CRIBBS CAUSEWAY AEROBIC DIGESTER

Environmental Permit Application

Operations and Environmental Management Plan

Prepared for: Advetec Limited

Client Ref: 416.11475.00002

SLR Ref: 416.11475.00002
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1.0 INTRODUCTION

1.1 Report Context

SLR Consulting Limited (SLR) has been instructed by Advetec Limited (Advetec) to prepare a new bespoke environmental permit application for the proposed Cribbs Causeway Aerobic Digestor. The application involves an aerobic digestion system, operated by Incentive Facilities Management Limited (Incentive FM), and located beneath the Cribbs Causeway Shopping Centre, Patchway, Bristol BS34 5DG (hereafter referred to as 'the Site').

This Operations and Environmental Management Plan (OEMP) document is reviewed and updated on an annual basis or as a result of a number of circumstances including, but not limited to, the following:

- issuance of a varied environmental permit by the Environment Agency (EA);
- a change to an operational process;
- a change in Site layout;
- a significant substantiated complaint; or
- a change to any legislation or guidance documents applicable to Aerobic Digestion Facilities.

This OEMP document is supplemented by the following documents prepared in support of the environmental permit variation application:

- Application Forms A, B2, B4 and F1 (SLR Ref: 416.11475.00002)
- Non-Technical Summary (SLR Ref: 416.11475.00002/NTS)
- Site drawings (SLR Ref: 416.11475.00002);
- Environmental Risk Assessment (SLR Ref: 416.11475.00002/ERA);
- Site Condition Report (SLR Ref: 416.11475.00002/SCR); and
- Ambient Bioaerosols Monitoring (SLR Ref: 416.11475.00002/Bioaerosols_Monitoring).

1.2 Site Location

The Site is located beneath the Cribbs Causeway Shopping Centre, Patchway, Bristol BS34 5DG, centred on National Grid Reference (NGR) ST 58779 80826. The aerobic digestor is located underground beneath the shopping centre, in a contained waste compound, approximately situated beneath the River Island store, near to the main entrance. Bristol City Centre is located 7.8km south and the town of Patchway lies 1km to the east. The Bristol Channel is located approximately 6km to the west. The Site Location is illustrated on Drawing EP1 Site Location Plan.

The Environmental Site Setting is illustrated on Drawing EP3 and Cultural and Natural Heritage on Drawing EP4.

The Site is immediately surrounded in all directions by commercial and industrial units comprising the Cribbs Causeway shopping centre and additional surrounding retail areas.

1.3 Report Structure

This report describes the operating techniques and management system that are implemented at the facility to ensure compliance with the conditions of the EP. The report has been drafted to satisfy the requirements of EA Guidance and is divided into the following sections.

Section 1	Introduction
Section 2	Management
Section 3	Operations
Section 4	Emissions and Monitoring
Section 5	Information
Section 6	Closure

1.4 Document Revision History

Any changes to the OEMP are labelled in chronological order and the date of the change recorded. All records of the changes are listed in the revision history table below:

Version	Reason for Revision	Date of Revision	Signature of Site Manager
1.0	First Version of Document Finalised and Released	*10/11/2021*	

2.0 MANAGEMENT

2.1 Management System

The management system operated by Incentive FM will ensure that;

- the risks that the activities pose to the environment are identified;
- the measures that are required to minimise the risks are identified;
- the activities are managed in accordance with the management system;
- performance against the management system is audited at regular intervals; and
- the EP is complied with.

2.2 Management Structure and Responsibilities

The Site Manager is responsible for day to day operations and compliance with the EP, included as Appendix A to this report.

The machine is loaded by at least one member of staff who is suitably trained and fully conversant with the requirements of the permit regarding:

- waste acceptance and control procedures;
- operational controls;
- maintenance;
- record-keeping;
- emergency action plans; and
- notifications to the EA.

Following manual loading, the machine is deigned to be operated and maintained remotely and therefore minimal staff will be required on Site in between the operations of loading and transfer off-Site.

2.3 Technical Competence and Training

The Site is managed by sufficient staff, competent to operate the Site. The management system ensures the following:

- all staff have clearly defined roles and responsibilities;
- records are maintained of the skills required for each post;
- records are maintained of the training and relevant qualifications undertaken by staff to meet the requirement of each post; and
- operations are governed by standard operating instructions.

Operations at the Site will be under the overall control of a technically competent person who holds the relevant Certificate of Technical Competence (COTC) under the Waste Management Industry Training and Advisory Board (WAMITAB) scheme. At the time of submission of this EP application, there are not currently any members of staff for the facility with the relevant WAMITAB certificate. A grace period has been applied for to allow time for a member of staff to obtain this. The appropriate WAMITAB will be obtained within this grace period timescale.

An assessment of staff training needs will be carried out to identify the posts for which specific environmental awareness training is needed, and to determine the scope and level of such training. The assessment of training needs is reviewed on an annual basis.

The training programme will ensure that relevant staff are aware of the following:

- regulatory implications of the permit for the Site and their specific work activity;
- all potential environmental effects from operations under normal and abnormal circumstances;
- the need to report deviations from the permit; and
- prevention of accidental emissions and the action to be taken should accidental emissions occur.

2.4 Site Security

In order to prevent unauthorised access, the Site benefits from security guards, CCTV, a lockable Site entrance and its location underground beneath the Cribbs Causeway shopping centre to minimise unauthorised entrance.

Access to the Site also requires passing through the South Loading Bays entrance which has a barrier and floor blockade to limit vehicles without permitted access.

The Site is inspected at the commencement of each working day. Any defects or damage which compromise the integrity of the compound are made secure by temporary repair by the end of the working day. Permanent repairs are affected as soon as practicable.

All inspections, any defects, damage or repairs is recorded in the Site diary.

2.5 Permit Surrender

A Site Condition Report is maintained for the Site (SLR ref. 416.11475.00002_SCR). Following the cessation of permitted activities, a review of the Site's condition will be undertaken. Following the review, the Site will be returned to a condition with reference to its condition prior to the commencement of activities on Site. An application will then be made to the EA to surrender the Site's EP.

2.6 Display of Environmental Permit

A copy of the EP is kept available for reference by all staff and contractors whose work may have an impact on the environment.

2.7 Managing Documentation and Records

Controls are in place to ensure that all documents within the scope of the Environmental Management System (EMS) are issued, revised and maintained in a consistent fashion.

The documents that are included within the scope of the controls are as follows:

- policies;
- responsibilities;
- targets;
- maintenance records;
- procedures;
- monitoring records;

- results of audits;
- results of reviews;
- complaints and incident records; and
- training records.

Records are made and kept up to date on a daily basis to reflect waste received to Site, on-Site aerobic digestion treatment and waste collected from Site following treatment. All records relating to waste acceptance are maintained and kept readily available on Site and kept for a minimum of 2 years after the waste has been treated and the by-products removed off Site.

2.8 Reporting Non-Compliance and Taking Corrective Action

Non-compliances detected at the Site will be reported, investigated and rectified. Staff will maintain awareness of non-compliances in the following areas:

- actual or potential non-compliance with conditions of the environmental permit;
- system failure discovered at internal audit;
- suppliers or subcontractors breaking the agreed operating rules;
- incidents, accidents, and emergencies;
- malfunction, breakdown or failure of plant;
- other operational system failure; and
- complaints.

The action taken in response to the non-conformance may include:

- obtaining additional information on the nature and extent of the non-conformance;
- discussing and testing alternative solutions;
- modifying procedures and responsibilities;
- seeking approval for additional resources and training; and
- contacting suppliers and contractors (as applicable).

2.9 Auditing and Legal Compliance

As part of the EMS, a formalised internal auditing procedure is adhered to, in order to ensure the facility is audited at defined intervals and that the progress of corrective and preventative action is monitored.

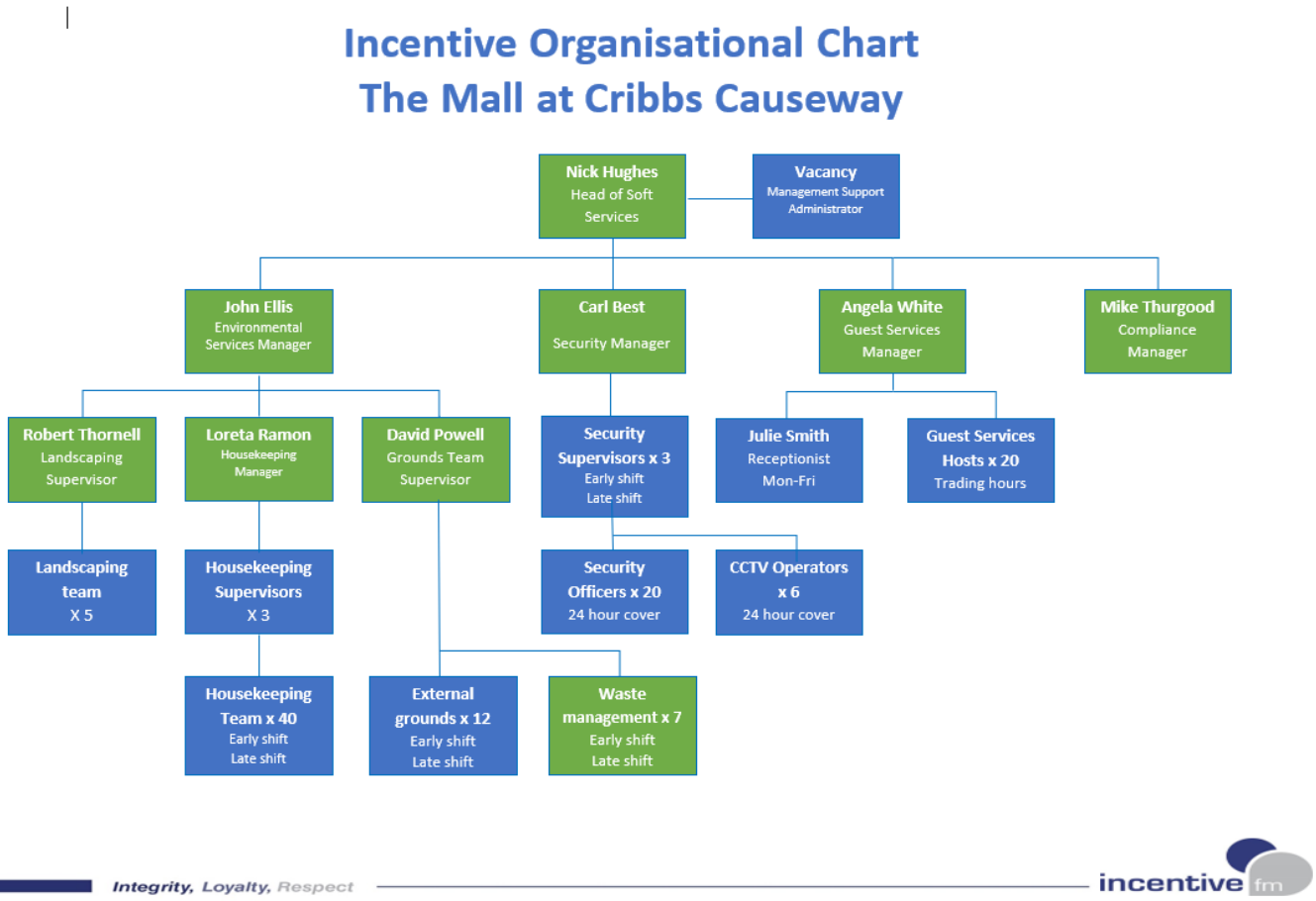
2.10 Monitoring, Measuring and Reviewing Environmental Performance

A formalised management structure reviews environmental performance, and ensures any necessary actions are taken. The management structure consists of the following tiers:

- Head of Soft Services – who will be WAMITAB certified
- Environmental Services Manager
- Grounds Team Supervisor
- Waste Management Operatives x 7.

The current management structure is illustrated in Figure 1. This document is to be updated when there is a change in management structure.

Figure 1 Management Structure



2.11 Operational Control, Preventative Maintenance and Calibration

The EMS contains operational procedures that will ensure effective control of Site operations, the use of approved suppliers and contract services, the maintenance of operational equipment and the calibration of monitoring equipment.

All plant and equipment are subject to a programme of planned preventative maintenance which will follow the inspection and maintenance schedule recommended by the manufacturer.

2.12 Design and Construction Quality Assurance

All relevant elements of the Site are designed in accordance with recognised standards, methodologies and practices.

The design process will use a risk-based approach and will be appropriately documented using drawings, specifications and method statements to provide an adequate audit trail.

Construction Quality Assurance (CQA) plans will govern all construction activities necessary in the future. These CQA plans will be prepared by competent and suitably qualified persons.

A competent and suitably qualified person will supervise the construction activities.

2.13 Hazard Identification

The following hazards are identified in the Environmental Risk Assessment (ERA) that was submitted in support of this EP application (reference 416.11475.00002/ERA):

- Odour;
- Noise and vibration;
- Dust;
- Contaminated run off;
- Pests and scavengers;
- Litter;
- Mud
- Loss of containment - spillage and leakage;
- Fire;
- Flooding; and
- Security and vandalism.

The following sections summarise the measures necessary to minimise the potential causes and consequences of accidents, as detailed in the ERA. Overall, the small scale of the aerobic digestor and the location of the Site being in an underground compound, means that environmental risk from the Site is considered to be low.

2.13.1 Odour

Due to the small scale of the aerobic digester (less than 2 tonnes per day), the risk of odour is low. The site is also located underground, which prevents odour from affecting sensitive receptors within a close proximity of the site.

The waste types accepted on site have low odour potential. Waste comes from a single source generated on the site of the shopping centre. Therefore, waste is received prior to undergoing degradation and putrefaction.

The digestion process is undertaken aerobically which limits odour generation compared to an anaerobic digestion process for example. The automatically controlled process ensures that anaerobic conditions will not develop within the vessel.

The aerobic digester is a sealed process benefitting from a carbon filter, which abates any odours which may be produced during the process.

The compactor in which the post-process flock is stored, is an enclosed bin, also stored underground away from receptors meaning that odour potential from storage of waste is low. The compactor is also collected and emptied a minimum of once a week and more often if so required, meaning the waste has little time for any potential odour to be generated.

Storage areas and the perimeter of the site is monitored daily for any unacceptable levels of odour. Any odour identified on site is recorded in the site diary, investigated by the site manager and remediated as soon as possible.

Storage of waste generated by the machine is stored within a lidded 1,100 litre wheelie bin prior to collection and transportation off-site. Storage prior to treatment is a non-Waste Framework Directive activity due to having been generated on the site of the waste producer.

The Site Manager is responsible for managing emissions of odour on site.

2.13.2 Noise and Vibration

It is considered unlikely that significant noise or vibrations will be generated by the aerobic digester. The scale and location of the aerobic digester will also prevent noise pollution as it is situated underground and treats approximately 2 tonnes of waste per day within a sealed vessel.

Noise pollution will be reduced compared to without the digester, as transport required to transfer the waste generated on site will be less frequent.

To ensure that noise and vibrations are limited, the following management techniques will be implemented:

- All plant and machinery will be operated and maintained in accordance with manufacturer's specifications;
- Machinery will be operated so as to minimise noise;
- Vehicles adhere to a speed limit on site, and within the wider Cribbs Causeway Shopping Centre; and
- Site surfaces will be kept in good repair to minimise noise associated with uneven roads.

Daily auditory monitoring will be carried out by site personnel to identify any unacceptable levels of noise. A record of the inspection findings will be made in the site diary. Remedial action will be taken in the event that noise from the site is detected at nearby sensitive receptor locations.

The Site Manager will be responsible for managing emissions of noise on site.

2.13.3 Dust

The digester is located within a compound with concrete surfacing leading to tarmacked roadways. As such, vehicles will not be tracking over dusty roads.

Use of the digester will result in a reduction in vehicle movements thereby reducing the potential for dust generation from this source.

Waste is bagged and stored in lidded wheelie bins. The lidded wheelie bins are loaded in to a hopper within a shrouded bin loader.

The aerobic digester accepts approximately 2 tonnes of waste each day. It is therefore a small scale activity.

Daily visual inspections will be conducted in response to any complaints. If dust is deemed a nuisance from any of these inspections, mitigation measures will be enforced to reduce any dust emissions.

The result of any inspections or investigations as a result of complaints will be recorded in the Site Diary.

The Site Manager will be responsible for implementing risk management measures in accordance with operational and management procedures including the Site's Dust Management Plan.

2.13.4 Bioaerosols

It is considered unlikely that the aerobic digester will emit significant levels of bio-aerosols due to the small scale of the machine which only treats up to 2 tonnes of waste per day.

The site is located within an underground compound which also decreases the risk of the aerobic digester harming sensitive receptors with bio-aerosols.

The digestion process is undertaken within a sealed vessel, benefiting from a carbon filter. This limits the release of bioaerosols from the treatment process.

Daily visual inspections shall be undertaken at all areas of the site to check for conditions potentially affecting bioaerosol release. Records of the findings will be recorded in the sit diary.

Operational areas and site surfaces shall be maintained in a clean condition; and processes shall take place in designated and controlled areas of the site.

2.13.5 Contaminated Run Off

Waste is stored in wheelie bins or within the digester while undergoing treatment. No waste is stored on the ground.

Waste comes from a single source generated on the site of the shopping centre. Therefore, waste is received prior to undergoing degradation and putrefaction.

All wastes received at the site are solid. No liquid wastes are accepted.

The treatment process is exothermic. The heating of the waste during the treatment process causes it to dry out with the moisture extracted and treated via the carbon filter.

Due to the site being located within an underground compound, the risk of contaminated run off is low. No rain falls on the site or through the compound.

Waste received at the site is low risk non-hazardous in nature.

The aerobic digestion process does not use water and does not discharge to a drain or sewer, which makes it a low potential risk.

The Site Manager will be responsible for implementing risk management measures in accordance with operational and management procedures.

2.13.6 Pests and Scavengers

Due to the site being located within an underground compound, it is unlikely that birds will be present, however there is low risk of other pests such as insects and vermin such as rats.

Waste is stored in wheelie bins or within the digester while undergoing treatment. No waste is stored on the ground. It is considered unlikely that the waste types accepted on site will generate significant levels of scavenging animals. Site personnel will conduct daily inspections of waste storage areas for signs of scavenging animals.

If scavenging animals are spotted a licenced contractor is contacted to remove them and the offending waste type will be investigated and removed if necessary.

The Site Manager is responsible for management of scavenging animals.

2.13.7 Litter

Due to the scale of the aerobic digestor, which only processes up to 2 tonnes of waste per day, the potential risk of litter is low.

Waste is bagged and stored in lidded wheelie bins. The lidded wheelie bins are loaded in to a hopper within a shrouded bin loader.

Waste output from the digester is loaded directly on a conveyor into a 1,100 litre wheelie bin.

The site is located underground and there is no wind that might blow litter during loading or unloading of the unit.

The site will be inspected daily for signs of litter. The site benefits from good housekeeping. In the event that any litter is identified on site, it is cleared from the affected area.

The Site Manager is responsible for managing emissions of litter on and off site.

2.13.8 Mud

Due to the site being located within an underground compound, underneath Cribbs Causeway shopping centre, there is a low potential risk for mud on roads on and off site. The access roads to the site are all tarmacked and therefore present low risk in terms of transferring mud.

The permitted waste types have low litter potential, therefore vehicles which transfer the residual waste off site have a low potential to track mud and waste on and off site.

All site vehicles will be checked to ensure that they are clear of loose waste prior to leaving the site.

Due to the small scale of residual waste produced from the aerobic digester, transport of the waste off site will be infrequent and therefore reduce the risk of mud being transferred.

Good housekeeping will be put in place by the site manager, which involves daily cleaning and inspections.

The site will be inspected daily for signs of litter, mud or waste. Any identified instances of mud, litter or waste are cleared immediately.

The Site Manager is responsible for managing emissions of litter and mud on site.

2.13.9 Loss of Containment and Spillage

There are no fuels stored on site, however there is the potential for fuel spillage from the vehicles transferring residual waste from the site.

The site will be monitored for any spillages associated with vehicle removals and any identified incidents are cleaned up as soon as they are identified.

The result of any inspections or investigations as a result of complaints will be recorded in the Site Diary.

The Site Manager will be responsible for implementing risk management measures.

2.13.10 Fire

Storage of waste generated by the machine is stored within a lidded 1,100 litre wheelie bin prior to collection and transportation off-site. Storage prior to treatment is a non-Waste Framework Directive activity due to having been generated on the site of the waste producer. In any event, waste is stored is small volumes within bins.

There are no other combustible materials stored on site, so a low magnitude risk is estimated.

Permitted activities do not include the burning of waste.

Smoke detectors and sprinklers are located throughout the site to detect fire, as well as fire extinguishers situated around the compound. It is also a requirement for all employees with access to the site to be trained as fire marshals.

An internal temperature monitor is situated within the compound which continually assesses the temperature of the aerobic digester. The temperature measurements can be accessed via cloud-based portal. The system is programmed with alerts and alarms to notify the user of any temperature related risks.

In the event of events such as arson and vandalism the incident is recorded in the site log and reported to the relevant authority. Site security measures are reviewed and improved where necessary. The Cribbs Causeway Shopping Centre benefits from security guards, restricted access areas and CCTV.

2.13.11 Flooding

The site lies in a Flood Zone 1, which is classified as “Land having a less than 1 in 1,000 annual probability of river or sea flooding”.

The Site Manager is responsible for the management of the site in the event of flooding.

2.13.12 Security and Vandalism

To prevent unauthorised access, the site has a lockable site entrance and benefits from being located within an underground compound beneath Cribbs Causeway Shopping Centre. The location of the site should minimise unauthorised access.

Access to the Site also requires passing through the South Loading Bays entrance which has a barrier and floor blockade to prevent vehicles entering the Site without permitted access.

In the event that damage is sustained repairs are made by the end of the working day. If this is not possible, suitable measures will be taken to prevent any unauthorised access to the site and permanent repairs are affected as soon as practicable.

The Site Manager will be responsible for managing security on site. This includes inspecting the site at the commencement of each day.

3.0 OPERATIONS

3.1 Process Description

Proposed permitted activities on Site comprise the treatment of up to 730 tonnes per annum (tpa) of non-hazardous general mixed waste and food waste in an aerobic digester, to reduce the volume and mass of waste prior to transfer off-site for recovery. The proposed permit application includes the following:

- The operation of an aerobic digester beneath Cribbs Cause Shopping Centre, Bristol for the treatment of general mixed waste and food waste generated within the shopping centre only.

The activities that are carried out at the Site as defined under Annex II of the Waste Framework Directive can be summarised as follows:

- **R3** Recycling or reclamation of organic substances which are not used as solvents;
- **R5** Recycling or reclamation of other inorganic materials; and
- **R12**: Exchange of wastes for submission to any of the operations numbered R1 to R11

3.2 Waste Types and Storage

The Site will treat up to 730 tonnes per annum (tpa) of non-hazardous waste.

All of the waste treated will originate on Site, from within the above Cribbs Causeway Shopping Centre. Waste will enter the Site area via a lift within standard 240 litre bins.

The waste list to be accepted on Site is shown in Table 1 below. No more than 2 tonnes of waste per day, equating to 730 tonnes per annum will be treated on Site.

Table 1 Waste List

List of Waste Code	Description
20	MUNICIPAL WASTES AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES INCLUDING SEPARATELY COLLECTED FRACTIONS
20 01 08	Biodegradable kitchen and canteen waste
20 03 01	Mixed municipal waste

Post-process flock is stored within lidded 1,100 litre wheelie bins before being transferred to the on-Site compactor unit. Unrecyclable residual waste which cannot be fed into the digestor, along with the post-process flock are loaded and store within the compactor unit before being collected, transferred off-Site and placed with an empty compactor bin. The compactor has a 28 cubic yard capacity and up to 5 tonnes of waste will be stored within the compactor bin at any one time.

Storage prior to treatment is a non-Waste Framework Directive activity due to being on the Site of the waste producer. Waste storage prior to treatment therefore benefits from an exemption is not within the scope of the permit.

3.3 Site Operations

Table 3 details the waste operation activities carried out on Site.

Table 2 Description of Waste Operations

Activity Reference	Activity Description	Limits of Activity
Aerobic digestion treatment of waste	R3: Recycling or reclamation of organic substances which are not used as solvents R5: Recycling or reclamation of other inorganic materials R12: Exchange of wastes for submission to any of the operations numbered R1 to R11	Treatment of wastes listed in Table 1, consisting treatment via aerobic digestion process including shredding of waste. No more than 730 tonnes of waste shall be treated per year. No more than 5 tonnes of waste will be stored on Site at any one time.

Only authorised persons will be allowed access to the Site. Only waste generated from the adjoining Cribbs Causeway shopping centre will be accepted on Site for treatment.

Once the bins have descended into the operational area, they are loaded into a bin-lifter which raises and diverts the waste into an internal shredder which shreds waste into 50mm^2 particle size. The shredded waste is then augered into a chamber, where bacteria and bio-stimulants are automatically dosed into the waste.

The XO3 has two chambers, with an internal mass of 3m^3 at any given point, through which the waste is moved for digestion. Movement is by a centralized shaft with engineered paddles that rotate according to pre-programmed algorithms. The paddles allow the system to stay aerobic while ensuring residence, and index mass throughout the process. A diagrammatic overview of an AD process is provided as Figure 2.

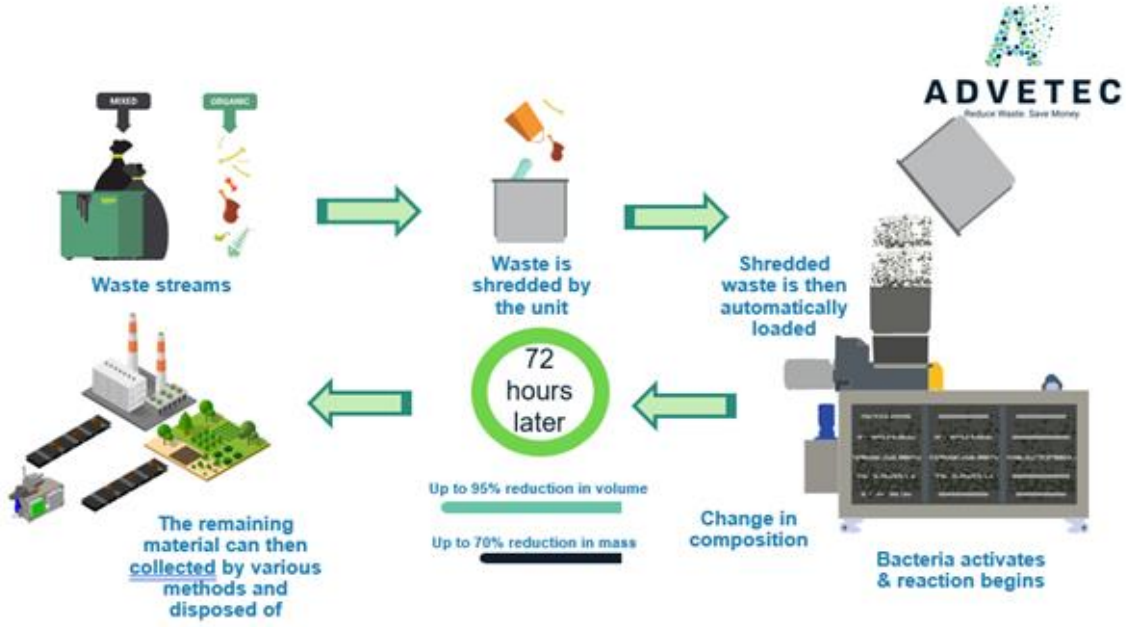


Figure 2 - Aerobic Digestion Process Overview

The only by-products of the AD system are water vapour, carbon dioxide and a post-process residue (flock). The process uses exothermic aerobic respiration; therefore, it generates its own heat which is channelled internally back into the process, using a closed-loop heating system. The process does not use water and does not discharge to a drain or sewer.

The entire AD process takes approximately 72 hours to complete, after completion the post-process flock exits the unit via a chute and is conveyed to an 1,100 litre bin with a capacity of approximately 200kg-275kg. Following this, the bins containing the flock are transferred to a compactor where the flock is disposed of. The flock is loaded into the compactor along with unrecyclable residual wastes which cannot be fed into the digestor. Waste is stored within the compactor bin before being collected, transferred off-Site and replaced with an empty compactor bin. Up to 5 tonnes of waste will be stored in the compactor bin at any one time. The compactor is collected and emptied a minimum of once a week but as and when required if more frequent collections are needed.

The XO3 is accessible via a regulated cloud-based portal. Data points are collected, logged and stored at programmable intervals, including temperature, humidity, rotational speeds, emissions monitoring, power consumption, maintenance schedules. Alert and alarm levels are programmed into the system to notify in the event of system errors or parameters moving out of range. There is also an in-line gas monitoring system which continuously monitors levels of methane (CH_4), carbon monoxide (CO), volatile organic compounds (VOCs) and sulphur dioxide (SO_2), which in the event of detection of any of these parameters, an alarm is raised. To mitigate against any possible odours from the AD process, an odour abatement system is fitted within the XO3 whereby the by-products of water vapour and carbon dioxide are vented to the atmosphere through a passive drum scrubber.

A picture of the installation can be seen in Figure 3.

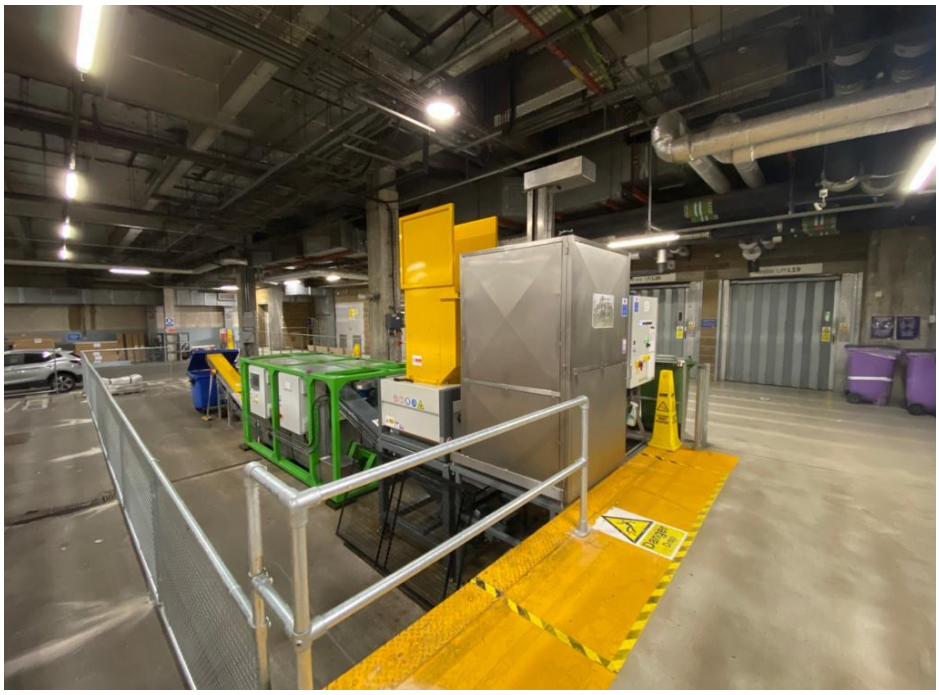


Figure 3 - Advetec Installation at Cribbs Causeway

3.4 Waste Acceptance

3.4.1 Hours of Operation

The Site is operational 24 hours, 7 days a week.

3.4.2 Load Inspection and Waste Control

All waste brought to Site will be from the adjoining on-Site shopping centre. No waste from any other source will be accepted onto Site. The waste brought to Site will undergo a visual inspection prior to any aerobic digestion treatment, to eliminate any foreign or incompatible waste from the load (i.e. metals).

All wastes entering the Site are recorded upon arrival and records of waste accepted for treatment at the Site will be kept, including details on:

- the quantity;
- characteristics;
- List of Waste (LoW) code; and
- delivery date and time.

Waste which is identified to be incompatible with the aerobic digestion process will also be recorded and separated from the waste. This waste is quarantined, recorded and removed from Site at the earliest opportunity, to a suitably licenced facility. Records of non-compliant waste received at the Site will be kept in the Site diary, and include details on:

- the quantity;

- characteristics;
- List of Waste (LoW) code; and
- delivery date and time.

Wastes are accepted unless the Site is adequately resourced to receive the waste.

3.5 Site Infrastructure and Equipment

3.5.1 Site Identification Board

A Site identification board which is easily readable from outside the entrance during hours of daylight is provided at the main Site entrance.

The identification board is inspected at least once per week. In the event of damage or defect that significantly affects the legibility of the board it is repaired or replaced within a timescale agreed with the Environment Agency.

The board displays the following information:

- Site name and address;
- Permit holder;
- Permit number;
- Emergency contact name and telephone number;
- Environment Agency national telephone numbers; and
- Days and hours Site is open for operations.

3.5.2 Plant and Equipment

The following items of plant and equipment will be present on Site.

- 1 x Advetec X03 Aerobic Digester; and
- Compactor bin.

All items of plant and equipment used on Site are maintained in accordance with manufacturer's recommendations. Spare plant is available in the event of breakdown.

4.0 EMISSIONS & MONITORING

The Site Manager will carry out a daily Site check, as detailed in Appendix B.

4.1 Point Source Emissions

The Site is operated so that there are no point source emissions to surface water, groundwater, or land.

4.1.1 Point Source Emission to Air

There will be one point source emission to air from the aerobic digestor from the carbon filter built into the machinery. Water vapour and carbon dioxide are vented through the passive drum scrubber for remediation of possible odours.

There is an in-line gas monitoring system that continuously monitors levels of methane (CH_4), carbon monoxide (CO), volatile organic compound (VOCs) and sulphur dioxide (SO_2) leaving the carbon filter. In the unlikely event of detection of any of these parameters, an alarm is raised.

4.2 Fugitive Emissions

Aerobic digestion takes place in a completely sealed vessel, meaning the potential for fugitive emissions to escape is considered very low.

The Site is entirely contained underground and therefore is not expected to produce any significant fugitive emissions. Despite this, the Site area and perimeter entrances will be inspected on a regular basis to ensure that no fugitive emissions are being produced.

4.2.1 Surface Water and Groundwater

The Site area is contained underground in a concreted compound. The waste which enters the Site area from the adjoining shopping centre will enter within sealed bins, no waste will be stored on the ground and will remain contained through the entire aerobic digestion process. No water is used during the aerobic digestion process and no other additional Site operations will require water. The Site does not discharge to any sewer or drainage system.

Due to this, it is not considered necessary for a surface or ground water management plan to be in place.

To ensure that the potential for the accidental release of emission off Site remains low, the Site area will be inspected regularly to ensure integrity and to check for any spillage of materials. Any defects will be repaired immediately with a temporary solution and fitted with a permanent repair as soon as practicable and to prevent the release of accidental emissions off Site. Any spillages are cleaned up immediately using spill kits that are provided on Site.

4.2.2 Sewer

The Site does not discharge fugitive emissions to sewer.

5.0 RAW MATERIALS

5.1 Raw Material Selection

The only raw materials used on Site are the range of bio-stimulants used within the digestor. Bio-stimulants are added to stimulate bacteria and bacteria indigenous to the waste stream to optimise the digestion process.

Typical usage levels and methods of storage for raw materials used on Site is shown in Table 3 below.

Table 3 Raw Materials Inventory

Raw material	Physical State	Storage arrangements	Storage capacity (ltrs)	Amount used (litres per year)	Description of how material is used	Environmental Impact
Bio stimulant	Liquid	Onboard tank of capacity	20	80	Added to the AD process to aid and optimise digestion	This raw material is a extract from algae, which is classed as non-hazardous poses no known impact (toxicological or ecological risk). Potential negative impact on trade effluent quality if spilled.

5.2 Minimisation of Raw Material Use

There is only one raw material used on Site, as detailed in Section 5.1. The aerobic digestion plant is powered using electricity and does not use any fuel. There are no other on Site processes which require fuel or the use of any raw materials.

The use of bio-stimulants on Site is low due to the small scale (only treating up to 2 tonnes of waste per day) of the activity.

- Despite the minimal use of raw materials on Site, the following optimisation techniques are employed within the Preventative and reactive maintenance of processing equipment; and
- Replacement and upgrading of processing equipment, when applicable, in accordance with best practice requirements.

5.3 Water Use

The AD process or the overall Site does not use or require any water.

5.4 Waste Handling

Waste generated by the machine is stored within lidded 1,100 litre wheelie bins prior to collection and transportation off-site. Storage prior to treatment is a non-Waste Framework Directive activity due to having been generated on the Site of the waste producer.

6.0 ENERGY

6.1 Current Energy Consumption

Due to the small scale of the Site, minimal energy is required for operations. Energy for the Site is obtained from electricity, supplied to the Site from the National Grid. The aerobic digestor uses approximately 6 kW/h of electricity. This equates to 72 kW of electricity used per tonne of waste treated.

The following measures on Site will be implemented to ensure high energy efficiency:

- The purchase of energy efficient equipment, where appropriate;
- Maintenance and operation of equipment in an efficient manner; and
- Continual and periodic review of operations and identification of areas or practices that would result in improved energy efficiency.

6.2 Energy Efficiency Measures

Tables 4, 5 and 6 below summarise the energy efficiency measures currently in place at the installation.

Table 4 Operating, Maintenance and Housekeeping Measures

Operating maintenance and housekeeping measures	Implemented in the installation?	Supplementary Information/ Justification
Air conditioning, process refrigeration and cooling systems maintenance (leaks, seals, temperature control, evaporator/condenser maintenance)	No	These systems are not required on Site
Motors and drivers	Yes	Motors and drivers can be controlled remotely using an installed cloud-based portal. Motors and drivers installed are variable speed.
Compressed gas system (leaks, procedures for use)	No	These systems are not required on Site
Steam distribution systems (leaks, traps, insulation)	No	These systems are not required on Site
Space heating and hot water systems	No	These systems are not required on Site
Lubrication to avoid high friction loss	Yes	The equipment will be maintained in accordance with the manufacturer's specifications ensuring relevant components are kept lubricated.
Boiler maintenance	No	A boiler is not required on Site
Variable speed drives on air compressors	No	These systems are not required on Site

Operating maintenance and housekeeping measures	Implemented in the installation?	Supplementary Information/ Justification
Phase optimisation of electronic control motors, such as on the inverters.	Yes	Electronic control motors incorporate phase optimisation.
Other maintenance activities within the installation	Yes	The preventative maintenance system covers all key items of productive plant.

Table 5 Physical Measures

Physical measures	Implemented in the installation?	Supplementary Information/ Justification
Sufficient insulation of steam systems, heated vessels and pipework.	Yes	The aerobic digestion vessel is insulated.
Provision of sealing and containment methods to maintain temperature	Yes	The aerobic digestion vessel is a sealed unit.
Simple sensors and timers to prevent unnecessary discharge of heated liquids and gases.	Yes	The aerobic digestor vessel and collected data is controlled remotely and monitored using an installed cloud-based portal.

7.0 INFORMATION

All relevant notifications and submissions to the EA regarding the Site are made in writing and will quote the EP reference number and the name of the permit holder.

Records are maintained for at least 2 years, however in the case of off-Site environmental effects, and matters which affect the condition of land and groundwater the records are kept until EP surrender. Duty of Care records are kept for a minimum of 2 years.

7.1 Reporting and Notifications

7.1.1 Changes in Technically Competent Persons

The EA will be informed in writing of any changes in the technically competent management of the Site and the name of any incoming person, together with evidence that such person has the required technical competence.

7.1.2 Waste Types and Quantities

A summary report of waste types and quantities accepted and removed from the Site for each quarter, will be submitted to the EA within 1 month of the end of the quarter unless otherwise required by the EP conditions.

7.1.3 Relevant Convictions

The EA will be notified of the following events:

- Incentive FM being convicted of any relevant offence; and
- Any appeal against a conviction for a relevant offence and the results of such an appeal.

7.1.4 Notification of Change of Operator's or Holder's Details

The EA will be notified of the following:

- Any change in the operator's trading name, registered name or registered office address; and
- Any steps taken with a view to the company going into administration, entering into a company voluntary arrangement or being wound up.

7.1.5 Adverse Effects

The EA will be notified without delay following the detection of the following:

- Any malfunction, breakdown or failure of equipment or techniques;
- Any accident;
- Fugitive emissions which have caused, are causing or may cause significant pollution; and
- Any significant adverse environmental and health effect.

APPENDIX A

Environmental Permit (to be inserted following issue of permit)

APPENDIX B

Daily Site Checklist

Advetec Holdings Ltd
Advetec XO3

OPERATING AND MAINTENANCE MANUAL

Advetec Group
Unit 1, Charlton Business Park
Westfield Industrial Estate
Midsomer Norton
BA3 4BE – United Kingdom

Tel: +44 (0) 01761 433434
Fax: +44 (0) 01761 433365
Email: info@advetec.net

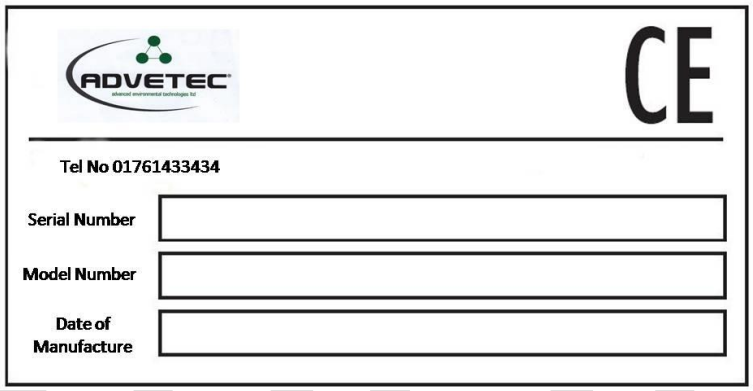
Preface

This manual includes important information in order for the machine to work correctly and safely.

To avoid mistakes and incorrect use, please ensure this manual is available to the operators and personnel involved in using the machine.

The warranty will not be valid unless these instructions are followed.

MACHINE MARKING



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List of Tables

Abbreviations

Any document specific abbreviations, deemed as likely to be unknown by the document's prerequisites, are contained within the table below.

Abbreviation	*Meaning*
I/O, IO	Input(s)/Output(s)
OSK	On-screen Keyboard
TAC	The Automation Clinic/Automation Clinic
ADV	Advetec
XO	Exothermic Reactor
PLC	Programmable Logic Controller
HMI	Human-Machine Interface
CSV	Comma-Separated Value (File)
VSD	Variable Speed Drive

Advetec XO3

1 Introduction

This Operating and Maintenance Manual is designed to ensure installers, operators and maintainers achieve effective installation, efficient operation and longest life from the Advetec XO and at all times ensuring the safety of both people and processes.

If there are any questions regarding this equipment or its application, please contact the local Advetec Holdings Ltd distributor, or contact Advetec Holdings Ltd at the following:

Manufacturer:	Advetec Holdings Ltd Unit 1 Charlton Business Park Midsomer Norton Radstock BA3 4BE United Kingdom	Tel: +44 (0) 01761 433434 Fax: +44 (0) 01761 433365 Email: info@advetec.net
Distributor:		

2 Project Specific Design Criteria

CLIENT NAME:	
CLIENT ADDRESS:	
CLIENT CONTACT:	
CONTACT TEL NO. OFFICE:	
CONTACT TEL NO. MOBILE:	
CONTACT E-MAIL:	

XO Model Reference:	
Advetec XO Serial Number:	
Clients Design Throughput	
Type of Feed Stock:	
Unit Maximum Design Throughput	
Performance Criteria: (Expected Reduction)	

2.1 Process Overview

The process uses bespoke blend micro-organisms. These strains of bacteria activate at elevated temperatures. Their ability to survive in these adverse conditions means that they have evolved high respiration rates and can consume substantial amounts of organic load very quickly.

As the micro-organisms consume the organic load, they produce two by-products, heat and water. These by-products keep the operating costs of the XO down as the produced heat is utilised by the system.

On initial set-up, the aim is to develop a mature and thriving biomass of bacteria and waste. Once the internal biomass reaches its operating temperature range, the bacteria become fully active and generate heat which is re-used within the process to both sustain it and optimise energy consumption. This enables reduced running costs.

The XO unit provides the optimum environment for the automatic dosing of specialised bacteria and Bio Stimulants. The environment is monitored and controlled with specialist equipment allowing the bacteria to operate at maximum efficiency. Waste is continuously dosed to provide new feed-stock for the biomass.

The Bio-Stimulant is made from purified natural plant extracts and is absorbed inter-cellularly by the bacteria to enhance an accelerated respiration rate. Fresh bacteria are continually dosed to ensure the biomass always has an active population.

The discharge rate of the digestate from the XO is also controlled to ensure manageable output. The process within the XO is aerobic and as such, the XO process requires aeration to ensure process stability. This is delivered through a paddle system powered by the main motor drive.

2.2 Ideal Feedstock for the Advetec XO Process

The Advetec XO ideal feedstock is high organic content material. Process compliance is subject to the Pre-Analysis Datasheet (PADS). Specific attention is made to the following but not limited to:

The maximum throughput is not exceeded (per 24hr period)
The equipment is maintained in compliance with the maintenance manual
The equipment is operated in compliance with the operations manual
Only trained personnel operate the equipment
The equipment has a compliant power supply

The XO unit itself operates under certain conditions which utilise aerobic bacteria for the digestion of organic content, therefore contamination of bio inhibitors or antibacterial products will have a negative effect on the performance of the equipment and process. In line with the process compliance and warranty the Advetec XO equipment can only be operated within compliance whilst adhering to the levels of contamination indicated in

Table 1: Contaminant Levels

Contaminant	Maximum Daily Composition Limit
Antibiotics	0.25%
Biocides	0.30%
Cleaning Products	0.50%
Acids < pH4	0.25%
Alkaline > pH10	0.30%
Heavy metals	0.50%
Poisons	0.25%
Toxins	0.25%
Enzyme Inhibitors	0.25%

3 Health and Safety Procedures

3.1 Warnings

The following warning symbols are used throughout this manual to describe the type of hazard that may be encountered during the installation, operation or maintenance of this equipment. All personnel should pay special attention to the procedures indicated.

Immediate hazard which WILL result in severe personal injury or death.

Hazard or unsafe practices which COULD result in severe personal injury or death.

Hazards or unsafe practices which COULD result in personal injury or product or property damage.

3.2 Introduction

This Operating and Maintenance Manual is provided to fulfil the responsibilities of Advetec Holdings Ltd to supply sufficient documentation and instructions to enable the users of the equipment supplied under this contract to operate and maintain the equipment in a safe manner.

The operation and maintenance of this plant and equipment must be carried out in compliance with all current and relevant Health and Safety and Welfare legislation.

By way of illustration, the following refer to the legislation that currently applies within the United Kingdom. For installations in other countries or jurisdictions, it is imperative that all personnel are made aware any aspects of Health and Safety legislation that may be in force, which may be at variance from the following.

The Health and Safety at Work Act 1974 states that:

a. It shall be the duty of every employee while at work, to take reasonable care for the health and safety of himself and of others who may be affected by his acts or omissions at work and as regards any duty or requirement imposed on his employer or any other person by or under any of the relevant statutory provisions, to co-operate with him so far as is necessary to enable that duty or requirement to be performed or complied with.

b. No person shall intentionally or recklessly interfere with or misuse, anything provided in the interests of health and safety or welfare in pursuance of any of the relevant statutory provisions.

3.3 Health and Safety During Operation and Maintenance

Equipment supplier's documentation will contain Health and Safety instructions pertinent to their equipment. The following instructions are offered as a general guideline and should be strictly observed but not be regarded as complete and exhaustive:

3.3.1 All work shall be carried out by appropriately trained and qualified personnel.

3.3.2 All equipment shall be made safe; this will require isolation from electrical power and/or process wastes. Mains isolators and isolation valves shall be selected and locked in the 'OFF' position before any maintenance work is carried out.

3.3.3 All work on electrical equipment shall be completed in strict compliance with the following:

- Electricity at Work Regulations 1989.IEE Wiring Regulations.
- BS 7671:2008+A3:2015 Requirements for Electrical Installations. IET Wiring Regulations
- Control Panel built BS (EN) 61439-2
- Manufacturer's Instructions.

3.3.4 Safe access must be provided to relevant parts of the plant and all lifting equipment shall be covered by current certification.

3.3.5 Appropriate protective clothing and equipment shall always be worn.

3.3.6 When working in confined spaces, gas detection equipment and breathing apparatus in accordance with safety procedures, shall be used.

NOTE: Recent legislation involving the 'Control of Substances Hazardous to Health Regulations 1988' and the 'Noise at Work Regulations 1989' also apply.

3.4 General Warnings

The following general WARNINGS must be observed before any maintenance work is carried out:

DANGER

HIGH VOLTAGES CAN KILL. BEFORE WORKING ON ANY COMPONENT THAT HAS ELECTRICAL CONNECTIONS:

MAKE SURE THE ELECTRICAL SUPPLY IS ISOLATED

MAKE SURE THE CIRCUIT BREAKERS ARE TRIPPED AND TAGGED

MAKE SURE A PERSONAL LOCK IS INSTALLED TO THE ISOLATION SWITCH ON THE MOTOR CONTROL CABINET TO PREVENT INADVERTENT CONNECTION OF THE ELECTRICAL SUPPLY

WARNING

WHEN WORKING IN CONFINED SPACES:

MAKE SURE YOU ARE IN CONTACT WITH A SECOND OPERATIVE.

MAKE SURE YOU HAVE THE NECESSARY SAFETY EQUIPMENT AND ARE FULLY TRAINED IN THEIR USE AND OPERATION

It is the requirement of the Health and Safety At Work Act 1974 that employers provide such information, instruction, training and supervision as is necessary, to ensure so far as is reasonably practicable the health and safety of his employees.

Observance of the foregoing health and safety advice will benefit both employees and employers alike in seeking to ensure the safe, efficient and reliable operation of the plant and equipment.

4 TECHNICAL DESCRIPTION AND FUNCTIONAL DESIGN SPECIFICATION

4.1 General

The Advetec XO is designed to be installed on a concrete or level hard standing. The loading of the unit via the feed hopper is required.

The feedstock into the Advetec XO can be loaded in several ways.

4.1.1 Smaller units (Model type A- and M-) are typically manually loaded from the top of the unit via a feed chute.

4.1.2 Model type B- and C- are typically loaded via feed augers depending on the site restrictions. The feed auger then spills the feedstock into a feed hopper which is automatically controlled via the control panel software.

4.1.3 The Advetec XO waste chambers are constructed in grade 304 stainless steel and housed within an exoskeleton.

4.2 Advetec XO

4.3 Advetec XO Electrical Loadings

The power ratings indicated in Table 2 are maximum load. These figures include the Advetec XO and associated components (i.e. heat pads, fans and monitoring equipment), in addition to an outfeed auger. No other auxiliary items are including in these figures. The Advetec XO does not operate at this power load. Typical operating values are 30% of the maximum load.

During commissioning, or after down-time, higher power is required to (re)establish the biomass. This is infrequent.

Table 2: Typical Power Supply Requirements

XO Model Number	Power Requirements	
	Volts	Kw
XO 1	415	22
XO 3	415	37
XO 6	415	40
XO 13	415	78

5 HMI Access & General Status Information

5.1 Security

5.1.1 Security Levels

There are three levels of access to the HMI of the XO3 machine and two different users. The HMI works at the lowest level of access when there is no active user. At this access level, only the following screens are accessible.

- The Home Screen
- The Alarms Screen
- The Historic Alarms Screen
- The Overview Screen
- The IO Status Screens

No settings or controls relating to the XO3 system are modifiable without user login.

5.1.2 Operator Level

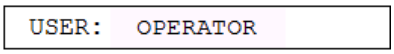
Working at operator level, in addition to functionalities accessible without logging in, allows a user to start and stop the system and to reset alarms.

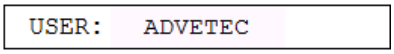
5.1.3 Advetec Level

Working at Advetec level allows complete access to the HMI and the XO3 systems functionalities.

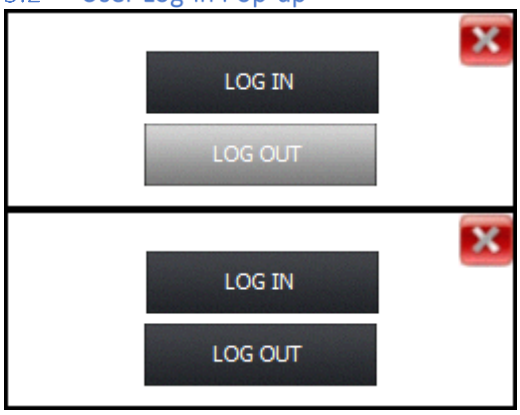
5.1.4 Active User Display

The Active User displays in the top-left corner of every screen with the exception to the Home screen. This clarifies the level of access that the user currently has. Pressing this on any screen except the User Log-in screen shows/hides the User Log-in pop-up.





5.2 User Log-in Pop-up

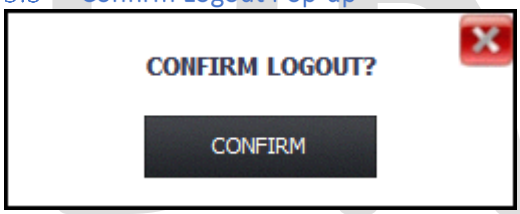


Upon pressing the Active User Display on any screen other than the User Log-in screen, or the LOGIN/LOGOUT button on the Main Menu screen, the User Log-in pop-up shows/hides. Pressing the button or navigating to another screen also hides the pop-up.

The LOG IN button navigates to the User Log-in screen.

The LOG OUT button shows the Confirm Logout Pop-up. If no user has logged in, then this button disables.

5.3 Confirm Logout Pop-up



Pressing the LOG OUT button on the User Log-in Pop-up shows the Confirm Logout Pop-up. Any of the following actions hides the pop-up:

- Pressing the button.
- Navigating to another screen.
- Pressing the active user display.
- Pressing the LOGIN/LOGOUT button on the Main Menu screen.

Pressing the CONFIRM button logs out of the current user, closes all popups and returns to the Home screen.

5.4 Status Bar

A status bar features at the top of every screen with exception to the Home screen. The status bar has the following statuses that display as follows:

Status Bar	Severity/Priority (1=HIGH)	Display Condition
EMERGENCY STOP ACTIVE	1	The emergency stop was pressed and not released
ALARM ACTIVE	2	Any alarm is active.
WARNING ACTIVE	3	Any warning is active.
MANUAL CONTROL ACTIVE	4	Manual Control is active
SYSTEM HEALTHY	5	Default Display (no other condition is true).

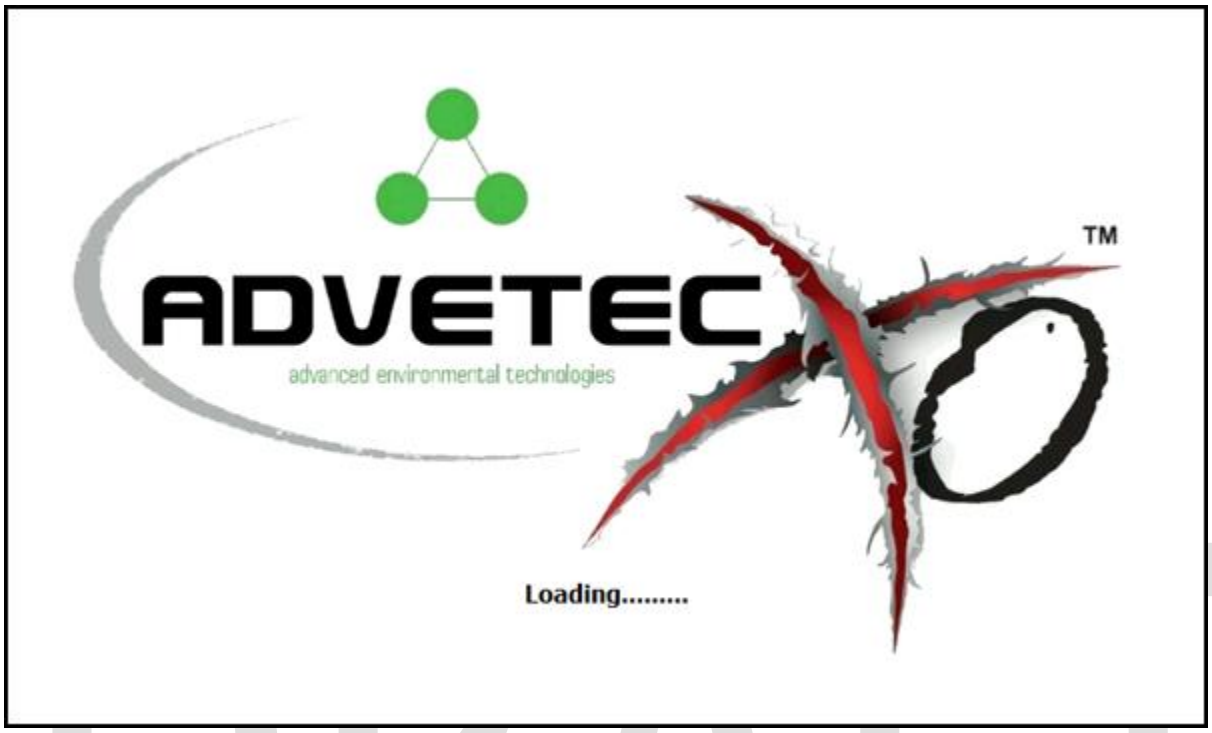
5.5 Time and Date Display

DD/MM/YYYY hh:mm:ss

The current HMI time and date features at the top of every screen with exception to the Home screen.

6 HMI Screens

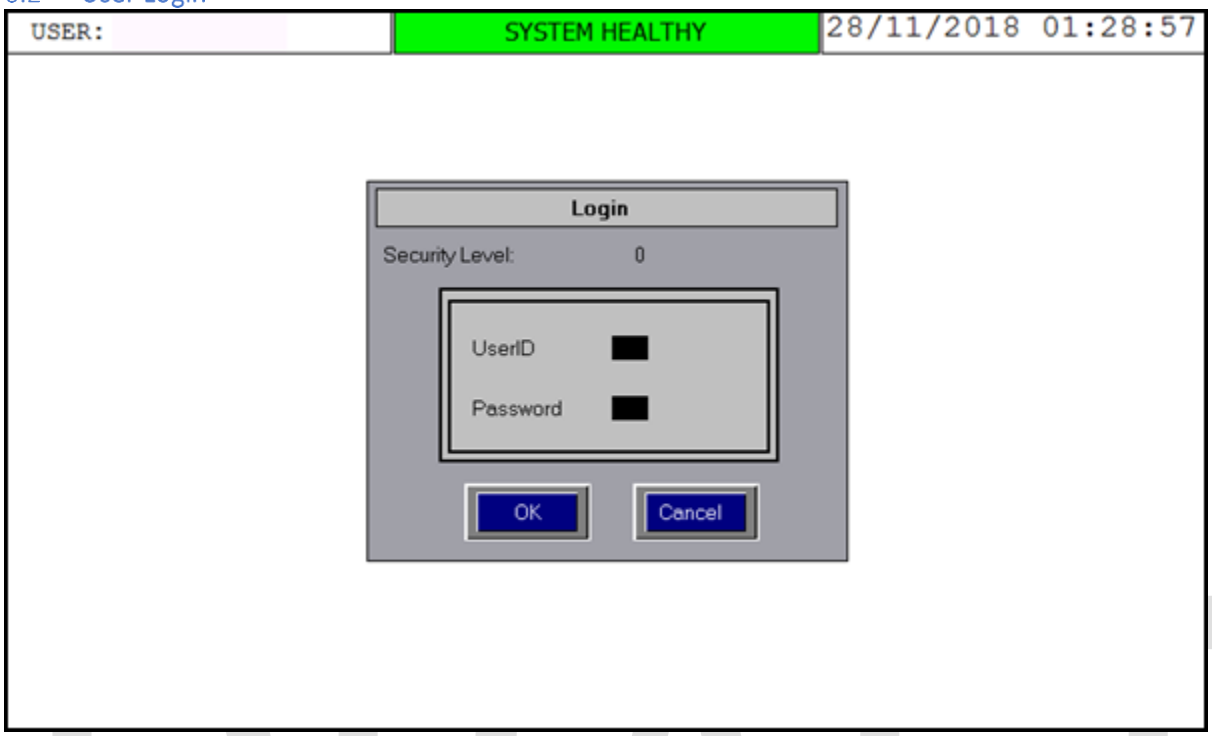
6.1 Home



Upon HMI start-up the Home screen displays. Consequent to receiving conformation from the PLC that the system is ready to use, an ENTER button appears in the place of Loading..... .

Pressing the ENTER button navigates to the Main Menu screen.

6.2 User Login



The user uses the User Login screen to log in. Any attempt to access HMI functions that inhibit, unless the user is working at a higher security level, results in this screen. If the user was trying to navigate to a screen, then the HMI will only carry out the function after log-in has been successful. If the user was trying to access other HMI functionality then the HMI will not carry out such function until the user has logged in with the correct security access and tried the given function again.

6.3 Security Level

Security Level: 0

The numeric ID of the internal HMI security level displays on this screen.

6.4 User ID/Username

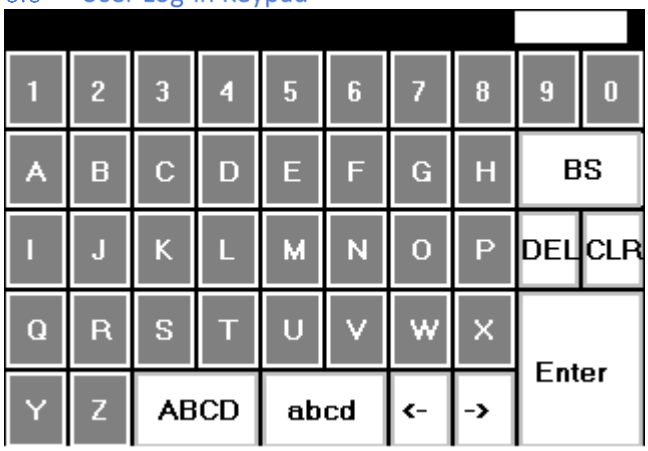
Pressing [redacted] next to UserID produces the User Log-in Keypad to allow username entry. Note that [redacted] will populate with text in either of the following instances:

- The screen has loaded after a user has logged in - [redacted] will populate with the Active User.
- The user has finished entering text into the UserID field by using the User Log-in Keypad - [redacted] will populate with the text entered via the User Log-in Keypad. This text will automatically clear upon navigation away from the screen unless successful log-in occurs.

6.5 Password

Pressing [redacted] next to Password produces the User Log-in Keypad to allow password entry. Note that [redacted] will populate with text when the user has finished entering text into the Password field by using the User Log-in Keypad. In this case, [redacted] will populate with the text entered via the User Login Keypad and this text will automatically clear upon navigation away from the User Log-in screen unless successful log-in occurs.

6.6 User Log-in Keypad



The User Log-in keypad works similarly to most on-screen keyboards. The user may enter up to 8 alphanumeric characters. Input displays in the top right corner of the keypad. Pressing the Enter key will close the keypad and save data entry.

6.7 OK Button

Pressing the 

button results in the HMI trying to log-in using the data in the UserID and Password fields. A successful log-in results in the following:

- If the user was trying to access a screen the HMI navigates to that screen.
- If the user was trying to access other HMI functionality the HMI navigates to the screen last accessed before the User Log-in screen. (The user must now try to access the given functionality again for the given function to take place.)

An unsuccessful login results in one of the following pop-ups showing:

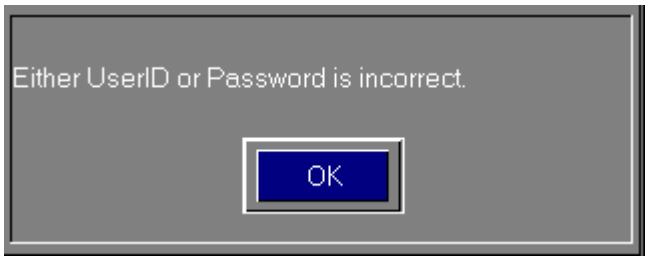
- Incorrect User or Password
- Incorrect Security Level

6.8 Cancel Button

The 

button will cancel the log-in attempt and return to the screen last accessed before the User Log-in screen.

6.9 Incorrect User or Password

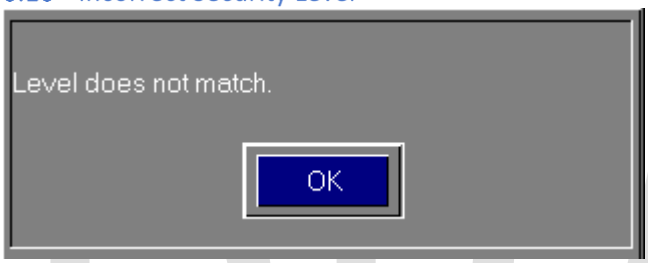


This pop-up shows if the UserID or Password was incorrect during a user log-in attempt.

Pressing the 

button will close the pop-up.

6.10 Incorrect Security Level

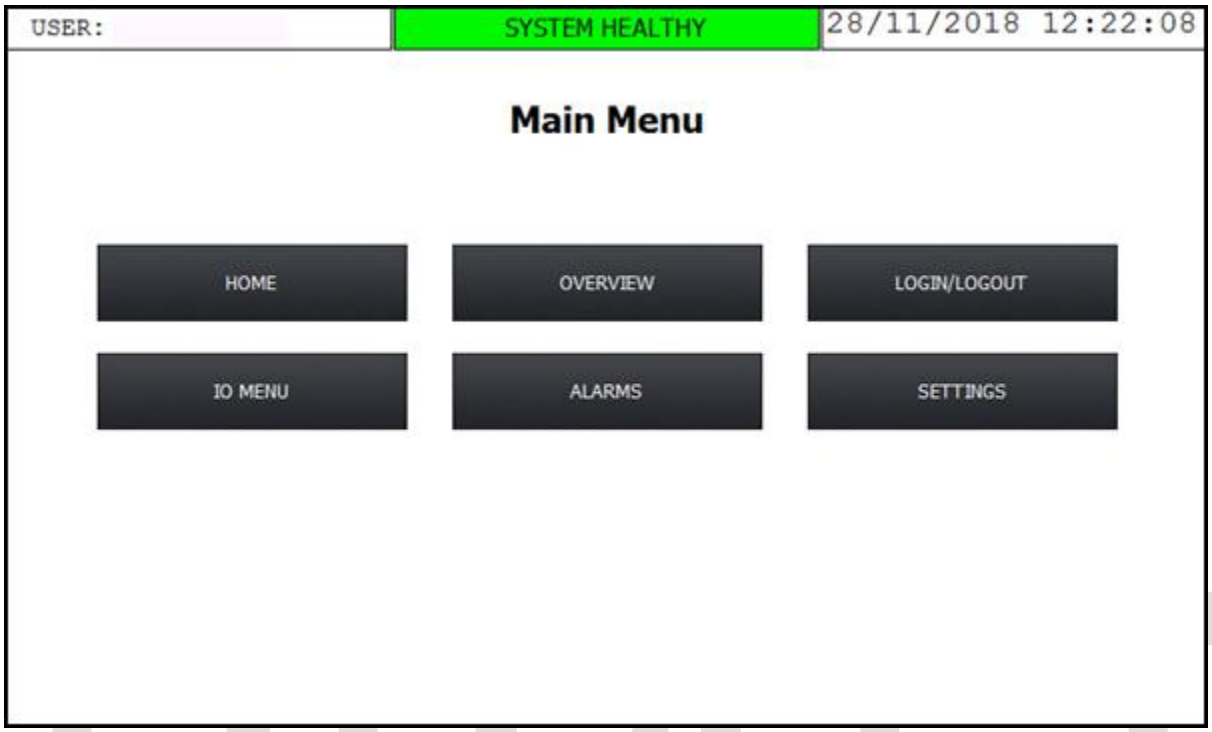


This pop up shows if an Operator has entered correct credentials but is trying to access an Advetec level function.

Pressing the 

button will close the pop-up.

6.11 Main Menu



The Main Menu screen features several buttons with different functionalities. See the list below:

- HOME - Navigates to the Home Screen.
- OVERVIEW - Navigates to the Overview Screen.
- LOGIN/LOGOUT - Shows/Hides the User Log-in Popup.
- IO MENU - Navigates to the IO Menu Screen.
- ALARMS - Navigates to the Active Alarms screen.
- SETTINGS - Navigates to the Settings Menu screen. (Advetec level users only.)

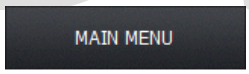
7 Alarms

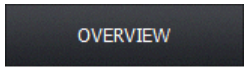
7.1 Active Alarms

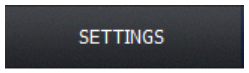
All active alarms associated with the XO3 Control Panel (See Appendix A) display chronologically on this screen alongside the time and date at which they activated.

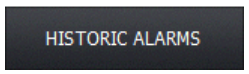
Buttons have the following functionalities:

- 

- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- 

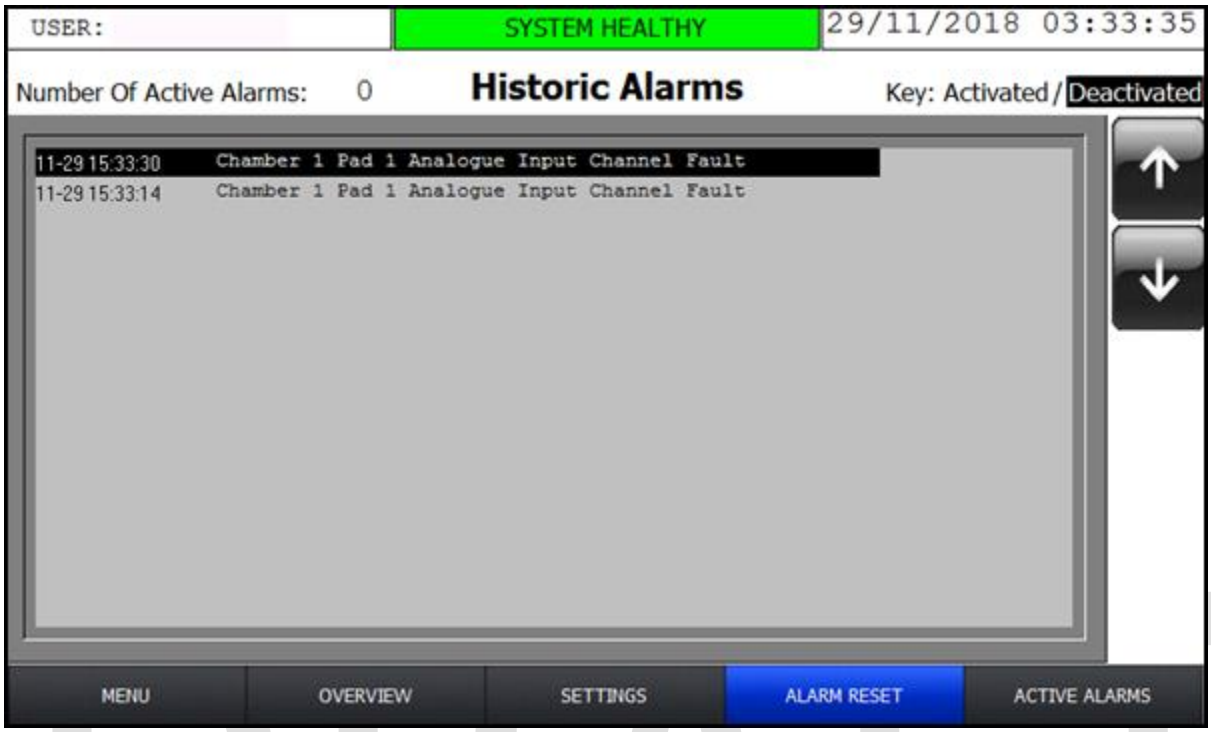
- Navigates to the Main Menu screen.
- 

- Navigates to the Overview screen.
- 

- Navigates to the Settings Menu screen. (Advetec level users only.)
- 

- Navigates to the Historic Alarms screen.
-  - Scroll up through alarms.
-  - Scroll down through alarms.

7.2 Historic Alarms



This screen displays the activation and deactivation time of any alarms that occur after HMI start-up. Alarms display in chronological order of activation/reset.

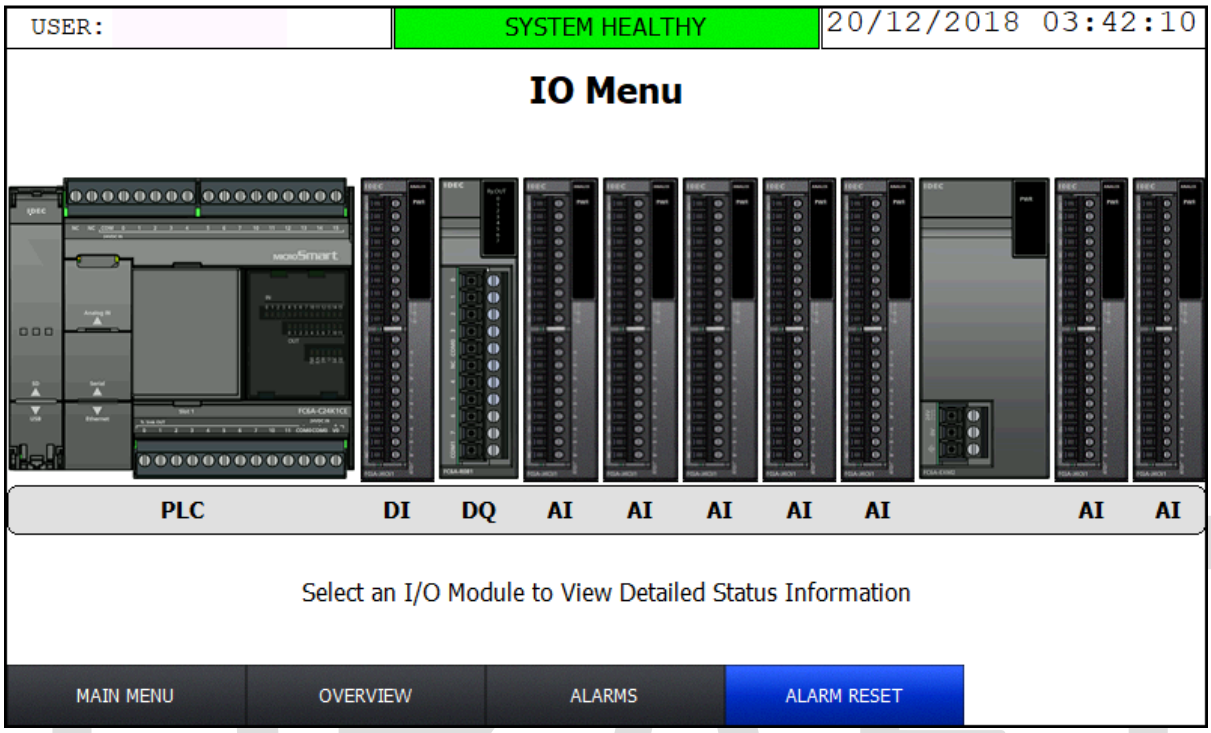
Buttons have the following functionalities:

- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- MAIN MENU - Navigates to the Main Menu screen.
- OVERVIEW - Navigates to the Overview screen.
- SETTINGS - Navigates to the Settings Menu screen. (Advetec level users only.)
- ACTIVE ALARMS - Navigates to the Active Alarms screen.
-  - Scroll up through alarms.
-  - Scroll down through alarms.

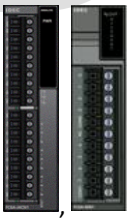
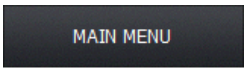
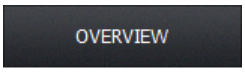
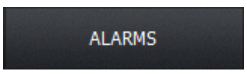
7.3 IO Status

For a summary of inputs and outputs see Appendix B.

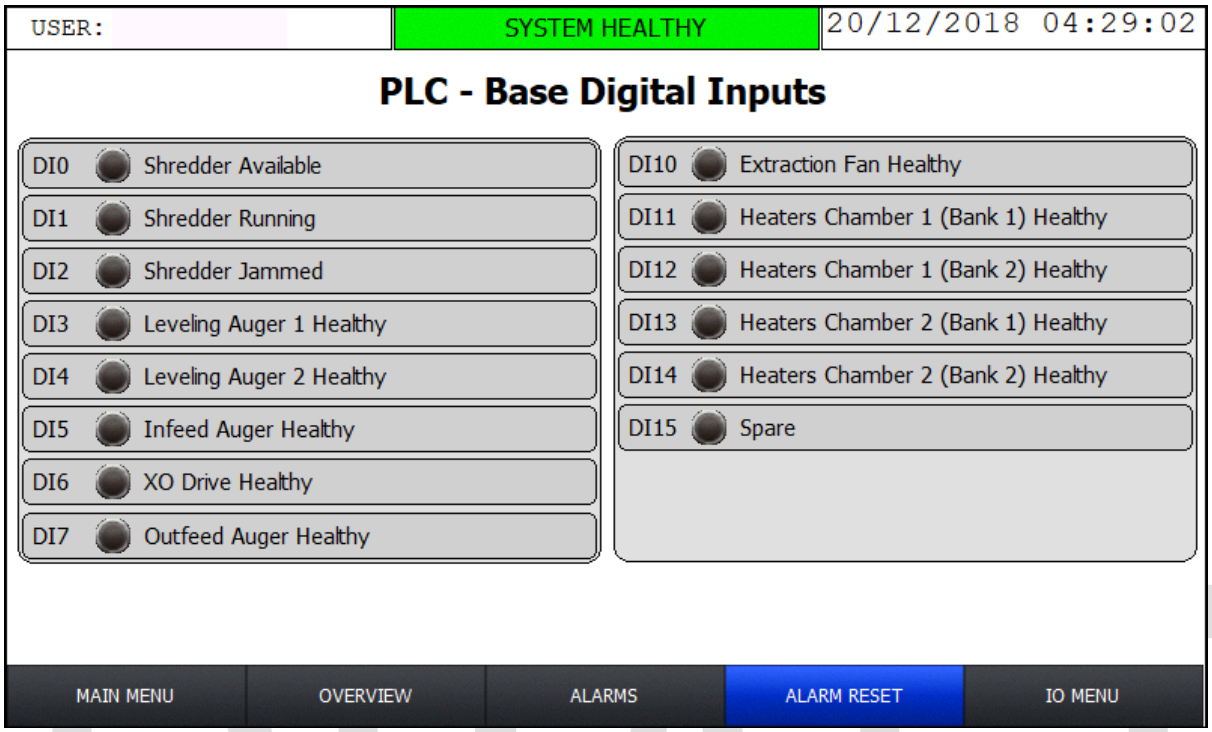
7.3.1 IO Menu



From the IO Menu screen the user can navigate to several IO status screens. Buttons have the following functionalities:

-   - Navigates to the Base IO - Digital Inputs screen.
-   - Navigates to the Base IO - Digital Outputs screen.
-  - Selecting an expansion card navigates to the relevant Digital or Analogue Status screen.
-  - Navigates to the Main Menu screen.
-  - Navigates to the Overview screen.
-  - Navigates to the Active Alarms screen.
-  - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.

7.3.2 Base IO - Digital Inputs



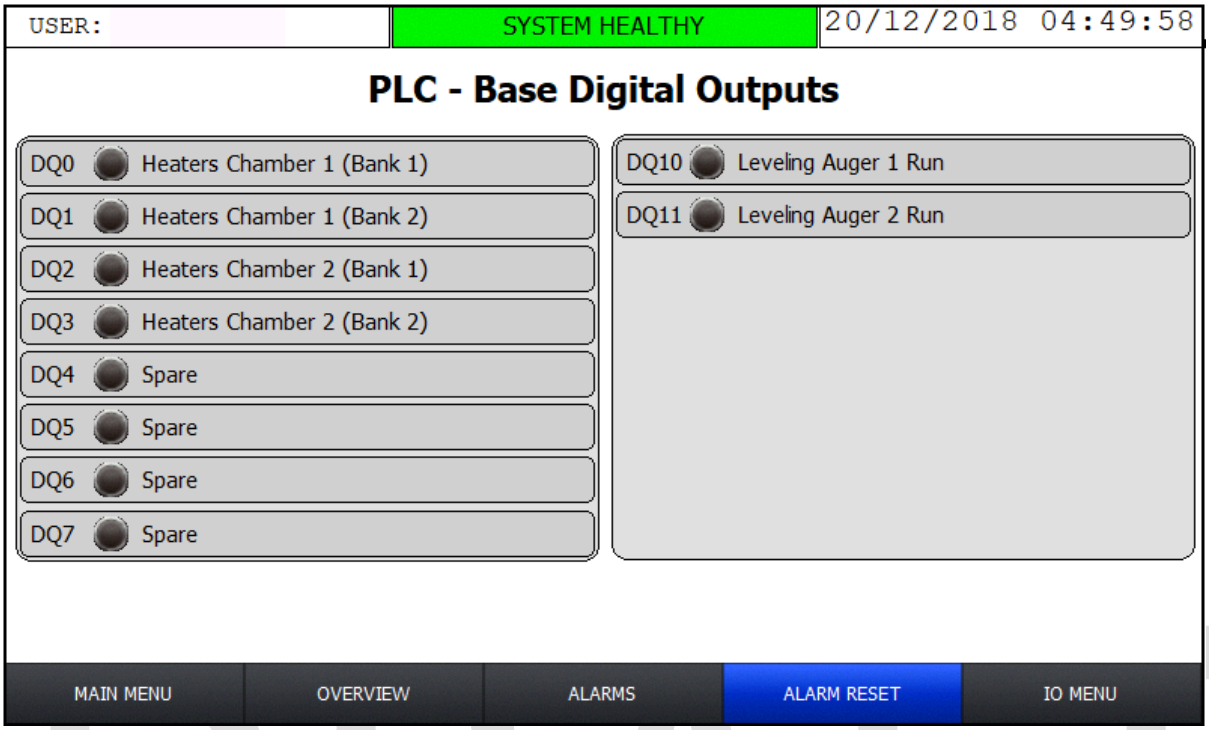
This screen shows the status of all Digital Inputs relating to the XO3 system:

- - Shows 0V at an input.
- - Shows 24V at an input.

The screen features several buttons with the following functionalities:

- MAIN MENU - Navigates to the Main Menu screen.
- OVERVIEW - Navigates to the Overview screen.
- ALARMS - Navigates to the Active Alarms screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- IO MENU - Navigates to the IO Menu screen.

7.3.3 Base IO - Digital Outputs



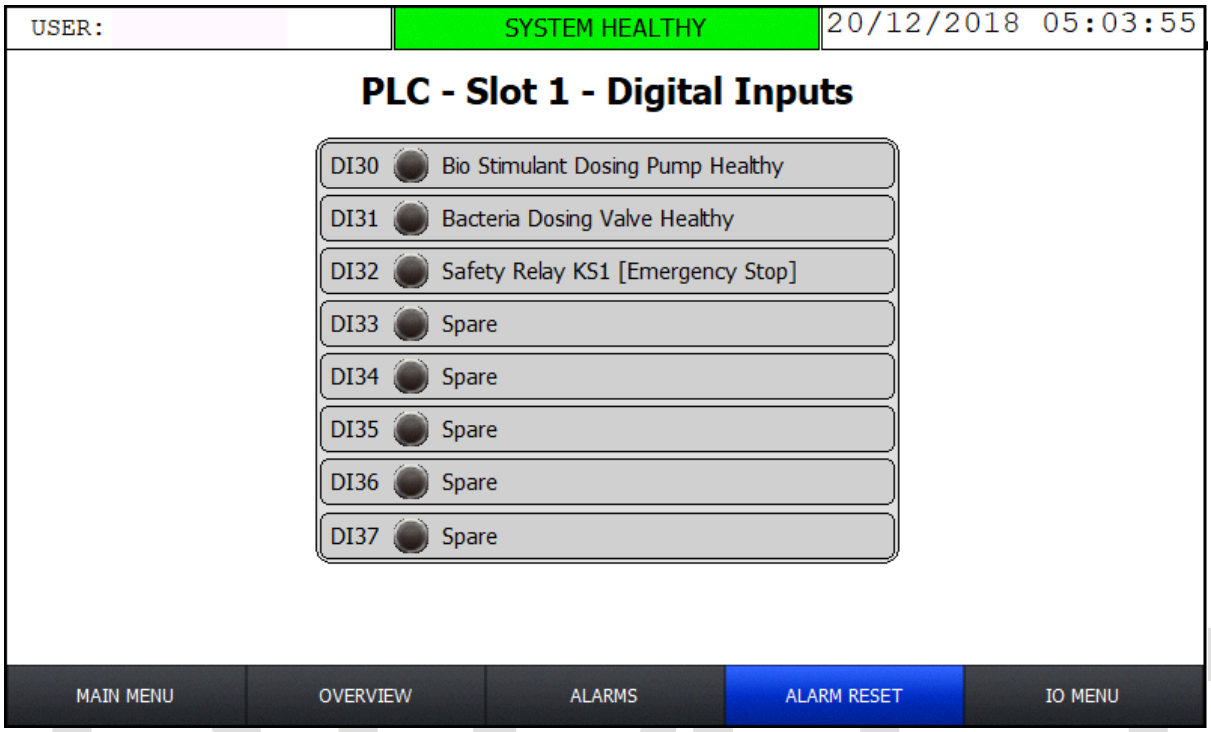
This screen shows the status of all Digital Outputs relating to the XO3 system:

- - Shows 0V at an output.
- - Shows 24V at an output.

The screen features several buttons with the following functionalities:

- MAIN MENU - Navigates to the Main Menu screen.
- OVERVIEW - Navigates to the Overview screen.
- ALARMS - Navigates to the Active Alarms screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- IO MENU - Navigates to the IO Menu screen.

7.3.4 Expansion Digital Inputs



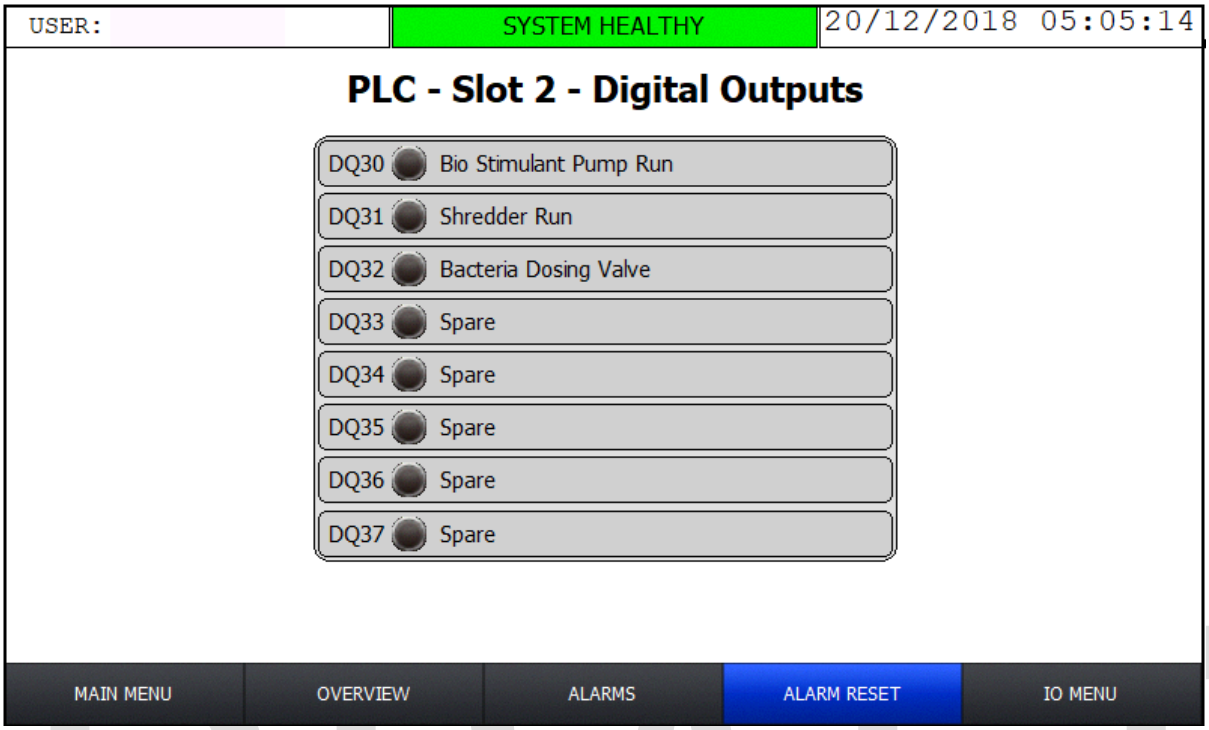
This screen shows the status of all Digital Outputs relating to the XO3 system:

- - Shows 0V at an output.
- - Shows 24V at an output.

The screen features several buttons with the following functionalities:

- MAIN MENU - Navigates to the Main Menu screen.
- OVERVIEW - Navigates to the Overview screen.
- ALARMS - Navigates to the Active Alarms screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- IO MENU - Navigates to the IO Menu screen.

7.3.5 Expansion Digital Outputs



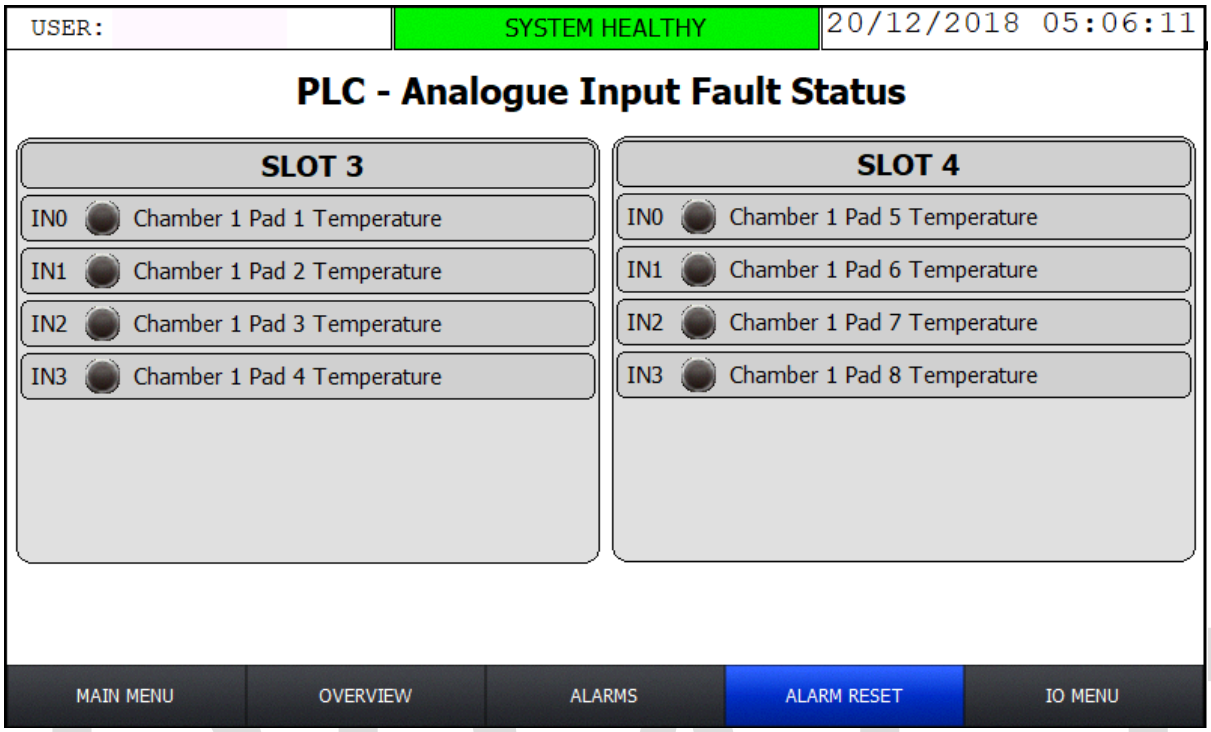
This screen shows the status of all Digital Outputs relating to the XO3 system:

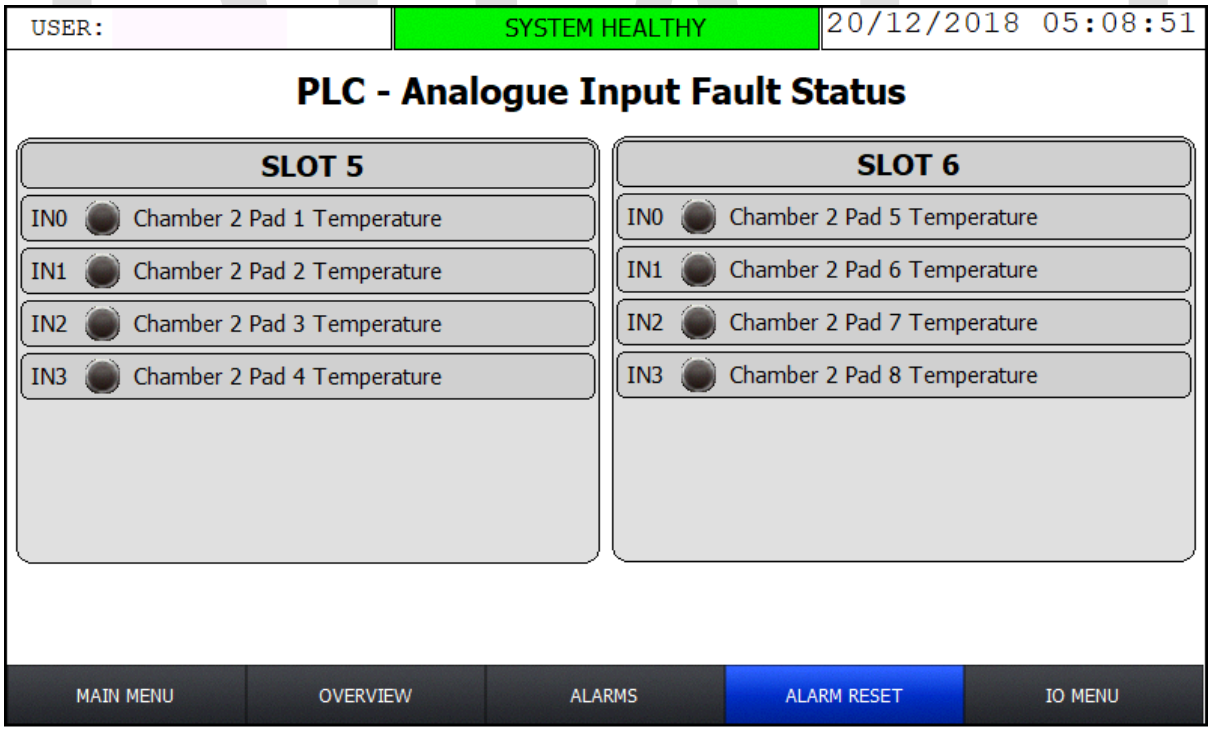
- - Shows 0V at an output.
- - Shows 24V at an output.

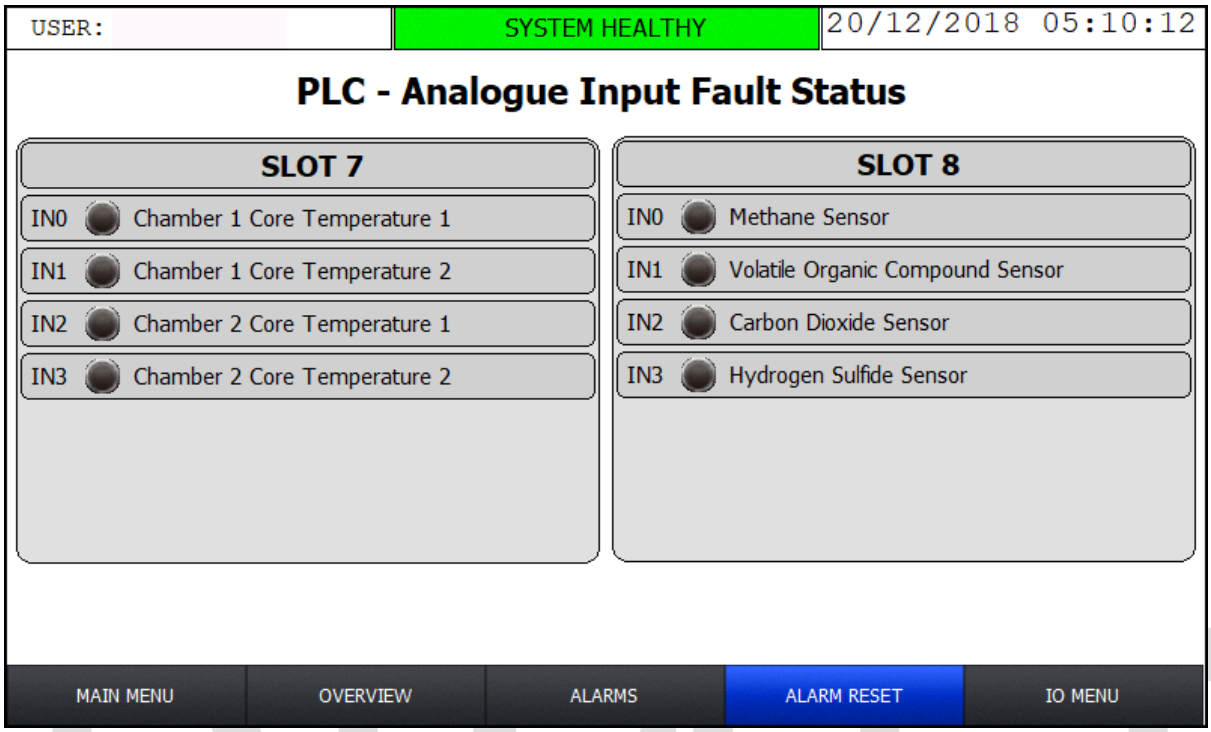
The screen features several buttons with the following functionalities:

- MAIN MENU - Navigates to the Main Menu screen.
- OVERVIEW - Navigates to the Overview screen.
- ALARMS - Navigates to the Active Alarms screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- IO MENU - Navigates to the IO Menu screen.

7.3.6 Analogue Input Fault Status


USER:
SYSTEM HEALTHY
20/12/2018 05:06:11
PLC - Analogue Input Fault Status
SLOT 3
IN0 Chamber 1 Pad 1 Temperature
IN1 Chamber 1 Pad 2 Temperature
IN2 Chamber 1 Pad 3 Temperature
IN3 Chamber 1 Pad 4 Temperature
SLOT 4
IN0 Chamber 1 Pad 5 Temperature
IN1 Chamber 1 Pad 6 Temperature
IN2 Chamber 1 Pad 7 Temperature
IN3 Chamber 1 Pad 8 Temperature
MAIN MENU
OVERVIEW
ALARMS
ALARM RESET
IO MENU


USER:
SYSTEM HEALTHY
20/12/2018 05:08:51
PLC - Analogue Input Fault Status
SLOT 5
IN0 Chamber 2 Pad 1 Temperature
IN1 Chamber 2 Pad 2 Temperature
IN2 Chamber 2 Pad 3 Temperature
IN3 Chamber 2 Pad 4 Temperature
SLOT 6
IN0 Chamber 2 Pad 5 Temperature
IN1 Chamber 2 Pad 6 Temperature
IN2 Chamber 2 Pad 7 Temperature
IN3 Chamber 2 Pad 8 Temperature
MAIN MENU
OVERVIEW
ALARMS
ALARM RESET
IO MENU



This screen shows the fault status of all Analogue Inputs relating to the XO3 system:

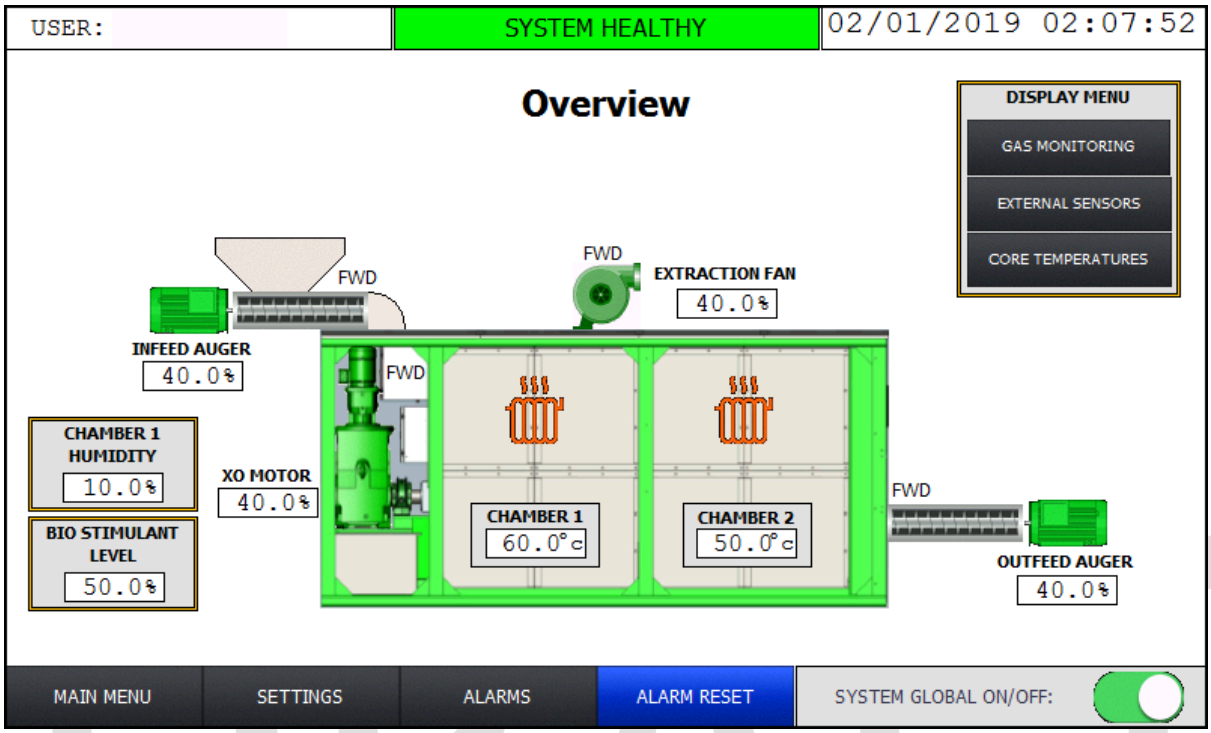
- - Indicates input healthy.
- - Indicates input in fault.

The screen features several buttons with the following functionalities:

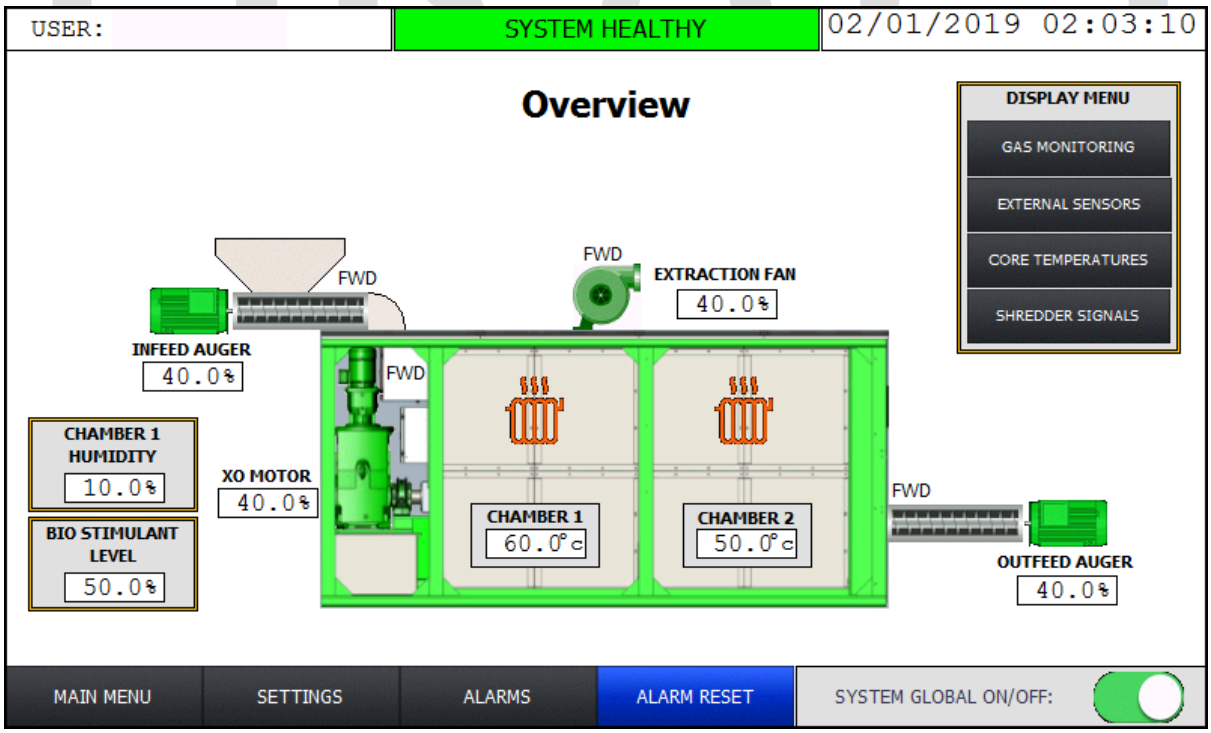
- MAIN MENU - Navigates to the Main Menu screen.
- OVERVIEW - Navigates to the Overview screen.
- ALARMS - Navigates to the Active Alarms screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- DIGITAL INPUTS - Navigates to the Base IO - Digital Inputs screen.
- DIGITAL OUTPUTS - Navigates to the Base IO - Digital Outputs screen.
- IO MENU - Navigates to the IO Menu screen.

7.4 Overview Screen

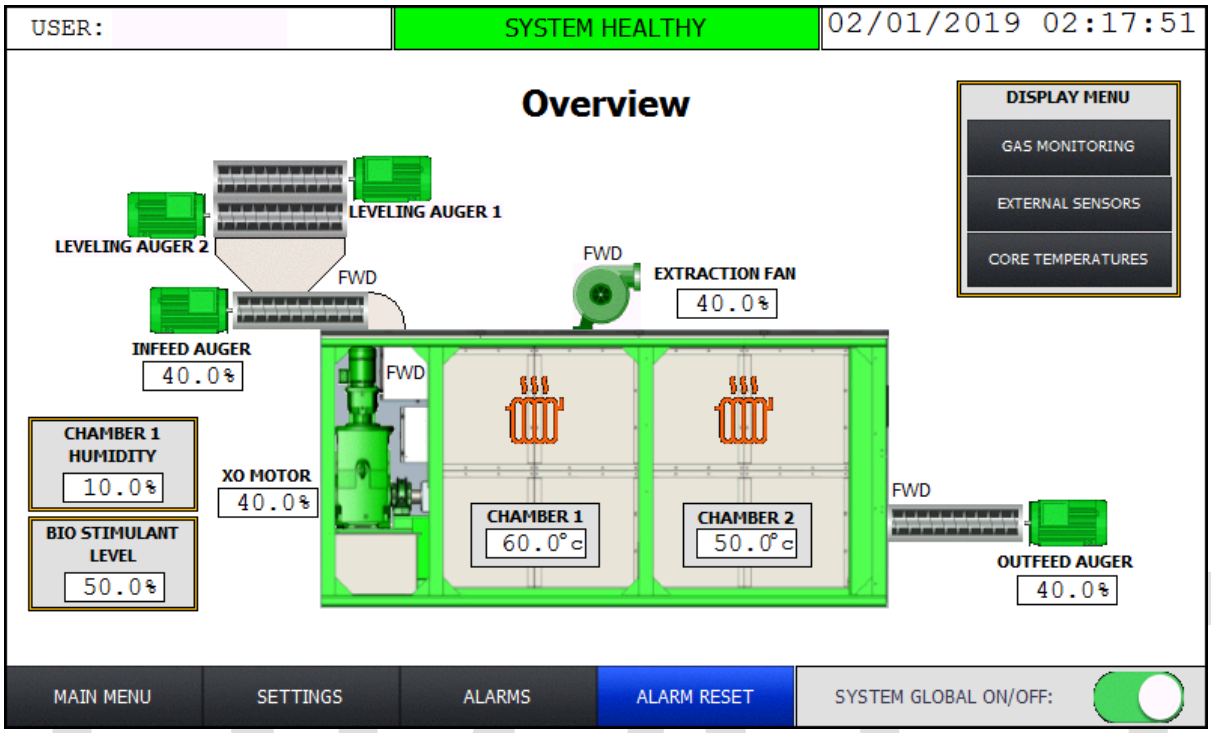
System has no Shredder and no Leveling Augers:



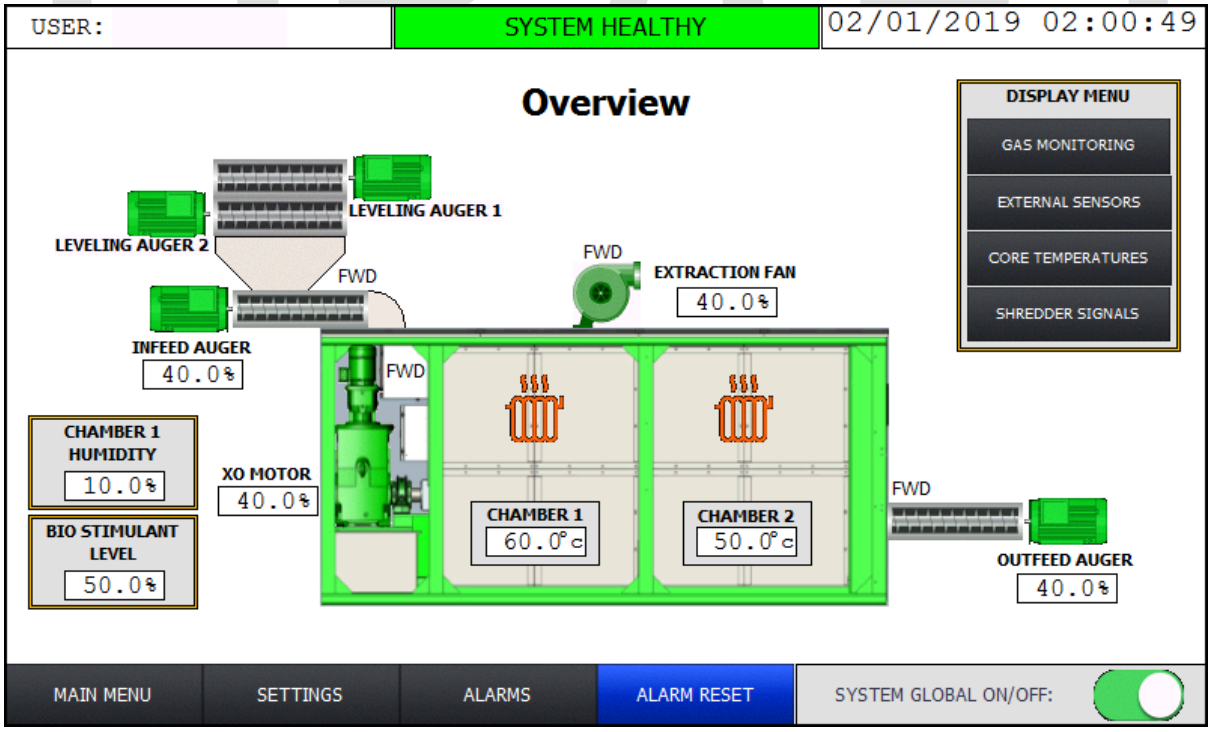
System has a Shredder and no Leveling Augers:

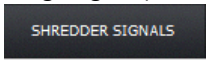


System has Leveling Augers and no Shredder:



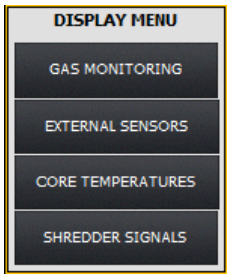
System has Leveling Augers and a Shredder:



The HMI features a graphical overview screen that displays a graphical representation of the XO3 machine and all components with exception to the Shredder and Dosing Systems. Leveling Augers (and associated statuses) will only display whereby the XO3 system has associated Leveling Augers. The 

button (and the associated pop-up) will only display whereby the XO3 system has an associated Shredder.

7.4.1 Display Menu Pop-up Buttons



- Produces the Gas Monitoring Pop-up.

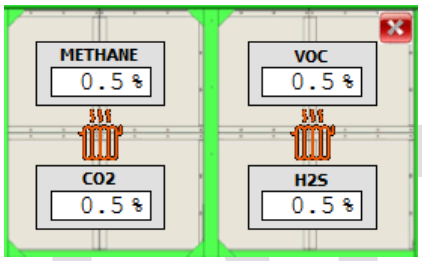
- Produces the External Sensors Pop-up.

- Produces the Core Temperatures Pop-up.

- Produces the Shredder Signal Pop-up.

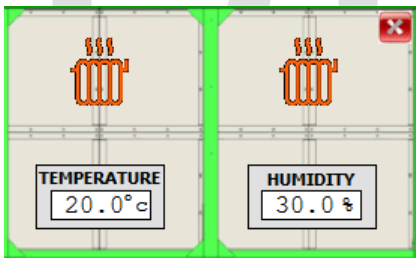
Also note that pressing  from any pop-up or directly from the Overview screen will produce the Pad Temperatures pop-up.

7.4.2 Gas Monitoring Pop-up



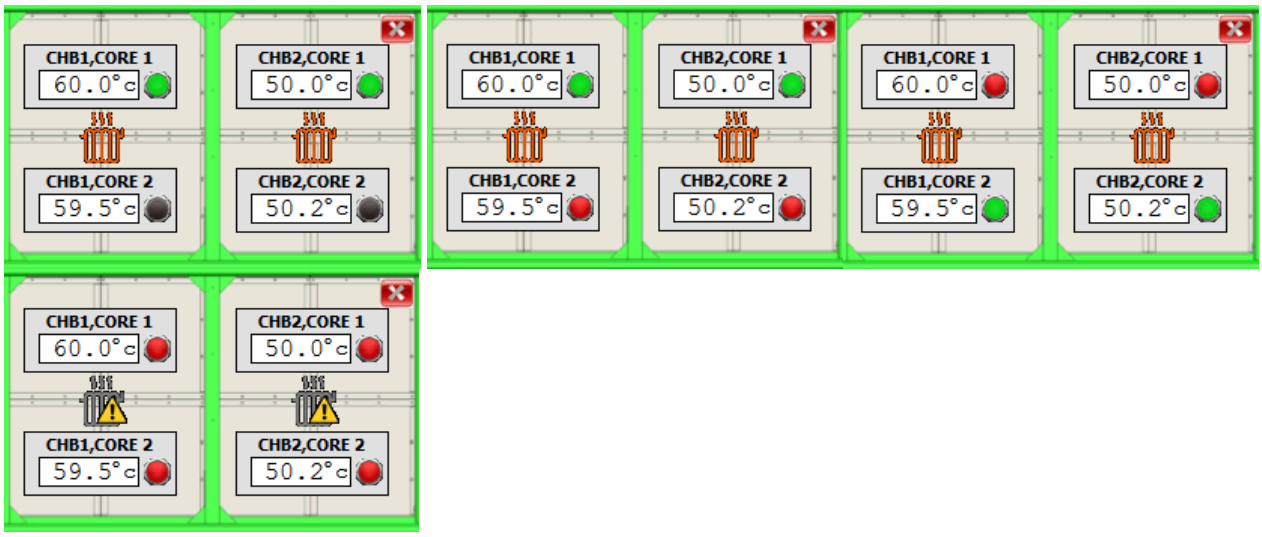
This pop-up displays the sensor readings relating to the XO3 Gas Monitoring system and the status of the heaters in each chamber. Pressing the  button will close the pop-up. The pop-up will also close if another Display Menu Pop-up opens.

7.4.3 External Sensors Pop-up



This pop-up displays the external temperature and humidity sensor readings and the status of the heaters in each chamber. Pressing the  button will close the pop-up. The pop-up will also close if another Display Menu Pop-up opens.

7.4.4 Core Temperatures Pop-up



This pop-up displays the core temperature sensor readings and the status of the heaters for each chamber. Pressing the button will close the pop-up. The pop-up will also close if another Display Menu Pop-up opens.

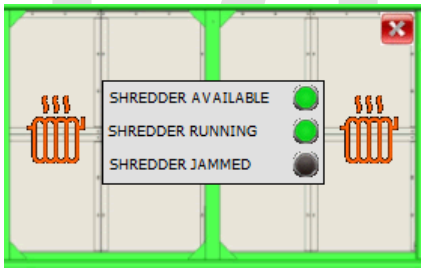
The status of the core temperature sensors also displays next to the corresponding reading:

7.4.5 - Core Temperature sensor active. (Used as the value for the Chamber Temperature to control the heaters.) Core Temperature sensor 1 is active by default.

7.4.6 - Core Temperature sensor inactive. (No sensor fault(s).)

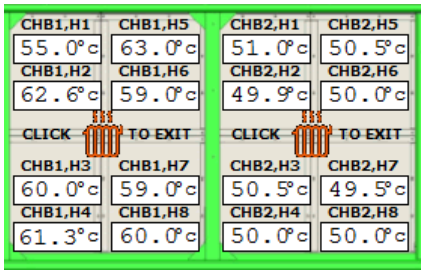
7.4.7 - Core Temperature sensor in fault.

7.4.8 Shredder Pop-up



This pop-up displays all signals received from the shredder and the status of the heaters in each chamber. Pressing the button will close the pop-up. The pop-up will also close if another Display Menu Pop-up opens.

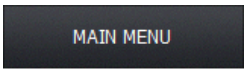
7.4.9 Pad Temperatures

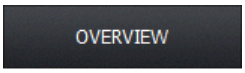


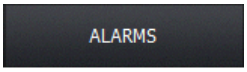
This pop-up displays all heater temperatures and the status of the heaters in each chamber. Pressing a button will close the pop-up. The pop-up will also close if another Display Menu Pop-up opens.

7.5 Further Buttons

The buttons featured on the Overview screen have the following functions:

- 

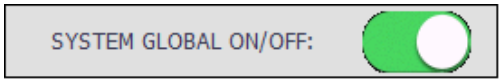
- Navigates to the Main Menu screen.
- 

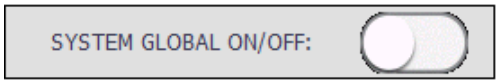
- Navigates to the Overview screen.
- 

- Navigates to the Active Alarms screen.
- 

- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.

7.6 Global On/Off Switch





A Global On/Off toggle switch features on the Overview screen operable at Operator level. When the Global On/Off' toggle switch is off then all system components disable unless enabled through Manual Control.

Upon the Global On/Off toggle switch switching on the Manual Control toggle switch automatically deactivates. Conversely, upon the Manual Control toggle switch switching on the Global On/Off toggle switch automatically deactivates.

When the Global On/Off toggle switch is on then all system components run as described below:

In Recipe Mode or Anti-Blockage Mode:

- Infeed Auger
- XO Drive
- Outfeed Auger

Only in Recipe Mode:

- Leveling Auger 1
- Leveling Auger 2
- Chamber 1 Heaters
- Chamber 2 Heaters

Continuously:

- Shredder
- Extraction Fan

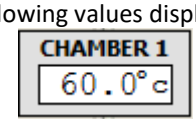
In Auto Mode or Continuously (controlled by HMI Setpoints):

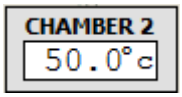
- Bacteria Dosing Valve
- Bio Stimulant Dosing Pump

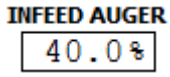
In Recipe Mode components run from parameters stored in 1 of 3 editable recipes unless a fault or safety related inhibit occurs.

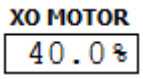
7.7 Displayed Values

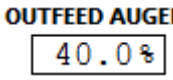
The following values display on the HMI Overview. Also see the Display Menu Pop-ups.

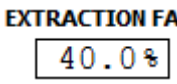
- 

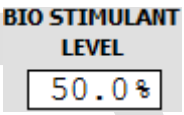
- Chamber 1 Temperature
- 

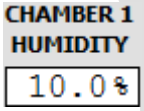
- Chamber 2 Temperature
- 

- Infeed Auger Speed Feedback
- 

- XO Motor Speed Feedback
- 

- Outfeed Auger Speed Feedback
- 

- Extraction Fan Speed Feedback
- 

- Bio Stimulant Level
- 

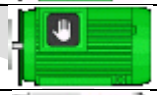
- Chamber Humidity

7.8 Status Indications

Note that all components have another light grey status indication that displays briefly when the HMI loads the Overview screen.

7.9 Leveling Auger 1

Leveling Auger 1 has the following status. This status displays on the HMI Overview screen provided that the Leveling Augers are a feature of the XO3 system.

Status Description	HMI Indication	Karnaugh Map				
		System Has Leveling Augers	Leveling Auger 1 Tripped	Emergency Stop Active	Leveling Auger 1 Running	Manual Control Active
Fault		1	1	X	X	X
Inhibit		1	0	1	1	X
Off		1	0	1	0	0
Running in Recipe Mode		1	0	1	0	1
Running in Manual Control		1	0	1	0	1
No Leveling Augers	 (light grey status)	0	X	X	X	X

Karnaugh Map Key: 0 = False, 1 = True, X = Either True or False (State is irrelevant)

7.9.1 Leveling Auger 2

Leveling Auger 2 has the following status. This status displays on the HMI Overview screen provided that the Leveling Augers are a feature of the XO3 system.

Status Description	HMI Indication	Karnaugh Map				
		System Has Leveling Augers	Leveling Auger 2 Tripped	Emergency Stop Active	Leveling Auger 2 Running	Manual Control Active
Fault		1	1	X	X	X
Inhibit		1	0	1	1	X
Off		1	0	1	0	0
Running in Recipe Mode		1	0	1	0	1
Running in Manual Control		1	0	1	0	1
No Leveling Augers	 (light grey status)	0	X	X	X	X

Karnaugh Map Key: 0 = False, 1 = True, X = Either True or False (State is irrelevant)

7.9.2 Infeed Auger

The Infeed Auger has the following status. This status displays on the HMI Overview screen.

Status Description	HMI Indication	Karnaugh Map							
		Infeed Auger Tripped	Infeed Auger Fault	Infeed Auger Communications Fault	Infeed Auger Blocked	Emergency Stop Active	Infeed Auger Running	Anti-Blockage Mode Active	Manual Control Active
Fault		1	X	X	X	X	X	X	X
		X	1	X	X	X	X	X	X
		X	X	1	X	X	X	X	X
	 & BLOCKED	X	X	X	1	X	X	X	X
Inhibit		0	0	0	0	1	X	X	X
Off		0	0	0	0	0	0	X	X
Running in Anti-Blockage Mode	 & UNBLOCKING	0	0	0	0	0	1	1	0
Running in Recipe Mode		0	0	0	0	0	1	0	0
Running in Manual Control		0	0	0	0	0	1	0	1

Karnaugh Map Key: 0 = False, 1 = True, X = Either True or False (State is irrelevant)

7.9.3 XO Drive

The XO Drive has the following status. This status displays on the HMI Overview screen.

Status Description	HMI Indication	Karnaugh Map							
		XO Tripped	XO VSD Fault	XO VSD Communications Fault	XO Blocked	Emergency Stop Active	XO Running	Anti-Blockage Mode Active	Manual Control Active
Fault		1	X	X	X	X	X	X	X
		X	1	X	X	X	X	X	X
		X	X	1	X	X	X	X	X
	 & BLOCKED	X	X	X	1	X	X	X	X
Inhibit		0	0	0	0	1	X	X	X
Off		0	0	0	0	0	0	X	X
Running in Anti-Blockage Mode	 & UNBLOCKING	0	0	0	0	0	1	1	0
Running in Recipe Mode		0	0	0	0	0	1	0	0
Running in Manual Control		0	0	0	0	0	1	0	1

Karnaugh Map Key: 0 = False, 1 = True, X = Either True or False (State is irrelevant)

7.9.4 Outfeed Auger

The Outfeed Auger has the following status. This status displays on the HMI Overview screen.

Status Description	HMI Indication	Karnaugh Map							
		Outfeed Auger Tripped	Outfeed Auger Fault	Outfeed Auger Communications Fault	Outfeed Auger Blocked	Emergency Stop Active	Outfeed Auger Running	Anti-Blockage Mode Active	Manual Control Active
Fault		1	X	X	X	X	X	X	X
		X	1	X	X	X	X	X	X
		X	X	1	X	X	X	X	X
	 & BLOCKED	X	X	X	1	X	X	X	X
Inhibit		0	0	0	0	1	X	X	X
Off		0	0	0	0	0	0	X	X
Running in Anti-Blockage Mode	 & UNBLOCKING	0	0	0	0	0	1	1	0
Running in Recipe Mode		0	0	0	0	0	1	0	0
Running in Manual Control		0	0	0	0	0	1	0	1

Karnaugh Map Key: 0 = False, 1 = True, X = Either True or False (State is irrelevant)

7.9.5 Heaters

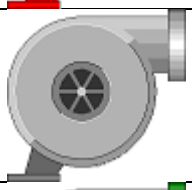
The Chamber 1 Heaters and Chamber 2 Heaters have separate statuses that display on the HMI Overview screen that display in an identical manner to each other.

Status Description	HMI Indication	Karnaugh Map						
		Heaters Tripped	Any Sensor Fault	Any Sensor > 160°C	Dwell Signal	Emergency Stop Active	Heater On	Manual Control Active
Fault		1	X	X	X	X	X	X
		X	1	X	X	X	X	X
		X	X	1	X	X	X	X
Inhibit		0	0	0	X	1	X	X
		0	0	0	1	X	X	X
Off		0	0	0	0	0	0	X
Running		0	0	0	0	0	1	0
Running in Manual Control		0	0	0	0	0	1	1

Karnaugh Map Key: 0 = False, 1 = True, X = Either True or False (State is irrelevant)

7.9.6 Extraction Fan

The Extraction Fan has the following status. This status displays on the HMI Overview screen.

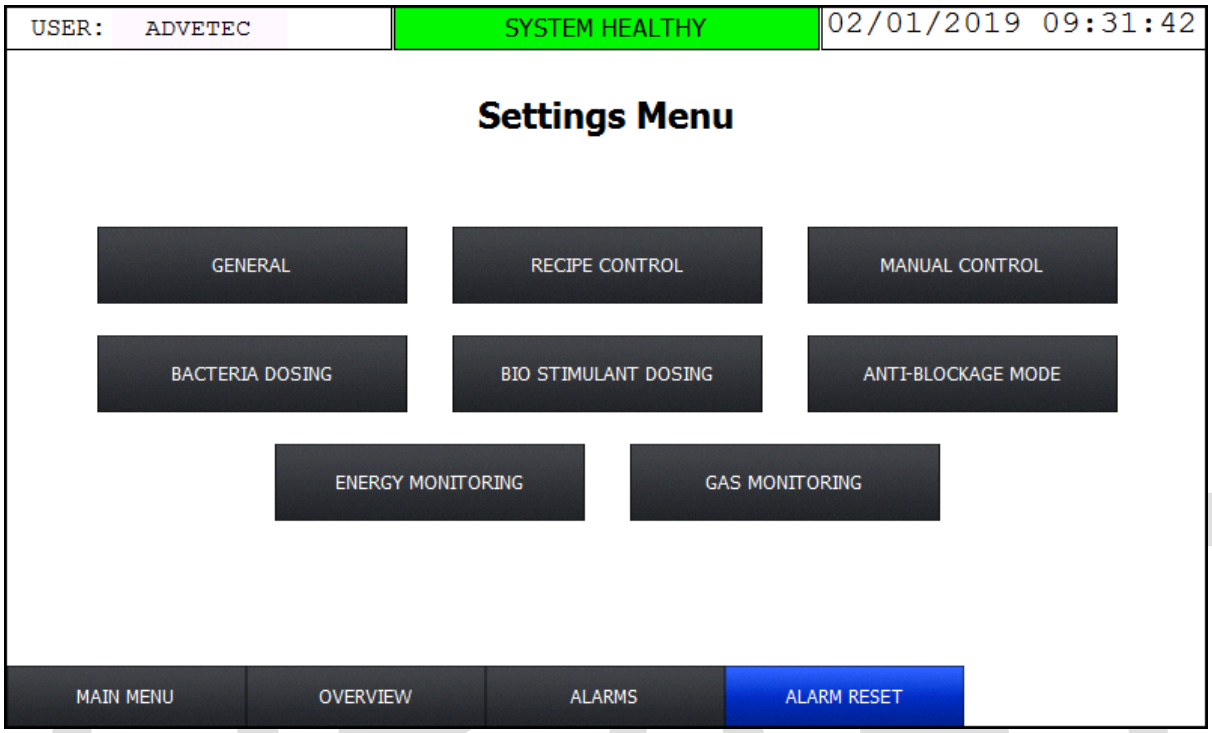
Status Description	HMI Indication	Karnaugh Map			
		Extraction Fan Tripped	Extraction Fan Running	Emergency Stop Active	Manual Control
Fault		1	X	X	X
Inhibit		0	X	1	X
Off		0	0	0	X
Running		0	1	0	0
Running in Manual Control		0	1	0	1

Karnaugh Map Key: 0 = False, 1 = True, X = Either True or False (State is irrelevant)

7.10 Settings

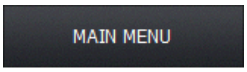
Only Advetec level users will have access to these screens and their specifically related functions.

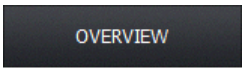
7.10.1 Settings Menu

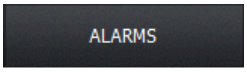


The buttons featured on the Settings Menu screen have the following functions:

- GENERAL - Navigates to the General Settings screen.
- RECIPE CONTROL - Navigates to the Recipe Control screen.
- MANUAL CONTROL - Navigates to the Manual Control screen.
- BACTERIA DOSING - Navigates to the Bacteria Dosing screen.
- BIO STIMULANT DOSING - Navigates to the Bio Stimulant Dosing screen.
- ANTI-BLOCKAGE MODE - Navigates to the Anti-Blockage Mode Menu screen.
- ENERGY MONITORING - Navigates to the Energy Monitoring screen.
- GAS MONITORING - Navigates to the Gas Monitoring Settings screen.

- 

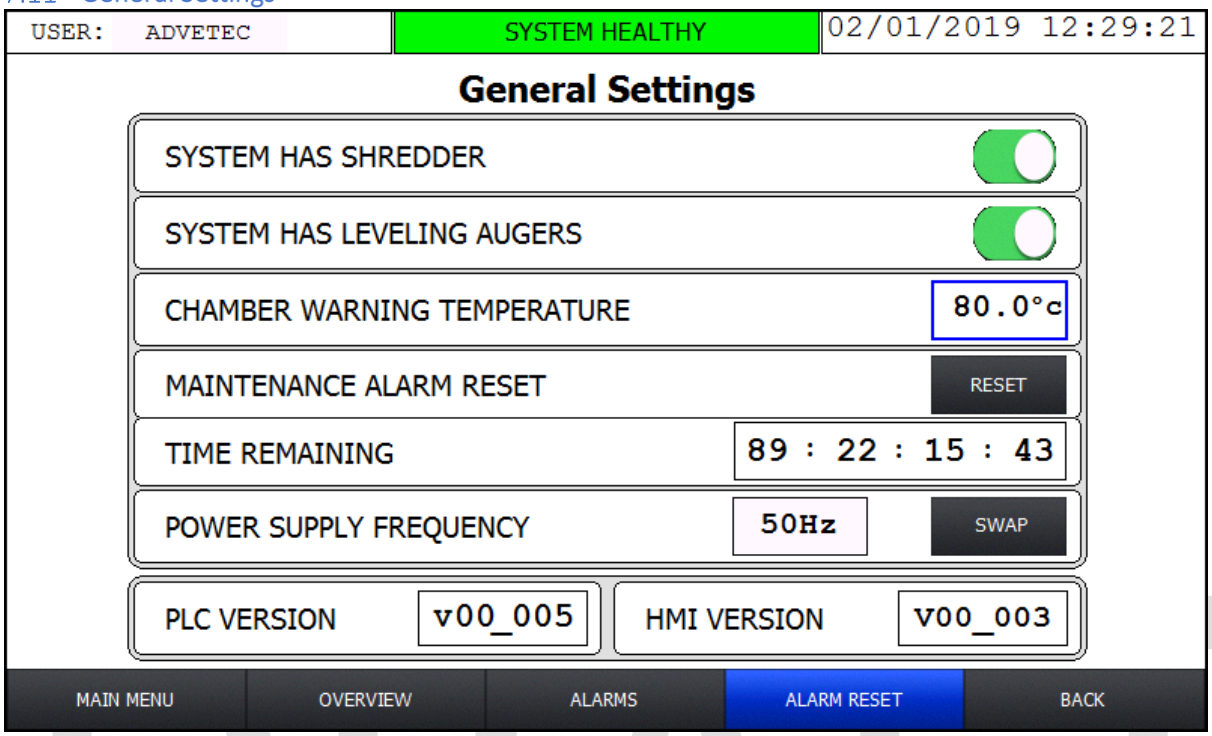
- Navigates to the Main Menu screen.
- 

- Navigates to the Overview screen.
- 

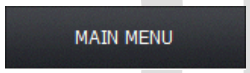
- Navigates to the Active Alarms screen.
- 

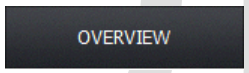
- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.

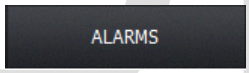
7.11 General Settings



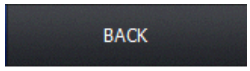
7.11.2 Navigational Buttons

- 

- Navigates to the Main Menu screen.
- 

- Navigates to the Overview screen.
- 

- Navigates to the Active Alarms screen.
- 

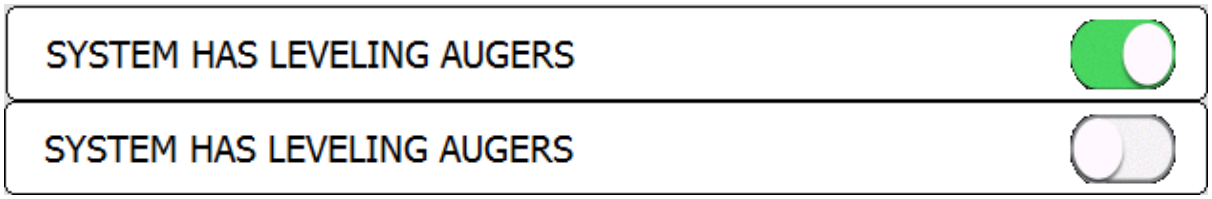
- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- 

- Navigates to the Settings Menu screen.

7.11.3 Shredder Inclusion

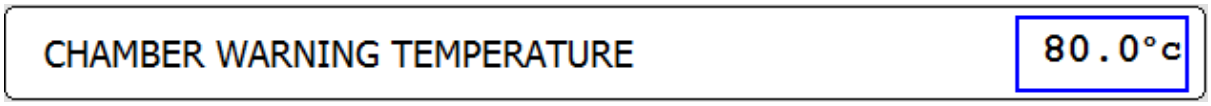
The addition of a shredder to the XO3 system depends upon the waste stream and therefore shredder functionality is optional – The user may enable/disable shredder functionality using the toggle switch detailed in the image above. Software is standardised across machines and therefore always includes the shredder functionality.

7.11.4 Leveling Auger Inclusion



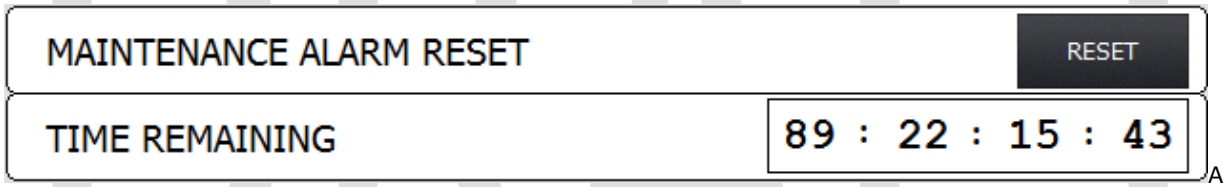
The addition of two Leveling Augers to the XO3 system depends upon the waste stream and therefore Leveling Auger functionality is optional – The user may enable/disable Leveling Auger functionality using the toggle switch detailed in the image above. Software is standardised across machines and therefore always includes functionality for the two Leveling Augers.

7.11.5 Chamber Warning Temperature



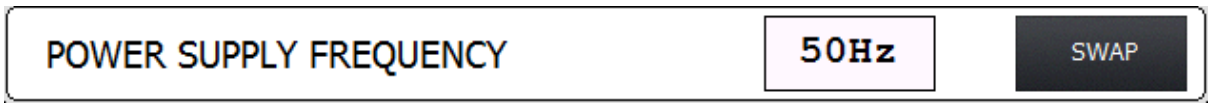
If the value read by any temperature sensor exceeds this setpoint then a corresponding warning activates. (For a complete list of warnings and alarms see Appendix A.) The user may change the value of this setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C).

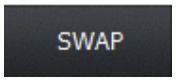
7.11.6 Maintenance Alarm

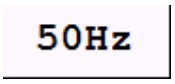


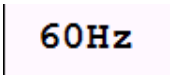
A resettable maintenance alarm generates after the XO3 panel has received power for a total of 90 days. To reset this alarm the user must press a maintenance alarm reset button, separate from the global alarm reset. The time until the alarm next occurs displays on the HMI next to the reset button in days, hours, minutes and seconds (no decimal places). The user must have Advetec level access to use the maintenance alarm reset.

7.11.7 Power Supply Frequency



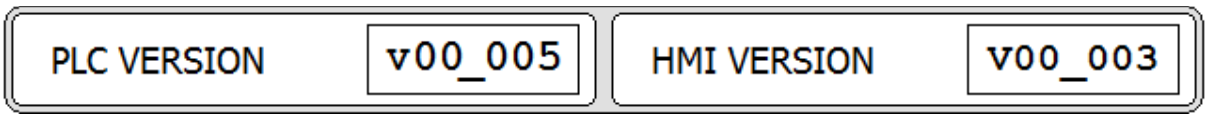
Pressing the 

button notifies the software of a power supply frequency change from 

to 

and vice versa. The VSDs need this information for speed conversions to and from their MODBUS values. This value is normally set at commissioning.

7.11.8 PLC and HMI Software Version Details

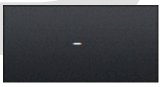


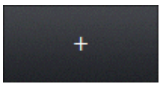
The PLC and HMI software version display on this page.

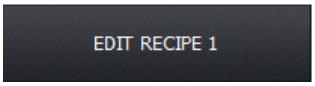
7.12 Recipe Settings

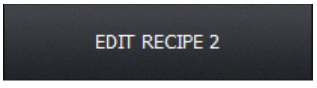
7.12.1 Recipe Control

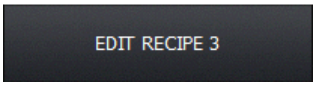
This screen allows the user to select between 3 recipes with a fixed structure and edit a given recipe by navigating to the respective Recipe Edit screen. The values within the current recipe govern the behaviour of the XO3 system when the Global On/Off toggle switch is set to the on position. The current recipe number displays in the window labelled **Select Current Recipe**. For buttons and controls available on this screen see below:

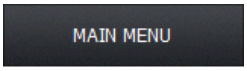
- 

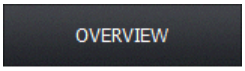
- Decrease the current recipe (whereby the current recipe is not Recipe 1).
- 

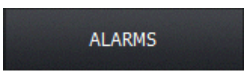
- Increase the current recipe (whereby the current recipe is not Recipe 3).
- 

- Navigates to the Edit Recipe 1 Menu screen.
- 

- Navigates to the Edit Recipe 2 Menu screen.
- 

- Navigates to the Edit Recipe 3 Menu screen.
- 

- Navigates to the Main Menu screen.
- 

- Navigates to the Overview screen.
- 

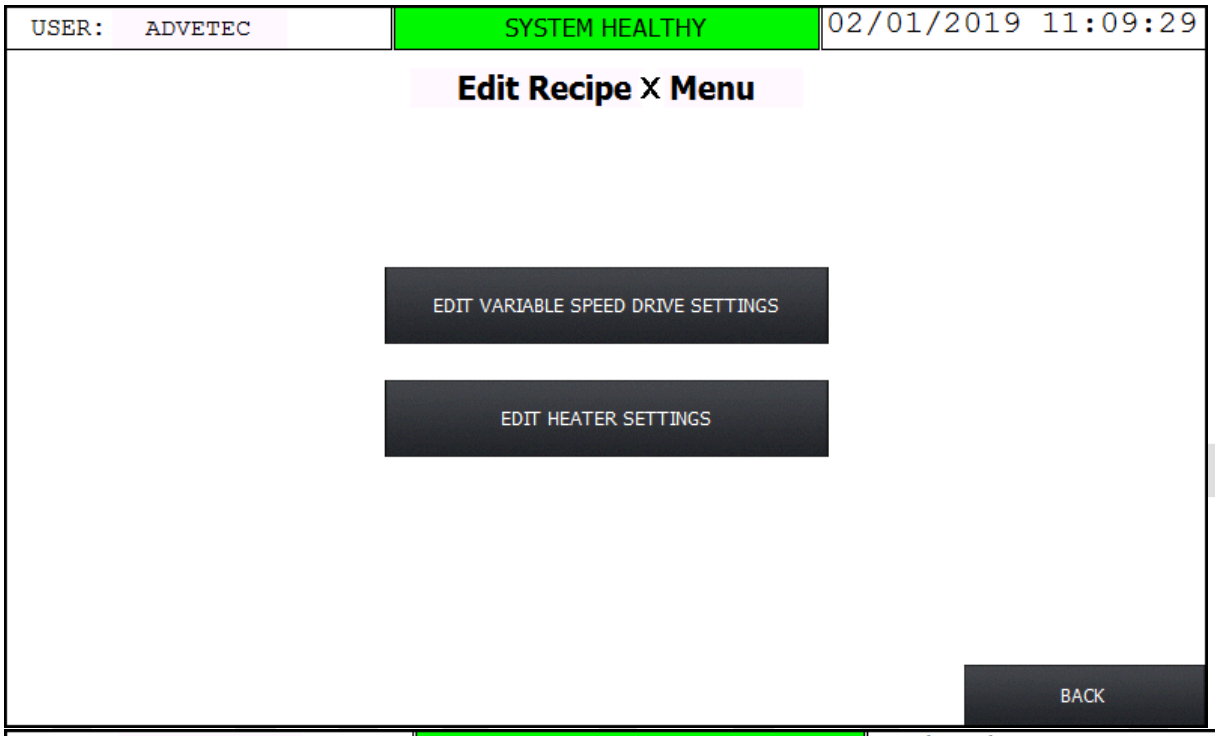
- Navigates to the Active Alarms screen.
- 

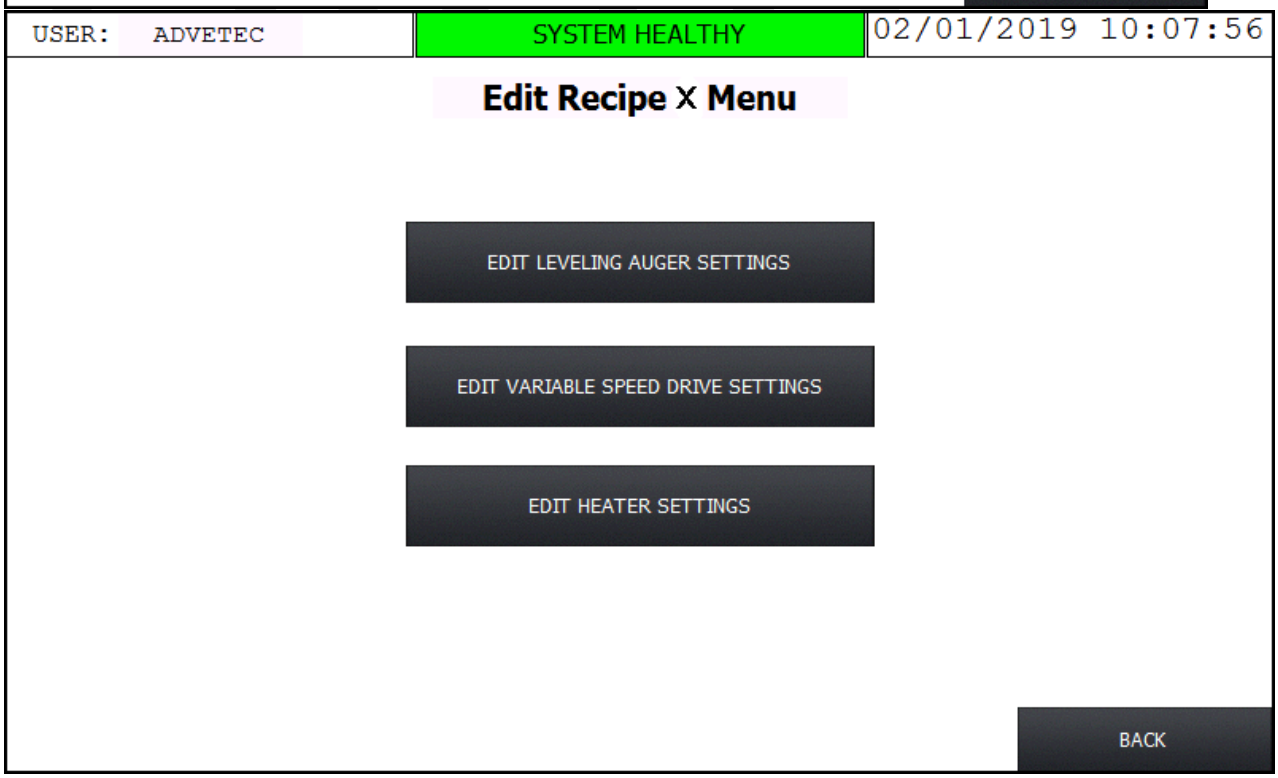
- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.

7.12.2 Edit Recipe

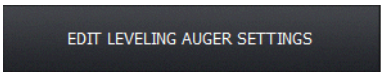
Note that the software replaces X (in the heading at the top of each screen) with the number of the recipe that the user is currently editing.

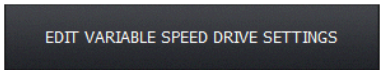
7.12.3 Recipe Edit Menu

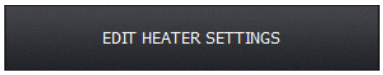


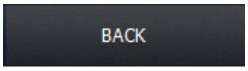


Buttons have the following functions:

- 

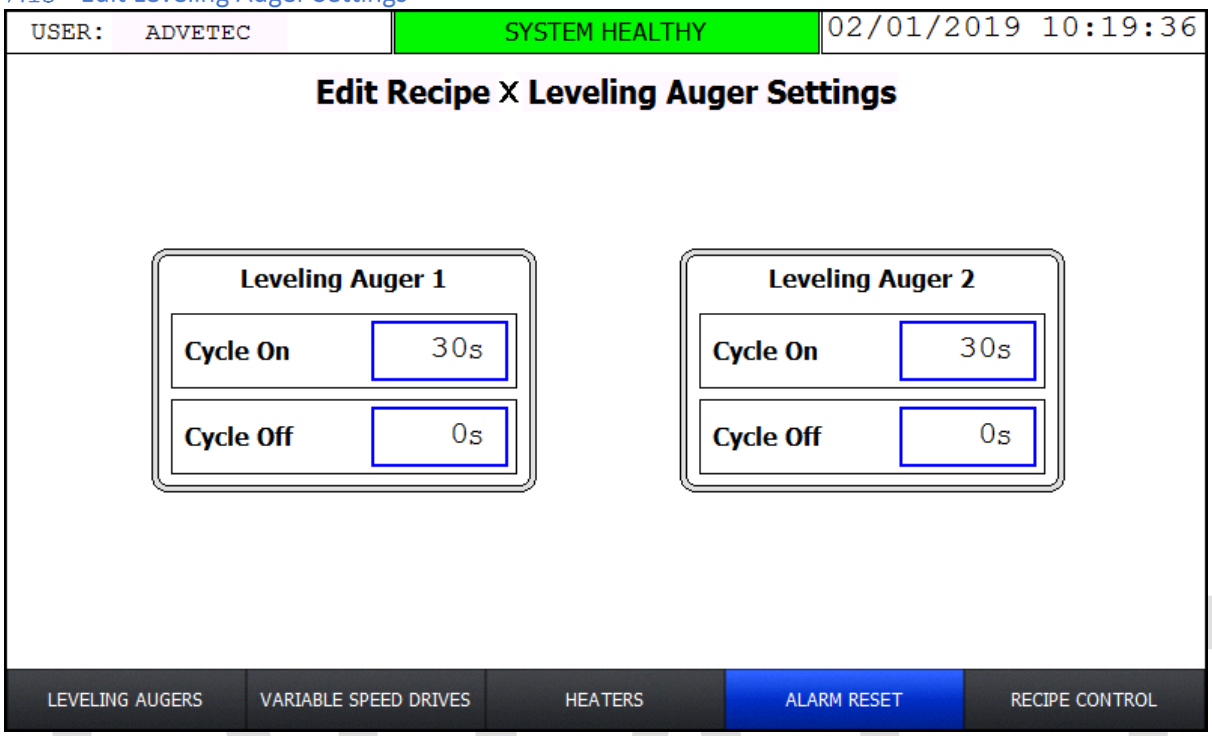
- Navigates to the Leveling Auger Settings screen. (Button only visible if the system has Leveling Augers.)
- 

- Navigates to the Variable Speed Drive Settings screen.
- 

- Navigates to the Heater Settings screen.
- 

- Navigates to the Recipe Control screen.

7.13 Edit Leveling Auger Settings



Note that this screen will only be accessible if the System has Leveling Augers

The user may change the value of any setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C). Note that only changing values in the current recipe will directly affect the system (See the Recipe Control screen).

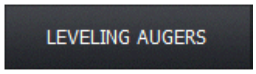
Buttons function as follows:

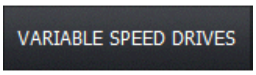
- LEVELING AUGERS - Navigates to the Edit Leveling Auger Settings screen.
- VARIABLE SPEED DRIVES - Navigates to the Edit Variable Speed Drive Settings screen.
- HEATERS - Navigates to the Edit Heater Settings screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- RECIPE CONTROL - Navigates to the Recipe Control screen.

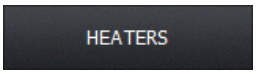
7.14 Edit Variable Speed Drive Settings

The user may change the value of any setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C). Note that only changing values in the current recipe will directly affect the system (See the Recipe Control screen).

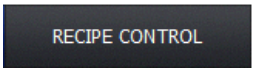
Buttons function as follows:

- 

- Navigates to the Edit Leveling Auger Settings screen. (Button only visible if the system has Leveling Augers.)
- 

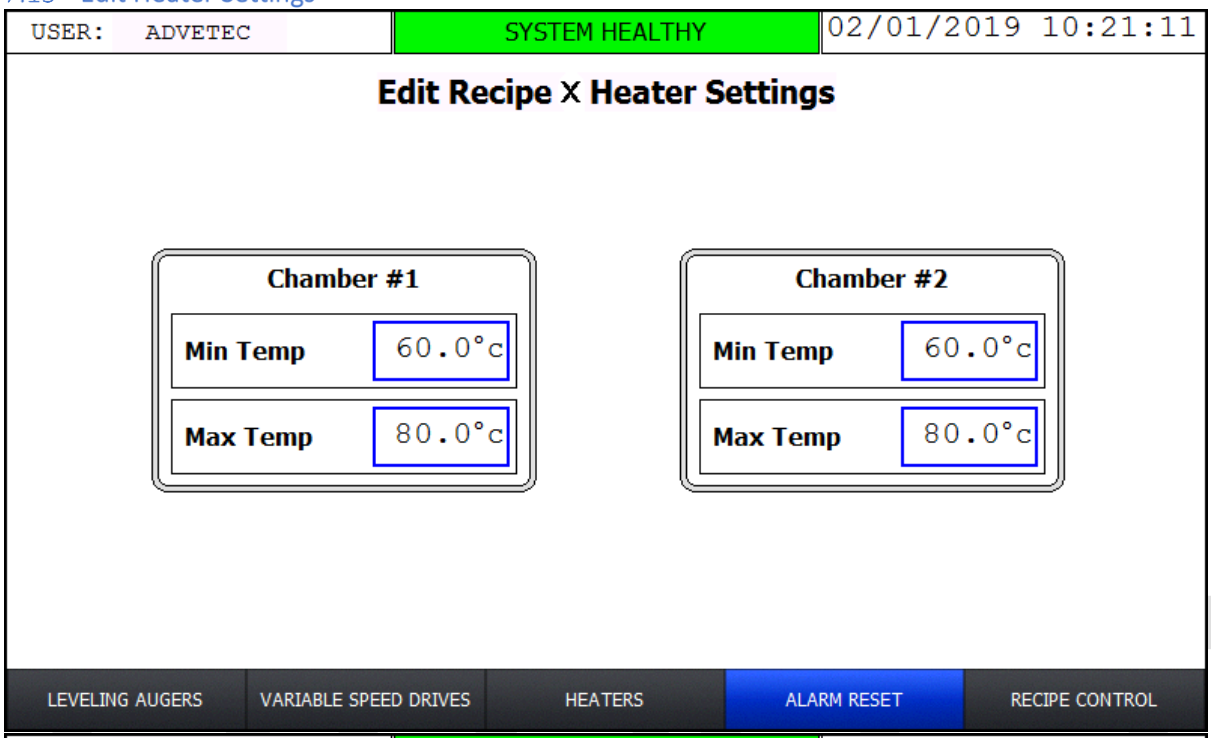
- Navigates to the Edit Variable Speed Drive Settings screen.
- 

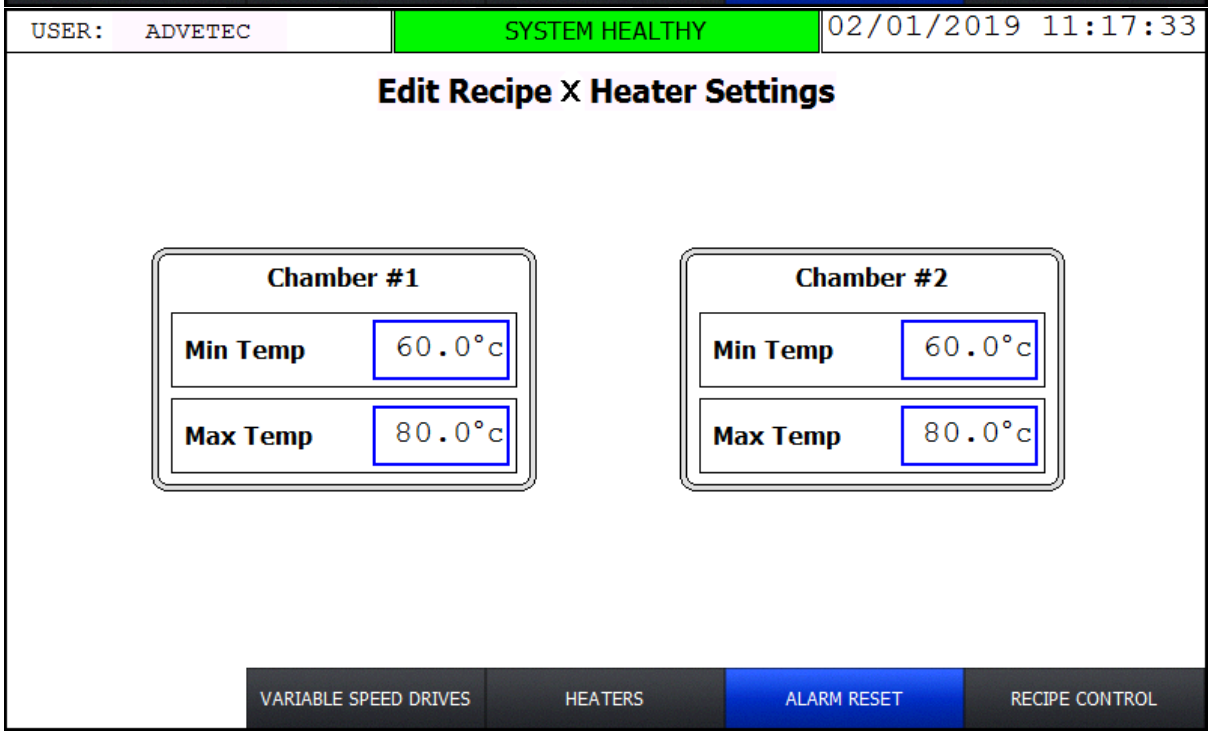
- Navigates to the Edit Heater Settings screen.
- 

- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- 

- Navigates to the Recipe Control screen.

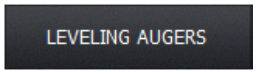
7.15 Edit Heater Settings

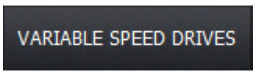


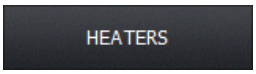


The user may change the value of any setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C). Note that only changing values in the current recipe will directly affect the system (See the Recipe Control screen).

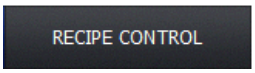
Buttons function as follows:

- 

- Navigates to the Edit Leveling Auger Settings screen. (Button only visible if the system has Leveling Augers.)
- 

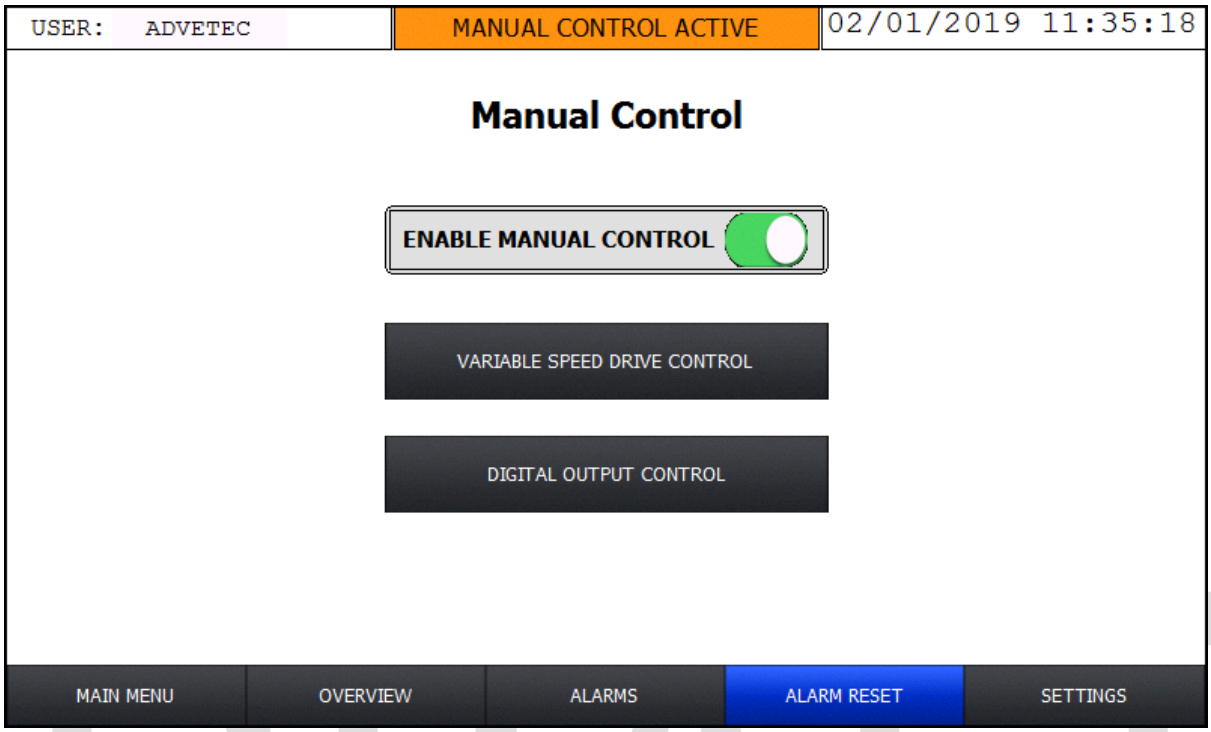
- Navigates to the Edit Variable Speed Drive Settings screen.
- 

- Navigates to the Edit Heater Settings screen.
- 

- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- 

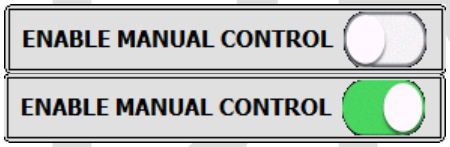
- Navigates to the Recipe Control screen.

7.16 Manual Control



This screen allows individual component control for commissioning and testing purposes.

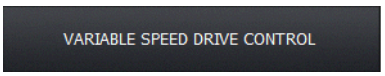
7.16.1 Manual Control Switch

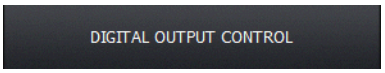


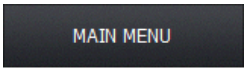
Pressing the toggle switch enables/disables Manual Control. The activation of manual control shows on the status bar, assuming a higher priority indication is not present.

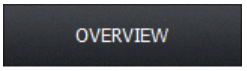
Upon the Manual Control toggle switch switching on the Global On/Off toggle switch automatically deactivates. Conversely, upon the Global On/Off toggle switch switching on the Manual Control toggle switch automatically deactivates.

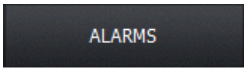
7.16.2 Navigational Buttons

- 

- Navigates to the Variable Speed Drive Control screen.
- 

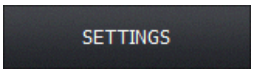
- Navigates to the Digital Output Control screen.
- 

- Navigates to the Main Menu screen.
- 

- Navigates to the Overview screen.
- 

- Navigates to the Active Alarms screen.
- 

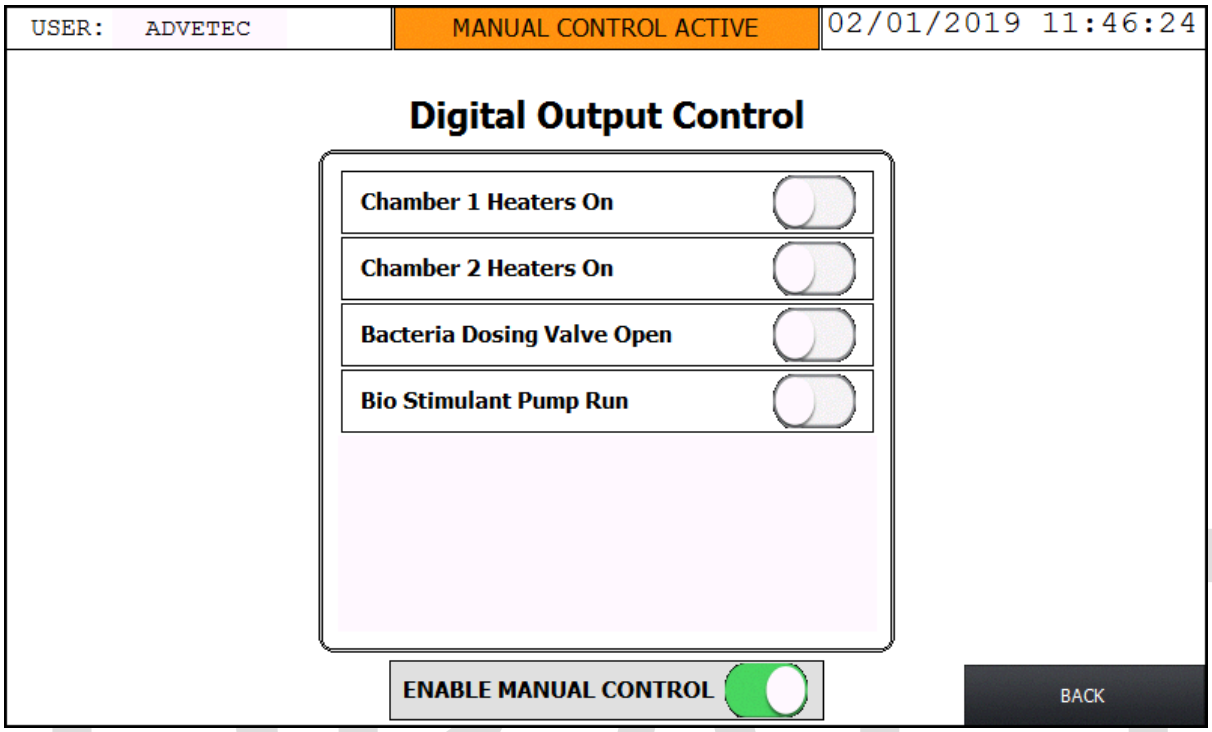
- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.

- 

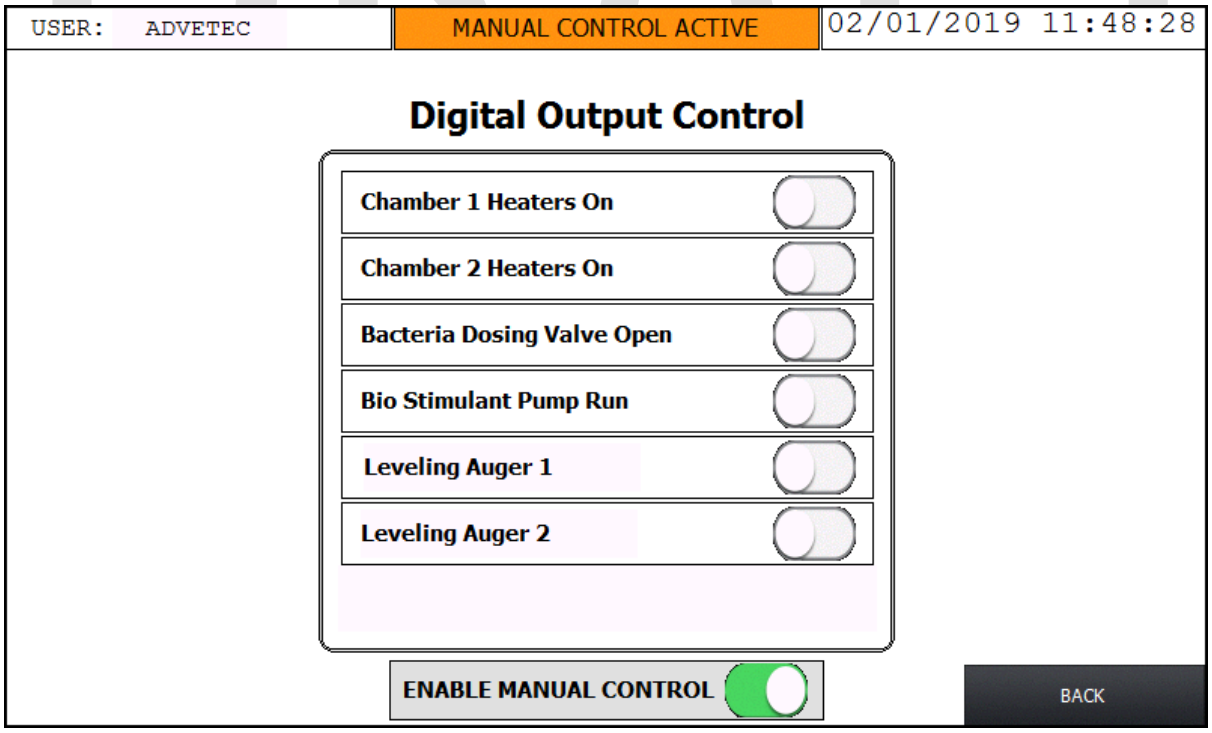
- Navigates to the Settings Menu screen.

7.16.3 Digital Output Control Screen

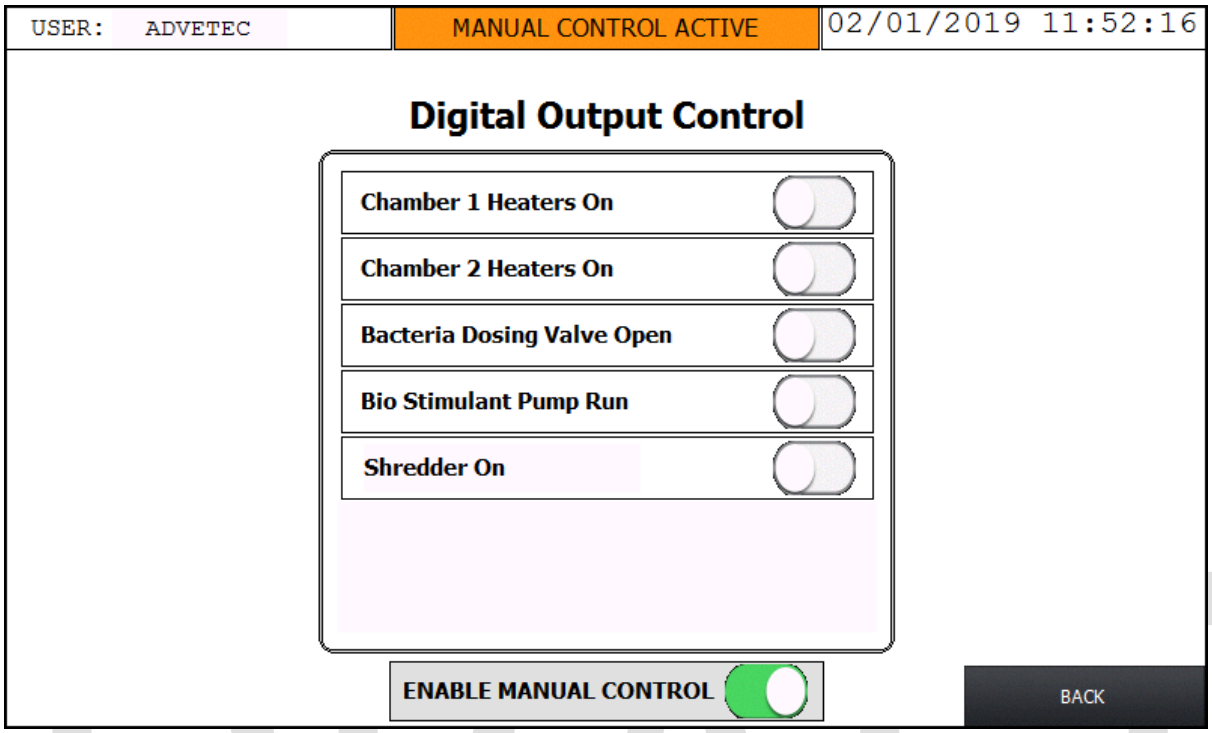
System has no Shredder and no Leveling Augers:



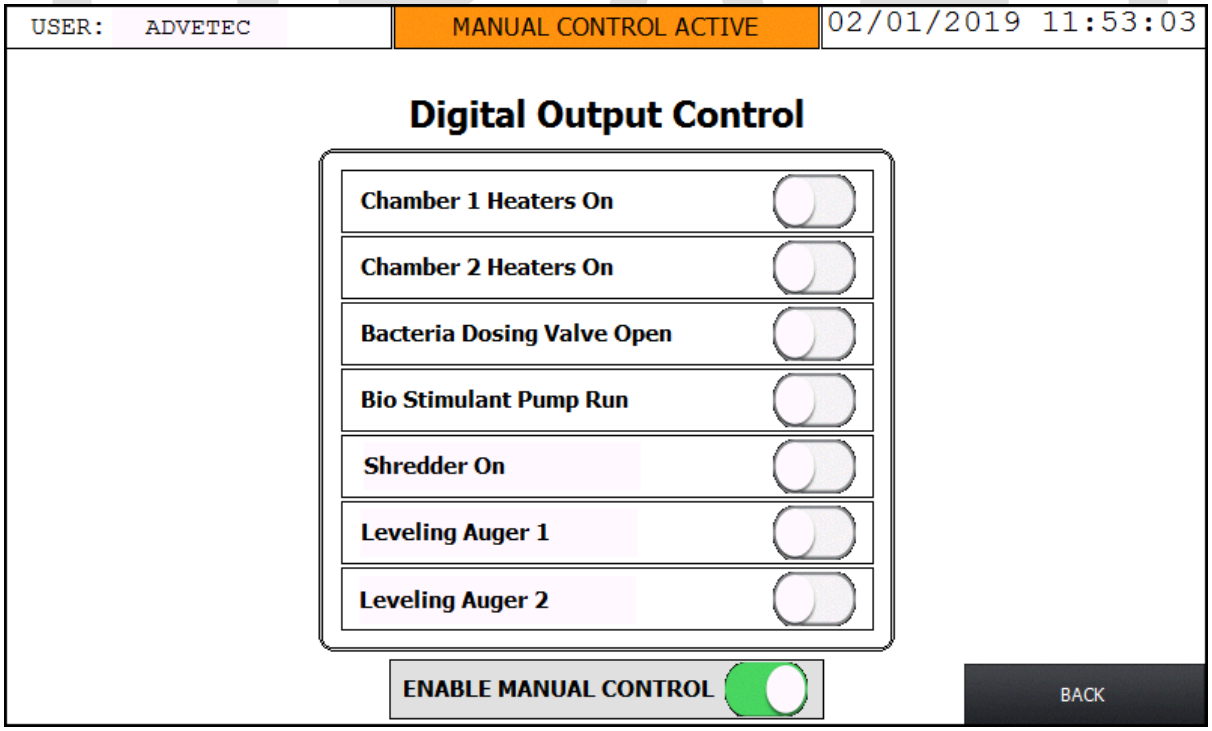
System has Leveling Augers and no Shredder:



System has a Shredder and no Leveling Augers:



System has Leveling Augers and a Shredder:



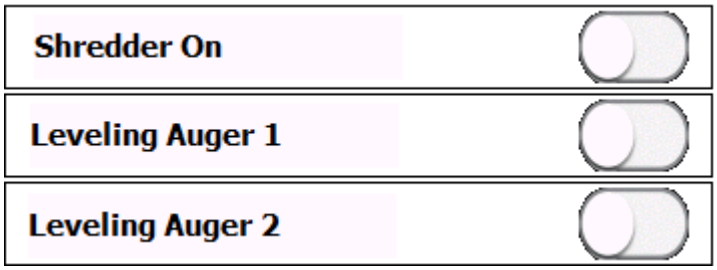
All controls on the Digital Output Control screen switch off and disable whilst Manual Control is not active (except for the Manual Control switch). Activation of these controls enables whilst Manual Control is active.

Note that the Manual Control switch functions identically on this screen to how it works on the Manual Control screen.

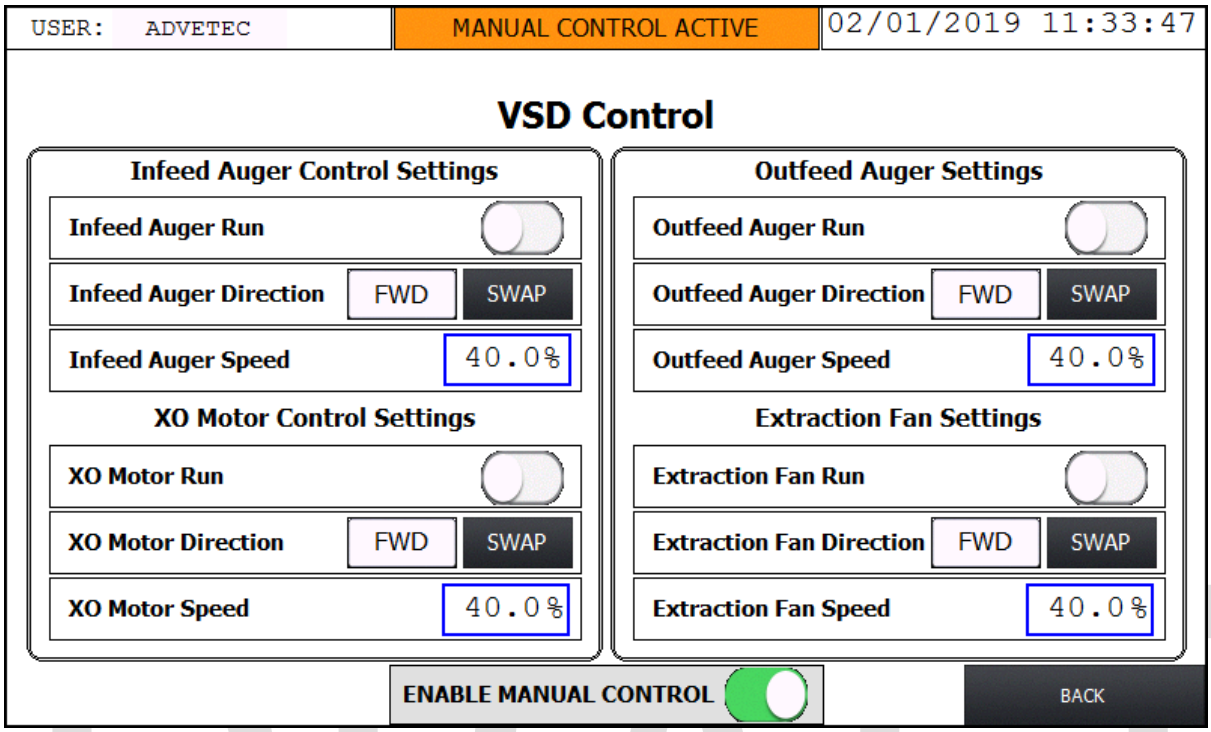
Pressing a toggle switch ( ) toggles on/off the respective Digital Output. For a summary of input and output signals see Appendix B.

7.16.4 Visibility of Controls

Certain controls will only become visible when the associated component is present within the specific XO3 system (See the General Settings screen). These controls include the following:



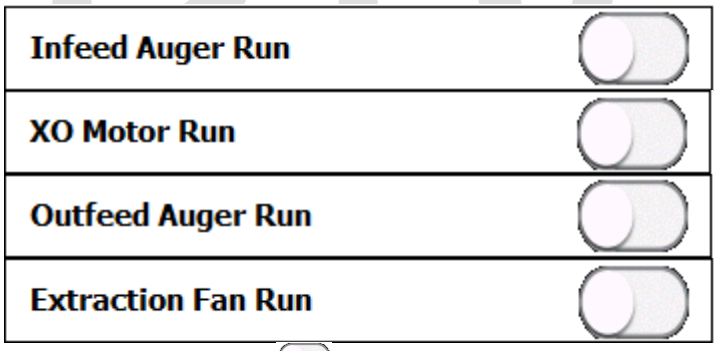
7.16.5 VSD Control Screen



All 'Run' controls from the Variable Speed Drive Control screen, switch off and disable whilst Manual Control is not active. Activation of these controls enables whilst Manual Control is active.

Note that the Manual Control switch functions identically on this screen to how it works on the Manual Control screen.

7.16.6 Run



Pressing a toggle switch ( ) toggles on/off the respective run signal.

7.16.7 Change Direction

Infeed Auger Direction	FWD	SWAP
XO Motor Direction	FWD	SWAP
Outfeed Auger Direction	FWD	SWAP
Extraction Fan Direction	FWD	SWAP

Pressing the SWAP button changes the direction of the motor/auger. The current direction of the motor/auger displays next to the SWAP button as follows:

- FWD - The motor/auger is running in the forward direction.
- REV - The motor/auger is running in the reverse direction.

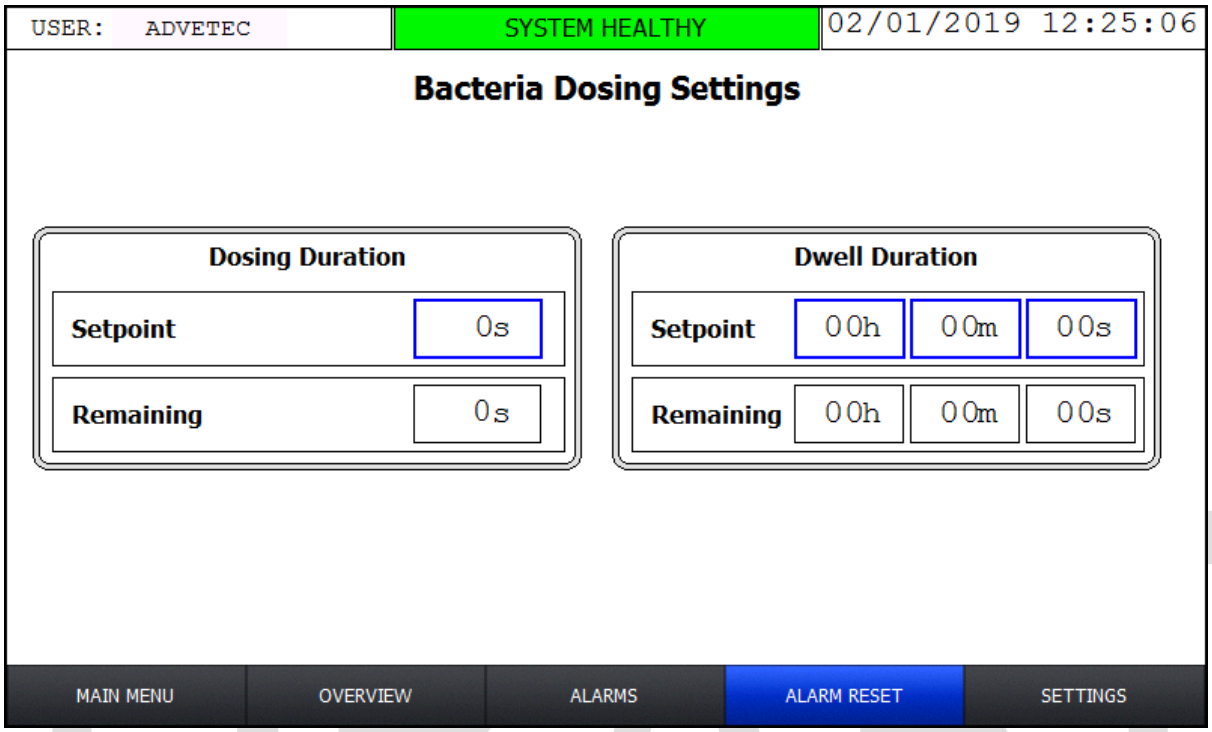
7.16.8 Set Speed

Infeed Auger Speed	40.0%
XO Motor Speed	40.0%
Outfeed Auger Speed	40.0%
Extraction Fan Speed	40.0%

The user may change the value of these setpoints by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C).

7.17 Dosing

7.17.1 Bacteria Dosing

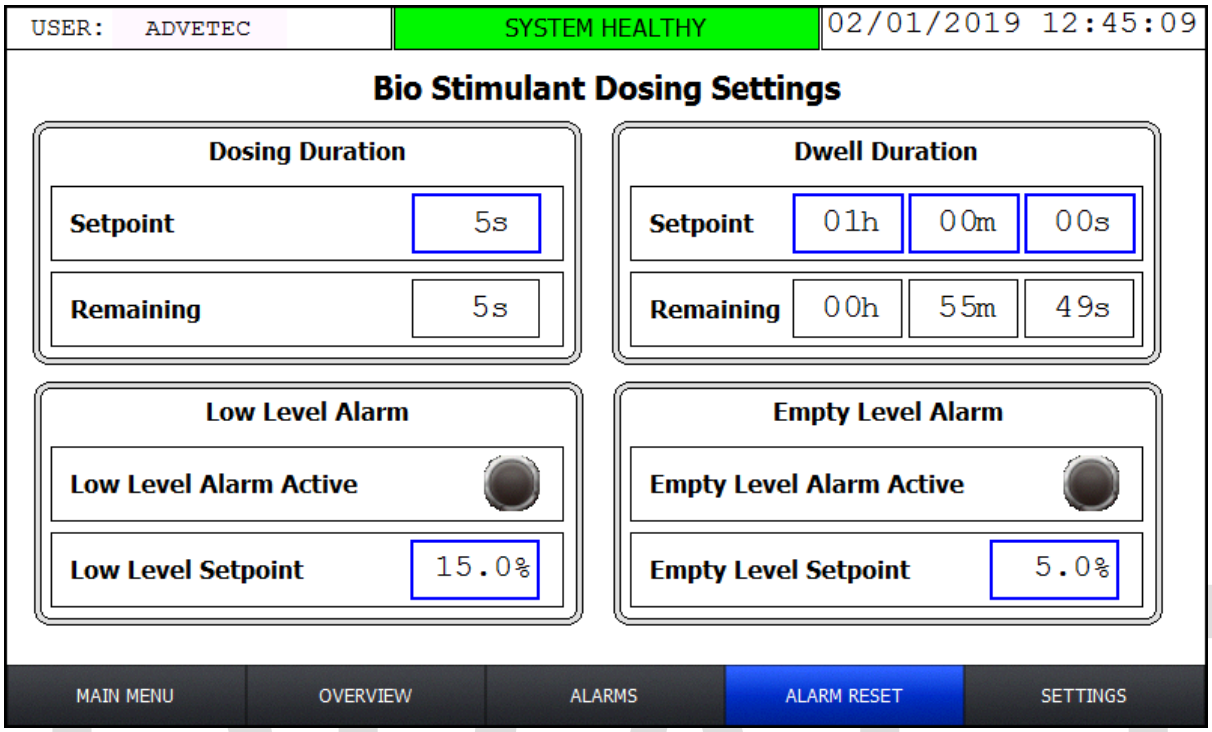


The Bacteria Dosing System consists of a Bacteria Dosing Valve controlled by several adjacent setpoints featured on the Bacteria Dosing screen. Note that setting the dosing duration to 0 inhibits the valve from opening and setting the dwell duration to 0, whilst the dosing duration is not 0, opens the valve continuously. The user may change the value of any setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C).

7.17.2 Navigational Buttons

- MAIN MENU - Navigates to the Main Menu screen.
- OVERVIEW - Navigates to the Overview screen.
- ALARMS - Navigates to the Active Alarms screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- SETTINGS - Navigates to the Settings Menu screen.

7.17.3 Bio Stimulant Dosing



The Bio Stimulant Dosing System consists of a Bio Stimulant Dosing Pump controlled by several adjacent setpoints featured on the Bio Stimulant Dosing screen. Note that setting the dosing duration to 0 inhibits the pump and setting the dwell duration to 0, whilst the dosing duration is not 0, runs the pump continuously. The user may change the value of any setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C).

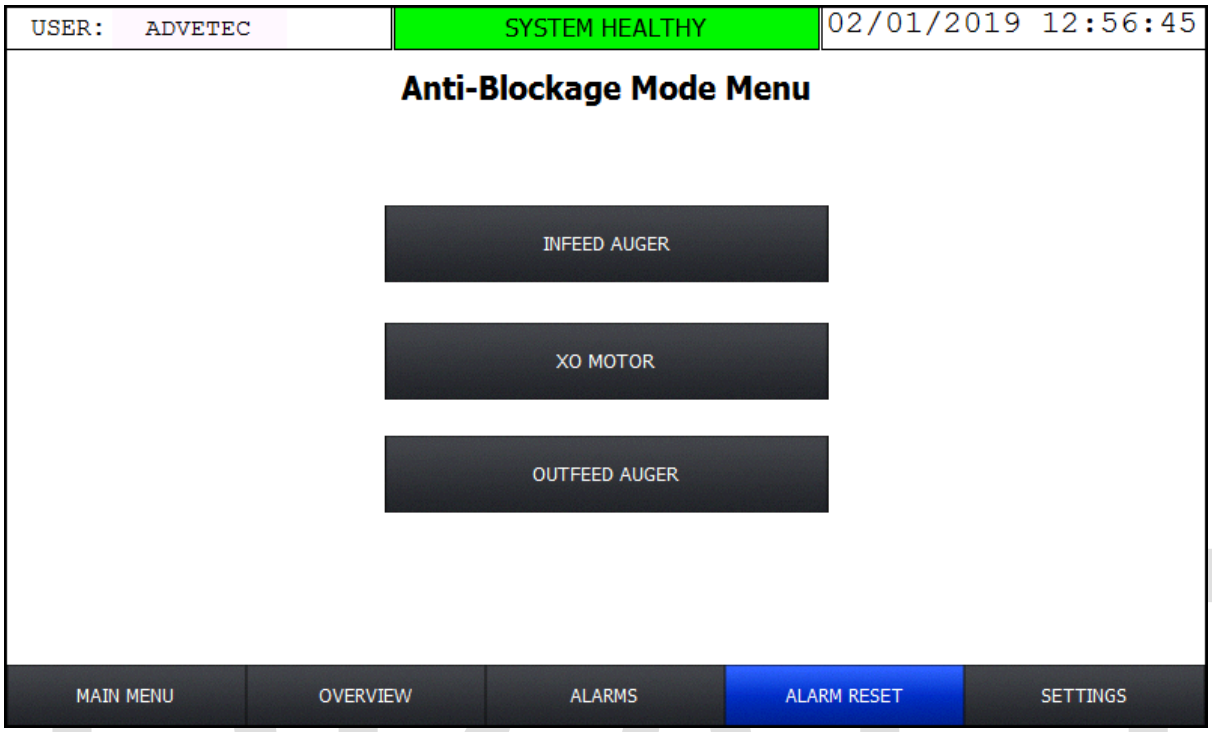
The status of both level alarms relating to the Bio Stimulant Dosing System displays on this screen. If the Bio Stimulant Tank Level is less than the respective setpoint then the respective alarm will activate. If an Empty Level Alarm is active, then the corresponding Low-Level Alarm will deactivate. The status of these alarms is as follows:

- - Alarm Inactive.
- - Alarm Active.

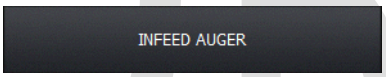
For a complete list of alarms see Appendix A.

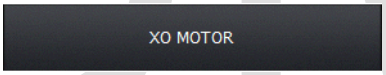
7.18 Anti-Blockage Mode

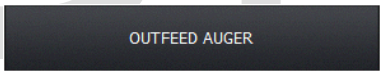
7.18.1 Anti-Blockage Mode Menu

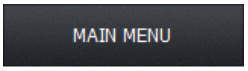


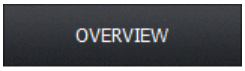
Buttons have the following functions:

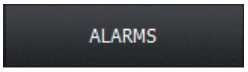
- 

- Navigates to the Infeed Auger Anti-Blockage Mode screen.
- 

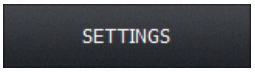
- Navigates to the XO Motor Anti-Blockage Mode screen.
- 

- Navigates to the Outfeed Auger Anti-Blockage Mode screen.
- 

- Navigates to the Main Menu screen.
- 

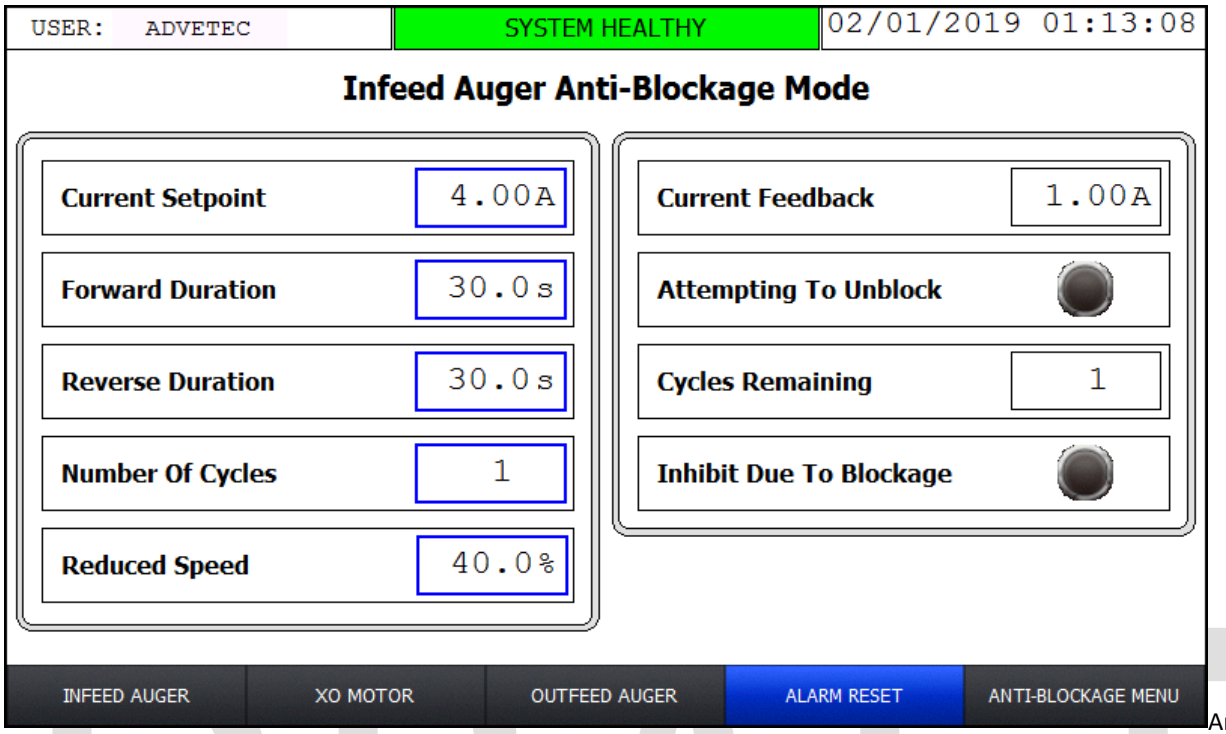
- Navigates to the Overview screen.
- 

- Navigates to the Active Alarms screen.
- 

- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- 

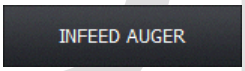
- Navigates to the Settings Menu screen.

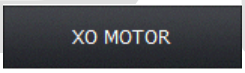
7.18.2 Infeed Auger

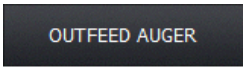


Anti-Blockage mode enables when the Infeed Auger is enabled, the 'Global On/Off' toggle switch is on and the Infeed Auger current exceeds the 'Current Setpoint' (showing a blockage). If at any point the Infeed Auger is no longer enabled or the 'Global On/Off' toggle switch is no longer on, then Anti-Blockage mode disables. The user may change the value of any setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C).

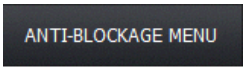
7.18.3 Navigational Buttons

- 

- Navigates to the Infeed Auger Anti-Blockage Mode screen.
- 

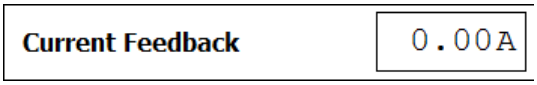
- Navigates to the XO Motor Anti-Blockage Mode screen.
- 

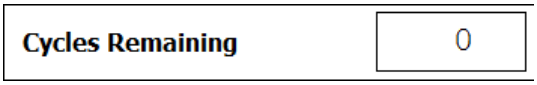
- Navigates to the Outfeed Auger Anti-Blockage Mode screen.
- 

- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- 

- Navigates to the Anti-Blockage Mode Menu screen.

7.18.4 Displayed Values

- 

- The Infeed Auger current.
- 

- The number of Anti-Blockage Cycles remaining.

7.18.5 Status Lamps

- **Attempting To Unblock** 

  Indicates Anti-Blockage mode is active with a  status lamp.

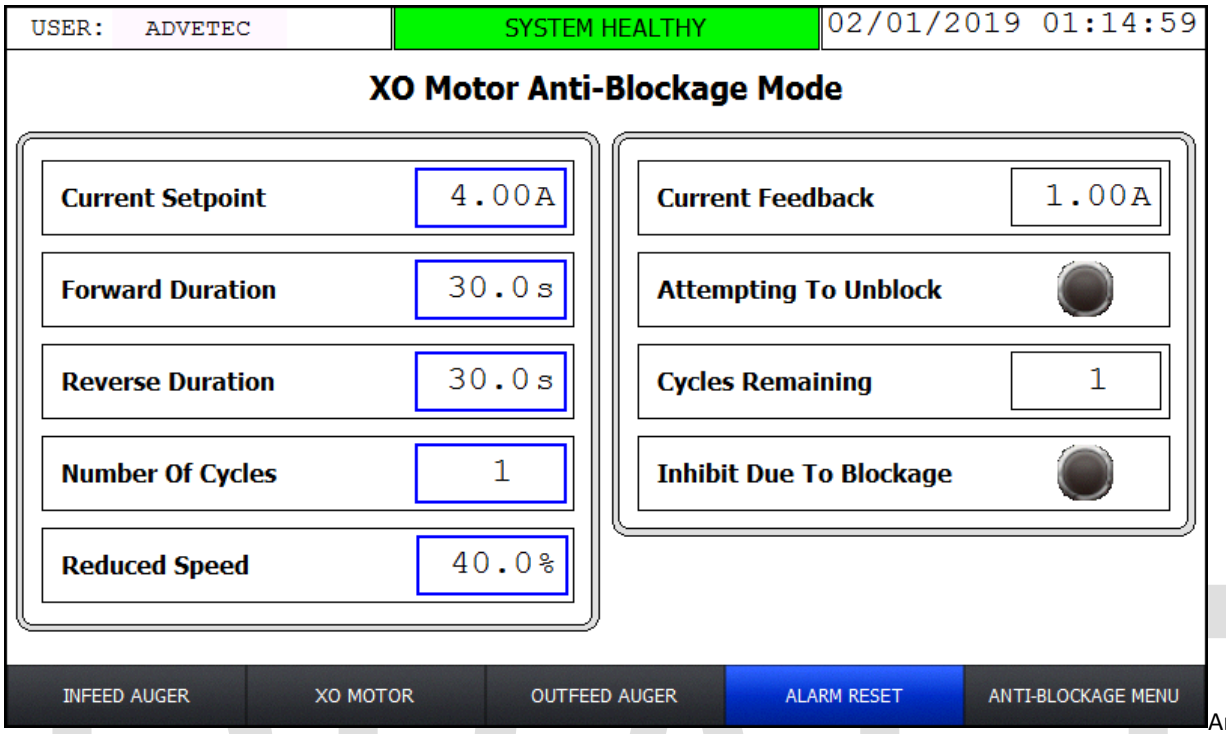
  Indicates Anti-Blockage mode is not active with a  status lamp.

- **Inhibit Due To Blockage** 

  Indicates the XO VSD blockage alarm is active with a  status lamp.

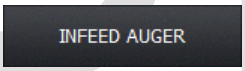
  Indicates the XO VSD blockage alarm is not active with a  status lamp.

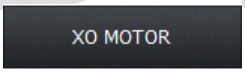
7.18.6 XO Motor

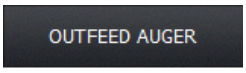


Anti-Blockage mode enables when the Infeed Auger is enabled, the 'Global On/Off' toggle switch is on and the Infeed Auger current exceeds the 'Current Setpoint' (showing a blockage). If at any point the Infeed Auger is no longer enabled or the 'Global On/Off' toggle switch is no longer on, then Anti-Blockage mode disables. The user may change the value of any setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C).

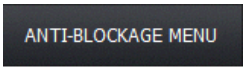
7.18.7 Navigational Buttons

- 

- Navigates to the Infeed Auger Anti-Blockage Mode screen.
- 

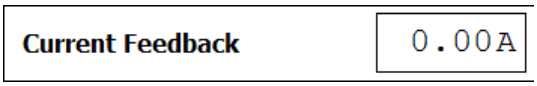
- Navigates to the XO Motor Anti-Blockage Mode screen.
- 

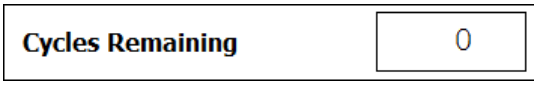
- Navigates to the Outfeed Auger Anti-Blockage Mode screen.
- 

- Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- 

- Navigates to the Anti-Blockage Mode Menu screen.

7.18.8 Displayed Values

- 

- The Infeed Auger current.
- 

- The number of Anti-Blockage Cycles remaining.

7.18.9 Status Lamps

- **Attempting To Unblock** 

  Indicates Anti-Blockage mode is active with a  status lamp.

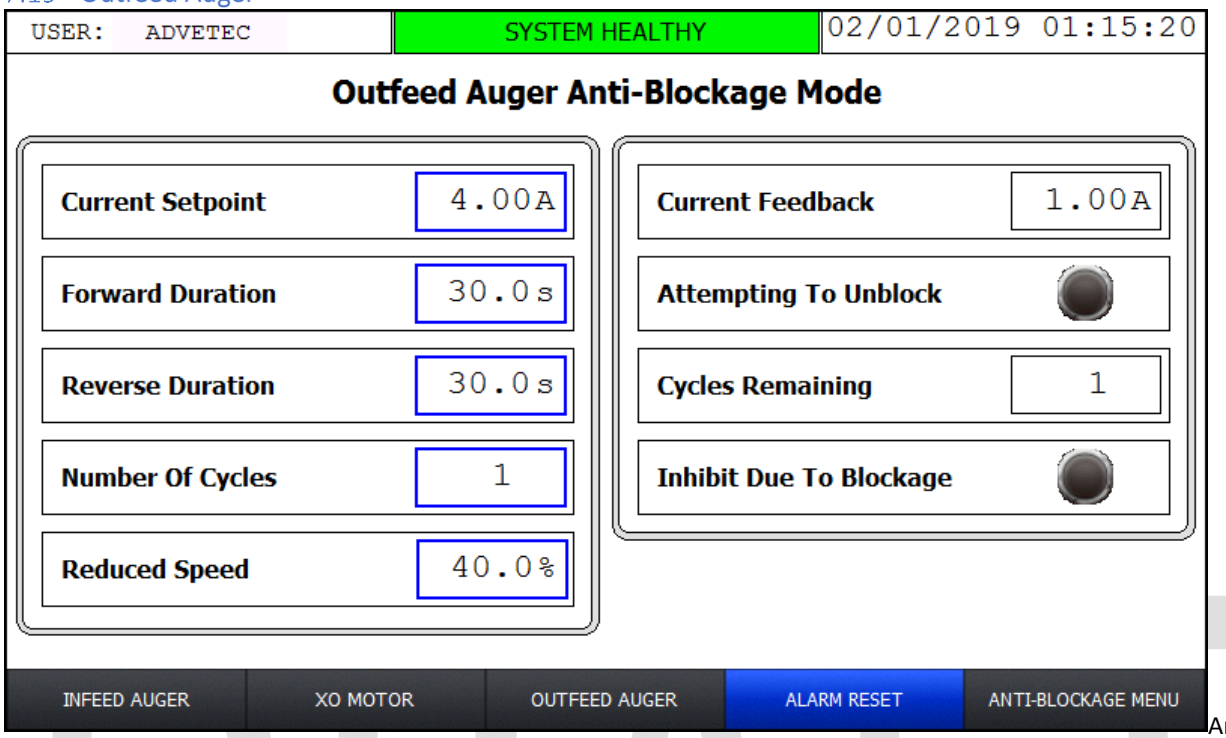
  Indicates Anti-Blockage mode is not active with a  status lamp.

- **Inhibit Due To Blockage** 

  Indicates the XO VSD blockage alarm is active with a  status lamp.

  Indicates the XO VSD blockage alarm is not active with a  status lamp.

7.19 Outfeed Auger



Anti-Blockage mode enables when the Infeed Auger is enabled, the 'Global On/Off' toggle switch is on and the Infeed Auger current exceeds the 'Current Setpoint' (showing a blockage). If at any point the Infeed Auger is no longer enabled or the 'Global On/Off' toggle switch is no longer on, then Anti-Blockage mode disables. The user may change the value of any setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C).

7.19.10 Navigational Buttons

- INFEED AUGER - Navigates to the Infeed Auger Anti-Blockage Mode screen.
- XO MOTOR - Navigates to the XO Motor Anti-Blockage Mode screen.
- OUTFEED AUGER - Navigates to the Outfeed Auger Anti-Blockage Mode screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- ANTI-BLOCKAGE MENU - Navigates to the Anti-Blockage Mode Menu screen.

7.19.11 Displayed Values

- Current Feedback 0.00A - The Infeed Auger current.
- Cycles Remaining 0 - The number of Anti-Blockage Cycles remaining.

7.19.12 Status Lamps

- **Attempting To Unblock** 

  Indicates Anti-Blockage mode is active with a  status lamp.

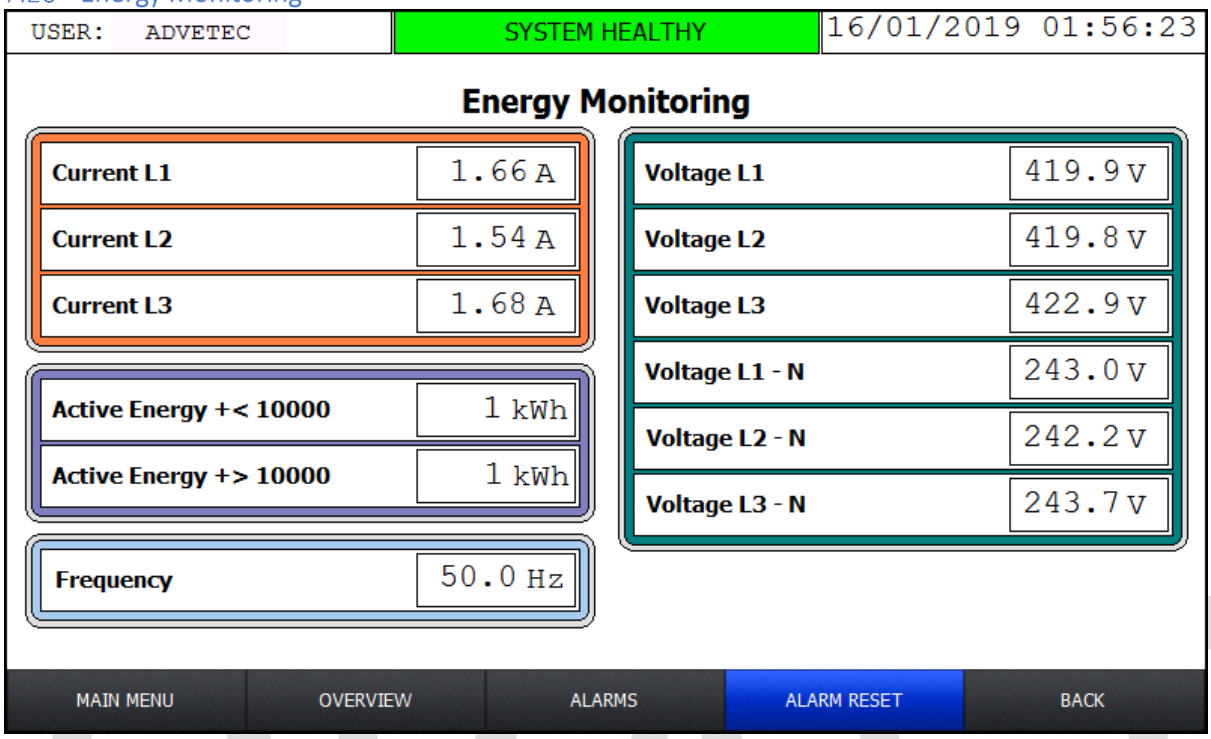
  Indicates Anti-Blockage mode is not active with a  status lamp.

- **Inhibit Due To Blockage** 

  Indicates the XO VSD blockage alarm is active with a  status lamp.

  Indicates the XO VSD blockage alarm is not active with a  status lamp.

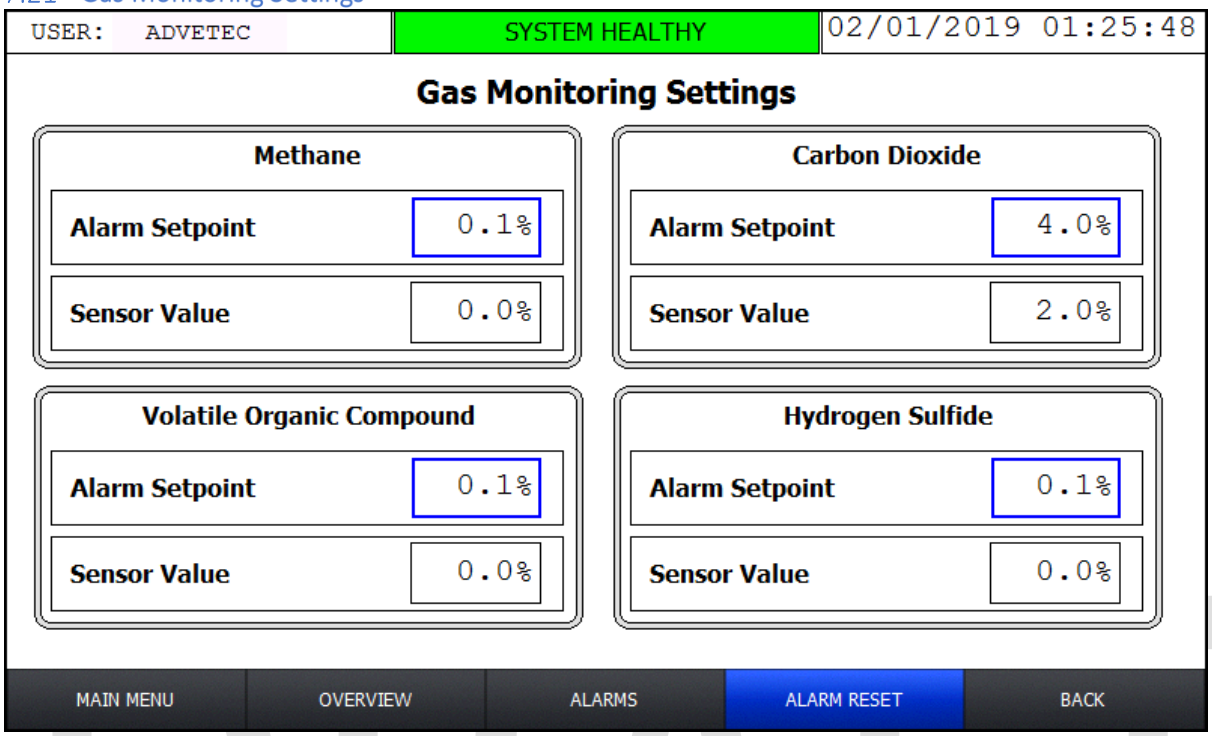
7.20 Energy Monitoring



This screen displays values relating to the energy usage of the XO3 system. Buttons have the following functions:

- MAIN MENU - Navigates to the Main Menu screen.
- OVERVIEW - Navigates to the Overview screen.
- ALARMS - Navigates to the Active Alarms screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- BACK - Navigates to the Settings Menu screen.

7.21 Gas Monitoring Settings



The values of all sensors relating to the Gas Monitoring System of the XO3 and their corresponding alarm setpoints display on this screen. The user may change the value of any setpoint by pressing the blue outlined field and entering data via the Numeric Entry Keypad (See Appendix C). Buttons have the following functions:

- MAIN MENU - Navigates to the Main Menu screen.
- OVERVIEW - Navigates to the Overview screen.
- ALARMS - Navigates to the Active Alarms screen.
- ALARM RESET - Alarms needing user acknowledgement may be reset at Operator level by pressing this button when their trigger condition has subsided.
- BACK - Navigates to the Settings Menu screen.

8 Machine Safety

8.1 Emergency Stop

An emergency stop button features on the door of the control panel of the XO3 machine.

Once activated the emergency stop inhibits the following components of the XO3 system:

- Shredder
- Leveling Augers
- Infeed Auger
- XO Motor
- Outfeed Auger
- Chamber 1 Heaters
- Chamber 2 Heaters
- Bacteria Dosing System
- Bio Stimulant Dosing System
- Extraction Fan

The emergency stop button generates an HMI alarm when activated.

The activation of the emergency stop shows on the status bar, assuming a higher priority indication is not present.

The emergency stop button needs manual release for the system to return to a healthy state.

9 Appendix A – Alarm List

The activation of any alarms or warnings shows on the status bar, assuming a higher priority indication is not present. Warnings have a lower priority than alarms. All alarms and warnings are recorded internally to the HMI and are logged and display on Netbiter.

9.1 Analogue Input Alarms

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Chamber 1 Pad 1 Analogue Input Fault	Alarm	Chamber 1 Pad 1 Analogue Input Fault	Inhibit Chamber 1 Heaters	HMI
Chamber 1 Pad 2 Analogue Input Fault	Alarm	Chamber 1 Pad 2 Analogue Input Fault	Inhibit Chamber 1 Heaters	HMI
Chamber 1 Pad 3 Analogue Input Fault	Alarm	Chamber 1 Pad 1 Analogue Input Fault	Inhibit Chamber 1 Heaters	HMI
Chamber 1 Pad 4 Analogue Input Fault	Alarm	Chamber 1 Pad 2 Analogue Input Fault	Inhibit Chamber 1 Heaters	HMI
Chamber 1 Pad 5 Analogue Input Fault	Alarm	Chamber 1 Pad 1 Analogue Input Fault	Inhibit Chamber 1 Heaters	HMI
Chamber 1 Pad 6 Analogue Input Fault	Alarm	Chamber 1 Pad 2 Analogue Input Fault	Inhibit Chamber 1 Heaters	HMI
Chamber 1 Pad 7 Analogue Input Fault	Alarm	Chamber 1 Pad 1 Analogue Input Fault	Inhibit Chamber 1 Heaters	HMI
Chamber 1 Pad 8 Analogue Input Fault	Alarm	Chamber 1 Pad 2 Analogue Input Fault	Inhibit Chamber 1 Heaters	HMI
Chamber 2 Pad 1 Analogue Input Fault	Alarm	Chamber 2 Pad 1 Analogue Input Fault	Inhibit Chamber 2 Heaters	HMI
Chamber 2 Pad 2 Analogue Input Fault	Alarm	Chamber 2 Pad 2 Analogue Input Fault	Inhibit Chamber 2 Heaters	HMI
Chamber 2 Pad 3 Analogue Input Fault	Alarm	Chamber 2 Pad 1 Analogue Input Fault	Inhibit Chamber 2 Heaters	HMI
Chamber 2 Pad 4 Analogue Input Fault	Alarm	Chamber 2 Pad 2 Analogue Input Fault	Inhibit Chamber 2 Heaters	HMI
Chamber 2 Pad 5 Analogue Input Fault	Alarm	Chamber 2 Pad 1 Analogue Input Fault	Inhibit Chamber 2 Heaters	HMI
Chamber 2 Pad 6 Analogue Input Fault	Alarm	Chamber 2 Pad 2 Analogue Input Fault	Inhibit Chamber 2 Heaters	HMI
Chamber 2 Pad 7 Analogue Input Fault	Alarm	Chamber 2 Pad 1 Analogue Input Fault	Inhibit Chamber 2 Heaters	HMI
Chamber 2 Pad 8 Analogue Input Fault	Alarm	Chamber 2 Pad 2 Analogue Input Fault	Inhibit Chamber 2 Heaters	HMI
Chamber 1 Core 1 Analogue Input Fault	Alarm	Chamber 1 Core 1 Analogue Input Fault	Inhibit Chamber 1 Heaters if an Alarm (not Warning) relating to Chamber 1 Core 2 is active.	HMI
Chamber 2 Core 1 Analogue Input Fault	Alarm	Chamber 2 Core 1 Analogue Input Fault	Inhibit Chamber 2 Heaters if an Alarm (not Warning) relating to Chamber 2 Core 2 is active.	HMI

Chamber 1 Core 2 Analogue Input Fault	Alarm	Chamber 1 Core 2 Analogue Input Fault	Inhibit Chamber 1 Heaters if an Alarm (not Warning) relating to Chamber 1 Core 1 is active.	HMI
Chamber 2 Core 2 Analogue Input Fault	Alarm	Chamber 2 Core 2 Analogue Input Fault	Inhibit Chamber 2 Heaters if an Alarm (not Warning) relating to Chamber 2 Core 1 is active.	HMI
Methane Sensor Fault	Alarm	Methane Sensor Fault	None	HMI
Volatile Organic Compound Sensor Fault	Alarm	Volatile Organic Compound Sensor Fault	None	HMI
Carbon Dioxide Sensor Fault	Alarm	Carbon Dioxide Sensor Fault	None	HMI
Hydrogen Sulfide Sensor Fault	Alarm	Hydrogen Sulfide Sensor Fault	None	HMI
Bio Stimulant Tank Level Sensor Fault	Alarm	Bio Stimulant Tank Level Sensor Fault	None	HMI
External Air Temperature Sensor Fault	Alarm	External Air Temperature Sensor Fault	None	HMI
External Air Humidity Sensor Fault	Alarm	External Air Humidity Sensor Fault	None	HMI
Chamber Humidity Sensor Fault	Alarm	Chamber 1 Humidity Sensor Fault	None	HMI

9.2 Tripped

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Leveling Auger 1 Tripped	Alarm	Leveling Auger 1 Tripped	Inhibit Auger	None
Leveling Auger 2 Tripped	Alarm	Leveling Auger 2 Tripped	Inhibit Auger	None
Infeed Auger Tripped	Alarm	Infeed Auger Tripped	Inhibit Drive	HMI
XO Drive Tripped	Alarm	XO Motor Tripped	Inhibit Drive	HMI
Outfeed Auger Tripped	Alarm	Outfeed Auger Tripped	Inhibit Drive	HMI
Extraction Fan Tripped	Alarm	Extraction Fan Tripped	Inhibit Drive	HMI
Heaters Chamber 1 Bank 1 Tripped	Alarm	Heaters Chamber 1 Bank 1 Tripped	Inhibit Chamber 1 Heaters	None
Heaters Chamber 1 Bank 2 Tripped	Alarm	Heaters Chamber 1 Bank 1 Tripped	Inhibit Chamber 1 Heaters	None
Heaters Chamber 1 Bank 3 Tripped	Alarm	Heaters Chamber 1 Bank 1 Tripped	Inhibit Chamber 1 Heaters	None
Bio Stimulant Dosing Pump Tripped	Alarm	Bio Stimulant Dosing Pump Tripped	Inhibit Pump	None
Bacteria Dosing Valve Tripped	Alarm	Bacteria Dosing Valve Tripped	Inhibit Valve	None
Heaters Chamber 1 Bank 1 Tripped	Alarm	Heaters Chamber 1 Bank 1 Tripped	Inhibit Chamber 1 Heaters	None
Heaters Chamber 1 Bank 2 Tripped	Alarm	Heaters Chamber 1 Bank 1 Tripped	Inhibit Chamber 1 Heaters	None
Heaters Chamber 1 Bank 3 Tripped	Alarm	Heaters Chamber 1 Bank 1 Tripped	Inhibit Chamber 1 Heaters	None

9.3 Safety

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Safety Relay KS1 Fault (Emergency Stop)	Alarm	Emergency Stop Activated.	Inhibit all XO3 system components.	Release E-Stop.

9.4 Shredder

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Shredder Not Available	Warning	Shredder Not Available. (Whereby a Shredder exists)	None	None
Shredder Jammed	Alarm	Shredder Jammed. (Whereby a Shredder exists)	None	None
Shredder Run Command Failed	Warning	A Shredder run command is being sent but the Shredder is not running. (Whereby a Shredder exists)	None	None

9.5 VSD

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Infeed Auger Fault	Alarm	VSD Predefined Alarm Active	Inhibit Drive	HMI
Infeed Auger Communications Fault	Alarm	There is no communication between the PLC and Infeed Auger	Inhibit Drive	HMI
Infeed Auger Blocked	Alarm	See Infeed Auger Anti-Blockage Mode	Inhibit Drive	HMI

XO Drive Fault	Alarm	VSD Predefined Alarm Active	Inhibit Drive	HMI
XO Drive Communications Fault	Alarm	There is no communication between the PLC and XO Drive	Inhibit Drive	HMI
XO Drive Blocked	Alarm	See XO Drive Anti-Blockage Mode	Inhibit Drive	HMI
Outfeed Auger Fault	Alarm	VSD Predefined Alarm Active	Inhibit Drive	HMI
Outfeed Auger Communications Fault	Alarm	There is no communication between the PLC and Outfeed Auger	Inhibit Drive	HMI
Outfeed Auger Blocked	Alarm	See Outfeed Auger Anti-Blockage Mode	Inhibit Drive	HMI
Extraction Fan Fault	Alarm	VSD Predefined Alarm Active	Inhibit Drive	HMI
Extraction Fan Communications Fault	Alarm	There is no communication between the PLC and Extraction Fan	Inhibit Drive	HMI

9.6 Dosing

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Bio Stimulant Low Level	Alarm	The Bio Stimulant Tank level is less than the low-level HMI setpoint and the Bio Stimulant Empty Level alarm is not active.	Half Bio Stimulant Dosing Duration.	None
Bio Stimulant Empty Level	Alarm	The Bio Stimulant Tank level is less than the empty level HMI setpoint.	Inhibit Bio Stimulant Dosing.	None

9.7 Core Temperature

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Chamber 1 Core Temperature Sensor 1 > Setpoint	Warning	Chamber#1 PT100 Sensor#1 > Global chamber warning temperature.	None	None
Chamber 1 Core Temperature Sensor 2 > Setpoint	Warning	Chamber#1 PT100 Sensor#2 > Global chamber warning temperature.	None	None
Chamber 2 Core Temperature Sensor 1 > Setpoint	Warning	Chamber#2 PT100 Sensor#1 > Global chamber warning temperature.	None	None
Chamber 2 Core Temperature Sensor 2 > Setpoint	Warning	Chamber#2 PT100 Sensor#2 > Global chamber warning temperature.	None	None
Chamber 1 Core Temperature Sensor 1 > 160 °C	Alarm	Chamber#1 PT100 Core #1 > 160°C	Inhibit Chamber 1 Heaters if an Alarm (not Warning) relating to Chamber 1 Core 2 is active.	None
Chamber 1 Core Temperature Sensor 2 > 160 °C	Alarm	Chamber#1 PT100 Core #2 > 160°C	Inhibit Chamber 1 Heaters if an Alarm (not Warning) relating to Chamber 1 Core 1 is active.	None
Chamber 2 Core Temperature Sensor 1 > 160 °C	Alarm	Chamber#1 PT100 Core #1 > 160°C	Inhibit Chamber 2 Heaters if an Alarm (not Warning) relating to Chamber 2 Core 2 is active.	None
Chamber 2 Core Temperature Sensor 2 > 160 °C	Alarm	Chamber#1 PT100 Core #2 > 160°C	Inhibit Chamber 2 Heaters if an Alarm (not Warning) relating to Chamber 2 Core 1 is active.	None

9.8 Heater Pad Temperature

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Heater 1 Temperature > Setpoint	Warning	Heater 1 Temperature > Global chamber warning temperature.	None	None
Heater 2 Temperature > Setpoint	Warning	Heater 2 Temperature > Global chamber warning temperature.	None	None
Heater 3 Temperature > Setpoint	Warning	Heater 3 Temperature > Global chamber warning temperature.	None	None
Heater 4 Temperature > Setpoint	Warning	Heater 4 Temperature > Global chamber warning temperature.	None	None
Heater 5 Temperature > Setpoint	Warning	Heater 5 Temperature > Global chamber warning temperature.	None	None
Heater 6 Temperature > Setpoint	Warning	Heater 6 Temperature > Global chamber warning temperature.	None	None
Heater 7 Temperature > Setpoint	Warning	Heater 7 Temperature > Global chamber warning temperature.	None	None
Heater 8 Temperature > Setpoint	Warning	Heater 8 Temperature > Global chamber warning temperature.	None	None
Heater 9 Temperature > Setpoint	Warning	Heater 9 Temperature > Global chamber warning temperature.	None	None
Heater 10 Temperature > Setpoint	Warning	Heater 10 Temperature > Global chamber warning temperature.	None	None
Heater 11 Temperature > Setpoint	Warning	Heater 11 Temperature > Global chamber warning temperature.	None	None
Heater 12 Temperature > Setpoint	Warning	Heater 12 Temperature > Global chamber warning temperature.	None	None
Heater 13 Temperature > Setpoint	Warning	Heater 13 Temperature > Global chamber warning temperature.	None	None
Heater 14 Temperature > Setpoint	Warning	Heater 14 Temperature > Global chamber warning temperature.	None	None
Heater 15 Temperature > Setpoint	Warning	Heater 15 Temperature > Global chamber warning temperature.	None	None
Heater 16 Temperature > Setpoint	Warning	Heater 16 Temperature > Global chamber warning temperature.	None	None
Heater 1 Temperature > 160 °C	Alarm	Heater 1 Temperature > 160°C	Inhibit Chamber 1 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 1 Core

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
				Temperature
Heater 2 Temperature > 160 °C	Alarm	Heater 2 Temperature > 160°C	Inhibit Chamber 1 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 1 Core Temperature
Heater 3 Temperature > 160 °C	Alarm	Heater 3 Temperature > 160°C	Inhibit Chamber 1 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 1 Core Temperature
Heater 4 Temperature > 160 °C	Alarm	Heater 4 Temperature > 160°C	Inhibit Chamber 1 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 1 Core Temperature
Heater 5 Temperature > 160 °C	Alarm	Heater 5 Temperature > 160°C	Inhibit Chamber 1 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 1 Core Temperature
Heater 6 Temperature > 160 °C	Alarm	Heater 6 Temperature > 160°C	Inhibit Chamber 1 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 1 Core Temperature
Heater 7 Temperature > 160 °C	Alarm	Heater 7 Temperature > 160°C	Inhibit Chamber 1 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 1 Core Temperature
Heater 8 Temperature > 160 °C	Alarm	Heater 8 Temperature > 160°C	Inhibit Chamber 1 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 1 Core Temperature
Heater 9 Temperature > 160 °C	Alarm	Heater 9 Temperature > 160°C	Inhibit Chamber 2 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 2 Core Temperature
Heater 10 Temperature > 160 °C	Alarm	Heater 10 Temperature > 160°C	Inhibit Chamber 2 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 2 Core Temperature
Heater 11 Temperature > 160 °C	Alarm	Heater 11 Temperature > 160°C	Inhibit Chamber 2 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 2 Core Temperature
Heater 12 Temperature > 160	Alarm	Heater 12 Temperature > 160°C	Inhibit Chamber 2 Heaters	HMI or auto-reset when sensors reads

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
°C				less than or equal to the Chamber 2 Core Temperature
Heater 13 Temperature > 160 °C	Alarm	Heater 13 Temperature > 160°C	Inhibit Chamber 2 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 2 Core Temperature
Heater 14 Temperature > 160 °C	Alarm	Heater 14 Temperature > 160°C	Inhibit Chamber 2 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 2 Core Temperature
Heater 15 Temperature > 160 °C	Alarm	Heater 15 Temperature > 160°C	Inhibit Chamber 2 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 2 Core Temperature
Heater 16 Temperature > 160 °C	Alarm	Heater 16 Temperature > 160°C	Inhibit Chamber 2 Heaters	HMI or auto-reset when sensors reads less than or equal to the Chamber 2 Core Temperature

9.9 Gas Monitoring Alarms

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Methane Consent Exceeded	Alarm	The sensor value has exceeded the value of the HMI setpoint.	None	HMI
Volatile Organic Compound Consent Exceeded	Alarm	The sensor value has exceeded the value of the HMI setpoint.	None	HMI
Carbon Dioxide Consent Exceeded	Alarm	The sensor value has exceeded the value of the HMI setpoint.	None	HMI
Hydrogen Sulfide Consent Exceeded	Alarm	The sensor value has exceeded the value of the HMI setpoint.	None	HMI

9.10 Energy Monitoring

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Energy Monitoring Communications Fault	Alarm	There is no communication between the PLC and Energy Monitoring Module.	None	None

9.11 Maintenance

Alarm Text	Warning / Alarm	Trigger Condition	Action	Reset Req
Maintenance Check Required	Warning	The maintenance alarm requires reset	None	HMI

10 Appendix B – Summary of Input and Output Signals

10.1 Digital Inputs

Name	Notes
Shredder Available	Signal received from the shredder. 0V indicates the shredder is not available.
Shredder Running	Signal received from the shredder. 24V indicates the shredder is running.
Shredder Jammed	Signal received from the shredder. 24V indicates the shredder is jammed.
Leveling Auger 1 Tripped	0V indicates fault.
Leveling Auger 2 Tripped	0V indicates fault.
Infeed Auger Tripped	0V indicates fault.
XO Drive Tripped	0V indicates fault.
Outfeed Auger Tripped	0V indicates fault.
Extraction Fan Tripped	0V indicates fault.
Heaters Chamber 1 Bank 1 Tripped	0V indicates fault.
Heaters Chamber 1 Bank 2 Tripped	0V indicates fault.
Heaters Chamber 1 Bank 3 Tripped	0V indicates fault.
Bio Stimulant Dosing Pump Tripped	0V indicates fault.
Bacteria Dosing Valve Tripped	0V indicates fault.
Safety Relay KS1	24V indicates fault.
Heaters Chamber 2 Bank 1 Tripped	0V indicates fault.
Heaters Chamber 2 Bank 2 Tripped	0V indicates fault.
Heaters Chamber 2 Bank 3 Tripped	0V indicates fault.

Name	Notes
Heaters Chamber 1 Bank 1	24V at these outputs will switch on the heaters in chamber 1. 0V at this output will switch off the heaters in chamber 1. These outputs must mimic one another.
Heaters Chamber 1 Bank 2	
Heaters Chamber 1 Bank 3	
Heaters Chamber 2 Bank 1	24V at these outputs will switch on the heaters in chamber 2. 0V at this output will switch off the heaters in chamber 2. These outputs must mimic one another.
Heaters Chamber 2 Bank 2	
Heaters Chamber 2 Bank 3	
Leveling Auger 1 Run	24V at this output will run leveling auger 1. 0V at this output will inhibit leveling auger 1.
Leveling Auger 2 Run	24V at this output will run leveling auger 2. 0V at this output will inhibit leveling auger 2.
Bio Stimulant Pump Run	24V at this output will run the bio stimulant dosing pump. 0V at this output will inhibit the bio stimulant dosing pump.
Shredder Run	24V at this output will run the shredder whereby the shredder is not under external control. 0V at this output will inhibit the shredder whereby the shredder is not under external control.
Bacteria Dosing Valve Open	24V at this output will open the bacteria dosing valve. 0V at this output will close the bacteria dosing valve.

10.2 Digital Outputs

10.3 Analogue Inputs

All sensor values will display on the HMI Overview screen.

Name	Notes
Chamber 1 Pad 1 Temperature	These sensors will be located internally to the heat pads.
Chamber 1 Pad 2 Temperature	
Chamber 1 Pad 3 Temperature	
Chamber 1 Pad 4 Temperature	
Chamber 1 Pad 5 Temperature	
Chamber 1 Pad 6 Temperature	
Chamber 1 Pad 7 Temperature	
Chamber 1 Pad 8 Temperature	
Chamber 2 Pad 1 Temperature	
Chamber 2 Pad 2 Temperature	
Chamber 2 Pad 3 Temperature	
Chamber 2 Pad 4 Temperature	
Chamber 2 Pad 5 Temperature	
Chamber 2 Pad 6 Temperature	
Chamber 2 Pad 7 Temperature	
Chamber 2 Pad 8 Temperature	
Chamber 1 Core Temperature 1	These sensors will be located inside their respective chamber.
Chamber 2 Core Temperature 1	
Chamber 1 Core Temperature 2	
Chamber 2 Core Temperature 2	
Methane	See Gas Monitoring.
Volatile Organic Compound	
Carbon Dioxide	
Hydrogen Sulfide	
Bio Stimulant Level	This sensor will be in the Bio Stimulant Tank.
External Air Temperature	These sensors will be external to the XO3 machine.
External Temperature	
Chamber Humidity	This sensor will be located in Chamber 1 of the XO3 machine.

11 Appendix C – Numeric Entry Keypad

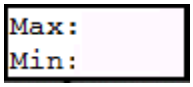
The Numeric Entry Keypad appears whenever the user presses a blue outlined setpoint on any screen of the HMI. The current value of the setpoint will populate the top-left corner of the entry keypad upon the keypad loading. Once the keypad has loaded the top-left corner will display the input value.

11.1 Clear Input

The input value will clear when the user presses the 

button.

11.2 Min and Max Display



The minimum and maximum acceptable values for the given setpoint display in the top-right corner of the entry keypad.

11.3 Input Data

Enter data by using numeric and decimal point buttons. Note that entering multiple decimal points is prohibited. Entered data will display as the input value.

11.4 Confirm Input – Enter/Close button

The 

button will try to update the value of the given setpoint with the keypads input value and, upon doing so, will then close the Numeric Entry Keypad. An update to the setpoint value will only occur if the newly entered value is between the minimum and maximum acceptable values for the given setpoint.

Figure 6: Lifting Positions

11.5 Move Keypad

Pressing the top-left corner of the keypad and then pressing another point on the screen changes the placement of the Numeric Entry Keypad on the screen. Note that the keypad will never extend off the screen. Once a move has begun a flashing white outline will appear around the keypad. To cancel moving the keypad press once again on the keypads top-left corner.

MAINTENANCE

7.1 Safety Recommendations

Before commencement of work on any system or installed item, it is important that a PERMIT TO WORK is issued by a competent person in authority, AND the item of plant is isolated and "Locked Off".
Before commencement of work on any system or installed item, make sure you have read and understood the safety rules and regulations for the works.
Before commencement of work on any system or installed item, make sure you have obtained a copy of the latest issue of the engineering drawing that gives you the schematic layout of the systems components.
Unreported faults and problems can cause serious breakdown to plant. Always report findings to the maintenance supervisor.
After maintenance, all plant that has been subjected to shutdown must be operated and tested prior to a qualified/authorised person signing off the permits.

7.2 Customer Maintenance Schedule

The following maintenance should be carried out as detailed in Table 3. If any problems are identified, refer to troubleshooting Section 8.

Table 3: Customer Maintenance Schedule

Action:	Daily	Weekly
Visual checks for oil leakage around gearbox and bearings	X	
Visual checks on input and output material	X	
Visual check on operation of motor(s) and drive(s)		X
Visual check on extraction fan	X	
Auditory bearing check		X
Visual check of material near heat pads – clear off any burnt substance		X
Clean shredder and remove any dried-on substances		X

7.3 Advetec Service Schedule

The following maintenance will be undertaken by the Advetec Service Engineer as detailed in Table 4.

Table 4: Advetec Service Schedule

Action:	3 Months	1 Year
Motor and drive inspection	X	
Moisture recovery inspection	X	
Odour control inspection and media change	X	
Infeed and outfeed inspection	X	
Internal paddle and chamber inspection	X	
Replenish inoculant and stimulant supply	X	
Annual full calibration service		X

7.4 Lubrication schedule

See Manual for Nord Powertrain.

7.5 Tools Required

The following tools are required for maintenance of the Advetec XO:
Selection of spanners (6mm to 19mm or ¼" to ¾")
Adjustable spanner
Selection of screwdrivers (large and small, Phillips and flat head)
Electrical cabinet key
Wire brush
Shovel

8 TROUBLESHOOTING

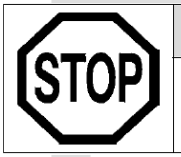
8.1 General

FAULT	POSSIBLE CAUSE	REMEDY
Advetec XO not operating	No electrical power	Check electric power supply Ensure red emergency stop button is pulled out and blue E-stop reset button is pressed
	Software error	Ensure start button on main panel is pressed Ensure all settings are in auto mode
No rotation of drive shafts	Check Gearboxes and electric motors for damage or broken couplings. Fracture in gear unit or shrink disc slippage	Consult Advetec Service
	Software error	Ensure start button on main panel is pressed Ensure all settings are in auto mode
Advetec XO jammed	Debris caught within the Advetec XO	Remove debris and check for damage. Consult Advetec Service
Gearbox unusual running noises or vibrations	Oil too low in gearbox Bearing Damage or toothed wheel damage	Consult Advetec Service
Gearbox oil escaping from gear unit or motor	Defective seal	Consult Advetec Service
Gearbox oil escaping from pressure vent	Incorrect oil level or contaminated oil	Oil change, use oil expansion tank

FAULT	POSSIBLE CAUSE	REMEDY
Gear unit becomes too hot	Incorrect oil level or contaminated oil Gear unit damage Gearbox placed in direct sunlight	Oil change Consult Advetec Service Consider repositioning Advetec XO or cover unit
Shock vibrations when Advetec XO starts	Defective motor coupling Loose gear unit mounting Defective bearing	Consult Advetec Service
Temperature levels low	Heat pads not turned on Extraction fan not operating Incorrect loading conditions Change in waste stream Inoculant/Stimulant dosing pump issues	Ensure heat pads are set to auto, and set to correct temperature in recipe menu Ensure product maximum temperature is set in the setup menu Check circuit breakers in cabinet panel. Consult Advetec Service See below Use regular intervals between loading, as advised by Advetec Revert back to original waste steam as agreed with Advetec. Or Consult Advetec Service Check levels of inoculant/stimulant in cabinet Check power to pumps Check for blockages in pipe Prime pumps
Extraction fan not operating	Fan not turned on	Ensure extraction fan is set to auto in software Check circuit breakers in cabinet panel. Consult Advetec Service

FAULT	POSSIBLE CAUSE	REMEDY
	Motor failure	Consult Advetec Service
Shredder not operating	Shredder not turned on	Ensure extraction fan is set to auto in software Check circuit breakers in cabinet panel. Consult Advetec Service
	Blockage in shredder	Clear blockage
Digestate not fully processed	Compressor not operating	Check power to compressor Check circuit breakers in cabinet panel. Consult Advetec Service Service compressor. Clean filters.
	Lack of oxygen in waste stream	Remove waste stream and reload in smaller quantities for a period of time
	Antibiotics & Biocides in waste stream	
	Biological inhibitors in waste stream	
	Cleaning fluids/products in waste stream	
	Acids in waste stream	
	Alkalines in waste stream	
	Concentrated heavy metals in waste stream	
	Enzyme inhibitors in waste stream	
	Water content in the material higher than 80% or lower than 20%	Pre-treat with belt press to remove/ add water to increase H2O
Drop in temperature & increase in moisture or a change in odour	Mass is binding together	Remove long strips of material (for mixed solid waste machines) Add material to waste stream to break it up (i.e. wood chips)

FAULT	POSSIBLE CAUSE	REMEDY
Increase in Nitrous Oxide	Bacteria has consumed all carbon-based material and is now consuming nitrous material	Increase feed stock for bacteria Reduce dosing amount/quantity
Increase in Hydrogen Sulphide	Process has become anaerobic	Increase rotations to aerate the process
Increase in Volatile Organic Carbons (VOCs)	Process has become anaerobic	Increase rotations to aerate the process
Increase in Methane	Process has become anaerobic	Increase rotations to aerate the process



Attention!

Warning: shut down the gear unit immediately should any of the above faults occur!

9 DRAWINGS

Detailed drawings of site-specific installation appear here.

Appendix 1

Project Specific Method Statement/Risk Assessment appear here.

Appendix 2

Dosages of Bacteria & Bio-Stimulant.

Advetec XO Model Number	Inoculant Usage (kgs/month)	Stimulant Usage (L/month)
XO1	0.1	2.0
XO3	0.25	5.0
XO6	0.50	10.0
XO13	1.0	15.0

Appendix 3

Electrical Diagrams: Control Panel, Nord Powertrain

Electrical diagrams are provided with the specific unit manual at installation.

Nord Powertrain manual provided at installation.

Appendix 4

Lift Certificate

These are provided with the specific unit manual at installation.

Appendix 5

Gas Monitoring and Odour Control

Advetec Gas Sampling System is a fixed sampler for TVOC, H2S, CO2, and Methane.

System includes:

All necessary sensors and components for complete measurement of these gasses
IP66 Stainless Steel cabinet with standard locking mechanism
Auto Draining Water Trap Filter
110V/240V power supply unit
4-20mA Cable communications block for onward data transmission to Advetec XO Control Panel
Replaceable inline carbon filter for filtered gas out
An O&M manual is provided at installation.

Advetec Odour Control Unit

Passive Drum Scrubber
Model Number: 3DR200
Media Type: Combination of activated Alumia and other binders
Tank Construction: Polypropylene or Stainless
An O&M manual is provided at installation.

Appendix 6 Log Sheets

Daily Check Sheet

Customer	
Machine	
Date installed	
Month	

Date \ Action	Visual checks for oil leakage around gearbox and bearings	Visual checks on input and output material	Visual check on extraction fan	Comments
1st				
2nd				
3rd				
4th				
5th				
6th				
7th				
8th				
9th				
10th				
11th				
12th				
13th				
14th				
15th				
16th				
17th				
18th				
19th				
20th				
21st				
22nd				
23rd				
24th				
25th				
26th				
27th				
28th				
29th				
30th				
31st				

Data Collection Record

Customer	
Machine	
Date installed	

Date	Time waste loaded	Ambient Temperature	Weight of waste fed in (kg)	Waste type	Digestate weight out (kg)	Core Temperature (celsius)			Data collected by	Comments / Observations
						1	2	3		

Weekly Check Sheet

Customer	
Machine	
Date installed	
Year	

Action / Date	Visual check on operation of motor(s) and drive(s)	Auditory bearing check	Visual check of material near heat pads – clear off any burnt substance	Comments
Week 1				
Week 2				
Week 3				
Week 4				
Week 5				
Week 6				
Week 7				
Week 8				
Week 9				
Week 10				
Week 11				
Week 12				
Week 13				
Week 14				
Week 15				
Week 16				
Week 17				
Week 18				
Week 19				
Week 20				
Week 21				
Week 22				
Week 23				
Week 24				
Week 25				
Week 26				
Week 27				
Week 28				
Week 29				
Week 30				
Week 31				
Week 32				
Week 33				
Week 34				
Week 35				
Week 36				
Week 37				
Week 38				
Week 39				
Week 40				
Week 41				
Week 42				
Week 43				
Week 44				
Week 45				
Week 46				
Week 47				
Week 48				
Week 49				
Week 50				
Week 51				
Week 52				

EUROPEAN OFFICES

United Kingdom

AYLESBURY
T: +44 (0)1844 337380

BELFAST
belfast@slrconsulting.com

BRADFORD-ON-AVON
T: +44 (0)1225 309400

BRISTOL
T: +44 (0)117 906 4280

CARDIFF
T: +44 (0)29 2049 1010

CHELMSFORD
T: +44 (0)1245 392170

EDINBURGH
T: +44 (0)131 335 6830

EXETER
T: + 44 (0)1392 490152

GLASGOW
T: +44 (0)141 353 5037

GUILDFORD
T: +44 (0)1483 889800

LONDON
T: +44 (0)203 805 6418

MAIDSTONE
T: +44 (0)1622 609242

MANCHESTER (Denton)
T: +44 (0)161 549 8410

MANCHESTER (Media City)
T: +44 (0)161 872 7564

NEWCASTLE UPON TYNE
T: +44 (0)191 261 1966

NOTTINGHAM
T: +44 (0)115 964 7280

SHEFFIELD
T: +44 (0)114 245 5153

SHREWSBURY
T: +44 (0)1743 23 9250

STIRLING
T: +44 (0)1786 239900

WORCESTER
T: +44 (0)1905 751310

Ireland

DUBLIN
T: + 353 (0)1 296 4667

France

GRENOBLE
T: +33 (0)6 23 37 14 14