 UTC
                        RTC time: Sat 2021-10-23 17:08:36
                       Time zone: Europe/London (BST, +0100)
      System clock synchronized: yes
systemd-timesyncd.service active: yes
                  RTC in local TZ: no
```

Test 3.2 - Device Time Synchronisation

Each device and gateway is equipped with an onboard GNSS receiver and continuously synchronised to UTC. Sunset/Sunrise is calculated daily using longitude, latitude and date information.

All timestamps are stored as UTC with time zone information.

	name character varying (255)	device_time timestamp with time zone	latitude real	longitude real	sunrise integer	sunset integer
1	elexon000001	2022-11-02 15:28:19.592177+00	52.2073	-0.5538	423	993
2	elexon000003	2022-11-02 15:28:24.850864+00	52.2073	-0.5539	423	993
3	elexon000002	2022-11-02 15:28:31.133944+00	52.2073	-0.5539	423	993
4	elexon000005	2022-11-02 15:28:43.134857+00	52.2075	-0.5539	423	993
5	elexon000004	2022-11-02 15:28:43.212137+00	52.2075	-0.5539	423	993

Test Group 4a – Detailed Inventory Information

Test Group 4	**Inventory control information** The CMS System test agent should confirm the processes for addition, modification and deletion of Inventory Control information required for the key test scenarios specified in Section 4, either manually or electronically. The Data subject to testing is: • Sub-Meter ID • Effective From Data • CMS Unit Reference • Number of Items • Charge Code There is also a detailed inventory test to confirm that it is input, stored and amended correctly with an appropriate audit trail. The methodology for ensuring that there is a process to synchronise the details held in the CMS and the Customer's detailed inventory (asset database), in particular how CMS Unit References are linked should be described. This must also confirm that where the CMS is operates in more than one Distribution Area, inventory information is assigned to the correct sub-meter ID. The operator of the MA System should demonstrate the recording of the audit trail for the entries made above.	Evidence is required that; • The Data is held within the CMS • Amendments to the Data should be demonstrated to the CMS Test Agent Details of the methodology for synchronising Data between the CMS and the Customer's asset database.

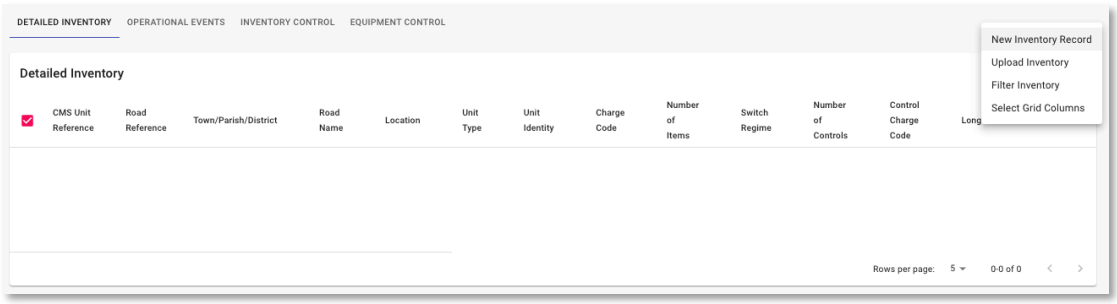
Detailed Inventory Information can be added and updated via the Borough Smart Dashboard individually or in batches. This section documents Test Group 4a and supports input element tests 4.1 to 4.1.17 in the Requirements Test Checklist

Test Ref	Requirement / Details	Requirement Reference
Test Group 4a	**Detailed Inventory information**	
Test 4.1	Add, delete, modify manually or electronically:	Functional
Test 4.1.1	Road Reference	Functional
Test 4.1.2	Town, Parish, District	Functional
Test 4.1.3	Road Name	Functional
Test 4.1.4	Location	Functional
Test 4.1.5	Unit Type	Functional
Test 4.1.6	Unit Identity	Functional
Test 4.1.7	CMS Unit Reference	Functional
Test 4.1.8	Charge Code	Functional
Test 4.1.9	Number of Items	Functional
Test 4.1.10	Switch Regime	Functional
Test 4.1.11	Number of Controls	Functional
Test 4.1.12	Control Charge Code	Functional
Test 4.1.13	Ordinance Survey Grid ref 'East' or Latitude	Functional
Test 4.1.14	Ordinance Survey Grid ref 'North' or Longitude	Functional
Test 4.1.15	Exit Point	Functional
Test 4.1.16	Distributor	Functional
Test 4.1.17	Sub-meter	Functional
Test 4.2	Audit Trail	Functional

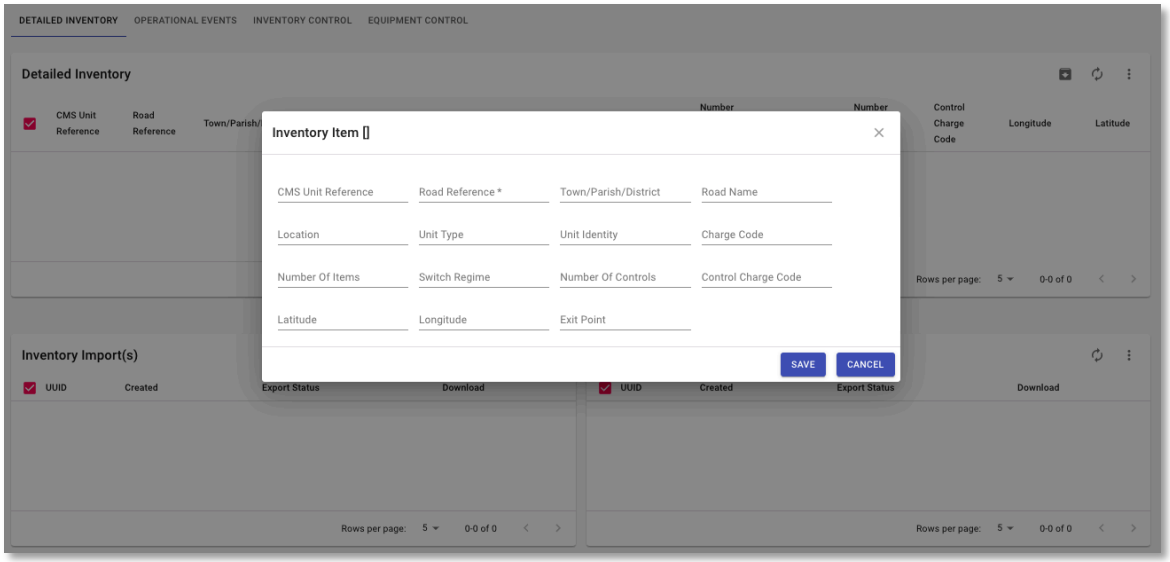
Test 4.1 – Add, delete, modify manually.

CMS_4_05-11-2022_1_Manual Test 4.1 – 4.1.17

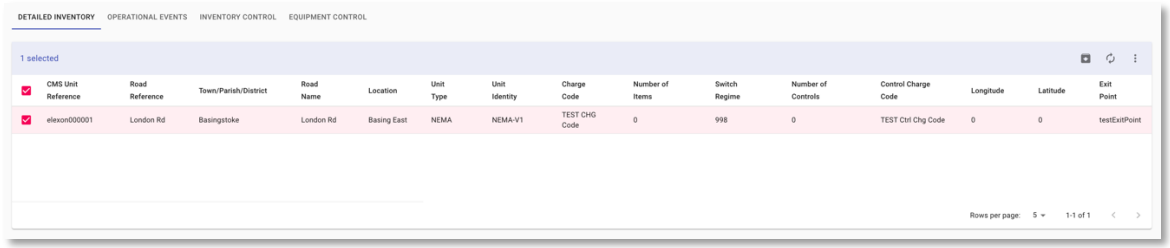
Select 'New Inventory Record' from the 'Detailed Inventory' grid menu:



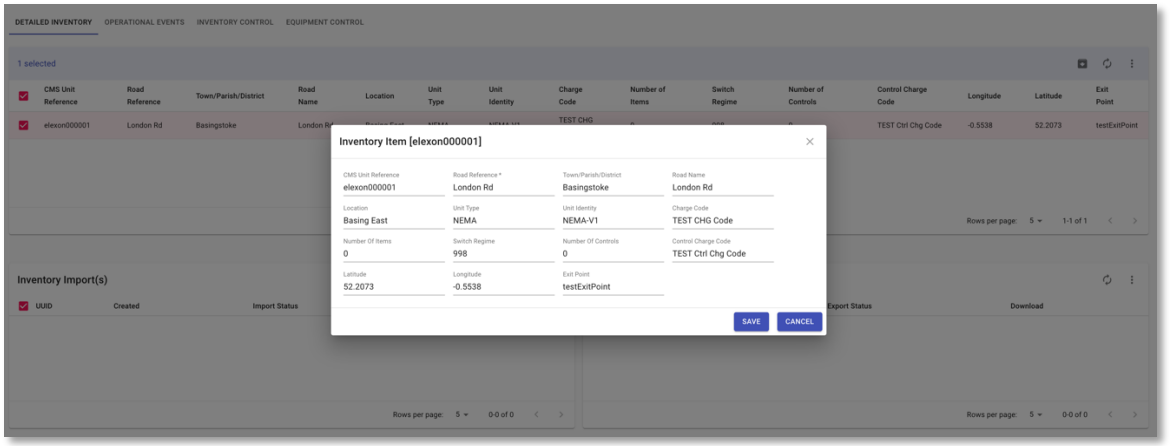
Enter the inventory item details and select ‘Save’



The new inventory item will appear in the ‘Detailed Inventory’ grid:



Select the new inventory item by clicking the item row in the ‘Detailed Inventory’ grid. Select ‘Update’ from the grid menu:

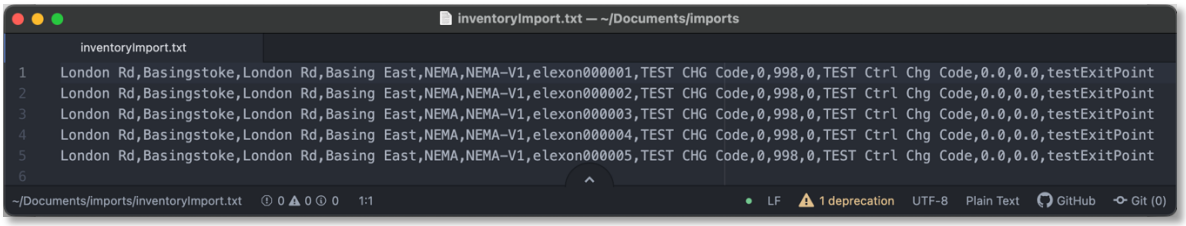


To delete the record select delete rather than update.

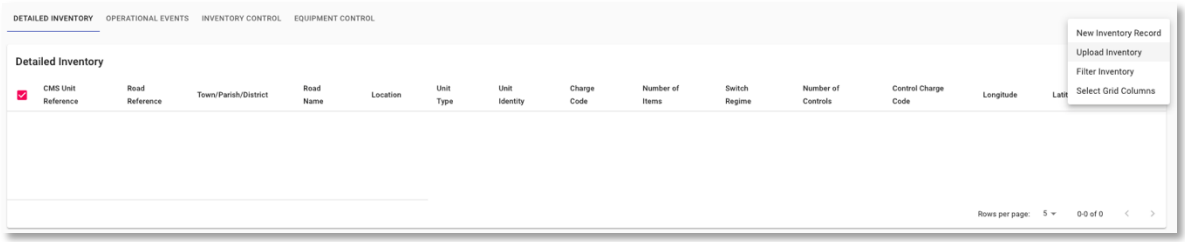
Test 4.1 – Add, delete, modify – batch.

CMS_4_05-11-2022_1_Batch Test 4.1 – 4.1.17

Detailed Inventory Information can be added and updated via batch files. The format of the batch files matches the order of the data elements listed 4.1.1 to 4.1.17 in the Requirements Test Checklist

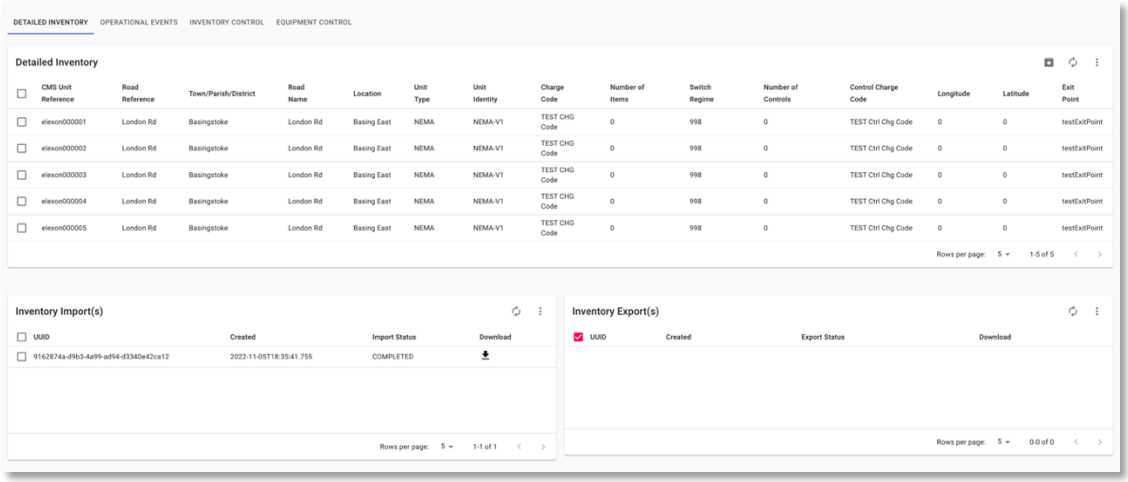


Select 'Upload Inventory' from the 'Detailed Inventory' grid menu:

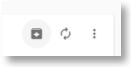


Drag a file into the drop zone or click the icon in the drop zone to browse the file system:

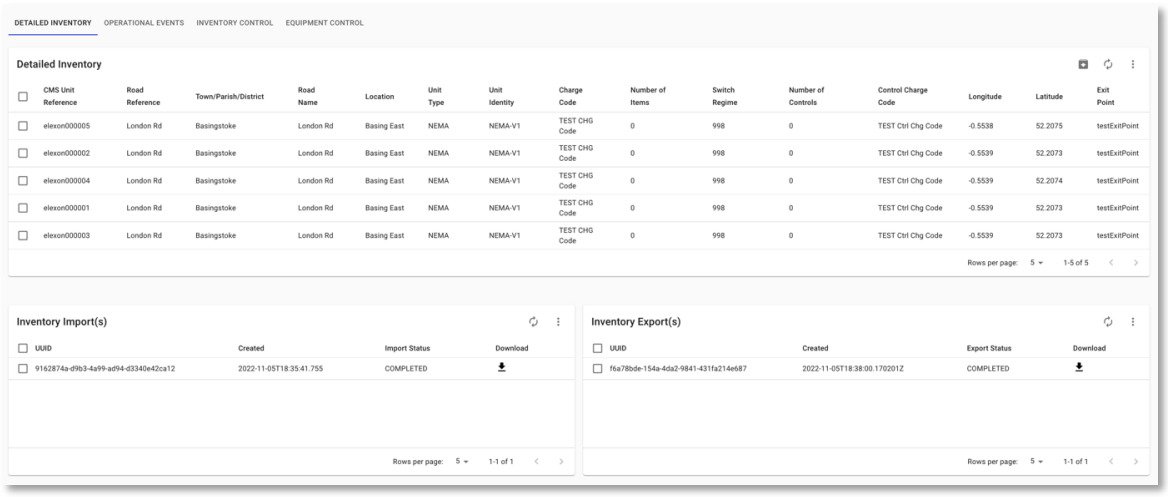
As the batch load commences an entry will appear in the ‘Inventory Import(s)’ grid. This enables the user to monitor the status of the import, access the file that was uploaded and a report of any invalid records.



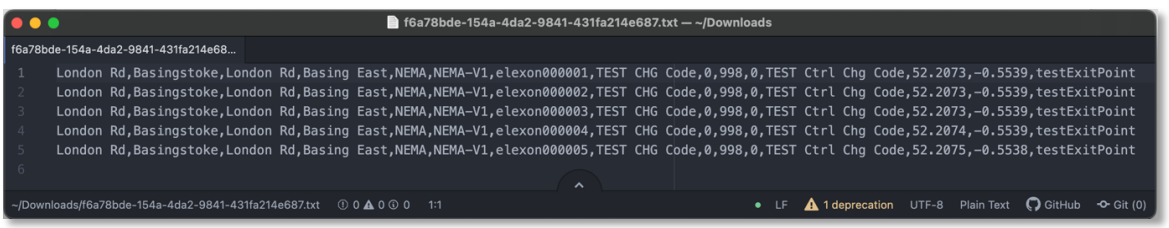
The user can filter, sort and modify the records via the dashboard or they can bulk update. This can be achieved by amending their original batch file or downloading the detailed inventory, amending the export and re-importing. To export the inventory in the detailed inventory grid select the download icon.



As the export commences the export detail will appear in the ‘Inventory Export(s)’ grid. Selecting the download icon will download the file.



Any changes made to the imported inventory items are reflected in the inventory export. In the export below the system has automatically updated the latitude and longitude for each active device.



Once the exported batch file is updated it can be imported by repeating the steps above.

Test 4.2 – Audit Trail

CMS_4_05-11-2022_1_Test 4.2

There are two categories of audit captured in the system 'Operational Audit' and 'Entity Audit'. Operational audit captures the operations performed by the user at a given point in time:

	uuid [PK] character varying (255)	created_at timestamp with time zone	updated_at timestamp with time zone	created_by character varying (255)	updated_by character varying (255)	operation character varying (255)
1	8b6327d3-c378-4d5e-a501-e317e4...	2022-11-05 18:23:07.771+00	2022-11-05 18:23:07.771+00	admin	admin	LOGIN
2	9944909b-209f-4c0d-a1f4-874df6c...	2022-11-05 18:35:41.872+00	2022-11-05 18:35:41.872+00	admin	admin	INVENTORY_IMPORT
3	9d59857a-1665-4f76-a8e2-624111...	2022-11-05 18:38:00.275+00	2022-11-05 18:38:00.275+00	admin	admin	INVENTORY_EXPORT

Entity Audit captures entity state transitions in relation to the operations performed by a given user or the system. Entity state is captured in two collections ELEXON_INVENTORY_ITEM and ELEXON_INVENTORY_ITEM_AUD. The first collection captures the latest state of the entity:

	cms_unit_reference [PK] character varying (255)	created_at timestamp with time zone	updated_at timestamp with time zone	created_by character varying (255)	updated_by character varying (255)	charge_code character varying (255)	control_charge_code character varying (255)	exit_point character varying (255)
1	elexon000001	2022-11-05 18:35:41.803+00	2022-11-05 18:56:55.455+00	admin	system	TEST CHG Code	TEST Ctrl Chg Code	testExitPoint
2	elexon000002	2022-11-05 18:35:41.806+00	2022-11-05 19:01:48.557+00	admin	system	TEST CHG Code	TEST Ctrl Chg Code	testExitPoint
3	elexon000003	2022-11-05 18:35:41.809+00	2022-11-05 18:36:41.77+00	admin	system	TEST CHG Code	TEST Ctrl Chg Code	testExitPoint
4	elexon000004	2022-11-05 18:35:41.811+00	2022-11-05 18:58:57.454+00	admin	system	TEST CHG Code	TEST Ctrl Chg Code	testExitPoint
5	elexon000005	2022-11-05 18:35:41.814+00	2022-11-05 19:03:11.891+00	admin	system	TEST CHG Code	TEST Ctrl Chg Code	testExitPoint

The ELEXON_INVENTORY_ITEM_AUD table captures each revision of a given entity detailing the deltas between each revision, for the inventory items above the audit table contains ten records which reflect the uploaded items and the changes made by the system when the GNSS locations were automatically synchronised:

	cms_unit_reference character varying (255)	created_at timestamp with time zone	updated_at timestamp with time zone	created_by character varying (255)	updated_by character varying (255)	latitude real	longitude real
1	elexon000001	2022-11-05 18:35:41.803+00	2022-11-05 18:35:41.803+00	admin	admin	0	0
2	elexon000002	2022-11-05 18:35:41.806+00	2022-11-05 18:35:41.806+00	admin	admin	0	0
3	elexon000003	2022-11-05 18:35:41.809+00	2022-11-05 18:35:41.809+00	admin	admin	0	0
4	elexon000004	2022-11-05 18:35:41.811+00	2022-11-05 18:35:41.811+00	admin	admin	0	0
5	elexon000005	2022-11-05 18:35:41.814+00	2022-11-05 18:35:41.814+00	admin	admin	0	0
6	elexon000005	2022-11-05 18:35:41.814+00	2022-11-05 18:35:57.208+00	admin	system	52.2075	-0.5538
7	elexon000002	2022-11-05 18:35:41.806+00	2022-11-05 18:36:24.551+00	admin	system	52.2073	-0.5539
8	elexon000004	2022-11-05 18:35:41.811+00	2022-11-05 18:36:36.488+00	admin	system	52.2074	-0.5539
9	elexon000001	2022-11-05 18:35:41.803+00	2022-11-05 18:36:38.389+00	admin	system	52.2073	-0.5539
10	elexon000003	2022-11-05 18:35:41.809+00	2022-11-05 18:36:41.77+00	admin	system	52.2073	-0.5539

User 'admin' logged in at 2022-11-05 18:23:07, then at 18:35:41 imported an inventory batch file and finally exported the inventory contents at 18:38:00

The system retains the import and export records for audit purposes, file content for the 18:35 import:

	uuid [PK] character varying (255)	created_by character varying (255)	date_created timestamp with time zone	extract oid	import_type integer	job_status character varying (255)
1	9162874a-d9b3-4a99-ad94-d3340e...	admin	2022-11-05 18:35:41.755+00	222768	0	COMPLETED

File content for the 18:38 export:

	uuid [PK] character varying (255)	created_by character varying (255)	date_created timestamp with time zone	export_type integer	extract oid	job_status character varying (255)
1	f6a78bde-154a-4da2-9841-431fa21...	admin	2022-11-05 18:38:00.170201+00	1	222769	COMPLETED

Test Group 4b – Inventory Control Information

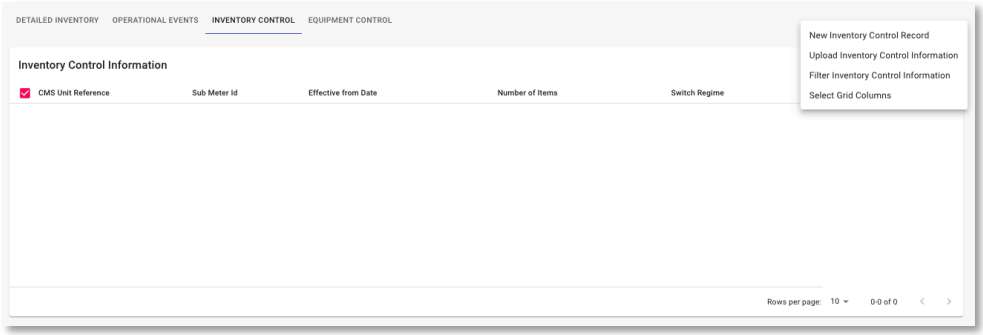
Inventory Control Information can be added and updated via the Borough Smart Dashboard individually or in batches. This section documents Test Group 4b and supports input element tests 4.3.1 to 4.3.6 in the Requirements Test Checklist

Test Group 4b	Inventory control information	
Test 4.3	Add, delete, modify manually or electronically:	Functional
Test 4.3.1	Sub-Meter ID	Functional
Test 4.3.2	Effective From Date	Functional
Test 4.3.3	CMS Unit Reference	Functional
Test 4.3.4	Number of Items	Functional
Test 4.3.5	Switch Regime	Functional
Test 4.3.6	Charge Code	Functional
Test 4.4	Audit Trail	Functional

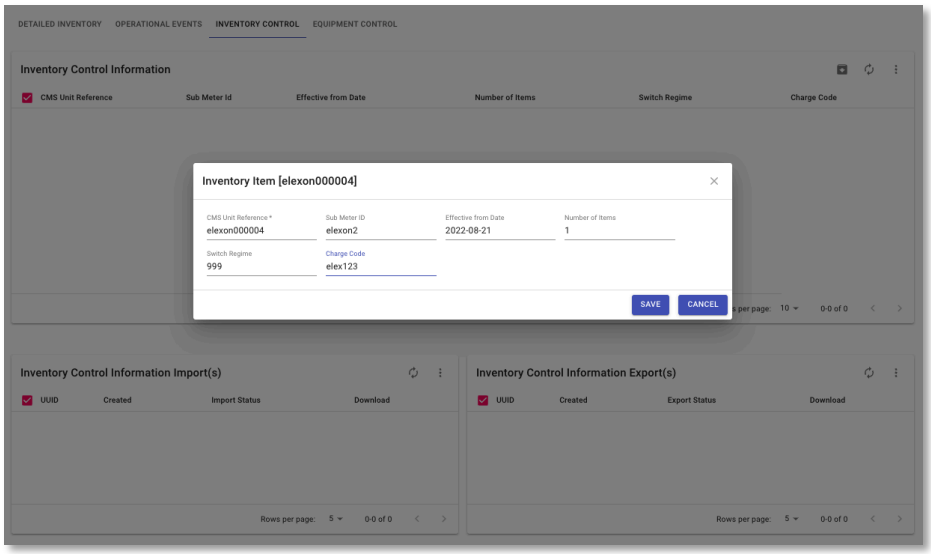
Test 4.3 – Add, delete, modify manually.

CMS_4_06-11-2022_1_Manual Test 4.3 – 4.3.6

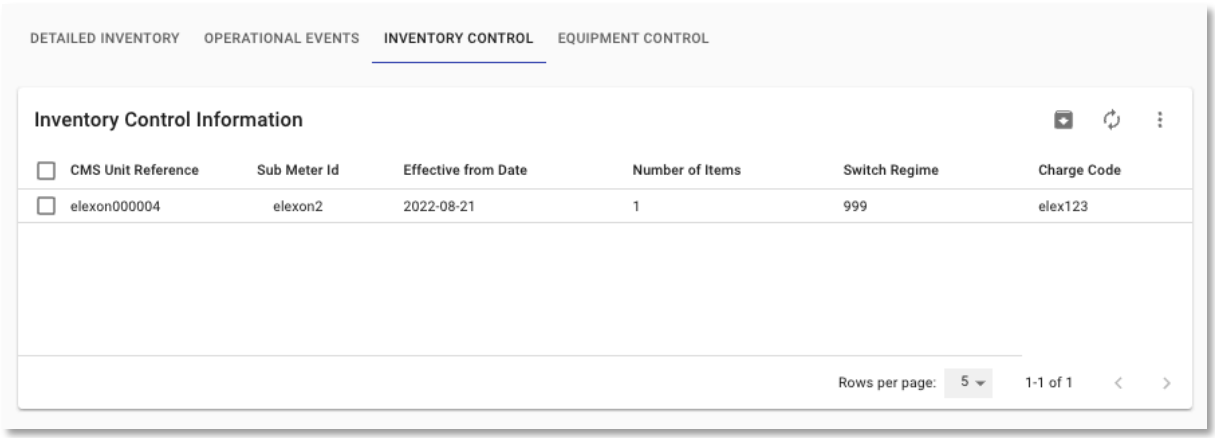
Select ‘New Inventory Control Record’ from the ‘Inventory Control Information’ grid menu:



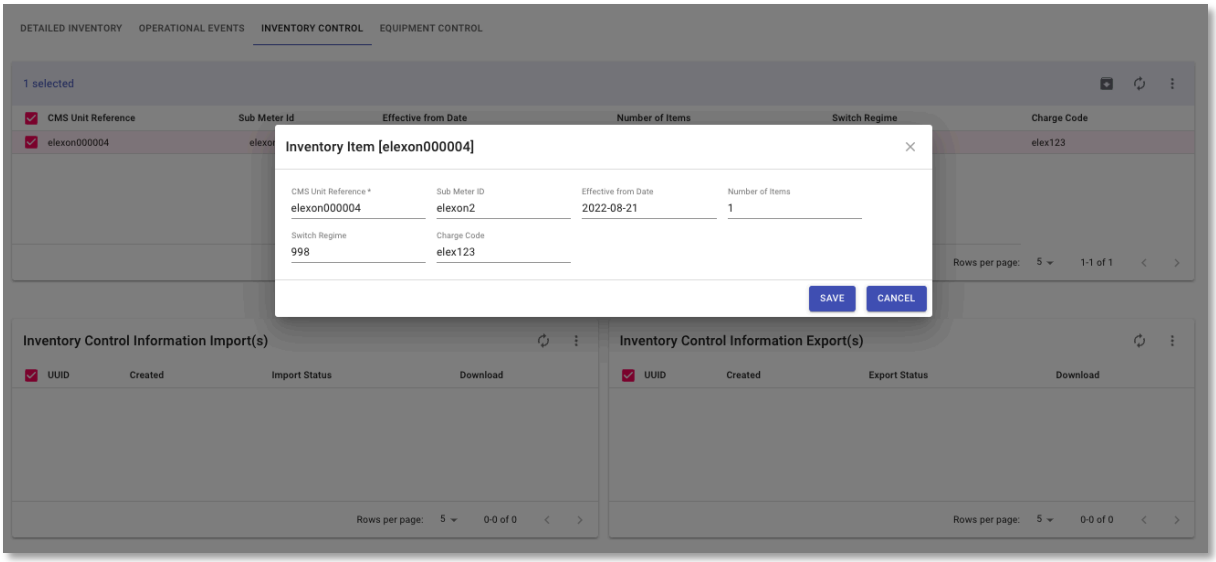
Enter the inventory control item details and select ‘Save’



The new inventory control item will appear in the ‘Inventory Control Information’ grid:



Select the new inventory control item by clicking the item row in the ‘Inventory Control Information’ grid. Select ‘Update’ from the grid menu :

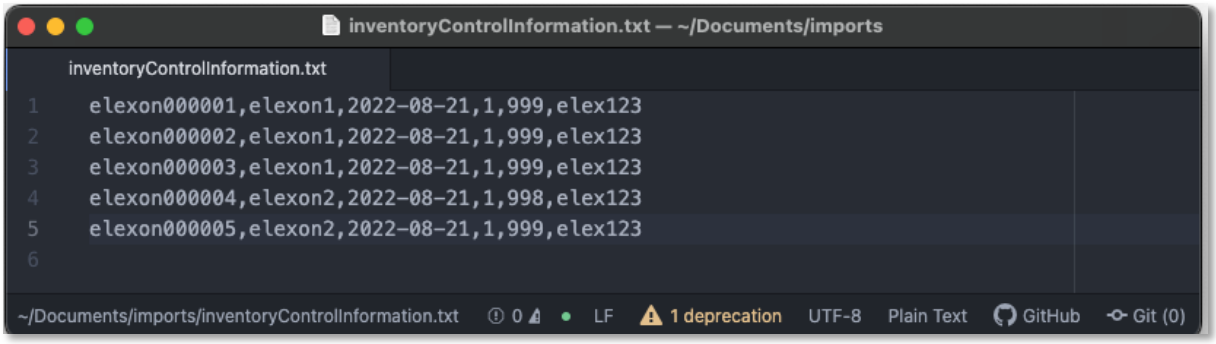


To delete the record select delete rather than update.

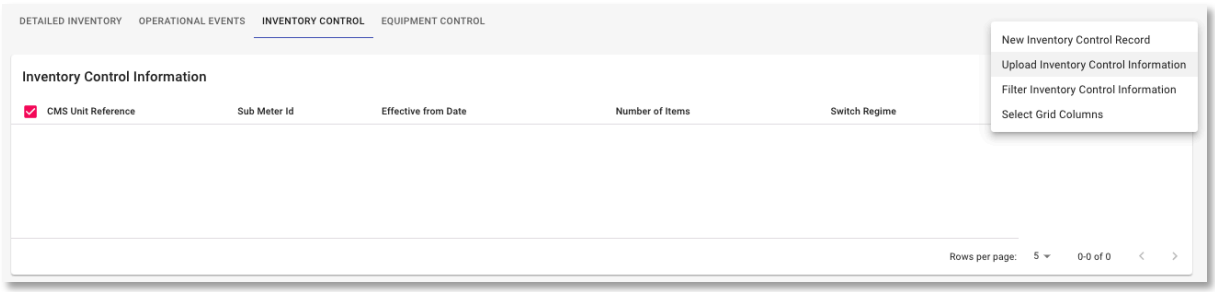
Test 4.3 – Add, delete, modify – batch.

CMS_4_06-11-2022_1_Batch Test 4.3 – 4.3.6

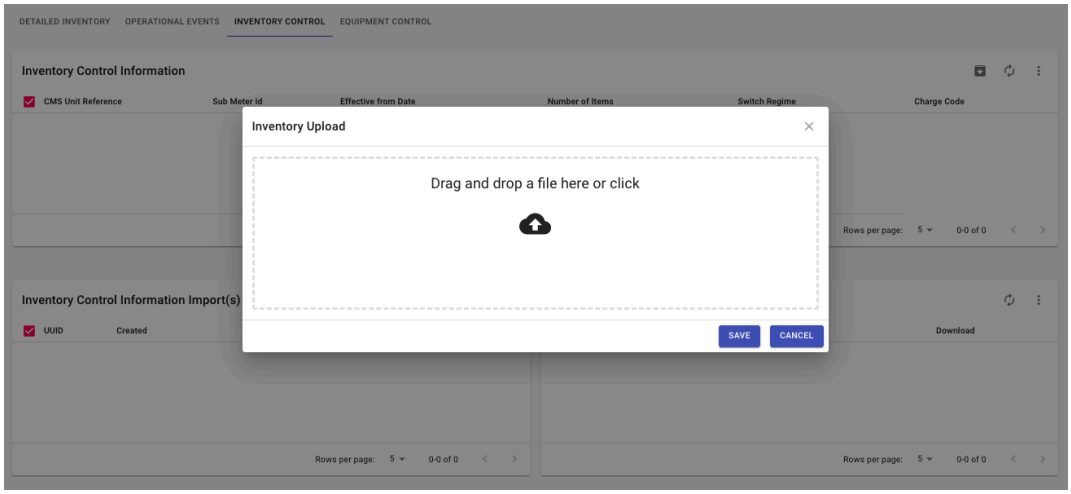
Inventory Control Information can be added and updated via batch files. The format of the batch files matches the order of the data elements listed 4.3.1 to 4.3.6 in the Requirements Test Checklist



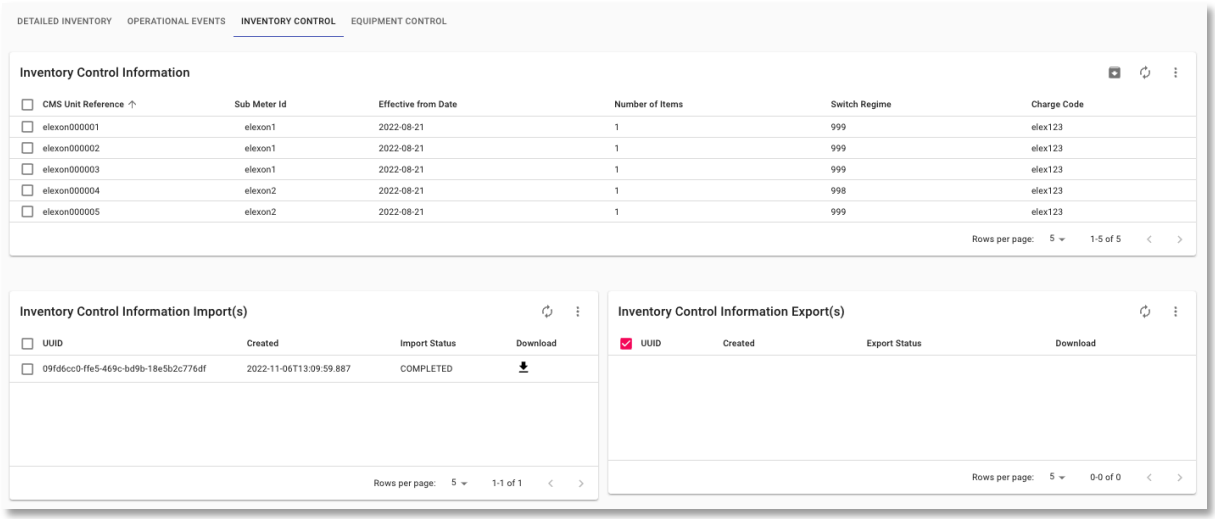
Select 'Upload Inventory Control Information' from the 'Inventory Control Information' grid menu:



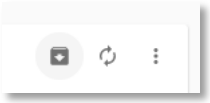
Drag a file into the drop zone or click the icon in the drop zone to browse the file system:



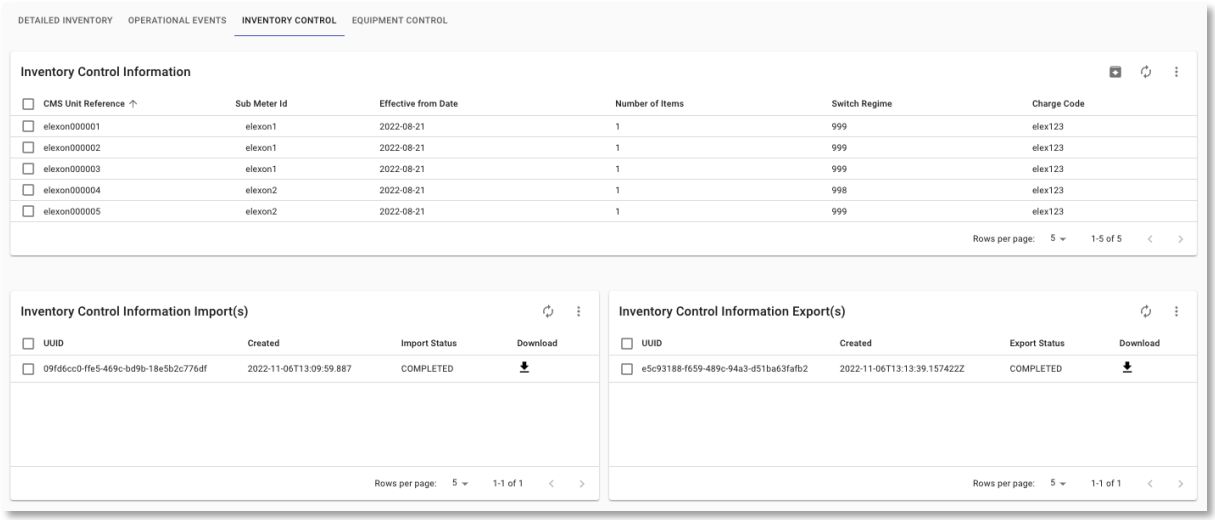
As the batch load commences an entry will appear in the ‘Inventory Control Information Import(s)’ grid. This enables the user to monitor the status of the import, access the file that was uploaded and a report of any invalid records.



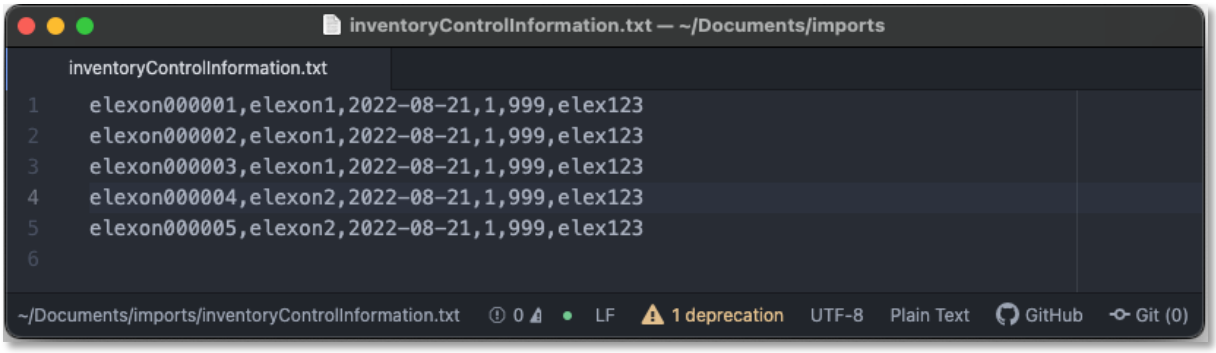
The user can filter, sort and modify the records via the dashboard or they can bulk update. This can be achieved by amending their original batch file or downloading the inventory control information, amending the export and re-importing. To export the inventory control information select the download icon in the top RHS of the inventory control information grid.



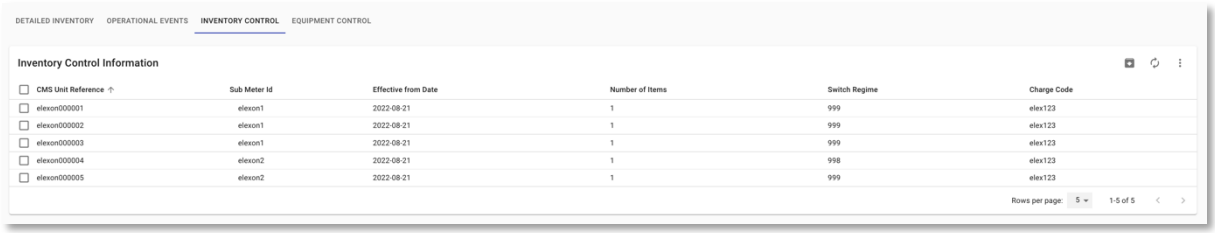
As the export commences the export detail will appear in the ‘Inventory Control Information Export(s)’ grid. Selecting the download icon will download the file.



Any changes made to the imported inventory control items are reflected in the inventory control export.



In the export above the Switch Regime for ‘elexon000004’ has been changed to 998 from 999. Selecting the upload inventory control menu item and selecting the modified file will result in the changes below:



The Switch Regime value for CMS unit ‘elexon000004’ has been updated.

Test 4.4 – Audit Trail

CMS_4_06-11-2022_1_Test 4.4

Operational audit:

	uuid [PK] character varying (255)	created_at timestamp with time zone	updated_at timestamp with time zone	created_by character varying (255)	updated_by character varying (255)	operation character varying (255)
1	8891e41b-00db-4eb3-bb45-f49988f1...	2022-11-06 12:50:18.705+00	2022-11-06 12:50:18.705+00	admin	admin	LOGIN
2	19db1db6-ae1d-4c59-9557-cdd49294...	2022-11-06 13:04:36.033+00	2022-11-06 13:04:36.033+00	admin	admin	INVENTORY_CONTROL_SAVE
3	37eb5a8a-c057-45db-b015-20455e63...	2022-11-06 13:09:59.975+00	2022-11-06 13:09:59.975+00	admin	admin	INVENTORY_CONTROL_IMPORT
4	4bbbe740-3860-433a-86a5-2750e6d3...	2022-11-06 13:13:39.229+00	2022-11-06 13:13:39.229+00	admin	admin	INVENTORY_CONTROL_EXPORT
5	c9d32407-22eb-4b5b-9778-bd35e58d...	2022-11-06 13:16:09.03+00	2022-11-06 13:16:09.03+00	admin	admin	INVENTORY_CONTROL_IMPORT
6	a0c9778f-ca22-486f-9172-ab81645c...	2022-11-06 13:17:21.201+00	2022-11-06 13:17:21.201+00	admin	admin	INVENTORY_CONTROL_SAVE

Entity Audit – ELEXON_INVENTORY_CONTROL_INFO

	cms_unit_reference [PK] character varying (255)	created_at timestamp with time zone	updated_at timestamp with time zone	created_by character varying (255)	updated_by character varying (255)	charge_code character varying (255)	effective_from_date timestamp without time zone	number_of_items integer	sub_meter_id character varying (255)	switch_regime integer
1	elexon000001	2022-11-06 13:09:59.918+00	2022-11-06 13:16:08.983+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon1	999
2	elexon000002	2022-11-06 13:09:59.92+00	2022-11-06 13:16:08.983+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon1	999
3	elexon000003	2022-11-06 13:09:59.922+00	2022-11-06 13:16:08.983+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon1	999
4	elexon000005	2022-11-06 13:09:59.925+00	2022-11-06 13:16:08.983+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon2	999
5	elexon000004	2022-11-06 13:01:17.184+00	2022-11-06 13:17:21.207+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon2	998

Entity Audit – ELEXON_INVENTORY_CONTROL_INFO_AUD

cms_unit_reference [PK] character varying (255)	rev [PK] integer	revtype smallint	created_at timestamp with time zone	updated_at timestamp with time zone	created_by character varying (255)	updated_by character varying (255)	charge_code character varying (255)	effective_from_date timestamp without time zone	number_of_items integer	sub_meter_id character varying (255)	switch_regime integer
elexon000004	7565	0	2022-11-06 13:01:17.184+00	2022-11-06 13:01:17.184+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon2	999
elexon000004	7570	1	2022-11-06 13:01:17.184+00	2022-11-06 13:04:36.038+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon2	998
elexon000001	7573	0	2022-11-06 13:09:59.918+00	2022-11-06 13:09:59.918+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon1	999
elexon000002	7573	0	2022-11-06 13:09:59.92+00	2022-11-06 13:09:59.92+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon1	999
elexon000003	7573	0	2022-11-06 13:09:59.922+00	2022-11-06 13:09:59.922+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon1	999
elexon000005	7573	0	2022-11-06 13:09:59.925+00	2022-11-06 13:09:59.925+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon2	999
elexon000004	7573	1	2022-11-06 13:01:17.184+00	2022-11-06 13:09:59.93+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon2	998
elexon000001	7578	1	2022-11-06 13:09:59.918+00	2022-11-06 13:16:08.983+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon1	999
elexon000002	7578	1	2022-11-06 13:09:59.92+00	2022-11-06 13:16:08.983+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon1	999
elexon000003	7578	1	2022-11-06 13:09:59.922+00	2022-11-06 13:16:08.983+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon1	999
elexon000004	7578	1	2022-11-06 13:01:17.184+00	2022-11-06 13:16:08.983+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon2	999
elexon000005	7578	1	2022-11-06 13:09:59.925+00	2022-11-06 13:16:08.983+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon2	999
elexon000004	7580	1	2022-11-06 13:01:17.184+00	2022-11-06 13:17:21.207+00	admin	admin	elex123	2022-08-21 00:00:00	1	elexon2	998

Test Group 5 - CMS Lighting - Issue Instructions

Test Group 5 Lighting CMS	**CMS Issue Instructions** The operator of the CMS System should demonstrate the issuing of operational switching times and power level instructions for CMS Units in the CMS System for the following scenarios: • Scenario 1 – Switch Regime 999; • Scenario 2 – Switch Regime 998; • Scenario 3 – Control Failure (no data for a CMS Unit); • Scenario 4 - Revised Data after control failure (following day). Details of the scenarios subject to testing are given in Section 4. If applicable a response should be received indicating that the instruction has been successful or unsuccessful.	• Evidence that the instructions were successful, except for the control failure where the necessary business processes or local working instruction were followed showing the operational procedures taken for fault correction to allow for a revised instruction the following day. • If applicable, evidence that the response to the instructions is correct..

Test Ref	Requirement / Details	Requirement Reference
Test Group 5	**Lighting CMS - Issue Instructions**	
Test 5.1	Scenario 1 - Switch Regime 999	4.5.2.3 (b)
Test 5.2	Scenario 2 - Switch Regime 998	4.5.2.3 (b)
Test 5.3	Scenario 3 - Control Failure	4.5.2.3 (b)
Test 5.4	Scenario 4 – Revised Data after control failure (following day)	4.5.2.3 (b) 4.5.2.3 (c)
Test 5.5	Receive Response (optional)	Functional

LED switching can be controlled by one of three methods:

- Onboard light level sensor with configurable LUX level threshold.
- Onboard Sunset/Sunrise values calculated using GNSS latitude, longitude and UTC time.
- Manual override - Enables dimming schedules to be overridden.

Dimming profiles can be configured in the system using the following methods:

- Modelled in the dashboard.
- Uploaded in JSON format.

Each LED controller device supports a wide range of commands. Commands are issued via the dashboard in the context of a given device or broadcast to a collection of devices. Commands can only be issued by users with the correct permission/roles.

Each device persists its state transition events in an in-memory event store. All commands received and processed by the device are audited as device events. Periodically the event store is sent to the dashboard allowing all device events to be synchronised with the centralised event store.

During the device event synchronisation process ‘Operational Event’ records are extracted from device events and stored separately allowing non-operational events to be filtered.

Examples of filtered events are:

- Dimming Schedule Update – Acknowledgement of a user uploading a new device dimming schedule.
- Tamper Events – Events denoting when column doors or LED enclosures have been opened/closed.
- Timer Events – Adjustments to timer periods that control device uplink message frequency.

Periodically devices send their state and event information to the dashboard via uplink messages. In the device the frequency is defaulted to every 15 minutes and can be remotely configured. Using device events and device state the system can identify and automatically resolve control failures.

Sending a command to a device instantly changes the local device state to the ‘expected’ state once the command is successfully processed. The local device status changes to COMMAND_PENDING and transitions to STATUS_PENDING when the command downlink is acknowledged by the device. When the device uplinks

are received the ‘expected’ state is compared to the ‘actual’ state of the remote device. If the ‘expected’ and ‘actual’ states match, the device status transitions to the current status of the device. On, Off, Override etc.

In the event of a control failure when issuing device instructions there will be a mismatch between the ‘expected’ and ‘actual’ state of the device. In this scenario the system will automatically replay commands to synchronise state.

In the following section(s) the behaviour of the system as described above will be evidenced in the context of test Scenarios 5.1 to 5.5 in the Requirements Test Checklist

Test 5.1 – Scenario 1 – Switch Regime 999

Event	Time On/Off	% Full Power (Circuit Watts)	Duration
1	On by lux level or by programmed event	100%	30 min
2	After 30 min	75 %	For 90 min
3	After 120 min	50 %	For 60 min
4	After 60 min	75%	For 120 min
5	After 120 min	100%	Till Dawn
6	Off by lux level or by programmed event.	0%	Off

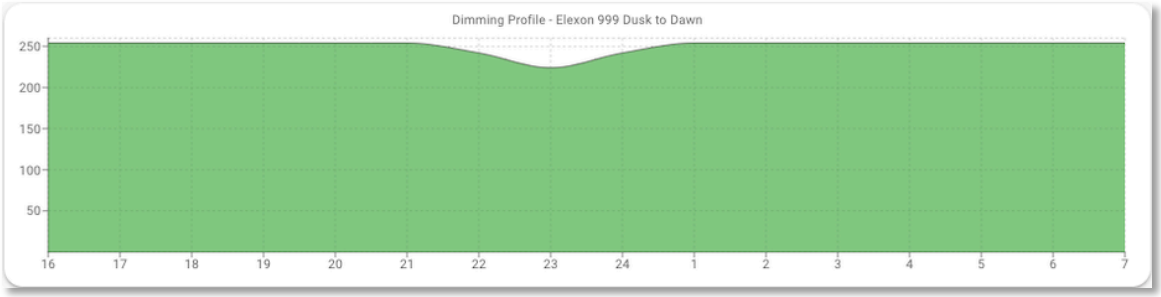
CMS_5_02-11-2022_1_Test 5.1

As described in the BSCP520-2

- “Dusk” means 30 minutes after sunset.
- “Dawn” means 30 minutes before sunrise.

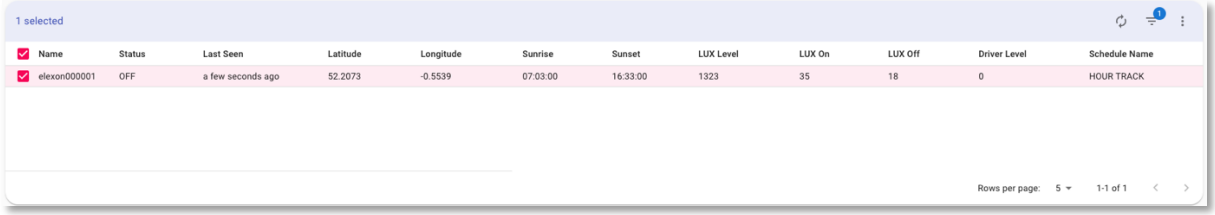
The following switch regime 999 utilises the configurable device LUX ON/OFF levels. At LUX ON 35 and LUX OFF 18 the switching times are aligned with “Dusk” and “Dawn”.

Modelling switch regime 999 in the dashboard yields the following graph. The Y-Axis relates to the DALI level over the Y-Axis time.

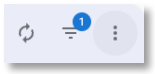


Changing the switch regime for a given device or collection of devices involves the following steps:

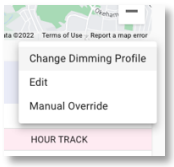
Step 1 – Sort, filter and select the target device(s):



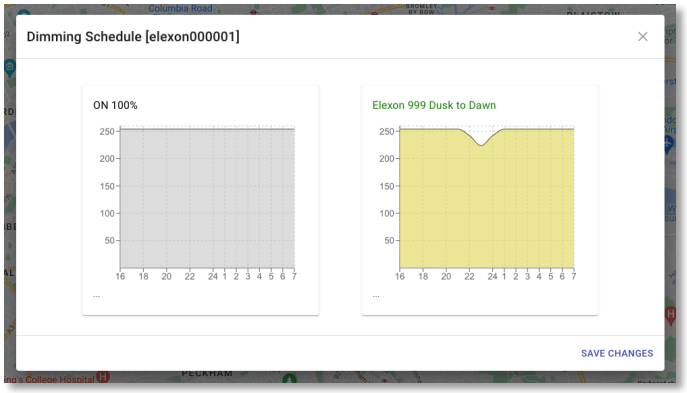
Step 2 – With the device(s) selected click the circular device menu icon:



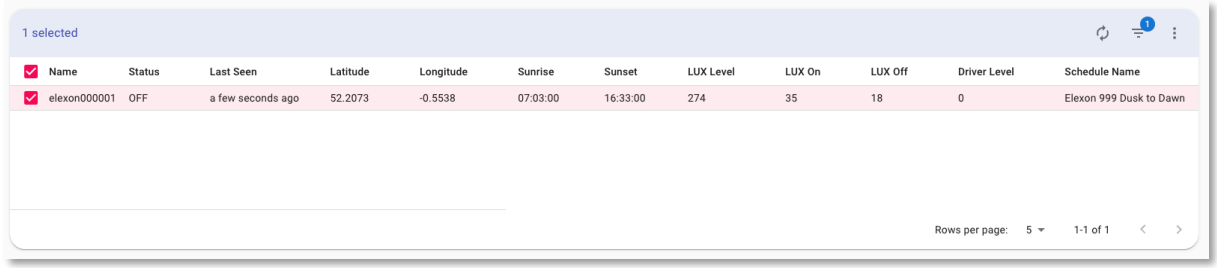
Step 3 – Select ‘Change Dimming Profile’



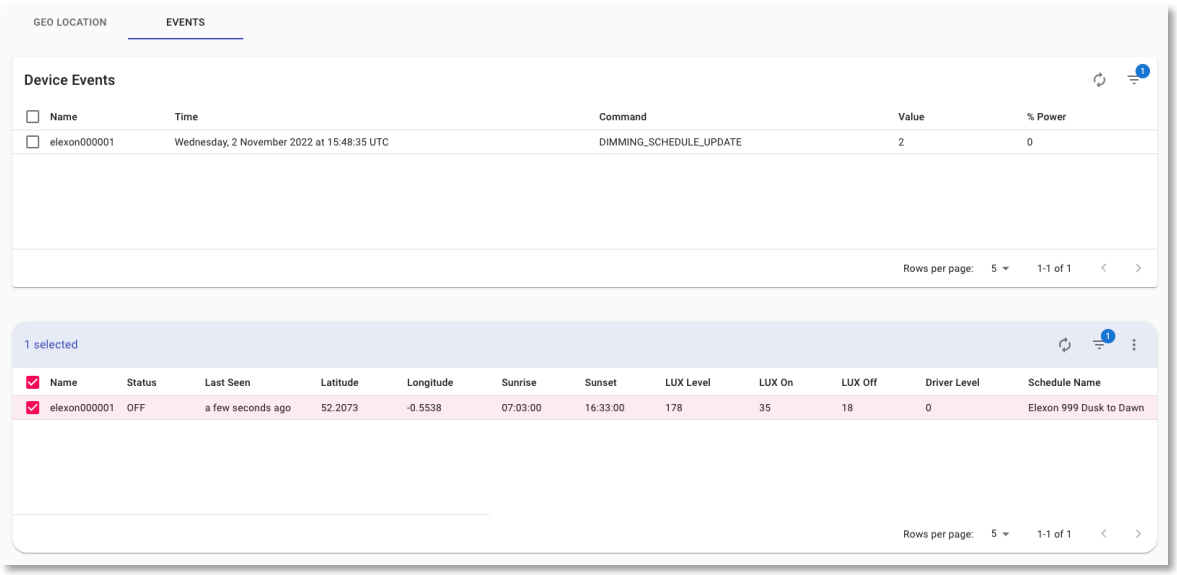
Step 4 – In the ‘Dimming Schedule’ modal screen select the ‘Elexon 999 Dusk to Dawn’ profile and click ‘Save Changes’:



Step 5 – Verify the update has been persisted by checking the ‘Schedule Name’ in the selected device:



Step 6 – Click the ‘Events’ tab above the map to view the sequence of events persisted in the selected device.



Finally querying the audit table reveals the user responsible for the change:

	uuid [PK] character varying (255)	created_at timestamp with time zone	updated_at timestamp with time zone	created_by character varying (255)	updated_by character varying (255)	operation character varying (255)
1	d5da9bba-e57f-4389-a0d3-fa9bc26...	2022-11-02 15:49:35.733+00	2022-11-02 15:49:35.733+00	admin	admin	CHANGE_DIMMING_PROFILE

The following operational event data represents the pattern of switching events generated by CMS Unit ‘elexon000001’ executing switch regime 999. Persisting the switch regime in non-volatile memory ensures the CMS Unit will continue to apply the switch regime indefinitely in the event of power failures or restarts.

	cms_unit_reference character varying (255)	event_date timestamp with time zone	base_power_percentage real	information_flag character varying (255)
1	elexon000001	2022-11-14 00:00:01+00	75	3
2	elexon000001	2022-11-14 01:00:02+00	100	3
3	elexon000001	2022-11-14 07:13:50+00	0	3
4	elexon000001	2022-11-14 16:24:11+00	100	3
5	elexon000001	2022-11-14 22:00:17+00	75	3
6	elexon000001	2022-11-14 23:00:13+00	50	3

The sequence of power level adjustments are applied in hourly increments. This switch regime and resulting event pattern is applied throughout the following test evidence sections.

Test 5.2 – Scenario 2 – Switch Regime 998

CMS_5_02-11-2022_1_Test 5.2

Continuous burning is achieved in the system via the 'Manual Override' feature which can be applied to a given device or collection of devices.

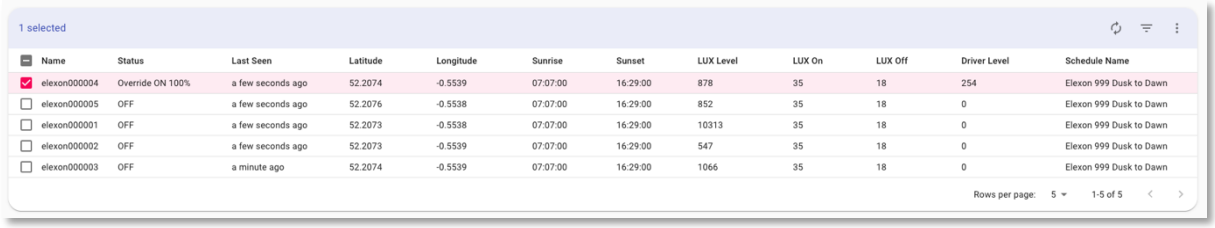
In accordance with this test the device will record the time and date of the manual override and the DALI level selected. In this scenario the DALI level chosen will be 254 which represents the max level for the driver.

In this scenario the device will remain in this state with all other dimming features disabled until the manual override is revoked.

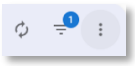
Event	Time On/Off	% Full Power (Circuit Watts)	Duration
1	Continuous burning	100%	Continuous

Changing the switch regime for a given device or collection of devices involves the following steps:

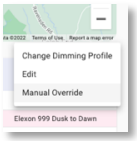
Step 1 – Sort, filter and select the target device(s):



Step 2 – With the device(s) selected click the device menu icon:

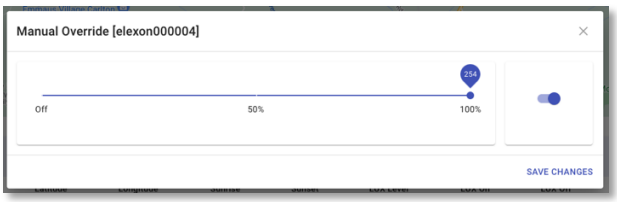


Step 3 – Select 'Manual Override'

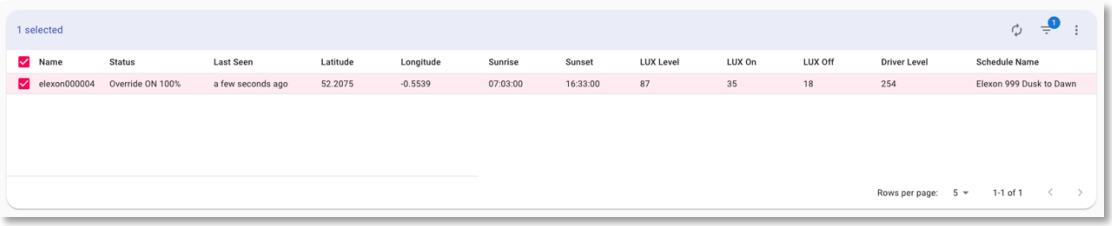


Step 4 – In the 'Manual Override' modal screen click the RHS toggle button enabling the slider:

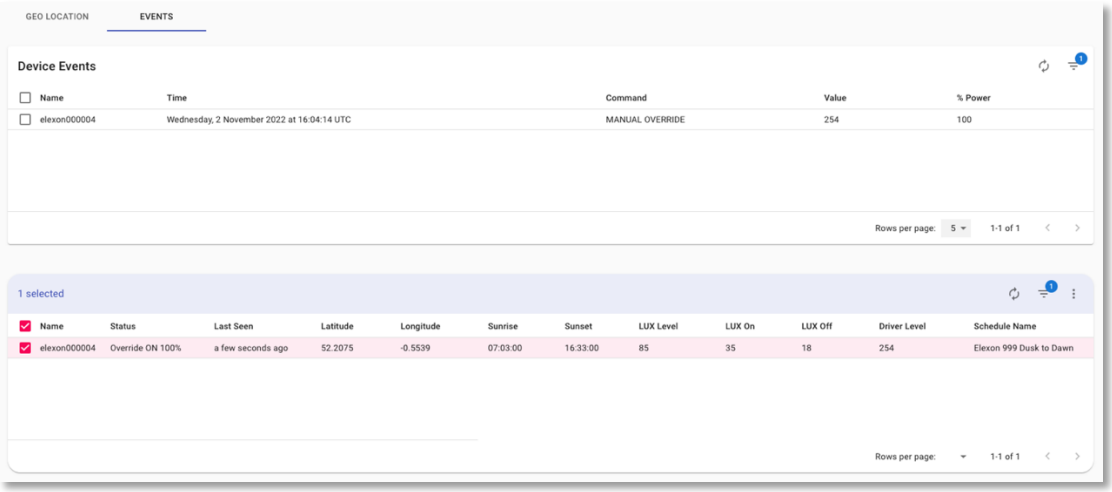
Step 5 – Click '100%' on the power slider and save the changes:



Step 5 – Verify the override has been actioned on the device by checking the ‘Status’ field of the selected device. This will indicate the current override level for the given device:



Step 6 – Click the ‘Events’ tab above the map to view the sequence of events persisted in the selected device. The ‘MANUAL_OVERRIDE’ event entry denotes that the device has processed and confirmed the override:



Finally querying the audit table reveals the user responsible for the change:

	uuid [PK] character varying (255)	created_at timestamp with time zone	updated_at timestamp with time zone	created_by character varying (255)	updated_by character varying (255)	operation character varying (255)
1	fc7a1dc6-bbb6-4432-a89e-d40f54f...	2022-11-02 16:07:18.215+00	2022-11-02 16:07:18.215+00	admin	admin	MANUAL_OVERRIDE

The following operational event data represents the pattern of switching events generated by CMS Unit ‘elexon000004’ executing switch regime 998. Persisting the override value in non-volatile memory ensures the CMS Unit will continue to apply the override indefinitely in the event of power failures or restarts.

	cms_unit_reference character varying (255)	event_date timestamp with time zone	base_power_percentage real	information_flag character varying (255)
1	elexon000004	2022-11-02 16:04:14+00	100	0
2	elexon000004	2022-11-03 00:00:00+00	100	0
3	elexon000004	2022-11-04 00:00:00+00	100	0

In this scenario CMS Unit ‘elexon000004’ continues to publish the initial override event. When handling the initial event for subsequent settlement days the CMS system injects a synthetic event denoting that the override is still applied for the settlement period.

Test 5.3 – Scenario 3 – Control Failure

CMS_5_02-11-2022_1_Test 5.3

As mentioned in Test 5.2 - In the event of a control failure when issuing device instructions there will be a mismatch between the 'expected' and 'actual' state of the end device. In this scenario the system can be configured to automatically replay commands to synchronise state.

Test 5.4 – Scenario 4 – Revised data after control failure (following day)

CMS_5_02-11-2022_1_Test 5.4

As described in Test 5.3 - Scenario 3 the system will replay commands once communication with the failed device is re-established.

Command audit entries capture a combination of the command issued and an acknowledgement flag. Upon receiving a device status uplink the application server checks the audit log for unacknowledged command entries. If the state of the device matches the command profile the acknowledgement flag is set. If the device state and command profile are inconsistent the command is reissued.

Pending commands can be cancelled/flushed by the system administrator.

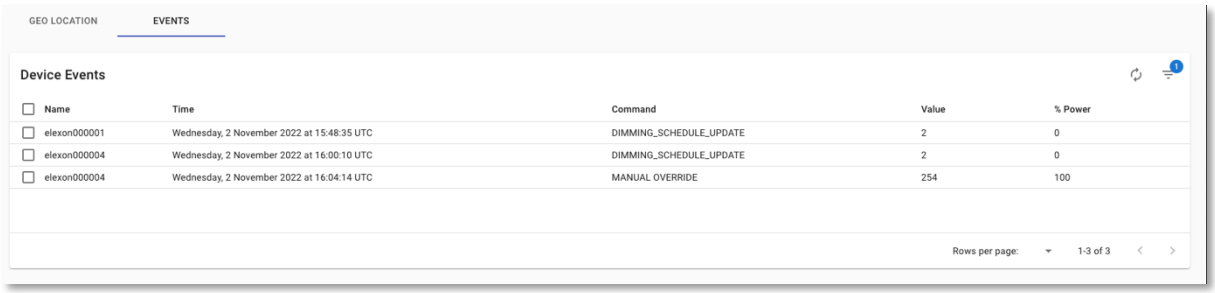
Test 5.5 – Receive Response

CMS_5_02-11-2022_1_Test 5.5

Each CMS device uses circular event buffers to audit commands that are received and processed. Once commands are processed locally in the device, uplinks are published to synchronise state with the CMS system. Periodic uplinks are generated by configurable timers to synchronise device initiated state transitions with the centralised CMS database. E.g. Dimming schedule lifecycle events.

In response to CMS commands issues in sections 5.1 & 5.2 the following events were captured in each device and synchronised with the CMS:

1. 15:48 UTC – Device elexon000001 updates its dimming schedule.
2. 16:00 UTC – Device elexon000004 updates its dimming schedule.
3. 16:04 UTC – Device elexon000004 via manual override issued DALI Level 254 turning on its LED at 100% power.



Test Group 6 - Record operational switching times and power levels

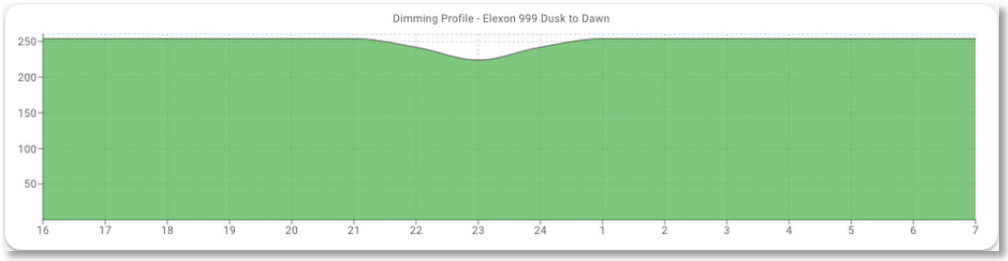
Test Group 6 Lighting CMS	**Record operational switching times and power levels** The operator of the CMS System should demonstrate the recording of operational switching times and power levels for CMS Units in the CMS System for the following scenarios: • Scenario 1 – Switch Regime 999; • Scenario 2 – Switch Regime 998; • Scenario 3 – Control Failure (no data for a CMS Unit); • Scenario 4 - Revised Data after control failure (following day) Details of the scenarios subject to testing are given in Section 4. The operator of the CMS System should demonstrate the audit trail for the above scenarios.	• Evidence that the data recorded is correctly in the CMS • Evidence that the audit trail is correct.

Test Group 6	**Lighting CMS - Record operational switching times and power levels**	
Test 6.1	Scenario 1 - Switch Regime 999	4.5.2.3 (b)
Test 6.2	Scenario 2 - Switch Regime 998	4.5.2.3 (b) 4.5.2.3 (c)
Test 6.3	Scenario 3 - Control Failure	4.5.2.3 (b) 4.5.2.3 (c)
Test 6.4	Scenario 4 – Revised Data after control failure (following day)	4.5.2.3 (b) 4.5.2.3 (c)
Test 6.5	Audit Trail	4.5.2.3 (j)

Test 6.1 – Scenario 1 – Switch Regime 999

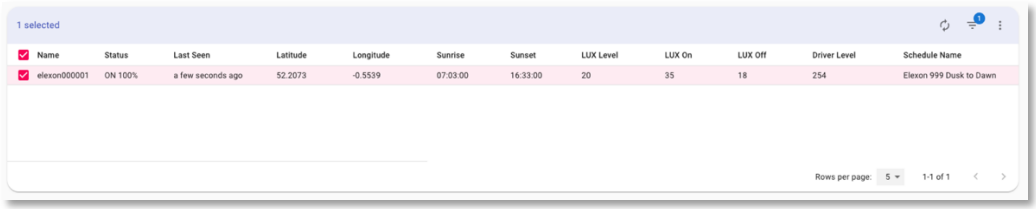
CMS_6_02-11-2022_1_Test 6.1

Prerequisites for this test were captured in *Test 5.1 – Scenario 1 – Switch Regime 999* where steps 1 to 6 demonstrated how the following dimming schedule is modelled and applied within the CMS system and connected devices – in this scenario a device with CMS Unit Reference ID: elexon000001 has had dimming profile 999 configured:



In the context of a device, dimming profiles are received and persisted in EEPROM enabling state to be maintained in the event of power outage or communication failure with the CMS. Using its RTC the device will continue to execute the dimming profile in isolation. Switching events generated from executing the dimming profile are persisted and periodically sent to the CMS system for state synchronisation.

In the screenshot below elexon000001 has stored the Elexon 999 profile locally and is communicating the profile ID of the profile stored in memory. In this scenario 'Elexon 999 Dusk to Dawn' is the profile name the device is also communicating the UTC Sunset and Sunrise values that it has calculated locally based on the device RTC and Geo Lat/Lon.



For elexon000001 the following operational events were published by the device and synchronised with the CMS system:

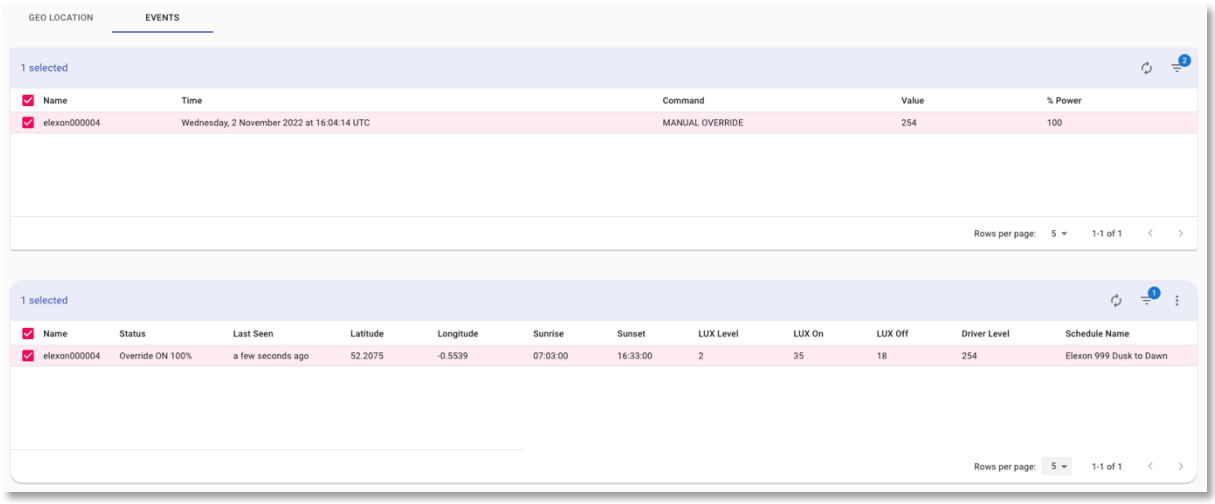
	cms_unit_reference character varying (255)	event_date timestamp with time zone	base_power_percentage real
1	elexon000001	2022-11-02 16:20:10+00	100

Test 6.2 – Scenario 2 – Switch Regime 998

CMS_6_02-11-2022_1_Test 6.2

Prerequisites for this test were captured in *Test 5.2 – Scenario 2 – Switch Regime 998* where steps 1 to 6 demonstrated how the 998 Switch Regime was modelled and applied within the CMS system.

Below device with CMS Unit Reference ID: elexon000004 has received and applied the manual override command. In this state the device overrides/ignores the dimming schedule and maintains the command defined driver level indefinitely.



For elexon000004 the following operational events were published by the device and synchronised with the CMS system. Until the manual override is reversed this would continue to be the latest event published by the device:

	cms_unit_reference character varying (255)	event_date timestamp with time zone	base_power_percentage real
1	elexon000004	2022-11-02 16:04:14+00	100

Note: As mentioned previously the device continues to publish the above event until manually reversed. In order to ensure the completeness and accuracy of the daily 'Operational Event' log the system will continue to insert a daily record at 00:00:00 reflecting the 100% base power percentage for the device.

Test 6.3 – Scenario 3 – Control Failure

CMS_6_02-11-2022_1_Test 6.3

In the event of a communication failure CMS Units/Devices continue to execute their EEPROM programmed dimming schedules despite being disconnected from the CMS network.

CMS Unit/Device RTCs are synchronised periodically via GPS/GNSS fixes. Device events continue to be persisted in a circular buffer. Event timestamps capture the date and time of the event creation synchronised with the device RTC.

Operational events are a subset of the data captured within device events. Operational events are created by the application server upon receipt of device events. Using the 'CMS Unit Reference' and 'Event Timestamp' as the primary key the system records each event at the exact time it was created by the device, to the nearest millisecond.

DALI levels are translated to 'Base Power Percentage' using a dimming curves for the associated drivers. Dimming curve administration is audited within the system.

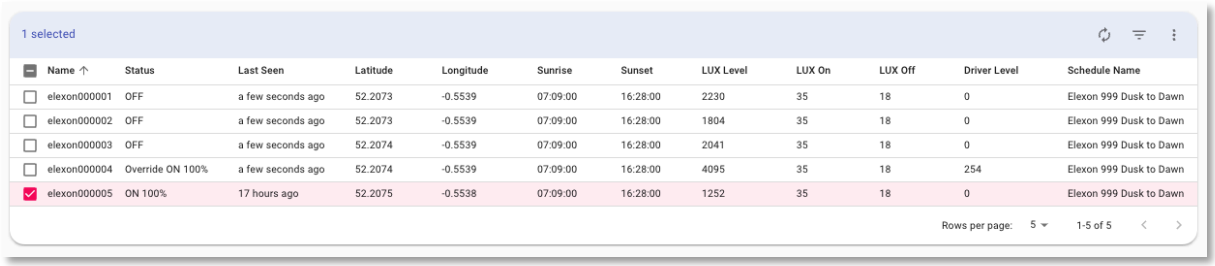
Within the application server CMS Units that are experiencing control failures are highlighted when their last communication timestamp exceeds the expected messaging interval for their device type.

In the following test scenario the device elexon00005 has been disconnected from the network at 17:00:00 UTC on the 2022-11-02 which means all communication from the device is ignored.

The last event communicated by the device indicates the ballast switched on at 16:39:07 UTC at 100% of base power.

	cms_unit_reference character varying (255)	base_power_percentage real	event_date timestamp with time zone	information_flag character varying (255)
1	elexon000005	100	2022-11-02 16:39:07+00	3

At 10:00:00 on the 2022-11-03 the dashboard reflects the state of 'elexon000005' when it was 'Last Seen' 17 hours ago.



For the dimming profile 999 the system expects another five events to be published by the device within the 2022-11-02 17:00:00pm - 2022-11-03 10:00:00pm 17hr window.

Once the device communication is re-established the server reconciles the missing events.

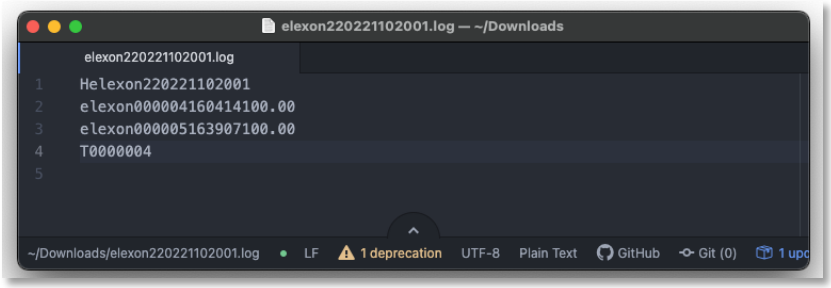
Test 6.4 - Scenario 4 - Revised Data after control failure (following day)

CMS_6_03-11-2022_1_Test 6.4

In scenario 3. CMS Unit/Device ‘elexon00005’ was disconnected from the network at 2022-11-02 17:00:00 UTC. The last event communicated by the device indicates the ballast switched on at 16:39:07 UTC at 100% of base power.

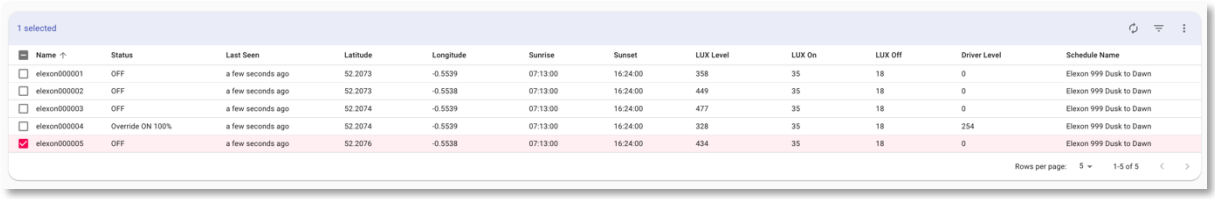
Despite being disconnected from the network the device continues to execute the dimming profile and accumulate event data during the lifecycle of the dimming schedule.

Generating the operational event log at 10:00:00 UTC yields the following results for log version 1 :

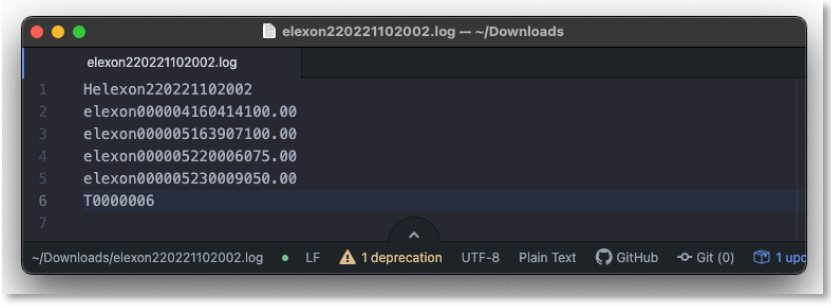


The log captures the events prior to the disconnect omitting the 2 expected events to complete the entries for the 2022-11-02 settlement day.

At 2022-11-03 10:30 UTC CMS unit ‘elexon000005 ‘ is reconnected. Shortly after the latest state of the device is reflected in the dashboard indicating that the device re-connection has been successful:



Generating the operational event log at 2022-11-03 10:35:00 UTC yields the following results for log version 2:



The missing events have been reconciled between the device and the application server.

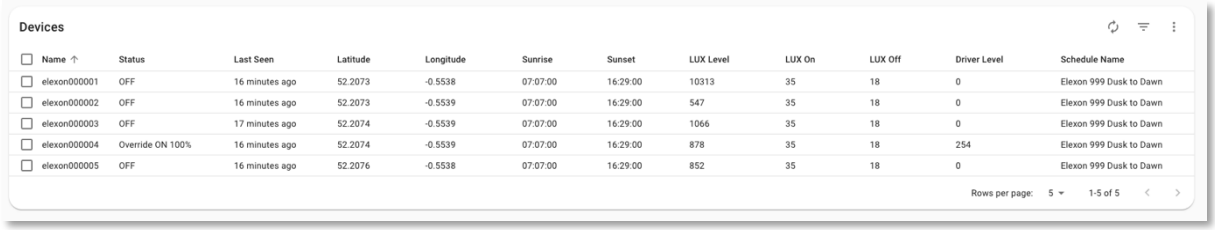
Test Group 7 – Lighting CMS - Generate Operational Event Log

Test Group 7 Lighting CMS	**Generate Operational Event Log - normal processing and control failure** The operator of the CMS System should demonstrate: The sending of a daily operational Event Logs (with operational switching times and power levels for specified CMS Units to the MA in the specified format for the following scenarios: • Scenario 1 – Switch Regime 999; • Scenario 2 – Switch Regime 998; • Scenario 3 – Control Failure (no data for a CMS Unit); • Scenario 4 - Revised Data after control failure (following day) The operator of the CMS system should demonstrate a control failure (no data for a CMS Unit) through use of the correct information flag as per Scenario 3. **Operational Event Log – revision to previously reported data** The operator of the CMS System should demonstrate that data can be revised by issuing an incremental operational Event Log to the MA in the specified format. (Scenario 3) The incremental Event Log should cover: • An incremental update of operational Event Log which includes previously unknown data; • An incremental update of operational Event Log which includes data which has been amended. Details of the scenarios subject to testing are given in Section 4 The operator should demonstrate that the operational Event Log has been retained for audit purposes and the audit trail is correct.	Evidence that: • The operational Event Logs have been successfully created; • The operational Event Log values are correct; • The operational Event Logs are sent on a daily basis • The operation Event Logs are in the specified file format (See Test Group 12) • The operational Event Log headers correctly identify the Event Log version where incremental Event Logs have been created The audit trail is correct and the operational Event Logs have been retained for audit purposes

Test Group 7	**Lighting CMS - Generate Operational Event Log**	
Test 7.1	Scenario 1 - Switch Regime 999	4.5.2.3 (b) 4.5.2.3 (c)
Test 7.2	Scenario 2 - Switch Regime 998	4.5.2.3 (b) 4.5.2.3 (c)
Test 7.3	Scenario 3 - Control Failure	4.5.2.3 (b) 4.5.2.3 (c)
Test 7.4	Scenario 4 – Revised Data after control failure (following day)	4.5.2.3 (c)

CMS_7_03-11-2022_1_Test 7.1 – 7.4

The following dashboard excerpt lists five CMS devices which have been actively sending uplinks between 2022-11-03 00:00:00 UTC and 2022-11-03 23:59:59 UTC:

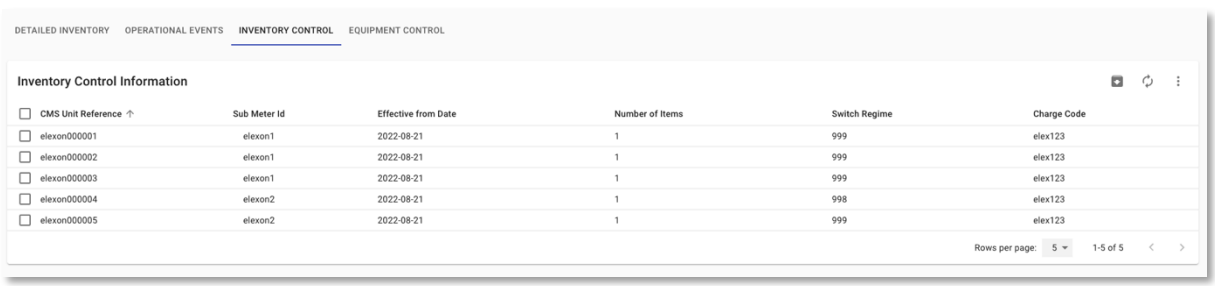


Devices

Name	Status	Last Seen	Latitude	Longitude	Sunrise	Sunset	LUX Level	LUX On	LUX Off	Driver Level	Schedule Name
elexon000001	OFF	16 minutes ago	52.2073	-0.5538	07:07:00	16:29:00	10313	35	18	0	Elexon 999 Dusk to Dawn
elexon000002	OFF	16 minutes ago	52.2073	-0.5539	07:07:00	16:29:00	547	35	18	0	Elexon 999 Dusk to Dawn
elexon000003	OFF	17 minutes ago	52.2074	-0.5539	07:07:00	16:29:00	1066	35	18	0	Elexon 999 Dusk to Dawn
elexon000004	Override ON 100%	16 minutes ago	52.2074	-0.5539	07:07:00	16:29:00	878	35	18	254	Elexon 999 Dusk to Dawn
elexon000005	OFF	16 minutes ago	52.2076	-0.5538	07:07:00	16:29:00	852	35	18	0	Elexon 999 Dusk to Dawn

Rows per page: 5 1-5 of 5

In the inventory control excerpt shown below the five CMS devices are assigned to two Sub Meter IDs and two switch regimes:



DETAILED INVENTORY OPERATIONAL EVENTS INVENTORY CONTROL EQUIPMENT CONTROL

Inventory Control Information

CMS Unit Reference	Sub Meter Id	Effective from Date	Number of Items	Switch Regime	Charge Code
elexon000001	elexon1	2022-08-21	1	999	elex123
elexon000002	elexon1	2022-08-21	1	999	elex123
elexon000003	elexon1	2022-08-21	1	999	elex123
elexon000004	elexon2	2022-08-21	1	998	elex123
elexon000005	elexon2	2022-08-21	1	999	elex123

Rows per page: 5 1-5 of 5

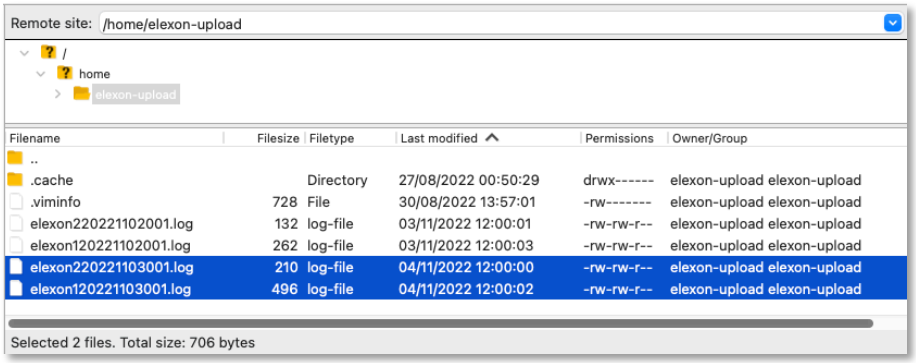
The following DB extract is the operational data collected for sub meter ID ‘elexon1’. CMS Units ‘elexon000001’ to ‘elexon000003’ are running switch regime 999:

	cms_unit_reference character varying (255)	event_date timestamp with time zone	sub_meter_id character varying (255)	base_power_percentage real	information_flag character varying (255)
1	elexon000001	2022-11-03 00:00:18+00	elexon1	75	3
2	elexon000001	2022-11-03 01:00:10+00	elexon1	100	3
3	elexon000001	2022-11-03 07:22:54+00	elexon1	0	3
4	elexon000001	2022-11-03 16:50:20+00	elexon1	100	3
5	elexon000001	2022-11-03 22:00:13+00	elexon1	75	3
6	elexon000001	2022-11-03 23:00:03+00	elexon1	50	3
7	elexon000002	2022-11-03 00:00:06+00	elexon1	75	3
8	elexon000002	2022-11-03 01:00:06+00	elexon1	100	3
9	elexon000002	2022-11-03 07:25:42+00	elexon1	0	3
10	elexon000002	2022-11-03 16:35:48+00	elexon1	100	3
11	elexon000002	2022-11-03 22:00:01+00	elexon1	75	3
12	elexon000002	2022-11-03 23:01:53+00	elexon1	50	3
13	elexon000003	2022-11-03 00:00:11+00	elexon1	75	3
14	elexon000003	2022-11-03 01:00:16+00	elexon1	100	3
15	elexon000003	2022-11-03 07:25:10+00	elexon1	0	3
16	elexon000003	2022-11-03 16:33:33+00	elexon1	100	3
17	elexon000003	2022-11-03 22:01:34+00	elexon1	75	3
18	elexon000003	2022-11-03 23:00:05+00	elexon1	50	3

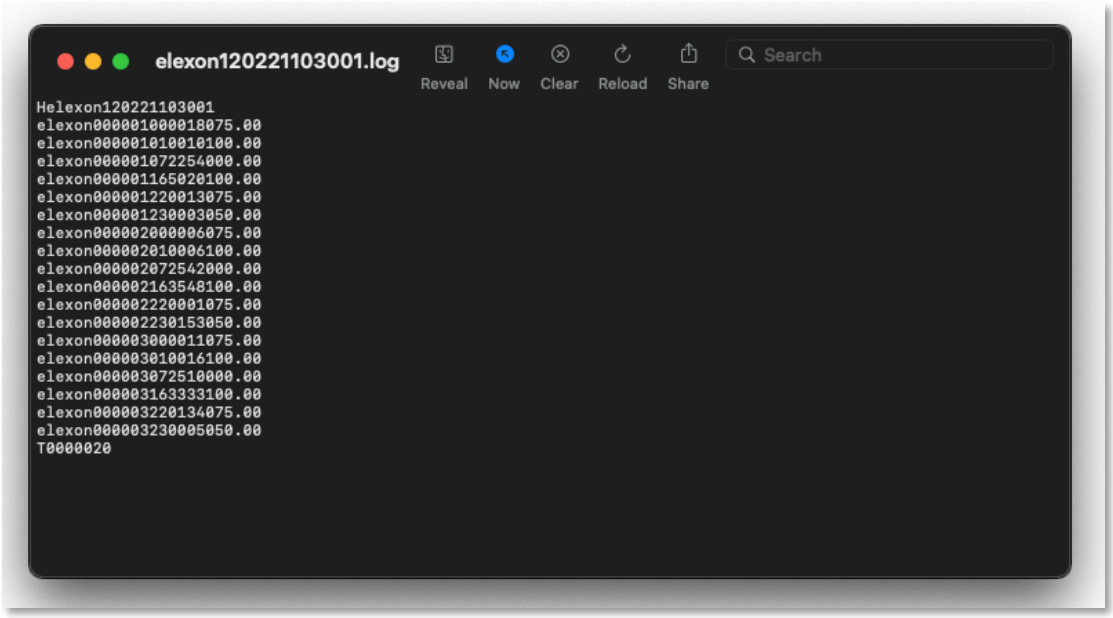
The following DB extract is the operational data collected for sub meter ID ‘elexon2’. This excerpt includes the data reconciled after the simulated control failure of device ‘elexon5’ detailed in Test 6.4 Scenario 4. ‘elexon000004’ is running switch regime 998. Information flag zero denotes 998 manual override, the event date 2022-11-03 00:00:00+00 has been generated from the original manual override event date which occurred during the previous settlement day:

	cms_unit_reference character varying (255)	event_date timestamp with time zone	sub_meter_id character varying (255)	base_power_percentage real	information_flag character varying (255)
1	elexon000004	2022-11-03 00:00:00+00	elexon2	100	0
2	elexon000005	2022-11-03 00:01:44+00	elexon2	75	3
3	elexon000005	2022-11-03 01:00:07+00	elexon2	100	3
4	elexon000005	2022-11-03 07:28:01+00	elexon2	0	3
5	elexon000005	2022-11-03 16:34:48+00	elexon2	100	3
6	elexon000005	2022-11-03 22:00:05+00	elexon2	75	3
7	elexon000005	2022-11-03 23:00:01+00	elexon2	50	3

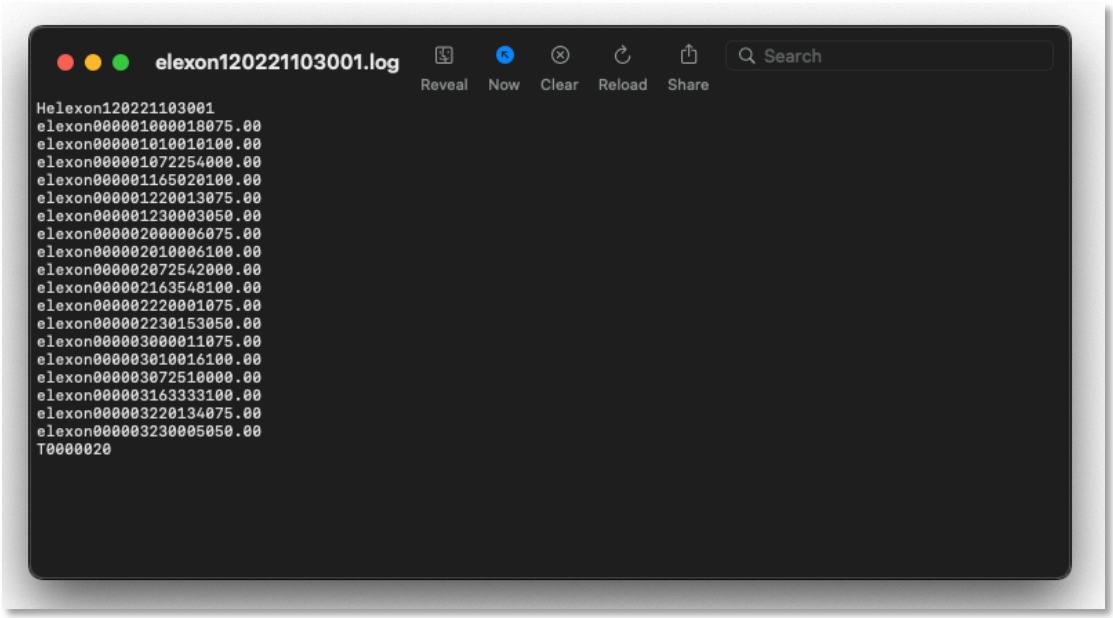
The following SFTP client snapshot lists the operational log files that have been automatically uploaded to the shared SFTP location:



Content of log file elexon120221103001.log for sub meter ID ‘elexon1:



Content of log file elexon220220826001.log for sub meter ID ‘elexon2:



Test 7.5 - Lighting CMS - Generate Operational Event Log

Test 7.5	Available daily (Separate CMS and MA System)	4.5.2.3 (b)

CMS_7_03-11-2022_1_Test 7.5

The operational log batch service is utilised by configurable schedulers to manage the timeliness of log file generation. The schedulers can be configured to meet specific MA requirements.

The operational log batch service delivers the following features:

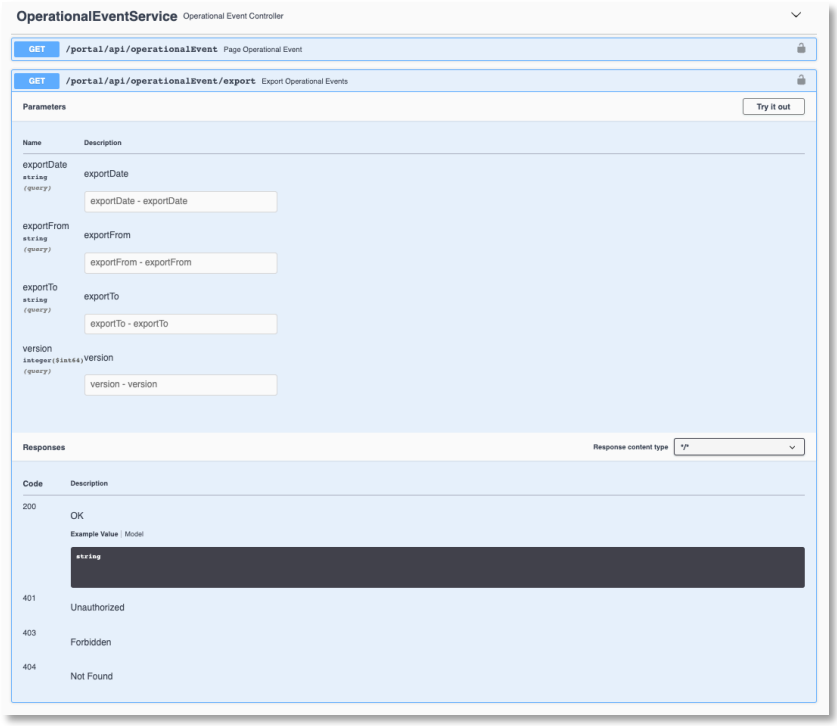
- Batch job execution & exception management.
- Complete audit of batch job execution including log file backup.
- Completeness, timeliness and accuracy checks.
- Operational log revision monitoring & control – complete refresh or deltas.

Operational Log Revision Monitoring and Control

The operational log export process generates an expected event profile for each CMS unit. If the expected event profile is not met the system generates an exception report.

In the exception scenario the system is able to revise the data through a complete refresh or incremental revisions once the exceptions have been resolved (See test 7.4).

Revised exports can be initiated either through the CMS dashboard or REST API as shown here:

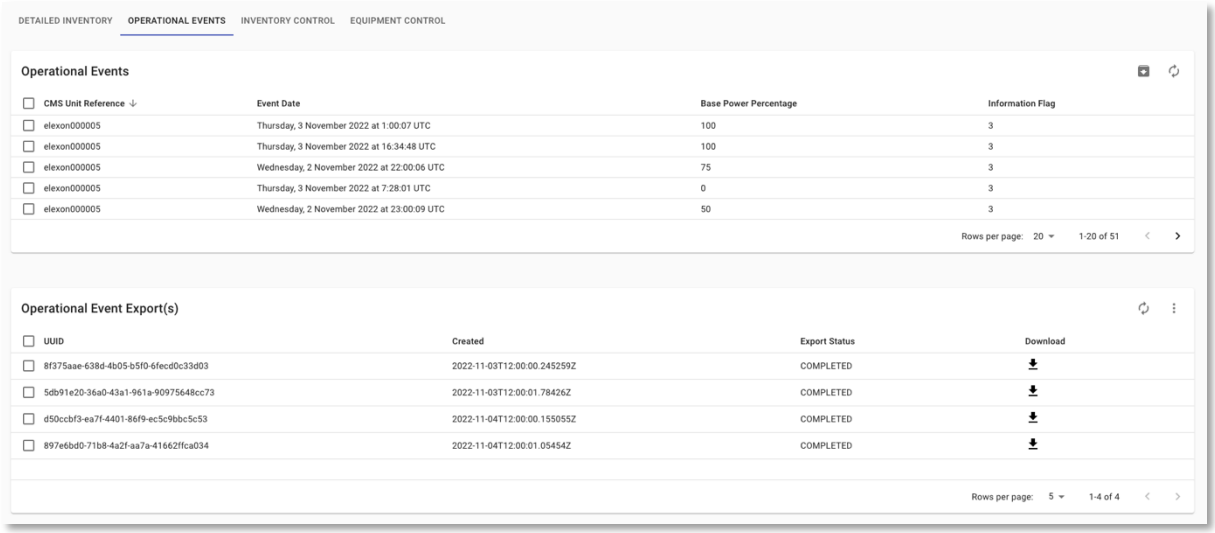


Test 7.7 - Lighting CMS - Generate Operational Event Log – Audit Trail

Test 7.7	Audit Trail	4.5.2.3 (j)

CMS_7_04-11-2022_1_Test 7.7

Operational events and event logs can be reviewed and accessed within the CMS system dashboard:



Users with ‘elexon’ permissions are able to sort, filter and download operational events for diagnostic purposes.

The system audits and retains operational log exports:

	uuid [PK] character varying (255)	created_by character varying (255)	date_created timestamp with time zone	extract oid	job_status character varying (255)	name character varying (255)
1	8f375aae-638d-4b05-b5f0-6fecd0c...	system	2022-11-03 12:00:00.245259+00	221816	COMPLETED	elexon220221102001.log
2	5db91e20-36a0-43a1-961a-909756...	system	2022-11-03 12:00:01.78426+00	221817	COMPLETED	elexon120221102001.log
3	d50ccbf3-ea7f-4401-86f9-ec5c9bb...	system	2022-11-04 12:00:00.155055+00	222240	COMPLETED	elexon220221103001.log
4	897e6bd0-71b8-4a2f-aa7a-41662ff...	system	2022-11-04 12:00:01.05454+00	222241	COMPLETED	elexon120221103001.log

In the above excerpt audit records have been created that capture the ‘system’ generated daily exports of the operational event logs. Any manual user initiated exports are also audited. The audit records here match the data produced for Test Group 8 data captured in this section.

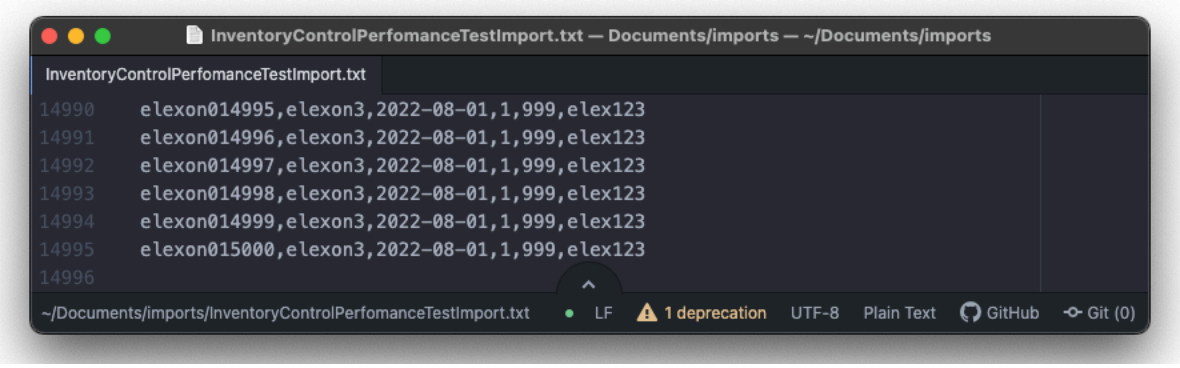
Test Group 11 - Volume and Performance

Test Group 11	**Volume and Performance** The operator of the CMS System should provide tests evidence of volume and performance tests completed by the applicant as part of their system testing, to the CMS Test Agent so that compliance with operational timescales can be accessed.	Evidence of volume and performance tests provided to the CMS Test Agent.

Test Group 11	**Volume and Performance**	
Test 11.1	Compliance with operational timescales	Functional

CMS_11_14-11-2022_1_Test 11.1

Using the 'Inventory Control' batch import feature introduced in Test Group 4B the following inventory file with 14995 test records was imported – the CMS system now is managing a total of 15000 CMS Units across 3 Sub Meter IDs – elexon1, elexon2, elexon3:



The following is the audit record for the batch upload – 14995 records were successfully persisted:

	job_name character varying (100)	start_time timestamp without time zone	end_time timestamp without time zone	status character varying (10)	read_count bigint	write_count bigint
1	importInventoryControlInform...	2022-11-14 09:37:53.124	2022-11-14 09:39:57.844	COMPLETED	14995	14995

For each of the 14995 inventory control records, six events were generated and inserted into the operational event log totalling 89970 records matching the 999 event pattern.

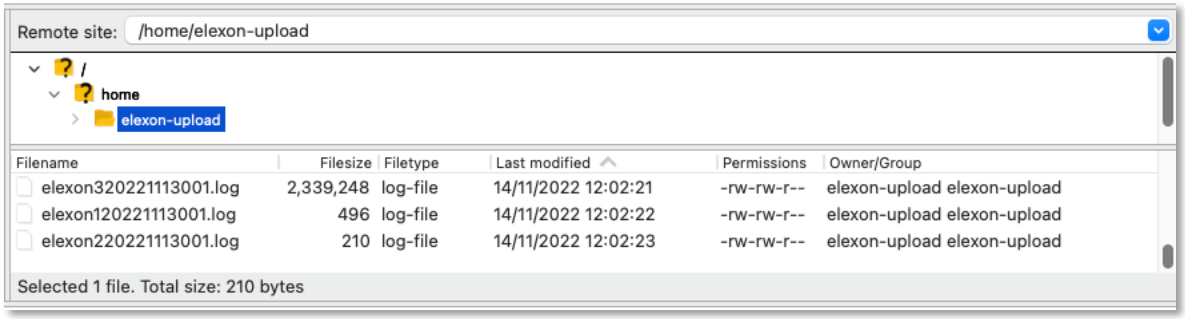
The following excerpt highlights the repeating pattern of events from elexon000006 to elexon015000:

	cms_unit_reference character varying (255)	event_date timestamp with time zone	base_power_percentage real	information_flag character varying (255)
1	elexon000006	2022-11-13 00:00:00+00	75	3
2	elexon000006	2022-11-13 01:00:00+00	100	3
3	elexon000006	2022-11-13 07:18:00+00	0	3
4	elexon000006	2022-11-13 16:29:00+00	100	3
5	elexon000006	2022-11-13 22:00:00+00	75	3
6	elexon000006	2022-11-13 23:00:00+00	50	3
7	elexon015000	2022-11-13 00:00:00+00	75	3
8	elexon015000	2022-11-13 01:00:00+00	100	3
9	elexon015000	2022-11-13 07:18:00+00	0	3
10	elexon015000	2022-11-13 16:29:00+00	100	3
11	elexon015000	2022-11-13 22:00:00+00	75	3
12	elexon015000	2022-11-13 23:00:00+00	50	3

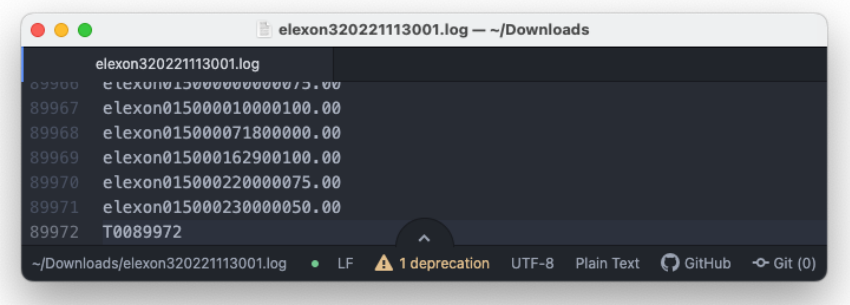
At 12:00:00 on the 14-11-2022 the automated export commenced initiating an export for each sub meter ID:

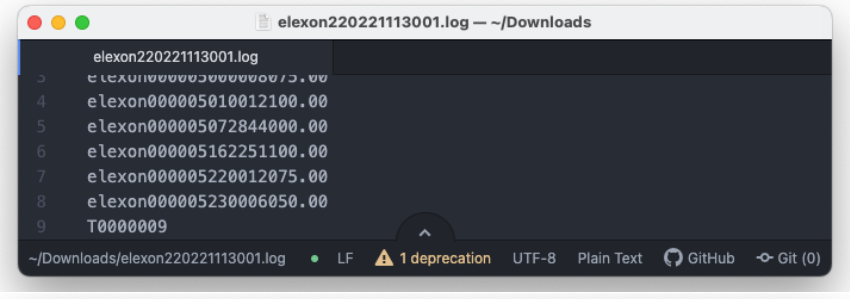
	job_name character varying (100)	start_time timestamp without time zone	end_time timestamp without time zone	status character varying (10)	read_count bigint	write_count bigint
1	exportEventStep	2022-11-14 12:00:00.217	2022-11-14 12:02:19.398	COMPLETED	89970	89970
2	exportEventStep	2022-11-14 12:02:21.122	2022-11-14 12:02:21.481	COMPLETED	18	18
3	exportEventStep	2022-11-14 12:02:22.236	2022-11-14 12:02:22.488	COMPLETED	7	7

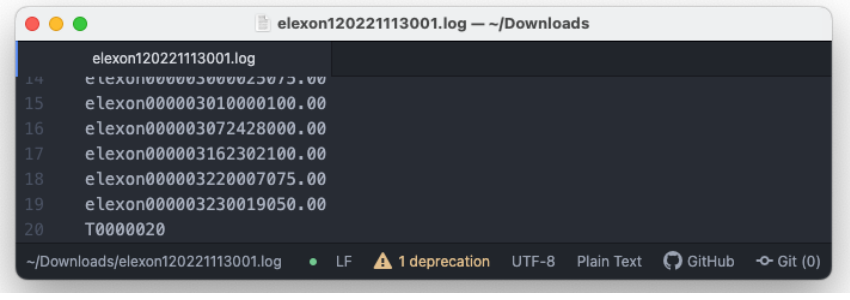
Three operational event logs were generated and uploaded to the SFTP server totalling 89995 – five events less than the potential 90000 total due to elexon000004 running the 998 switch regime:



Checking the footer of each file confirms all events are accounted for:







Test Group 12 – Data Output Requirements

Test Group 12	**Operational Event Log – File format** The operator of the CMS System should demonstrate that the operational event logs are in the specified format as per BSCP520 Section 4.5.2.3(c).	Evidence that the operational Event Logs are in the correct format including the Filename, Trailer and the following key data fields: • Header identifier • Sub-Meter ID • Date • Version • CMS Unit reference • Time • Percentage of base power • Information Flag Each CMS Unit Reference has a different time (HHMMSS) reported for each entry

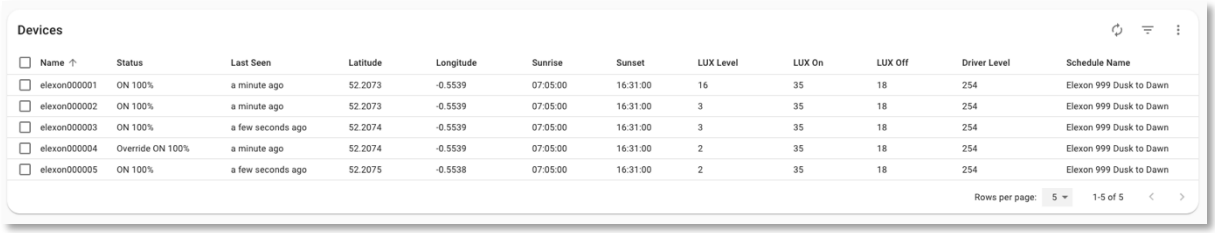
Test Ref	Requirement / Details	Requirement Reference
Test Group 12	**Operational Event Log**	
Test 12.1	File Format	4.5.2.3 (c)
Test 12.2	Filename	4.5.2.3 (c)
Test 12.3	Header identifier	4.5.2.3 (c)
Test 12.4	Sub-Meter ID	4.5.2.3 (c)
Test 12.5	Date	4.5.2.3 (c)
Test 12.6	Version	4.5.2.3 (c)
Test 12.7	CMS Unit reference	4.5.2.3 (c)
Test 12.8	Time	4.5.2.3 (c)
Test 12.10	Percentage of base power	4.5.2.3 (c)
Test 12.10	Information Flag	4.5.2.3 (c)
Test 12.11	Trailer	4.5.2.3 (c)

The operator of the CMS System should demonstrate that the operational event logs are in the specified format as per BSCP520 Section 4.5.2.3(c).

Test 12.1 – 12.11 – File Format Evidence

CMS_12_03-11-2022_1_Test 12.1 – 12.11

In Test 4.1 five CMS units were uploaded to the CMS system with CMS unit ID elexon000001 – elexon000005

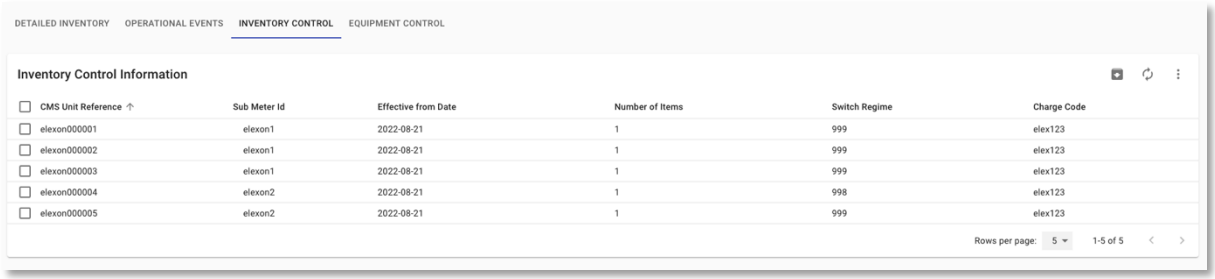


Devices

Name	Status	Last Seen	Latitude	Longitude	Sunrise	Sunset	LUX Level	LUX On	LUX Off	Driver Level	Schedule Name
elexon000001	ON 100%	a minute ago	52.2073	-0.5539	07:05:00	16:31:00	16	35	18	254	Elexon 999 Dusk to Dawn
elexon000002	ON 100%	a minute ago	52.2073	-0.5539	07:05:00	16:31:00	3	35	18	254	Elexon 999 Dusk to Dawn
elexon000003	ON 100%	a few seconds ago	52.2074	-0.5539	07:05:00	16:31:00	3	35	18	254	Elexon 999 Dusk to Dawn
elexon000004	Override ON 100%	a minute ago	52.2074	-0.5539	07:05:00	16:31:00	2	35	18	254	Elexon 999 Dusk to Dawn
elexon000005	ON 100%	a few seconds ago	52.2075	-0.5538	07:05:00	16:31:00	2	35	18	254	Elexon 999 Dusk to Dawn

Rows per page: 5 1-5 of 5

CMS Units – elexon000001 – elexon000003 are assigned to Sub Meter ID – elexon1 and elexon000004 – elexon000005 are assigned to Sub Meter ID – elexon2 as shown in the test Inventory Control Information:



Running a query across the inventory control and operational event data for events between 2022-11-03 00:00:00+00 and 2022-11-03 23:59:59+00 for Sub Meter ID – elexon1 yields the following results:

	cms_unit_reference character varying (255)	event_date timestamp with time zone	sub_meter_id character varying (255)	base_power_percentage real	information_flag character varying (255)
1	elexon000001	2022-11-03 00:00:18+00	elexon1	75	3
2	elexon000001	2022-11-03 01:00:10+00	elexon1	100	3
3	elexon000001	2022-11-03 07:22:54+00	elexon1	0	3
4	elexon000001	2022-11-03 16:50:20+00	elexon1	100	3
5	elexon000001	2022-11-03 22:00:13+00	elexon1	75	3
6	elexon000001	2022-11-03 23:00:03+00	elexon1	50	3
7	elexon000002	2022-11-03 00:00:06+00	elexon1	75	3
8	elexon000002	2022-11-03 01:00:06+00	elexon1	100	3
9	elexon000002	2022-11-03 07:25:42+00	elexon1	0	3
10	elexon000002	2022-11-03 16:35:48+00	elexon1	100	3
11	elexon000002	2022-11-03 22:00:01+00	elexon1	75	3
12	elexon000002	2022-11-03 23:01:53+00	elexon1	50	3
13	elexon000003	2022-11-03 00:00:11+00	elexon1	75	3
14	elexon000003	2022-11-03 01:00:16+00	elexon1	100	3
15	elexon000003	2022-11-03 07:25:10+00	elexon1	0	3
16	elexon000003	2022-11-03 16:33:33+00	elexon1	100	3
17	elexon000003	2022-11-03 22:01:34+00	elexon1	75	3
18	elexon000003	2022-11-03 23:00:05+00	elexon1	50	3

Events are grouped and ordered by CMS Unit Reference and event date.

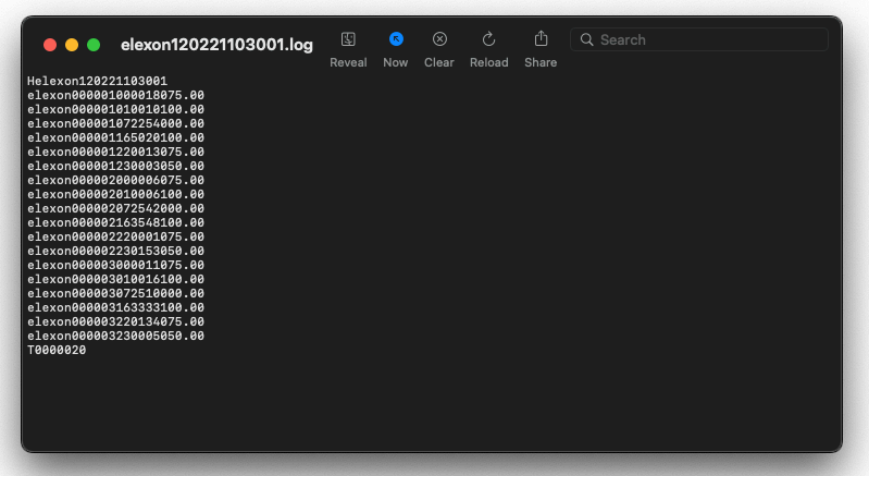
CMS_12_03-11-2022_1_Test 12.2

Using settlement day 2022-11-03 and Sub Meter ID elexon1 the CMS system generated and uploaded operational event log elexon120221103001.log the content of which is shown below:

CMS_12_03-11-2022_1_Test 12.10

CMS_12_03-11-2022_1_Test 12.11

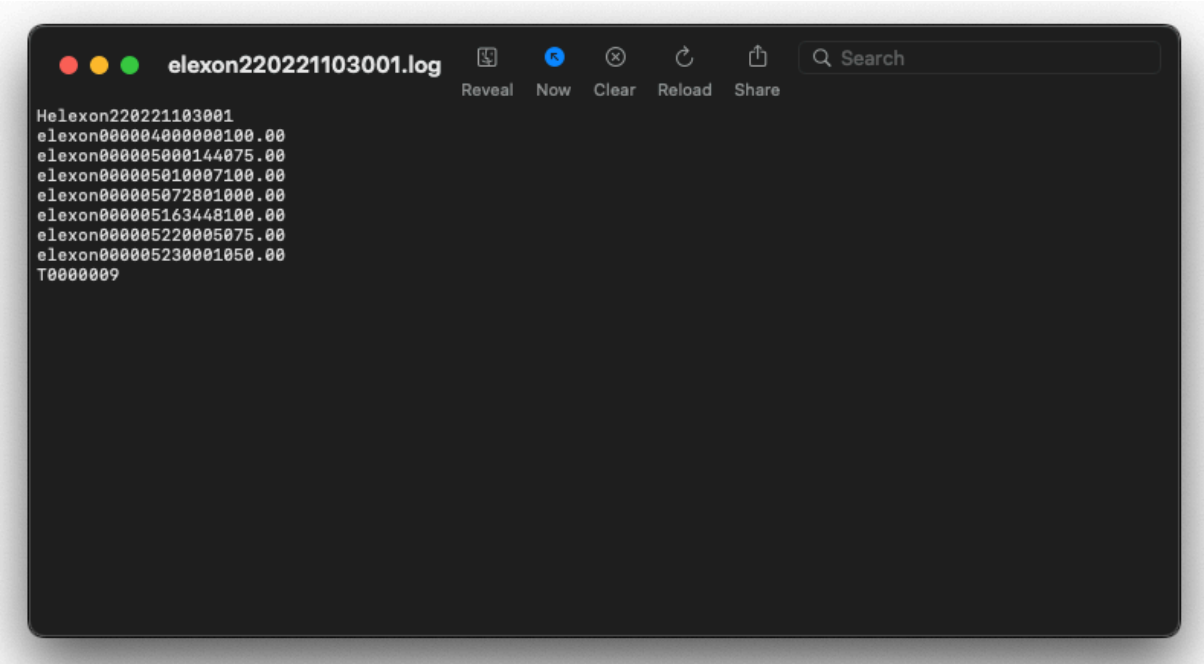
Note: In this scenario the information flag has been replaced by space character.



Using settlement day 2022-11-03 and Sub Meter ID elexon2 the CMS system persisted the following records:

	cms_unit_reference character varying (255)	event_date timestamp with time zone	sub_meter_id character varying (255)	base_power_percentage real	information_flag character varying (255)
1	elexon000004	2022-11-03 00:00:00+00	elexon2	100	0
2	elexon000005	2022-11-03 00:01:44+00	elexon2	75	3
3	elexon000005	2022-11-03 01:00:07+00	elexon2	100	3
4	elexon000005	2022-11-03 07:28:01+00	elexon2	0	3
5	elexon000005	2022-11-03 16:34:48+00	elexon2	100	3
6	elexon000005	2022-11-03 22:00:05+00	elexon2	75	3
7	elexon000005	2022-11-03 23:00:01+00	elexon2	50	3

File elexon220221103001.log is the operational log uploaded to the SFTP server for the 2022-11-03 settlement day.



Note: CMS Unit ID elexon000004 is running switch regime 998. In agreement with the MA the system has replaced the original 998 switch event (generated prior to the settlement day) with an entry that reflects the current settlement day, specifically 2022-11-03 00:00:00+00. This will be done until the switch regime for the CMS unit is updated.

The file name and content adheres to the specified file format as per BSCP520 Section 4.5.2.3(c)