Loadbank Installation & Operation Manual

Revision: 1.0.6

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CRESTCHIC

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1 General Loadbank Information

This unit is a device that generates an electrical load, applies the load to an electrical power source and converts or dissipates the resultant power output of the source. The loadbank is intended to accurately mimic the operational or "real" load which a power source will see in actual application.

However, unlike the "real" load, which is likely to be dispersed, unpredictable and random in value, this unit provides a contained, organized and fully controllable load.

Where the "real" load is served by the power source and uses the energy output of the source for some productive purpose, the loadbank serves the power source, using its energy output to test, support or protect the power source.

For more than 30 years, we have been designing and manufacturing loadbanks that provide accurate, reliable electrical test loads for commissioning and maintaining power systems. We provide market-leading products for sale and rental to some of the world's biggest companies, backed up by our consultative service. We work with you right from specification stage, offering unrivalled quality, choice, and expertise to create the right solution for your needs.

1.1 Uses

The loadbank is suitable for use in the outdoors. They come in varients of either purely resistive, reactive, resistive/reactive, or capacitive for electrically load testing either AC or DC power supplies. They can be used for load duration testing (heat runs) or load acceptance testing. Loadbanks for M-load testing are also available.

Loadbanks with; Trakker, Regen or Baseload control systems can also be specified for site correction and apply a variable load to prevent wet stacking of generators. They can be made for use in either transportable or fixed applications, and their arrangement varies depending on the design and specification.

The function of the loadbank is the dissipation of electrical energy which is transformed into heat by the resistive elements. The heat is removed from the loadbank by the fan(s) passing air over the resistive elements. Reactors and capacitors are also cooled by air movement within the loadbank, it is therefore essential the inlet and outlet grilles are free from any obstruction otherwise the loadbank could potentially overheat and subsequently trip out upon over temperature.

The loadbank should only be operated by Trained and Qualified Personal and the user must be fully conversant with this manual and in full understanding of it.

1.2 Tolerance

The standard tolerance of Crestchic's Loadbanks are:

Power kW/kVA Tolerance	**+/- 5%**
Voltage Tolerance	**+5% for Short Duration (+5% Max.10 mins Not Continuous)**
Frequency Tolerance	**+/- 5%**

If the loadbank specification requires a greater range than this (voltage) it will be marked on the Rating Plate and considered during the loadbank design. Refer to Wiring Diagram available from *Crestchic Customer Portal.*

1.3 Rating Plate

Consult the loadbank name plate for nominal capacities, voltage, frequency, and current ratings. Additional information such as weight, enclosure colour and type can be found here.

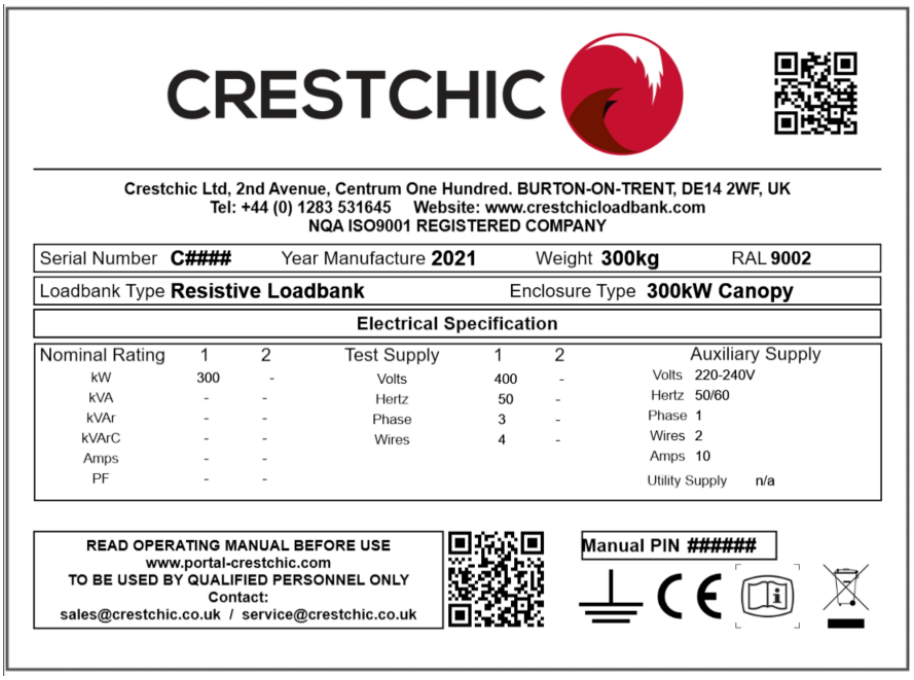


Figure 1- AC Rating Plate

1.4 Crestchic Customer Portal

Loadbank specific documentation can be downloaded from the Crestchic Customer Portal.

www.portal-crestchic.com

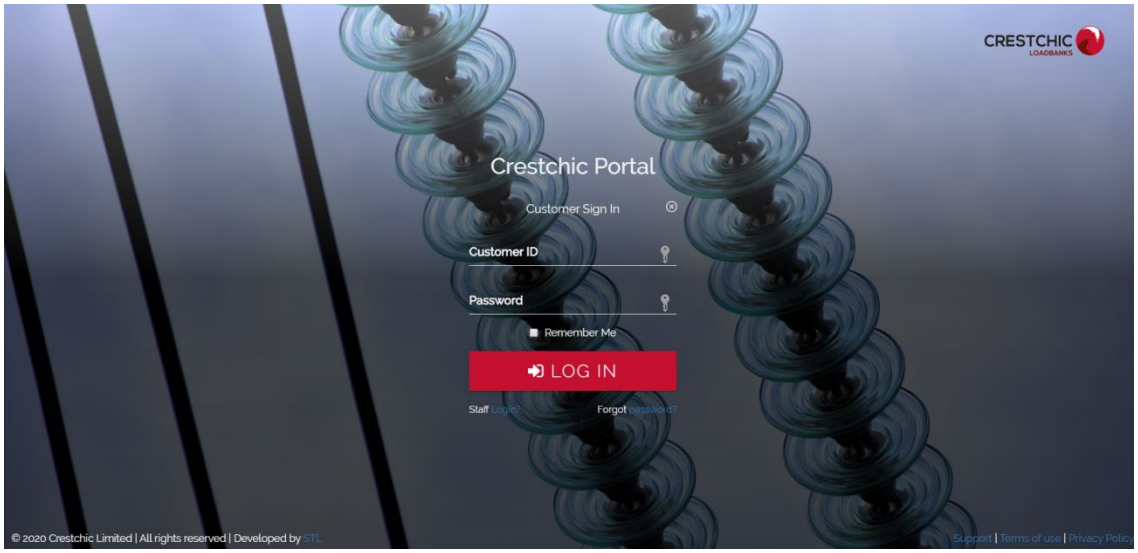


Figure 2- Crestchic Customer Portal

The information available includes:

Specifications, Wiring Diagrams and General Arrangement Drawings, Additional User Manual Information, Test Results, Calibration Files and Software.

Login Access is given to the Customer portal via email at the completion of loadbank ordering. It is also available via login credentials available on the loadbank. To login use loadbank serial number, and the unique PIN provided.

1.5 Power Calculations

Apparent Power	*MVA / kVA / VA*
Real/Actual Power	*MW / kW / W*
Reactive Power	*MVAr / kVAr / VAr*
Power Factor	*p.f. = cosφ*
Unity Power Factor	*kW = kVA*

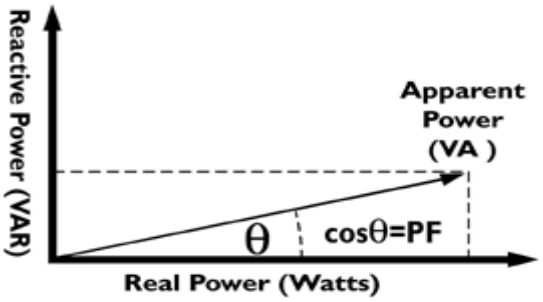


Figure 3- Power Relationship

1.5.1 Ohm's Law

$$I\ (Amps) = \frac{V\ (Volts)}{R\ (\Omega)}$$

1.5.2 AC Power Calculations

e.g. *Loadbank = 3.3MVA @ 0.8p.f. 400V 50Hz.*

$\boldsymbol{Real\ Power\ kW = kVA \times pf}$	$\boldsymbol{3300 \times 0.8 = 2640kW}$
$\boldsymbol{Reactive\ Power\ kVAr = \sqrt{kVA^2 - kW^2}}$	$\sqrt{3300^2 - 2640^2} = 1980kVAr$
$\boldsymbol{Apparent\ Power\ kVA = \sqrt{kW^2 + kVAr^2}}$	$\sqrt{2640^2 + 1980^2} = 3300kVA$
$\boldsymbol{Real\ Power\ kW = \sqrt{kVA^2 - kVAr^2}}$	$\sqrt{3300^2 - 1980^2} = 2640kW$
$\boldsymbol{Real\ Power\ 3\Phi\ Current = \frac{kW \times 1000}{\sqrt{3} \times V}}$	$\frac{2640 \times 1000}{1.732 \times 400} = 3810A$
$\boldsymbol{3\Phi\ Current = \frac{kVA \times 1000}{\sqrt{3} \times V \times pf}}$	$\frac{3300 \times 1000}{1.732 \times 400 \times 0.8} = 4763A$
$\boldsymbol{3\Phi\ Current = \sqrt{Amps_{(kW)}{}^2 + Amps_{(kVAr)}{}^2}}$	$\sqrt{3810^2 + 2856^2} = 4763A$
$\boldsymbol{Apparent\ Power\ kVA = \sqrt{3} \times V \times I}$	$\sqrt{3} \times 400 \times 4763 = 3300kVA$

1.5.3 DC Power Calculations

$DC\ Power\ kW = V \times I$	$48 \times 200 = 9.60kW$
$DC\ Current = P \div I$	$3550 \div 125 = 28.4A$

1.5.4 Loadbank Resistive Capacity at other Voltages

$$kW_{nom} \times \left(\frac{V_{applied}}{V_{nom}}\right)^2 = kW$$

e.g. $300kW \times \left(\frac{400V}{415V}\right)^2 = 279kW$

1.5.5 Loadbank Reactive Capacity at other Frequency

Refer to loadbank Wiring Diagram for details of capacity at different voltages and frequency or contact Crestchic.

WARNING: **Falling frequency will overload the contactors/fuses of an inductive reactive load step and may subsequently cause serious damage and a risk of fire.**

Conversely, rising frequency will overload the contactors/fuses of a capacitive reactive load step and may subsequently cause serious damage and a risk of fire.

If testing at a frequency different to nominal is required, you should contact Crestchic who can advise a maximum voltage and load.

1.5.6 Temperature Calculation

$$℃ = \frac{℉ - 32}{1.8} \qquad ℉ = (1.8 \times ℃) + 32$$

1.5.7 Metric Conversions

$1\ inch = 25.4\ mm\ (2.54\ cm)$ $\qquad$ $1cm = 0.3937\ inch$

$1\ lb = 0.4536\ kg$ $\qquad$ $1kg = 2.2046\ lbs$

1.6 Crestchic Loadbank Range

Crestchic offers loadbanks of all sizes, voltages or capacities for any application including replicating a lagging power factor for complete engine and alternator testing. Our purpose-designed air-cooled AC loadbanks are available containerised units and canopies.

Our containerised loadbanks are available in a range of sizes (375kVA to 6.25MVA) and specifications, including **resistive only**, **resistive / reactive**, **capacitive** and **MV multi-voltage**. They are housed in ISO style mini, 6, 10, 20, 30 & 40ft containers with 'Twistlock' corner castings and painted with a marine spec finish.

Figure 4 - Containerised Loadbank

Our canopies are available in a range of sizes (10kW to 2000kW) **resistive only**, **reactive only**, **resistive / reactive** and **capacitive**. We can provide transportable models; castors, fork-lift base, crash-pack lifting kit or trailer mounted, and fixed models for permanent installation. The forced air cooling on canopy loadbanks can be horizontal or vertical. Typically, Crestchic's loadbanks are horizontal blow, up to 700kW, and vertical blow for higher capacities.

Figure 5 - Canopy Packaged Loadbanks

Please refer to specific to Crestchic loadbank range datasheets & brochures, or to the loadbank general arrangement drawing for specific information. These are available from sales@crestchic.co.uk and the Crestchic customer portal.

2 Safety

2.1 Safety considerations

WARNING: The loadbank produces a hot exhaust gas approximately 200°C (400°F) above ambient temperature at the outlet grilles.

Operation of loadbanks does present some degree of risk due to dangers inherent in their operation. The operators must be fully conversant with this manual and in full understanding of it before using the loadbank. To support operators who are not familiar with Crestchic's loadbanks, we can offer a training program as part of our commissioning service, or later through our service/ rental department.

The loadbank must be operated only by trained personnel adequately experienced in the operation of the loadbank and the power source(s) being connected to it, and the connected devices should be viewed as a complete system.

All operators should also be trained in local and site-specific working practices and use these together with the enclosed instructions to minimise risk and ensure the safety of those working in proximity to the loadbank. It is also recommended that all persons not directly involved with tests must be kept at a safe distance from the loadbank when conducting tests.

Produce a safe system of work for using the loadbank. Misuse and/or failure to obey these instructions and safe working practices could result in serious injury and/or damage to the equipment and property. Stop using equipment immediately if it appears to be faulty and have it checked by a competent person.

The dangers inherent in loadbank operation are:

- **Handling and Lifting Operations**

Safe handling and lifting needs to be properly planned by a competent person, appropriately supervised, and carried out safely in line with local regulation. For further details about Crestchic's loadbanks see *Canopy Lifting Instructions* & *Container Lifting Instructions*.

- **Working with Electricity**

The main hazards of working with electricity are electric shock and burns from contact with live parts and injury from exposure to arcing and potential fire. Risks are exacerbated by working outdoors in wet conditions. When connecting supplies to the loadbank use secure isolation methods such as safe locks.

- **Working with Machinery**

The loadbank contains extract fans to cool load elements and for ventilation of control equipment. The moving parts can cause serious injury. Only operate the loadbank with all the guards, covers and protective screens securely in position. Do not enter the electrical compartment of containerised loadbanks when the fans are in operation.

Ensure the work area around the machine is kept clean and tidy, free from obstructions, well-lit and slips or trip hazards. Ensure there are no loose or trailing cables that can cause personnel to trip or fall around the loadbank and ensure easy access to the loadbank emergency stop.

If the loadbank is to be installed with a control system which allows automatic/remote start-up, ensure that adequate warning signs are displayed, and the area is cordoned off from personnel.

- **Working with high temperatures and hot exhausts**

Exhaust air from the loadbank can be extremely hot and can cause serious injuries to the flesh such as burns or scalds. You should therefore not touch or stand close to the outlet vents while the loadbank is running, or for a few minutes afterwards whilst the loadbank cools.

- **Noise**

Noise from loadbank operation can cause hearing damage and can interfere with communications and make warnings harder to hear. Noise can also reduce a person's awareness of his or her surroundings increasing other risks. Hearing protection should be issued to operators and working practices and communications should not rely on verbal communication.

- **Working at Height**

Depending on the type of loadbank, some working at height may be required for unpacking, lifting and maintenance operations. To minimise risk operators must use the correct equipment and always following local guidelines.

2.2 Personal Protective Equipment (PPE)

It is always recommended to wear appropriate Personal Protective Equipment when operating the loadbank.

Figure 6- PPE

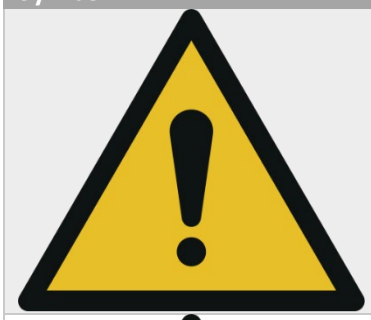
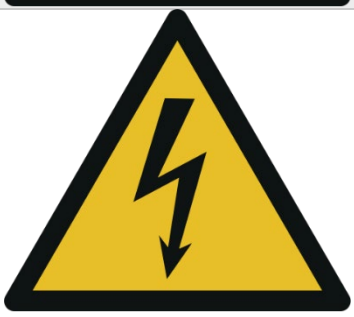
To minimise risk, ensure that the competent personnel using the loadbank are provided with appropriate personal protective equipment (PPE). PPE can include items such as safety helmets, gloves, eye protection, ear protection, high-visibility clothing, safety footwear and safety harnesses. It may also include respiratory protective equipment (RPE). For high voltage testing, arc flash protection equipment may also be required.

Consult local regulation, industry standards and site safety policies to evaluate PPE needs.

2.3 Operating and Warning Symbols and Labelling

Observe instructive and warning labels on the loadbank. As part of regular maintenance all labels should be checked for deterioration and replaced if no longer suitable.

Loadbank covers and openings are labelled appropriately, these help with easy identification of the hazards and risks that could occur, and how they may be avoided.

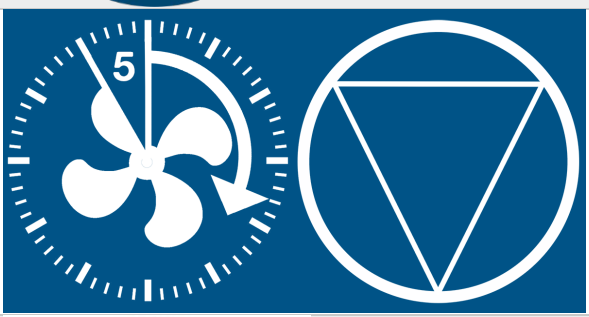
Symbol	Explanation
	**General Warning Sign** Will be accompanied by other symbols or instructions. ISO 7010 2011-06 W001
	**Electrical Shock Hazard** This symbol will be applied to the doors and covers that contain uninsulated electrical connections or components. Opening and working behind these covers creates a risk of electrical shock, take care to avoid contact with electricity and use safe practices to minimise risk if work must be undertaken. ISO 7010 2011-06 W012
	**Warning Hot Surface** Applied in the vicinity of outlet grilles to warn of a hot surface take care to avoid contact with the hot surfaces of the loadbank. ISO 7010 2011-06 W017
	**Auto Start-Up Mechanism** Unit may start-up automatically without warning. ISO 7010 2011-06 W018
	**Warning: Laser Beam** Do not look directly into end of fibreoptic cable. ISO 7010 2011-06 W004

	**Combined Warning Symbol** AIR OUTLET KEEP CLEAR Vertical and horizontal air outlets. Warning hot surface and loadbank hot exhaust gas Maintain clearance around Air Outlet Grills
	**Combined Warning Symbol** AIR INLET KEEP CLEAR Warning air intake and presence of air-circulating fan. Danger of rotating fan parts if protective grills removed. Maintain clearance around Air Inlet Grills and keep free from debris.
	**Warning: Rotating Fan** Danger of rotating fan parts. Keep clear of rotating parts. Rotating fan blades can cause serious injury.
	**Warning: Overhead obstacle** **When entering containers be aware of overhead obstacles.** ISO 7010 2011-06 W020
	**Warning: Floor-level obstacle** **When entering containers be are of door sills.** ISO 7010 2011-06 W007

General mandatory action sign
ISO 7010 2011-06 M001

Refer to instruction manual/booklet
ISO 7010 2011-06 M002

Ear Protection
Ear protection is required during loadbank operation. Wear PPE.
ISO 7010 2011-06 M003



Combined Mandatory Action Symbols
Run ventilations fans for 5min.

'IMPORTANT - BEFORE COMPLETING TEST RUN FANS FOR 5 MINUTES WITH ZERO LOAD SELECTED'

Disconnect

Disconnect before carrying out maintenance or repair
ISO 7010 2011-06 M021

Protective Earth Symbol
The loadbank is a Class I appliance which must have its body/enclosure connected to earth.
ISO 7010 2011-06 M005

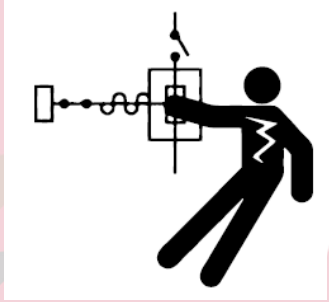
	**Test Supply Connection Symbols**
	**Auxiliary Supply Symbol**
	**Lifting Point** ISO7000-1368
	**Forklift Pocket** ISO7000-2869
	**Centre of Gravity** ISO7000-0627
	**Risk of Electrical Shock** More than one disconnect switch may be required to de-energise the equipment before servicing.

Table 1- Crestchic Loadbank Operating and Warning Signs

2.4 Lifting and Handling

The weight of the Crestchic loadbank is recorded on the Rating Plate and General Arrangement Drawings.

Safe handling and lifting needs to be properly planned by a competent person, appropriately supervised, and carried out safely in line with local regulation. Any equipment you use must be appropriate for use and properly maintained. When using multi-slings make sure the sling angle is considered.

WARNING: Crestchic's loadbanks can be unbalanced, before fully lifting an unbalanced load, find its centre of gravity.

Make sure the load is properly attached to the lifting equipment. It is preferably to use lifting slings rather than chains to avoid damage to the loadbank enclosure metalwork and paint.

When transporting castor mounted loadbanks it is essential to block the base to ensure the castors are raised, otherwise the castors and the enclosures will become damaged when strapping down. When manouvering castor mounted loadbanks ensure that you remain in full control of movement at all times to avoid risk of injury.

Figure 7- Strapping down castor mounted loadbank

When handling for all Crestchic containerised loadbanks & transformers it is preferable to transport using twist locks or with strapping clear of the loadbank to avoid damage to enclosure metalwork and paint.

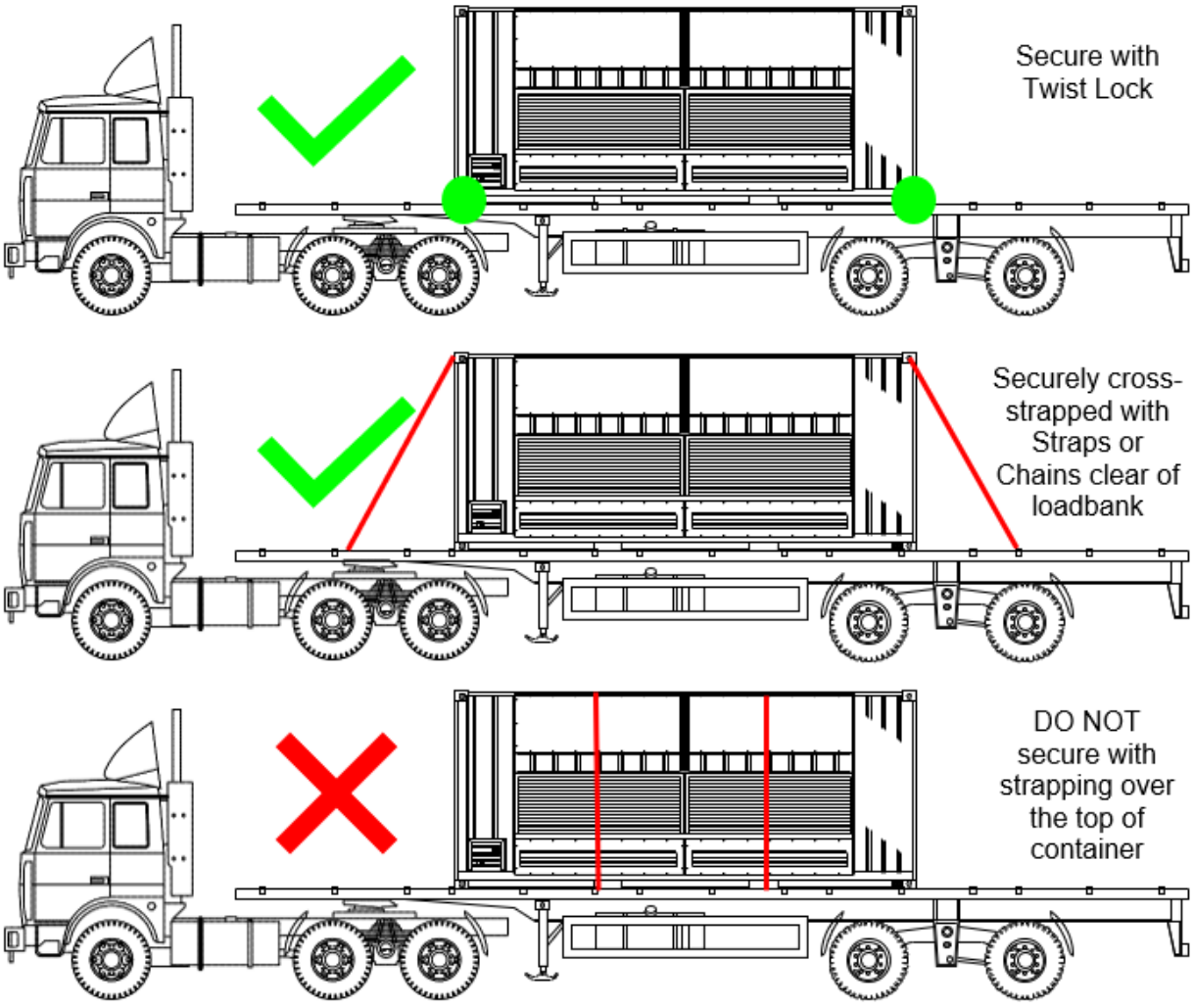


Figure 8 - Containerised Handling

2.4.1 Canopy Lifting Instructions

The table below shows the appropriate lifting techniques for the different variants of canopy loadbanks, *subject to change and customer specification.*

✓/✗ is optional and will depend on the unit.

These should only be used where the loadbank is fitted with such lifting points. See your specification sheet for confirmation.

Direction of Air Exhaust	Fixed or Transportable Model	Power kW & Fans	Lifting Eyes	Castors	Forklift Pocket	Shackle Lifts	Crash Pack Model with Single Point Lift
Horizontal	Fixed	100	✓				
		300	✓				
		400	✓				
		700	✓				
		1000			✓	✓	
	Transportable *	100	✓	✓	✓/✗		✓/✗
		300	✓	✓	✓/✗		✓/✗
		400	✓	✓	✓/✗		✓/✗
		700	✓	✓	✓/✗		✓/✗
		1000			✓	✓	
Vertical	Fixed	800 - 2 Fan	✓		✓	✓	
		1200 - 3 Fan			✓	✓	
		1600 - 4 Fan			✓	✓	
		2000 - 5 Fan			✓	✓	
		2400 - 6Fan			✓	✓	
	Transportable *	800 - 2 Fan	✓	✓	✓	✓	
		1200 - 3 Fan			✓	✓	
		1600 - 4 Fan			✓	✓	
		2000 - 5 Fan			✓	✓	
		2400 - 6Fan			✓	✓	

Table 2- Canopy Lifting

NOTE: **When using forklifts be mindful of studs / openings under the loadbank. *lifting eyes are not present on trailer mounted loadbanks.**

2.4.2 Container Lifting Instructions

These instructions are to be used in conjunction with the British Standard for lifting Freight Containers BS ISO 3874:2017.

There are four preferred methods for lifting Crestchic containerised loadbanks, as follows:

1. *Bottom Lift Sling Method*
2. *End Lift Sling Method (≤ 20ft Containers Only)*
3. *Top Lift Spreader Method*
4. *Forklift Pockets (10ft & 20ft containers* only)

WARNING: Top Lift Sling Method *(Figure 9)*should not be used to lift containerised Crestchic loadbanks.

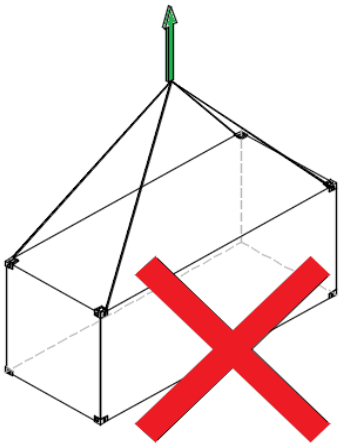


Figure 9- Incorrect Container Lifting

WARNING: Under no circumstance shall containers be lifted by forks underneath the base of the container.

Figure 10- Lifting Label will be attached to the top corner of containerised loadbanks for local labelling.

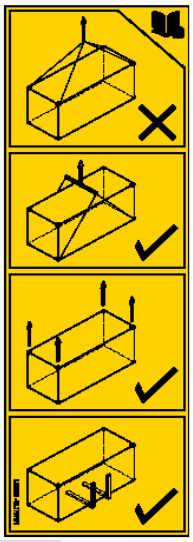
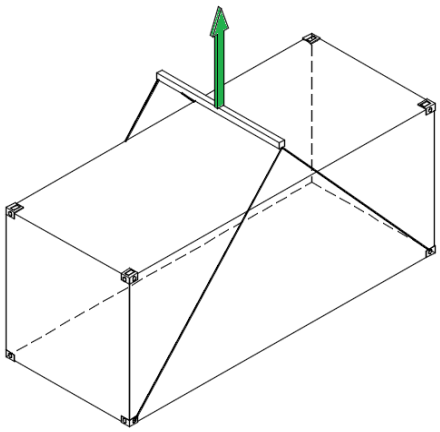


Figure 10- Lifting Label

2.4.2.1 Bottom Lift Sling Method

The container is lifted from side apertures of the four bottom corner fittings by means of slings. The bottom sling attachment shall bear on the corner fittings only and should be such to exert lifting forces not more than 38mm away from the outer face of the corner fittings (Figure 11- Bottom Sling).

Containers ≤20ft
Fitted with 8 Corner Castings



Containers >20ft
Fitted with 8 Corner Castings
And 4 inboard lifting points

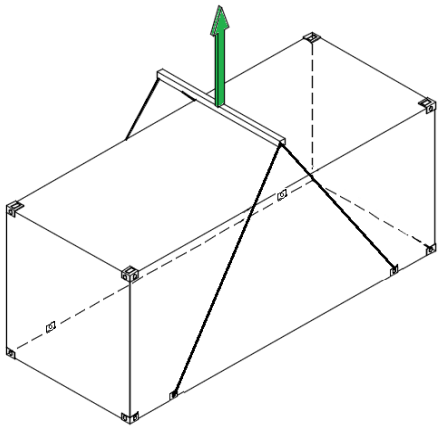


Figure 11- Bottom Sling Lifting

2.4.2.2 End Lift Sling Method (≤ 20ft Containers Only)

The container is lifted by means of crane or special side loading vehicle (Figure 12- End Sling Lifting).

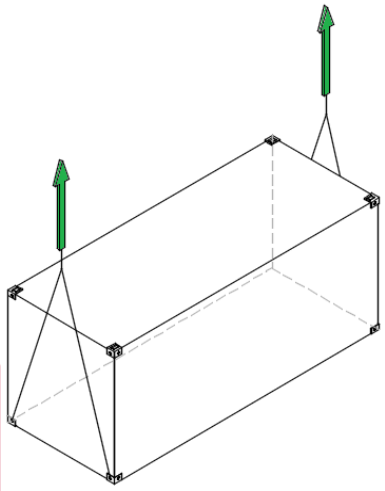


Figure 12- End Sling Lifting

2.4.2.3 Top Lift Spreader Method

The container is lifted by means of a spreader designed to lift containers by the top apertures of the four corner fittings, the lifting forces being applied vertically. These spreaders should be fitted with lifting devices specifically designed to connect to the top corner fittings of freight containers. They do not use normal hooks. (Figure 13- Spreader Lifting).

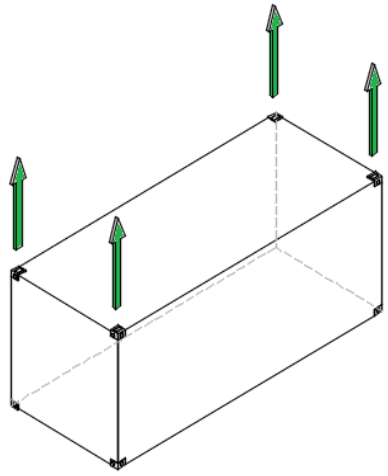


Figure 13- Spreader Lifting

2.4.2.4 Forklift Pockets (10ft & 20ft containers only)

The container, if provided with fork-lift pockets, is lifted by means of forks (Figure 14- Container).

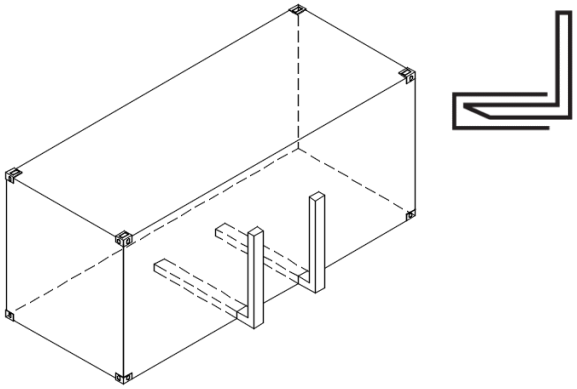


Figure 14- Container Forklift

2.5 Operating Conditions

The loadbank must be properly sited, stable, and located in a well ventilated area. Do not position the loadbank where hot exhaust air is able to recirculate back through the inlet grille, as this will cause the unit to overheat.

A minimum recommended clearance of 2m must be allowed from the inlet grille.

A minimum recommended clearance of 2m is required from the outlet grille. It is recommended that the operator cordon off this area prior to operation of the unit, to prevent accidental contact with the exhaust grilles and the hot gas whilst the loadbank is operating.

WARNING: The loadbank produces a hot exhaust gas approximately 200°C (400°F) above ambient temperature at the outlet grilles.

The operator must provide clear access to the Emergency Stop and control section and put fail safe measures in place in case of an emergency.

Safe access is always required to all sides of the unit for Service and Maintenance. Allow clearance for the opening of all doors and removal of panels.

Loadbanks are not to be used in a gaseous environment, use only in free air conditions. The loadbank is not to be exposed to the ingestion of particulate laden air, such as high concentrations of generator exhaust fumes, paint spray, cement dust, sand or other airborne particulates.

Do not allow objects to enter or block the loadbank's air inlet or outlet grilles. A blockage will cause the loadbank to overheat. If an object enters the loadbank it may cause damage to the fan(s) and or resistor elements. If objects enter the loadbank grilles then the unit must be switched off and disconnected from all electrical supply sources, and then physically and electrically inspected to ensure no damage has occurred.

2.6 Environmental Requirements

The loadbank must be properly sited, stable, and located in a well ventilated area. Do not position the loadbank where hot exhaust air is able to recirculate back through the inlet grille, as this will cause the unit to overheat.

Standard operating temperatures are -20°C to +40°C (-5°F to 105°F). If used at higher temperatures special consideration is required. If you intend to do so, please contact Crestchic.

Where possible, protect the loadbank from direct solar radiation, particularly at the control end of the loadbank. In high ambient temperatures above +50°C (125°F) it is recommended to provide shade for the entire unit if possible.

Rated Maximum Relative Humidity 95% RH.

Crestchic's loadbanks are rated to 500m (1600ft) above sea level as standard. If used at greater elevations special consideration is needed. If you intend to do so, please contact Crestchic.

Do not position the loadbank where hot exhaust air is able to re-circulate back through the inlet grille, as this will cause the loadbank to overheat.

When installing two or more loadbanks ensure they are sufficiently spaced from each other, so the hot exhaust from one unit does not feed the air intake of another.

Failure to observe the above may result in overheating and subsequent activation of the over-temperature protection.

It is not recommended to add your own duct work or sound attenuation to a loadbank. If sound attenuation is required, please discuss your requirements with Crestchic prior to order.

2.7 Installation

Remove and dispose of any packing materials or export tags. Ensure that there is no; loose paper, plastic bags, or other debris that may be drawn on to the air inlet grille, obstructing the airflow.

For safety purposes, upon receiving the loadbank an initial inspection is recommended. Inspect the loadbank for obvious signs of damage such as broken wires, broken or dented panels, cracked ceramic insulators, or any other component breakage that may have occurred in transportation of the equipment.

After installing a loadbank into its final position, it is recommended to inspect the unit for any scratches that may have occurred during shipping or lifting. These should be addressed immediately by applying paint of the appropriate colour *(paint colour on Order Specification or General Arrangement),* which will help to protect the loadbank from rust and ensure a long service life.

Touch up paint is available from the *Service and Spares* Department

3 Electrical Supply

3.1 Isolation and Safety

WARNING: Personal injury from electrical shock may result if the power is not isolated before any installation or maintenance. Working with electricity must only be carried out by qualified personnel.

The loadbank must be operated only by trained personnel adequately experienced in the operation of the loadbank and the power source(s) being connected to it, and the connected devices should be viewed as a complete system. As standard there is no protective device on the loadbank test connections, appropriate isolation, overcurrent, and short circuit protection must be provided on the supply.

When working on loadbanks be aware that multiple power sources may be present. This poses a risk of electrical shock more than one disconnect switch may be required to de-energise the equipment before servicing.

For fault finding, when a supply is required, then only the auxiliary supply, and if provided the lighting and heating supply should be connected. Maintenance work should only be done by qualified personnel, fully aware of the danger involved.

3.2 Earth Requirements

The loadbank is a Class I appliance which must have its body/enclosure connected to earth.

Class 1

Connect a ground (Earth) wire from the Loadbank Earth Stud Terminal to the power supply under test. The loadbank and its power sources **must not** be operated without an adequate Earth connection sized in accordance with the local regulations.

The Earth connection should be the first connection to be made, and the last to be removed from the loadbank.

3.3 Test Supply

Crestchic manufactures a wide range of loadbanks that can be customised to meet requirements. Always consult the loadbanks rating plate or drawings for ratings before use.

Observe the correct (AC) 3-phase and neutral sequence (if neutral connected) when connecting the loadbank to the power source. Connecting a phase to the neutral will damage the loadbank. If the loadbank is designed specifically for 4-Wire applications, a neutral is required for operating the control system if operating on internal (test) supply.

Do not operate the Loadbank over the rated voltage or frequency as this may cause failure to the loadbank.

To power the loadbank from the test supply select “Internal” on the Control Supply Switch (SW1). If the equipment being tested fails, and this is providing the power for the control system, then the cooling fans will stop. Whilst this is not dangerous on an occasional basis, it is to be avoided if there is the possibility of the power source under test repeatedly shutting down when close to full load. In these circumstances an external Auxiliary Supply should be used for the control system, to keep the fans running and prevent unnecessary thermal stressing of the loadbank resistive elements.

3.3.1 Connection

If more than one loadbank is to be used, then the test supply should be connected to each loadbank in parallel. (Loadbank terminals are not designed as junction points).

Ensure that the load cables are of good condition and suitably rated for the current they will be required to carry from the power source to the loadbank. Observe the minimum bend radius for the load cable and ensure that it is unstressed and protected from mechanical damage. All cable must be sized in accordance with the local regulations.

Securely connect the test load cables to the terminals provided (Table 3 - Connection Terminals) observe the correct 3-Phase and Neutral sequence (if Neutral connected) when connecting the loadbank to the power source. Connecting a Phase to the Neutral will damage the loadbank.

Standard* Loadbank Test Connection Terminals	
Loadbank Model	**Connection**
30kW	M6 Stud
100kW <100A Load	M6 Stud
100kW >100A Load	M12 Stud
300kW	M16 Stud
700kW	Punched Busbar – M16
Vertical Blow Canopy	Punched Busbar – M16
Container	Punched Busbar – M16
*** Other sizes available on request.**	

Table 3 - Connection Terminals

NOTE: This is subject to change and can vary depending on order specification.

Moulded Panel Drains for connectors such as Powersafe, Powerlock, Litton, or Camlock can be provided as an optional extra. Only use compatible cables and connectors.

All connections must be made by suitably trained and authorised personnel.

All cables and conductors must pass through the same opening to the connection chamber. Do not leave any connection chamber doors open once cables are fitted.

3.4 Load Configuration

As standard, Crestchic loadbanks are wired Star connected (Y, wye), with three phases of balanced resistive and or reactive load. *Refer to Loadbank Wiring Diagram for details.*

Depending on capacity, voltage and loadbank requirements options are available for connections such as:

- **Star Y (standard)**
- **Delta Δ**
- **Single Phase**
- **DC loadbanks**

There is also the option for load to be 'configurable' which allows loadbanks to be operated with two Nominal Voltages. Depending on; capacity, voltage and loadbank requirements this can be achieved via 'Automatic Configuration' using contactors and switches, or 'Manual Configuration' by adjusting copper linking bars.

- **Star or Delta**
- **Star or Delta and Single Phase**
- **DC loadbanks – Series or Parallel**

Refer to Loadbank Wiring Diagram and/or diagram in the connection area for details.

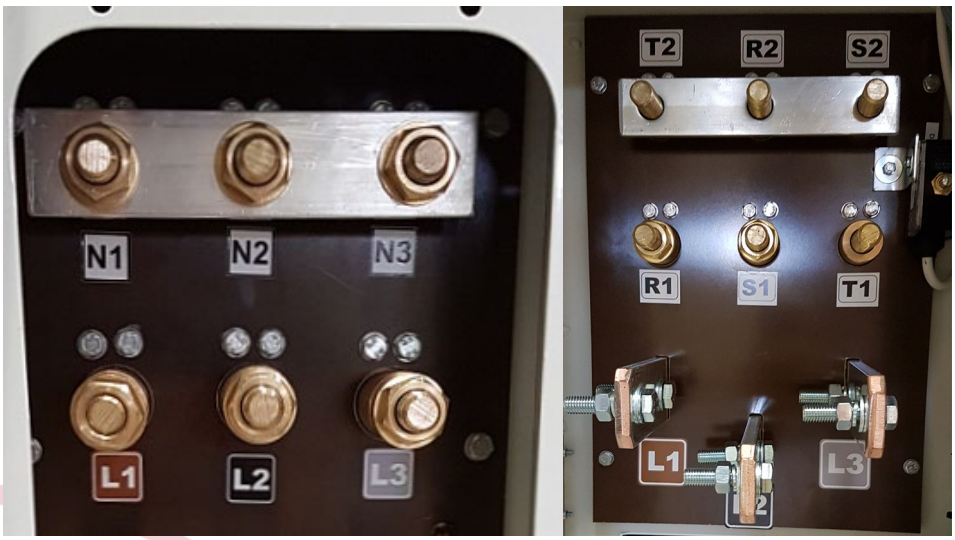


Figure 15- Star/Delta Manual Configuration

3.5 Auxiliary Supply

The majority of Crestchic's loadbanks have the facility for connecting a separate auxiliary supply for the control system and the cooling fans as an alternative to operating on the test supply. Crestchic recommend that where possible the auxiliary supply is used, especially when testing unproven or erratic generators which could potentially damage the loadbank.

NOTE: DC Loadbanks can only be operated via an auxiliary supply.

To power the loadbank from the auxiliary supply select "External" on the Control Supply Switch (SW1)

This is the most suitable option to maintain the control/fan (s) supply if the test supply should fail. If testing on a new unproven generator for the first time, then it is highly recommended that a stable auxiliary supply is utilised. An erratic generator (voltage/frequency hunting) may damage the loadbank.

The rating of the auxiliary supply may be different from the test supply, and for ≤300kW loadbanks is usually 1-phase supply. *Always refer the Rating Plate or Wiring Diagram for auxiliary power supply requirements before use.*

As an optional requirement loadbanks can be fitted with a secondary Control s Supply Selector Switch (SW2) that allows the loadbank to be supplied from different ranges of voltage supplies. This must be configured to the appropriate supply that is being fed, either Internal or External, for the control circuitry.

NOTE: If the control of the loadbank control supply (derived from a 3-phase supply, either internal or external) voltage falls below 340V while under load the cooling fan(s) will stop, resulting in the load being dropped.

3.6 Utility Supply (Heating, Lighting and Socket)

A single phase inlet socket or terminals **may** be provided for internal lighting and anti-condensation heating. This circuit also powers consumer sockets if fitted to the loadbank. These features are usually reserved for containerised loadbanks or as an additional extra depending on customer requirements.

The details of this supply if fitted can be found on the loadbanks rating plate.

In containerised loadbanks this supply is fitted with an 30mA Type A RCD for protection of the lighting circuit and consumer socket.

If provided this circuit should remain live whenever possible, to prevent condensation build-up inside the load module and the micro control chamber. If this is not connected the control supply is used to prevent condensation in the micro control chamber when the loadbank is switched on.

WARNING: The single phase Utility Supply for the internal lighting and heating, if connected is not affected by the Emergency Stop.

4 Start-up Procedure

1. Ensure that all covers are fixed, and all doors are closed before applying power to the loadbank.

2. Ensure that all air inlets and outlets are unobstructed and free from debris and or protective covers.

3. Ensure that the relevant control system is connected (controller and extension leads/reels), and if applicable the control mode required is selected on Multiple Modes - Mode Selection Switch (SW10).

4. If applicable, Select the appropriate supply voltage for the control system using Control Voltage Supply Selector Switch (SW2) if present. Switch must be configured to the appropriate range of the supply that is being fed either, Internal or External, for the control circuitry.

   Eg.1 For 480V test supply – no auxiliary, select the following: -
   SW1 = Internal SW2 = 440-480V
   Eg.2 For 480V test supply – 380V auxiliary supply, select the following: -
   SW1 = External SW2 = 380V-440V

5. Select 'Internal' or 'External' auxiliary supply as required using Control Supply Switch (SW1) on the control fascia.
   a. Internal – control supply taken from the test supply
   b. External – control supply taken from the separate auxiliary supply. Recommended.

6. This equipment is fitted with an 'Emergency Stop' if pressed this will shed all load and stop the movement of the fan(s). Ensure that the fault/hazard has been cleared before resetting the Emergency Stop.

WARNING: The Emergency Stop does not isolate the Test Supply or the Auxiliary Supply; this must be done at source.

7. The equipment is now ready for use.

8. Switch on the Auxiliary Supply if one is to be used. Ensure that the control supply is stable if using a generator supply.

9. Switch on the test supply. Ensure that the control supply is stable.

10. Fan Start
    - MCS - NOVA Loadbanks – The loadbank fan(s) will be started via the software.
    - KCS / Toggle Switch Loadbanks – Press the *Figure 16*- Start-Stop Button to start the cooling fan(s).
    - Trakker/Baseload/Regen - The loadbank fan(s) will start when load is required.
    - Wire to Terminals (WTT) - The loadbank fan(s) will start upon customer activation.

11. If the fan(s) fail to start, see *Troubleshooting & Fault Finding*

12. Once the fan(s) have started check that the airflow is normal and forced away from the fans and through the elements. If the loadbank is incorrectly installed or modification made so that fan(s) operate in reverse direction, and load is applied this can potentially result in a serious failure of the equipment.

13. The loadbank can now be used to apply load following the appropriate *Control Systems instructions.*

WARNING: The loadbank produces a hot exhaust gas approximately 200°C (400°F) above ambient temperature at the outlet grilles.

14. Avoid contact with the outlet grille during test and a period afterwards as this becomes very hot during operation and may result in serious burns.

15. During Operation of the loadbank we recommend that all procedures outlined in the *Safety Chapter* are followed.

16. At the end of a test the load must be set to zero and the loadbank fan(s) left running for a minimum of 5 minutes to cool the resistive elements.

17. The number of starts per hour of the fan(s) should be limited to ten to avoid overheating.

Figure 16- Start-Stop Button

5 Shutdown Procedure

At the end of a test the load must be set to zero and the loadbank fan(s) left running for a minimum of 5 minutes to cool the resistive elements. At this point, the Stop Button can be actuated or the loadbank can be shutdown.

Avoid contact with the outlet grille during the shutdown period and afterwards as the outlet grille becomes very hot during operation and may result in serious burns.

NOTE: In the event of a stop-start test sequences. The number of starts per hour of the fan(s) should be limited to ten to avoid overheating fan motors.

5.1 MCS Loadbanks

The software controls the shutdown process. When all load testing has been completed and no load is applied, the button can then be used to initiate the loadbank shutdown sequence.

Once this sequence commences the fans will run for up to 240 seconds to ensure the loadbank elements are at a sufficiently low temperature before the cooling fans are stopped and the loadbank power is removed.

5.2 Rundown Timer

This is an Optional Feature. If fitted the Rundown Timer will handle the shutdown procedure and switch off the mains power to your unit after a pre-set period. This timer can be used to provide a safety feature should the unit be accidentally left on.
Refer to Loadbank Wiring Diagram or Specifications for details.

6 Emergency Stop & System Stop

The Emergency Stop is a highly visible button designed to shutdown operation in emergencies.

The Emergency Stop should not be used for shutdown as repeated operation on full load can be detrimental to the loadbank. Activating the E-stop on the loadbank may impact the source generator under test.

Crestchic's loadbanks are Stop Category 0. Load will be dropped immediately, but fans are subject to an uncontrolled stop and will continue to rotate for a brief period.

WARNING: **The Emergency Stop (E-STOP) will stop the movement of all fan(s) and remove load from the loadbank. It does not isolate any equipment, remove the supply, or remove the risk of electric shock. Ensure that the fault/hazard has been cleared before resetting the Emergency Stop.**

When the Emergency Stop is reset most control systems will have to be restarted before load can be applied.

The exceptions to this are:

- Automatic Control Systems *(Baseload, Regen, Trakker II)* where the control system will look for load requirement before restarting.
- *Remote WTT – Wired To* Terminals, where fans and load will be applied immediately if any of the customer load enable signals are still energised. It is recommended that any of these switches/signals are reset to zero before releasing the Emergency Stop.

There is the optional facility to add terminals **E1**&**E2** for the addition of a remote NC E-STOP. See **Error! Reference source not found.** for further details.

NOTE: **The single phase Utility Supply for the internal lighting and heating, if connected is not affected by the Emergency Stop.**

6.1 System Stop (MCS Loadbanks Only)

System Stop is provided for use when operating multiple loadbanks in a network and is fitted to MCS Loadbanks that have facility for *Multiple Loadbank Operation*. If an Emergency Stop command on any loadbank is detected the System Stop will pass the command to all loadbanks on the network. This will remove all load and stop all fans.

WARNING: **The Emergency Stop (E-STOP) will stop the movement of all fan(s) and remove load from the Loadbank. It does not isolate any equipment, remove the supply, or remove the risk of electric shock. Ensure that the fault/hazard has been cleared before resetting the Emergency Stop.**

All loadbanks within a System Stop Network are to be on control supply from the same source. Loss of control power supply will disable operation of that loadbank, but it will not interfere with any other loadbanks. System Stop commands will still be passed on the connected network.

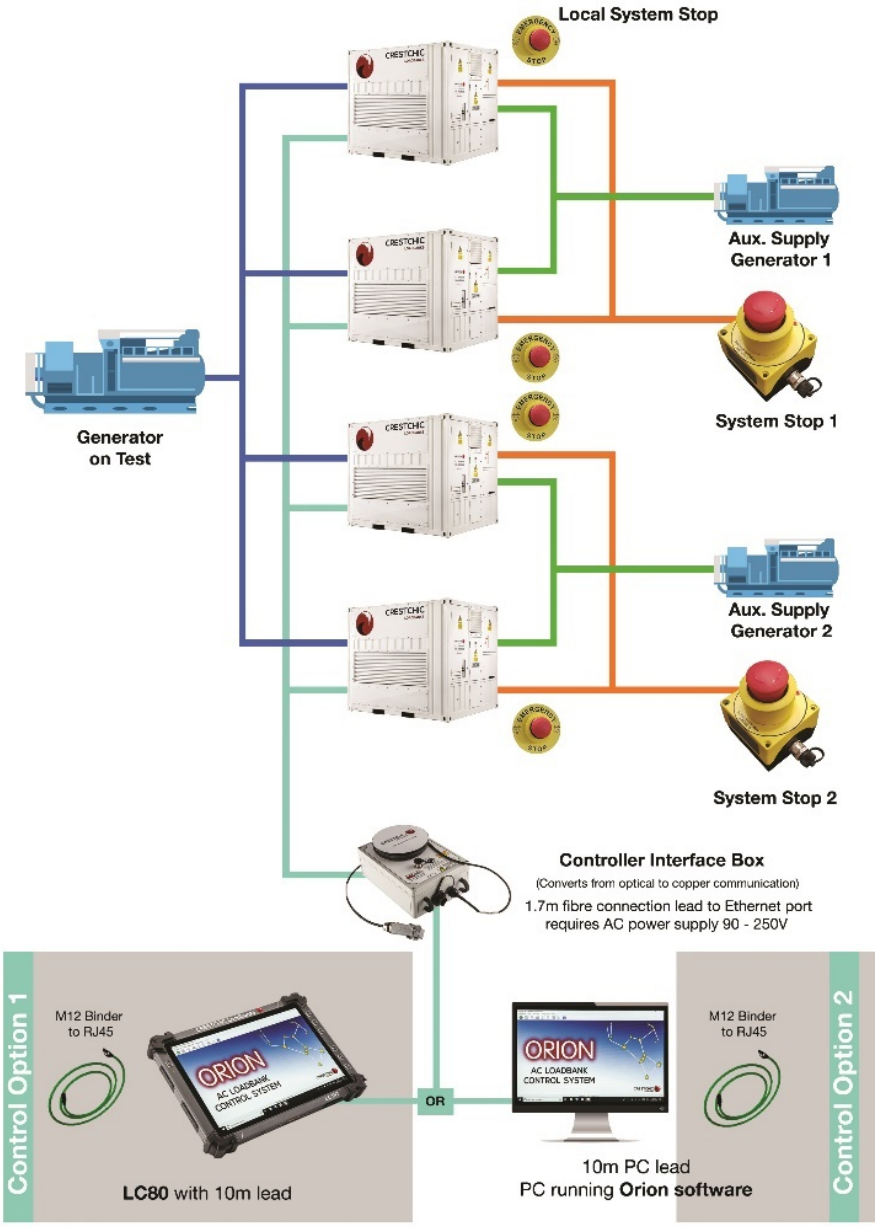


Figure 17- System Stop Network

Figure 18- System Stop Facia

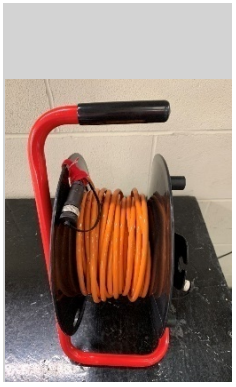


Figure 19- System Stop Cable

If a multiple loadbanks are to be used in a network connect the SYSTEM STOP control cables in cascade i.e. from 'SYSTEM STOP IP/OP' on the first unit to 'SYSTEM STOP IP/OP' on the second unit. The SYSTEM STOP IP/OP port may also be used for a remote System Stop which can be provided as an optional extra

7 Control Systems

The loadbank must be operated only by personnel adequately experienced in the operation of the power source(s) being connected to it.

7.1 Remote WTT – Wired To Terminals

This control option allows operation of the loadbank using the customers own control system. All functional controls and signals can be wired out to terminals for the customer to connect to. Terminals provided will be DIN rail mounted SAK4 or similar.

For location of Customer Terminals please *refer to General Arrangement drawings specific to your loadbank.*

For canopy loadbanks terminals are usually located within the Gland Box if present on the loadbank. On Containers <20ft control terminals are usually located behind the door to the right of the cable entry.

Figure 20- Terminals Location

On Containers >20ft terminals are usually located in the cupboard to the left hand side of the entry door. Access can be via the recess control pocket, or via the gland plate at floor level if fitted.
Refer to General Arrangement drawings specific to your loadbank.

Connect the control system to the terminals using a cable suitable for local regulations, site conditions and control requirements. In most circumstances Crestchic recommends the use of CY cable. For the functions of different terminals and their ID r*efer to 'Loadbank Wiring Diagrams'*

Note: **If a fault condition occurs or the loadbank is shutdown without re-initialising the external control system, then if any of the load energisation contacts remain closed and the loadbank is powered up, the load will be applied immediately.**

If the equipment being tested fails, and this is providing the power for the control system, then the cooling fans will stop. Whilst this is not dangerous on an occasional basis, it is to be avoided if there is the possibility of the power source under test repeatedly shutting down. In these circumstances an external auxiliary supply should be used for the control system, to keep the fans running and prevent unnecessary thermal stressing of the loadbank resistive elements and fans.

7.1.1 Remote Emergency Stop Terminals

Terminals **E1** and **E2** can be provided for the provision of a remote Normally Closed (NC) Emergency Stop function if this is required. Note that this circuit carries 230V 50/60Hz AC. These terminals must be linked-out (short circuit) if this facility is not utilized.

7.1.2 Remote Fan Start and Load Step Terminals

Crestchic's standard control voltage is 220-240V 50/60Hz, and the loadbank can be used to power the control system. In this case Terminal **LSL** is control live and can be used if the control signals are provided as Volt-Free. Link terminal **LSZ** to terminal **LSN** and utilize terminal **LSL** as live. **LSN** is the loadbanks control circuit neutral. **LSZ** is used to allow provision of a separate control supply.

NOTE: **If a separate customer provided supply is used then terminals LSL and LSL must NOT be used. Switch between each load step terminal and LSZ using an appropriately rated control supply.**

Terminals can be provided to remote start fans. This will be marked **FS**. To start fans switch (close circuit) between **LSL** and **FS**. Rundown timers can be provided to timeout the fan.

Loadbanks with this design should display Automatic Start-Up Mechanism warnings locally.

To control each contactor switch (close circuit) between **LSL** and **LSR#/LSX#.** Specific load step resolutions can be requested at time of order. The load may be removed by switching the relevant signal(s) off. *For further details refer to 'Loadbank Wiring Diagram' and see example below Table 4 - WTT Example of Contactor Load Steps and Ratings.*

Power	Contactor	Terminal
1kW	CR0	LSR0
2kW	CR1	LSR1
3kW	CR2	LSR2
4kW	CR3	LSR3
1.98kVAr	CX0	LSX0
3.96kVAr	CX1	LSX1
7.92kVAr	CX2	LSX2
etc	etc	etc

Table 4 - WTT Example of Contactor Load Steps and Ratings

7.1.3 Signal and Indication Volt Free Contacts

Volt free contacts can be provided to output signals from the loadbank to the customer control system. Depending on the signal provided these can be Single-Pole, Single-Throw SPST or Single-Pole, Double-Throw SPDT and will switch on change of loadbank state. The switching capacity of the contacts will be marked on the wiring diagram. *For further details refer to 'Loadbank Wiring Diagrams'.*

Volt free signals can be requested to provide indication of:

Indication	Meaning
Load Permit	The loadbank is ready to accept load
Emergency Stop Status	Position of local emergency stop
General Fault	The loadbank has a fault which needs investigating
Cooling Fault	The loadbank is overtemperature, or insufficient airflow.
Phase Sequence Fault	Three phase auxiliary supply faults.
Etc	Other indication available at time of order.

Trakker and other control systems allow the use of Site Load Current. An input for customers CT's is made at terminals **S1**&**S2**.

Provision can be made for remote voltage sensing taken from separate supply provided by the customer. E.g. At generator to counteract voltage drop in supply cables. These terminals are marked **RV1** (phase 1), **RV2** (phase 2), **RV3** (phase 3), **RVN** (neutral).

Select 'Loadbank/Internal' or 'Remote Sensing/External' for voltage sensing as required on the control facia (SW3).

7.2 Toggle, Selector Switches& Pushbuttons

Provision can be made so that load can be applied using ON-OFF switches or buttons.
These can be located on the loadbank facia, or remotely

The size of each load step is specified at the time of ordering and will be clearly displayed on the Facia and in the Wiring Diagram for the loadbank.

Figure 21 - Toggle, Selector & Pushbutton Facia

For operation select Control Supply and Start Fans using facia controls. If fans fail to start refer to *Troubleshooting & Fault Finding* and the *Wiring Diagram specific to your loadbank.*

WARNING: If the loadbank is shutdown or a fault condition occurs or without resetting the switches to OFF, then load energisation contacts remain closed. If the loadbank is powered up the load will be applied immediately.

- Once the fans are started, load can be applied using ON-OFF switches.
- Select the kW required by selecting appropriate switches to “On”. Each switch selected to “On” will apply a specific load. *Please refer to Wiring Diagram specific to your loadbank.*
- The load may be removed by switching to “Off”.

See *Shutdown Procedure* when load testing is finished.

7.3 KCS100

This is the most commonly utilised of our available control systems, it is a manually operated PCB mounted system and is used on single voltage Loadbanks where accurate local or remote manual control is required. Consisting of decoder and driver cards mounted within the Loadbank, the system can be supplied in 4 configurations each allowing loads to be selected with 1kW switching resolution.

Once a load has been applied it can be increased or decreased in kW increments using the indexing selector switch, this is achieved by dialling in the new load requirement and using the enter button. A 'Clear' button allows all load to be removed in a single step at any time.

Figure 22- KCS

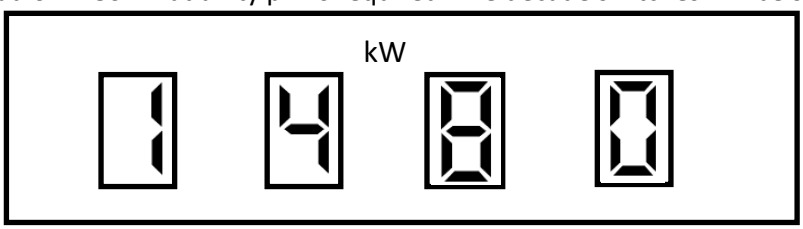
All control signals between the control terminal and the Loadbank are carried out at 12V

7.3.1 Resistive Only Loadbanks

Select the kW required on the indexing switches and press the 'Enter' button to apply the load. The next load step may be selected but will not be applied until the 'Enter' button is pressed again.

The load may be removed at any time by pressing the 'Clear' button.

e.g. A load of 1480kW at unity p.f. is required. The decade switches will be set as below:

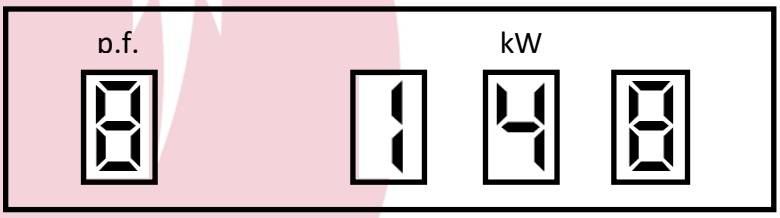


7.3.2 Resistive Reactive Loadbanks

Select the kW and power factor required on the indexing switches and press the 'Enter' button to apply the load. The next load step may be selected but will not be applied until the 'Enter' button is pressed again.

The first digit here is the power factor. 1 represents unity p.f. and 8 represents 0.8 p.f.
The three remaining switches are the load. This value is multiplied by 10.
The load may be removed at any time by pressing the 'Clear' button.

e.g. A load of 1480kW at 0.8 p.f. is required. The decade switches will be set as below:

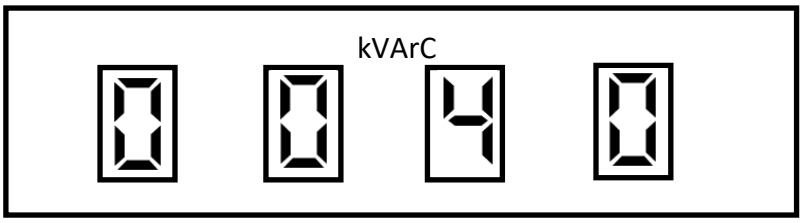


7.3.3 Capacitive Loadbanks

WARNING: This controller is to be used with Capacitive loadbanks only.

Select the kVArC required on the indexing switches and press the 'Enter' button to apply the load.

e.g. A load of 40kVArC is required. The decade switches will be set as below:



The next load step may be dialled in but will not be applied until the previous load has been removed and a time of nominally 50 seconds as elapsed to discharge the capacitors. The 'Capacitors Discharging Please Wait Until the Light Is Extinguished Before Applying Next Load' indicator will illuminate until the time has elapsed. If the 'Enter' button is pressed while the lamp is illuminated the load will be applied immediately after the discharge time has elapsed.

The load may be removed at any time by pressing the 'Clear' button.

7.3.4 H – Handheld

This is a handheld remote terminal and is supplied with 10 metres of screened control cable (extension cables available up to 100m).

Check that the decade switches on the remote controller are all set to zero.

Connect the controller unit to the control-input socket mounted on the load module facia of the master unit, this is marked 'Control I/P'. In some cases, this may be via an extension reel. Ensure that the cables are in good condition. A damaged cable or plug may lead to failure of the loadbank.

7.3.5 L- local (Loadbank mounted)

With the same functionality as the KCS100H but is locally mounted on the Loadbank facia.

The indexing switched will be mounted on the facia or the side of the loadbank. Ensure the protective cover is tightened down when the loadbank is not in use.

7.3.6 R – Remote (Remote panel mounted)

The control terminal can be designed for flush mounting on a customer's generator control panel or wall mounting box. *See General Arrangement CL8019*

Connect the remote panel mounted controller terminals to the corresponding loadbank terminals e.g.T1 to T1, T18 to T18 etc See Wiring Diagram CL7107

7.3.7 D - Mains Failure (Remote with Mains Failure Input, panel mounted)

This is the same as the KCS100R but fitted with the facility to switch load to zero upon receipt of a mains failure signal from customers system, this designed to prevent possible overloading when automatic changeover switch operates.

Connect the remote panel mounted controller terminals to the corresponding loadbank terminals.

e.g. T1 to T1 up to T18 to T18

Connect the mains failure input customer Volt Free NO Signal (close upon mains failure) to terminals T19 and T20 at the controller.

7.3.8 Extendable & Non-Extendable

This optional feature when fitted allows two or more similarly equipped Loadbanks to operate together as a single load under the control of one of the control terminals, the ability to offer 1kW resolution is retained.

If slave units are to be used, connect their control cables in cascade i.e. from the 'Control O/P' socket on the master unit to the 'Control I/P' socket on the first slave unit and so on until all slave units are connected – This only requires one controller.

If the unit is to be used 'Stand Alone', the 'Control O/P' socket is not used.

7.3.8.1 Follow & Overflow Mode

Selection is made on the unit using the local Key Switch if this option is selected.

7.3.8.2 Follow

The load entered on the controller is applied equally on each loadbank in the chain.

7.3.8.3 Overflow

The load is applied to the first loadbank and then passed onto the next unit in the chain.

kW Input Signal	Load Applied by this Loadbank	Load Signal to next Loadbank
From previous unit in the chain, or from Main KCS Controller	kW input signal or maximum load available if loadbank capacity is lower than input signal.	**Follow Mode =** kW Input Signal
		Overflow Mode = kW input signal -Applied load

Table 5 - KCS Follow & Overflow Modes

7.4 Trakker II

Trakker II – The control system is designed to monitor the load on an engine and detect when it falls below a pre-set minimum value. At this point it will subsequently apply load to bring the total load on the engine above its pre-set minimum.

Trakker loadbanks require an external (customer supplied) CT and a signal with a 5A secondary connected to terminals **S1** and **S2** installed on the L1 phase. Connect the Mains Failure relay to terminals **TA** and **TB**. If MFR is not fitted these terminals must be linked out.

Customer Terminals are usually located within the Gland Box if present on the unit. *For location of Customer Terminals please refer to General Arrangement drawings specific to your loadbank.*

Ensure the correct orientation of the CT being installed and connection of S1 to S2 to the loadbank for correct operation of the loadbank. Failure to do so can result in all the load being applied and not removed.

Ensure that the cabling between the CT and the loadbank is of suitable diameter to minimise volt-drop and is adequately mechanically protected. Never operate the loadbank system with Open Circuit CT's.

For positioning of the CT please *see CL8060 or CL9622*

This control system allows automatic/remote start-up, ensure that adequate warning signs are displayed, and the area is cordoned off from personnel.

Loadbanks with this design should display Automatic Start-Up Mechanism warnings locally.

For further details please refer to the *Trakker II User Manual.*

WARNING: Never operate the loadbank system with Open Circuit CT's.

Figure 23- Trakker II

7.5 Baseload (Minimum load on a Generator)

The control system is designed to monitor the load on an engine and detect when it falls below a pre-set minimum value. At this point it will subsequently apply load depending on configuration of up to 16 equal load steps to bring the total load on the engine above its pre-set minimum.

Customer to have provided information to Crestchic at time of ordering for programming the Baseload module – Current Transformer (CT) primary rating – Secondary to be 5A, and the Load Call Level, the load to be maintained on the generator. These values are factory set – should the requirement change on site (CT value or alternative call level) then the loadbank PCB will require returning to Crestchic for modification.

Baseload loadbanks require an external (customer supplied) CT signal connected to terminals **S1** and **S2** installed on the L1 phase. Customer Terminals are usually located within the Gland Box if present on the unit. *For location of Customer Terminals please refer to General Arrangement drawings specific to your loadbank.*

Ensure the correct orientation of the CT being installed and connection of S1 to S2 to the loadbank for correct operation of the loadbank. Failure to do so can result in all the load being applied and not removed.

Ensure that the cabling between the CT and the loadbank is of suitable diameter to minimise volt-drop and is adequately mechanically protected. Never operate the loadbank system with Open Circuit CT's.

Baseload - For positioning of the CT please *see CL9622*

This control system allows automatic/remote start-up, ensure that adequate warning signs are displayed, and the area is cordoned off from personnel.

Loadbanks with this design should display Automatic Start-Up Mechanism warnings locally.

Example of operation

- 200kW loadbank switched in 4 equal load steps of 50kW connected to a 528kW generator with a pre-set level (Load Call Level) of 330kW, if the service load falls below 329kW, a single step of 50kW will be applied.
- This will bring the total load on the generator to 379kW. If the site load should now increase, bringing the site load to 404kW (329kW + 150% of one 50kW step), the 50kW load will now be removed, reducing the load to 354kW.
- Should the service load again decrease the 50kW load will be reconnected if it falls below 329kW. If a single step of 50kW is insufficient to bring the load above the minimum pre-set level, the second and any subsequent load steps will be added in approximate 1 second intervals, if there is a rapid decrease. In each case the steps will be removed in 100mS intervals, when the load rises above 404kW.
- Upon applying the first load step the loadbank cooling fan(s) will energise. Upon the service load being above the required minimum load and a cool down period of approximately 5 minutes the fan(s) will stop and await the next call.

7.6 Regen

The control system is designed to monitor the load on an engine and detect when it falls below a pre-set minimum value to reduce the risk of applying regenerative power going back to the generator i.e. when a crane is lowering. At this point the loadbank will subsequently apply load depending on configuration of up to 16 equal load steps to bring the total load on the engine above its pre-set minimum.

Customer to have provided information to Crestchic at time of ordering for programming the Regen module – Current Transformer (CT) primary rating – Secondary to be 5A, and the Load Call Level, the load to be maintained on the generator. These values are factory set – should the requirement change on site (CT value or alternative call level) then the loadbank PCB will require returning to Crestchic for modification.

Regen loadbanks require an external (customer supplied) CT signal connected to terminals **S1** and **S2** installed on the L1 phase. Customer Terminals are usually located within the Gland Box if present on the unit. *For location of Customer Terminals please refer to General Arrangement drawings specific to your loadbank.*

Ensure the correct orientation of the CT being installed and connection of S1 to S2 to the loadbank for correct operation of the loadbank. Failure to do so can result in all the load being applied and not removed.

Ensure that the cabling between the CT and the loadbank is of suitable diameter to minimise volt-drop and is adequately mechanically protected. Never operate the loadbank system with Open Circuit CT's.

Regen – For positioning of the CT please *see CL8060*

This control system allows automatic/remote start-up, ensure that adequate warning signs are displayed, and the area is cordoned off from personnel.

Loadbanks with this design should display Automatic Start-Up Mechanism warnings locally.

Example of operation

- 200kW loadbank switched in 4 equal load steps of 50kW connected to a 528kW generator with a pre-set level (Load Call Level) of 50kW, if the service load falls below 50kW, a single step of 50kW will be applied.
- This will bring the total load on the generator to 100kW. If the site load should now increase, bringing the site load to 125kW (50kW + 150% of one 50kW step), the 50kW load will now be removed, reducing the load to 75kW.
- Should the service load again decrease the 50kW load will be reconnected if it falls below 50kW. If a single step of 50kW is insufficient to bring the load above the minimum pre-set level, the second and any subsequent load steps will be added in approximate 1 second intervals, if there is a rapid decrease. In each case the steps will be removed in 100mS intervals, when the load rises above 75kW.
- Upon applying the first load step the loadbank cooling fan(s) will energise. Upon the service load being above the required minimum load and a cool down period of approximately 5 minutes the fan(s) will stop and await the next call.

7.7 Micro Control System (MCS)

7.7.1 NOVA – Orion Software

Orion is the latest control technology used by Crestchic's range of AC loadbanks. When operating a single NOVA loadbank the *LC80 Handheld Controller* or PC that will be used as the controller can be connected, via the FMC1 media convertor module, to any of the fibre connectors on the loadbanks fascia. This can be done either directly or using a number of extension reels and distribution hubs. With multiple loadbanks, these can be linked in either "daisy-chain" or "star" layout.

Refer to Orion User Manual for Further Details

Figure 24- FMC1 Media Converter

Figure 25- FDH1/2 Distribution Hub

Figure 26- NOVA SYSTEM PCB's

7.7.2 DC Loadbanks – Corona & Fusion Software

The Corona Software is used to control Crestchic DC loadbanks from a PC or LC80 controller.

The Fusion Software provides Crestchic DC loadbanks with the facility to perform constant-current or constant-power battery discharge tests. It can provide automatic termination of discharge test after a specified elapsed time and/or at a specified minimum voltage

Refer to Corona User Manual or Fusion User Manual for Further Details

7.7.3 LC80 Handheld Controller

The LC80 is a rugged handheld device to control the loadbank. Crestchic Orion software is preinstalled on the device. *Refer to LC80 User Manual for Further Details*

Figure 27- LC80 Handheld Controller

7.7.4 NOVA - Modbus

When operating in Modbus mode each loadbank becomes a stand-alone Modbus server accepting commands from the customer's Modbus client application program. Using this protocol, the Crestchic loadbanks can be incorporated with other data acquisition and logging equipment to form part of an integrated system, whether in a production test facility or development laboratory environment.

To use Modbus, connect to the RJ45 provided (Subject to specification at time of order) and select this control mode using Multiple Modes - Mode Selection Switch (SW10).

Refer to MCS Modbus Programming Guide

A description of the actual Modbus protocol is beyond the scope of this document. For more information on this visit the www.modbus.org website.

7.7.5 Fibre Optic Communication System

Connect the controller unit (LC80 or PC with loadbank control software installed) through fibre crossover cable to the control socket mounted on the loadbank facia of the unit, this is marked 'FIBRE IP/OP'. In some cases, this may be via an extension plug and socket fibre cable drum up to a maximum of 500m (1600ft) with fibre crossover cable. Ensure that the cables are in good condition. A damaged cable or plug may lead to failure of the loadbank.

Figure 28- Fibre Cable Reel

Figure 29- Fibre Facia

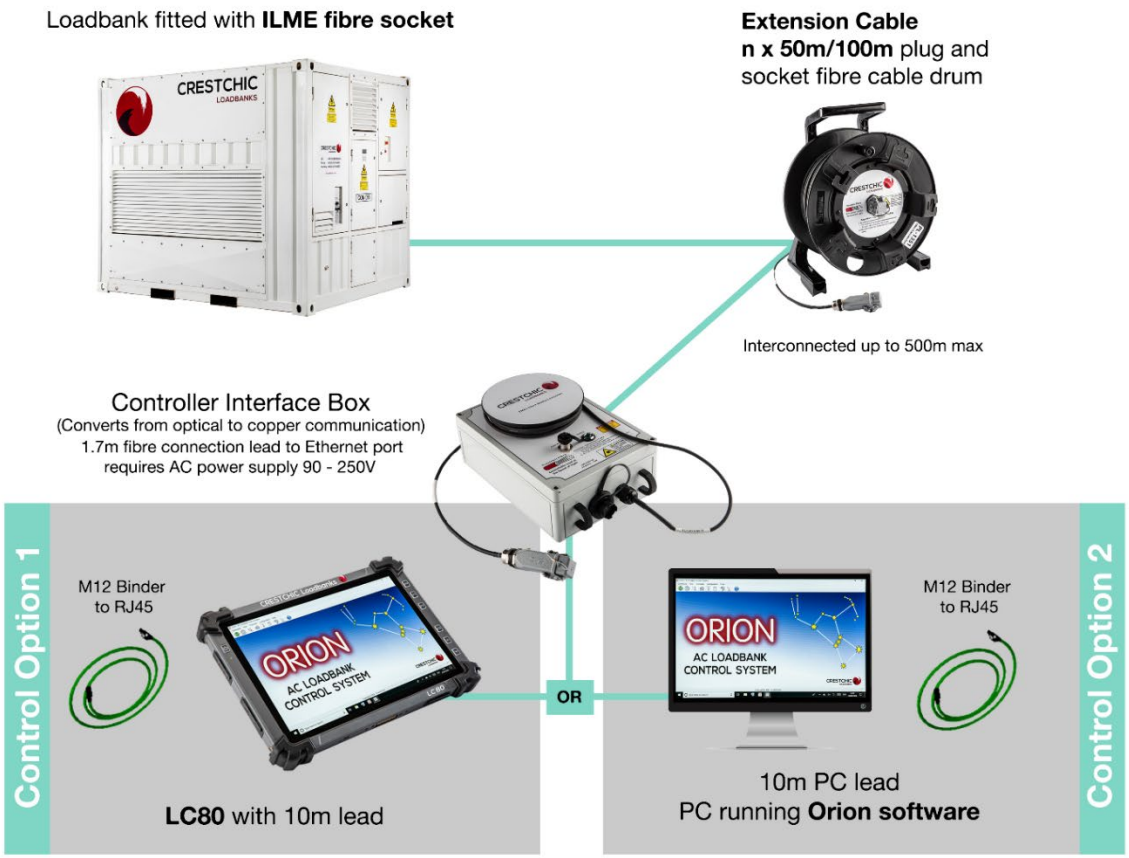


Figure 30- Fibre Connection Sequence

7.8 Remote Panels

Please refer to Wiring Diagram and Specific Guide made available with loadbank. Subject to specification at time of order, remote panels can be made to provide indication of the loadbanks operation and to provide a terminal for control of loadbank function.

Connect the remote panel using a cable suitable for local regulations, site conditions and control requirements. Ensure that the cabling between the remote panel and the loadbank is of suitable diameter to minimise volt-drop and is adequately mechanically protected. In most circumstances Crestchic recommends the use of CY cable.

7.9 Multiple Modes - Mode Selection Switch

If multiple modes of operation have been specified with the Loadbank then a Mode Selection Switch (SW10) will be available to choose the operating mode.

Operating mode should be selected whilst the loadbank is shutdown.

Figure 31- Mode Selection Switch

8 Multiple Loadbank Operation

8.1 Installation Requirements

When installing two or more loadbanks ensure they are sufficiently spaced from each other, so the hot exhaust from one unit does not feed the air intake of another.

The loadbank test supply terminations must not be used as a junction for the supply of other loadbanks. Each loadbank required its own supply from the source.

See *System Stop* for details on Emergency Stop of Multiple Loadbanks.

8.2 Control Cables

If a 'master/slave' configuration is to be used, connect the control cables in cascade i.e. from 'Port B' on the first unit to 'Port A' on the second unit.

It should be noted that for correct operation only one controller should be fitted to a chain of multiple loadbanks, and it is usual for this to be connected to one of the loadbanks at the end of the chain.

If the unit is to be used 'Stand-alone', Inter-module communication ports 'Port A' and 'Port B' are not required and any extend cables should not be connected (If a cable is connected to a slave loadbank that is not in operation, this will cause an error).

8.3 NOVA System - Fibre Control Cables

With multiple loadbanks, these can be linked in either "daisy-chain" or "star" layout. The system extendible to control up to 15 loadbanks with proportional load-sharing.

8.3.1 Daisy Chain

For "daisy-chain" configuration simply connect each loadbank to its neighbour using a 15m fibre crossover cable to form a chain of loadbanks. If the loadbanks are separated by greater distances extension reels can be used to provide the additional cable length. The PC controller can then be plugged into an available fibre socket on any of the loadbanks, via the FMC1 module and any necessary extension reels.

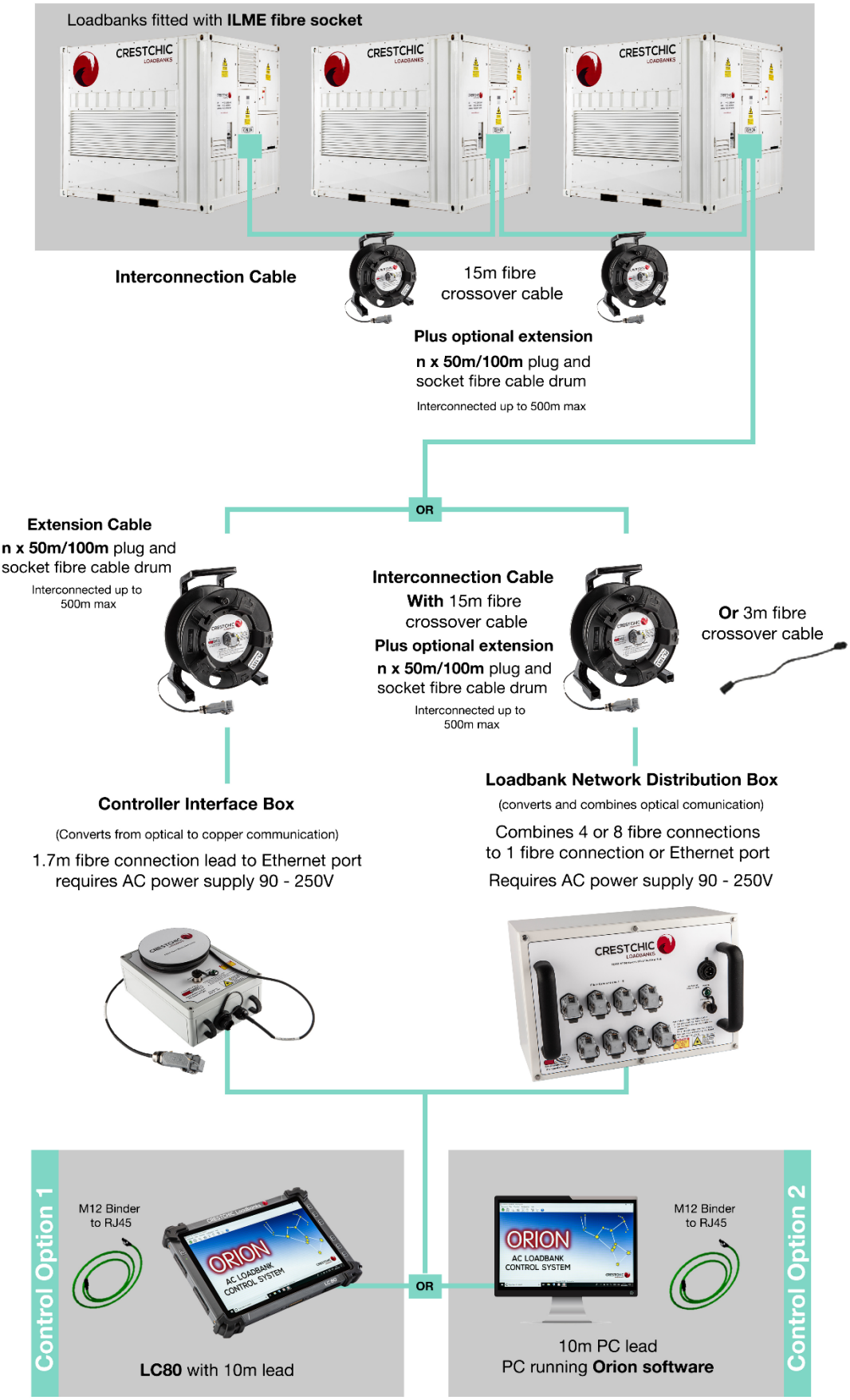


Figure 32- Daisy Chain Communication Layout

8.3.2 Star Layout

In “star” connection mode, each loadbank is connected to a Crestchic FDH1/2 fibre distribution hub using a fibre crossover cable and any required extension reels. In this case, the PC should be then connected to a spare fibre socket on the FDH1/2 module to allow the controller to be sited at a further distance from the FDH1/2 module using extension reels. Alternatively, the PC can be connected directly to the hub module using the standard 5m PC lead.

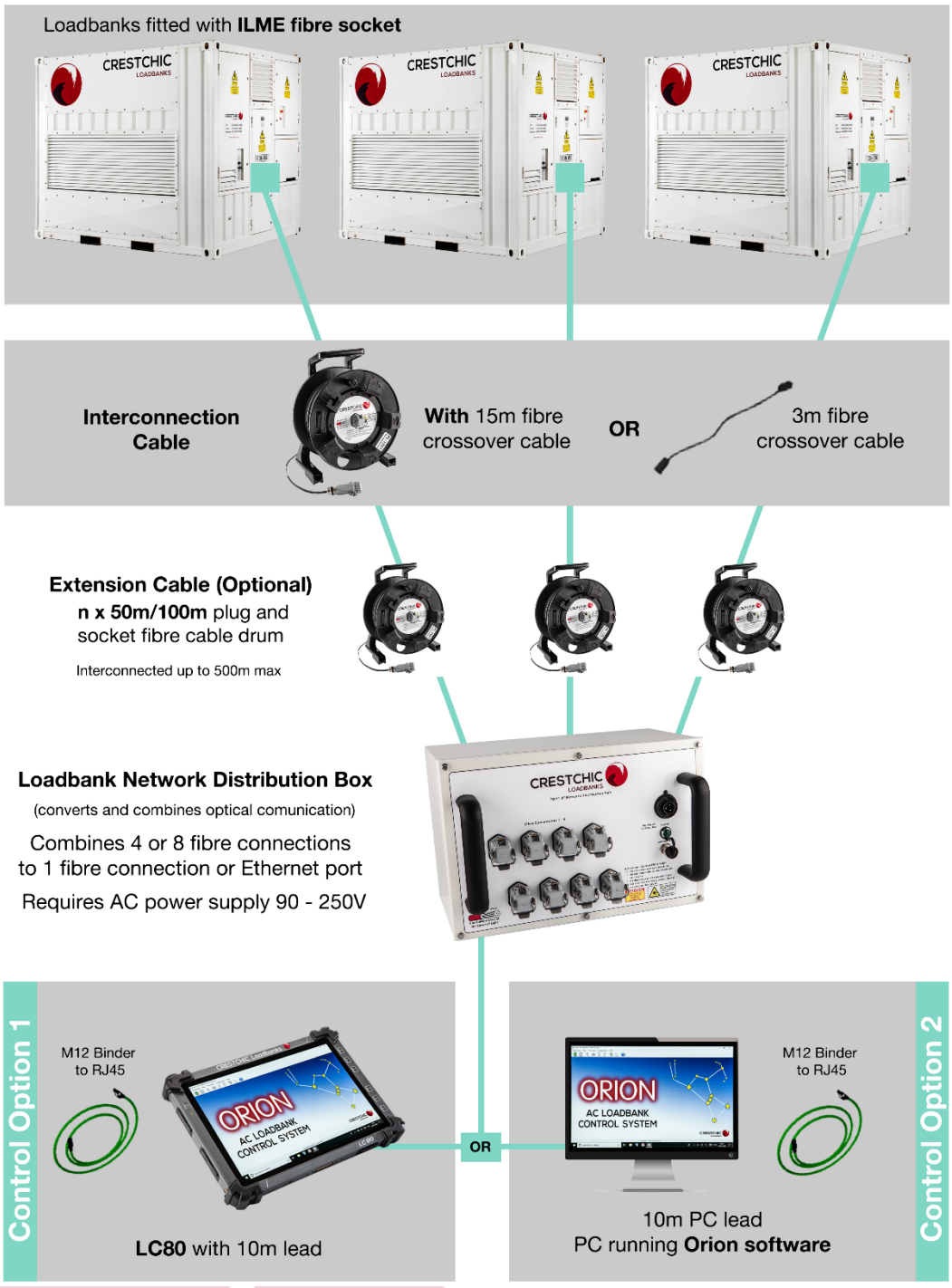


Figure 33- Star Communication System

9 Troubleshooting & Fault Finding

Maintenance should only be carried out with the main power isolated from the loadbank, and only done by competent and qualified service engineers/technicians. Auxiliary power supply may be required to carry out necessary checks. Ensure Wiring Diagrams are available to assist with fault finding.

9.1 Problem - Loadbank control supply not on

Check Blown fuses / Circuit breaker(s) not closed
Action Replace fuse(s) / Close circuit breaker. Repeated fuse blowing or breaker tripping must be investigated further

Check Internal / Off / External switch (SW1) is set to the Off position
Action Set the switch to the Internal or External position as required

Check Control Mode Selection Switch (SW10) is set to the Off or incorrect position
Action Set the switch to the correct position as required

Check Emergency Stop or System Stop actuated
Action Check cause has been cleared. Release the emergency stop

Check Remote Emergency Stop terminals not linked
Action 1 Link-out (short circuit) terminals E1-E2 if no Stop fitted.
Action 2 Fit remote NC E-STOP button wired to terminals E1-E2

9.2 Problem - Fan(s) not running/Fan contactor(s) not energised (Emergency Stop out)

Check If the fan(s) fail to start check the 'Phase sequence incorrect lamp' if present.
Action If this is illuminated, you **MUST** swap over any two phases of the control supply.
Note: If loadbank cooling fan(s) require a three phase supply the loadbank can be fitted with automatic correction of phase rotation on the fan supplies as an optional extra.

Check Fan motor overload tripped
Action Reset fan motor overload. Repeated tripping must be investigated further

Check Check Logo Relay LCD for no display when power is on (if fitted)
Action Check and reset circuit breaker CB10. Repeated tripping must be investigated further. Possible Logo failure – Contact Crestchic

Check Check FSC1 PCB503 / FSC2 PCB504 control boards (if fitted on MCS Loadbank). Check comms cable to FSC2. PCB504CAB
Action If no LED illuminated when 24V supply is available – contact Crestchic

Check If the loadbank control is 3 phase and fan(s) fail to start check the 'Phase sequence incorrect lamp' if fitted.
Action If this is illuminated, you **MUST** swap over any two phases of the supply to control system (Internal = Test Supply or External = Auxiliary Supply)

Check If the loadbank control is 3 phase and fitted with 'Phase sequence incorrect lamp' it could have a PSR Supply problem

Action Refer to **Table 6 - Manual Correction. Phase Failure Relay / Supply Problems**

Check If the loadbank control is 3 phase and fitted with Automatic Correction of Phase Rotation check Phase Sequence Relays - PSR or PSF Supply problem.

Action Refer to **Table 7–Auto Correction Phase Failure Relay /** Supply Problems

Supply Condition	PSR		Action
	Green LED	Red LED	
Normal	On	Off	**No action required**
Under Voltage Condition or phase missing	On	On	**Correct supply voltage, use auxiliary supply or increase cable sizes**
PSR Failure	Off	Off	**Check and replace PSR**
No Supply	**Off**	**Off**	**Check supply at CB64**

Table 6 - Manual Correction. Phase Failure Relay / Supply Problems

Supply Condition	PSR		PSF		Action
	Green LED	Red LED	Green LED	Red LED	
Normal	On	Off	On	Flashing	**No action required**
	On	Flashing	On	Off	
Under Voltage Condition or phase missing	On	On	On	On	**Correct supply voltage, use auxiliary supply or increase cable sizes**
PSR Failure	Off	Off	On	Off	**Check and replace PSR**
PSF Failure	On	Off	Off	Off	**Check and replace PSF**
No Supply	**Off**	**Off**	**Off**	**Off**	**Check supply at CB64**

Table 7–Auto Correction Phase Failure Relay / Supply Problems

Check Loose connection(s)

Action Check and tighten as necessary

Check Fan(s) failure

Action Check and replace if necessary

9.3 Problem – No load applied

Check Load circuit breaker(s) not closed

Action Close circuit breaker(s). Repeated tripping of the circuit breaker must be investigated

Check Loadbank Over Temperature Sensor(s)activated. Activates if 90°C (195°F) is reached and the load will automatically lock out.

Action Check loadbank cooling/airflow for any obstructions.
Standard switch will reset at 75°C (170°F)
Note: Some loadbanks require manual reset of sensor(s) to resume operation.

Check Air-flow paddle not energised. Depending on the size of the loadbank, Air-flow switches may be fitted to detect the fans are running. If an air-flow switch as not activated upon start-up, or should open during operation, the load will be dropped after a 12 second delay to prevent overheating.

Action Check air-flow paddle switch(s) operation and/or air-flow.

Check Loadbank Over Voltage sensor activated (if fitted)

Action Check loadbank test voltage for correct voltage.

Check Reactor Over Temperature sensor activated. If the reactor temperature sensors exceed 150°C (300°F) and the load will automatically lock out.

Action Check loadbank reactor cooling fan(s) for sufficient airflow over reactors. Check filter status and replace if necessary.

Check Check Driver Board PCB501 (MCS NOVA Only)

Action If no POWER LED illuminated when 24V supply is available – contact Crestchic

Check Loose connection(s)

Action Check and tighten as necessary

9.4 Problem - Load step not energised

Check Fuse(s) blown / Circuit breaker(s) not closed

Action Check and replace fuse(s) / Close circuit breaker. Repeated fuse blowing or breaker tripping must be investigated further

Check Contactor(s) failure

Action Check and replace if required

Check Relay Driver board slave relay failure

Action Check and replace as required

Check Loose connection(s)

Action Check and tighten as necessary

9.5 Problem - Load step not providing the rated load

Check Applied voltage is de-rated

Action Check and correct if necessary

Check Fuse(s) blown

Action Check and replace. Repeated fuse blowing must be investigated further

Check Contactor not fully energised

Action Check and replace contactor if necessary

Check Load step resistor element(s) are open-circuit

Action Check and replace as required. *Refer to Loadbank Wiring Diagram for approximate resistance values for each associated step.*

9.6 Problem – Unable to apply required load

Check Voltage applied is different from that programmed in Generator Parameters (MCS control loadbanks only)
Action Set generator parameters according to size of generator under test.
Refer to Orion User Manual

9.7 Problem - Contactor "chattering"

Check Control circuit voltage too low
Action Check control voltage and auxiliary supply and/or test supply

Check Contacts/core dirty or corroded
Action Check and replace contactor if necessary

Check Connection to the contactor coil loose
Action Check and tighten as necessary

9.8 Problem – No communication response

Check Check all control leads
Action Check connection security/lead integrity. If using an extension reel, try plugging the controller directly into the loadbank

Check Check power supply(s)
Action Check power supply(s) for correct DC voltage output

Check Check all ribbon cable connections (KCS)
Action Check connection security/lead integrity

Check Check KCS Systems Board (Fuse/Transformer)
Action Check and replace as required

Check Check MCS NOVA micro control PCB500 (MCS NOVA Only)
Action If POWER LED is illuminated but no display on the display screen – contact Crestchic

Check Check NOVA PCB500 and Media converter. Check CAT6 connection.
Action If POWER LED is illuminated but no display on the display screen – contact Crestchic

Check Check Driver Board PCB501 (MCS NOVA Only)
Action If no POWER LED illuminated when 24V supply is available – contact Crestchic

9.9 Problem - No communication response - fibre system

Check Check power to FMC1 or FDH1 devices
Action System will not operate without power to these devices.

Check Incorrect use of crossover and extension leads between loadbanks and controller.
Action Refer to NOVA *System* - Fibre Control Cables

9.10 Problem - Loadbank error messages (MCS Only)

Check	Error message on controller screen – Supply Voltage too High
Action	Check test supply voltage against specification of loadbank. If test supply voltage is correct – Possible voltage imbalance – Check and replace fuse(s) Possible Transducer failure – contact Crestchic
Check	Error message on controller screen – Supply Voltage too Low
Action 1	Check test supply is switched on.
Action 2	set Int-Ext remote voltage sensing switch (SW3) to Internal position if remote sensing not used.
Action 3	Check and close instrumentation circuit breaker(s) (CB65) Repeated tripping of the circuit breaker must be investigated.
Action 4	If a generator voltage is lower than the rated voltage of the loadbank, example 230V on a 400V loadbank, this can also indicate Supply Voltage too Low.
Action 5	Possible Transducer failure – contact Crestchic
Check	For all other Error messages on controller screen
Action	Refer to the summary of loadbank error messages in the *Orion User Manual*

10 Maintenance

WARNING: Personal injury from electrical shock may result if the power is not isolated before any installation or maintenance. Working with electricity must only be carried out by qualified personnel.

Maintenance work should only be carried out by a competent person, fully aware of the danger involved. General maintenance must be carried out with the test and auxiliary power isolated from the loadbank. More than one disconnect switch may be required to de-energise the equipment before servicing. For fault finding, when a supply is required, then only the auxiliary supply should be connected.

Crestchic's Loadbanks are virtually 'maintenance free' however we do recommend preventative maintenance and safety inspections are required to ensure the continued safe and reliable operation of the unit. The loadbank should be checked every 6 months for tightness of all electrical and mechanical connections, and the load contactors should be checked for wear.

The resistive elements are long life maintenance free items, if an element was to "blow" or become damaged for any reason, obviously this would affect the loading of the electrical supply under test. The element cannot be repaired, and a replacement element would have to be installed, this can be obtained from Crestchic Ltd. (please specify kW rating and voltage engraved on the element).

The cooling fans should be checked for free movement. It is recommended in high humidity/coastal areas that fans are operated regularly for a brief period to ensure contamination is "thrown" from the motor shaft and bearings.

All panel/door seals must be inspected every 6-months to ensure they make a good seal to prevent water or any foreign matter entering the enclosure.

Castors, door hinges and fasteners must be lubricated every 6-months.

All labels should be checked for deterioration and replaced if no longer suitable.

10.1 Replacing Elements

Disconnect the cables or coppers connected to the faulty element termination points. The elements are fitted with two glands at the termination ends which securely hold the element in position, some Loadbanks are fitted with element support hooks and others fitted with `toast racks` to support the other end. Remove the nuts on the glands to free the element. Remove one of the grilles in the element chamber (the nearest to the element) and slide the element out.

10.2 Regular Inspection of Reactor Filters

The reactive loadbank are fitted with air inlet louvres on the reactor fan intake and the reactor side panels, these louvres help to cool the inner chamber of the loadbank. Filters are mounted behind these louvres to prevent the entry of dust, sand, and any foreign particles into the loadbank.

The filters must be inspected monthly or after use especially when operated in a dirty environment or preceding a long duration load test and subsequently changed or cleaned if required to ensure good air flow into the unit. This is to prevent the interior of the container from overheating, particularly the reactors, and failure to regularly monitor these filters may cause the loadbank to shutdown with reactor cooling fault.

Reactor Fan Inlet Filter – Grade 4 (293x293x48mm) – Crestchic Stock Ref. – FAN370

10.3 Replacing Filters

For the Reactor Fan Filter remove the 4 fixing screws (an Earth connection may also be removed to access the filter) for the louver and pull out the filter for inspection / replacement. Ensure the replacement filter is inserted according to the direction arrow on the side.

For the Reactor Side Filters remove the fixings (8 or 10 depending on size) and pull out the louvered panel from the main reactor side panel to access the filter for inspection / replacement. The overall reactor side panel is not required to be removed, just the louvered piece.

10.4 Insulation Resistance

With regard to insulation readings of the loadbank, the minimum recommended constant safe level to use is 1MΩ. Crestchic's loadbanks are an outdoor piece of equipment and therefore depending on the time of year and/or climatic conditions, and moisture over the exposed parts of the loadbank, the insulation reading may be measured below the minimum recommended.

When taking insulation readings, should any instrumentation/transducers be included with the loadbank *(e.g. Energy Meters)* then these should be isolated before an IR test, as damage may be caused to the instruments.

Ensure the equipment to be tested and the work area is safe, the equipment is de-energised and disconnected.

The loadbank should be thoroughly inspected before use, checking resistance levels are in the region of those stated on the electrical drawing. If resistance values are not in the region of the stated values, then further investigation will be required to ascertain potential failed elements.

If element resistance values are not satisfactory, then it is possible to use the loadbank on load for a period to remove any moisture and apply heat to the equipment. It is then advised before any further use; the insulation reading is again checked to ensure the level is above the recommended minimum acceptable value of 1MΩ.

Should the level not be above the recommended minimum value after the period of operation then there is the possibility of an element that is leaking to earth, and each element bank will be required to be individually inspected to identify the section and then removing the copper to identify the specific element.

NOTE: **The element insulation can degrade over a period time, depending on usage or extreme climatic conditions.**

10.5 Torque Settings

To ensure correct tightness of all electrical POWER connections, the torque settings shown in Table 8 - Torque Settings below must be used.

		Steel Fixings		Brass Fixings	
Location	Connections	Torque (Nm.)	Torque (lbf.in)	Torque (Nm.)	Torque (lbf.in)
Busbars& Electrical Connections	M4	**1**	**8.8**		
	M5	**3**	**26.6**		
	M6 Copper	**7.2**	**63.7**		
	M8 Copper	**17**	**150.5**		
	M10 Copper	**28**	**247.8**		
	M12 Copper	**45**	**398.3**	**33**	**292.1**
	M16 Copper	**91**	**805.4**	**74**	**654.9**
Elements ELE###	M4 Elements			**1**	**8.8**
	2BA Elements			**2.5**	**22.1**
	M5 Elements			**3**	**26.6**
	M14 *(Bulkhead)* Nut			**35**	**310**
	3/8" BSP *(Bulkhead)* Nut			**35**	**310**
Elements ELE###Z	M14 *(Bulkhead)* Nut			**24**	**212**
	3/8" BSP *(Bulkhead)* Nut			**24**	**212**
Fuses	Bolt-on fuses M8	**17**	**150.5**		
	32A Fuse Holder	**2**	**17.7**		
	63A Fuse Holder	**3**	**26.6**		
	100A Fuse Holder	**3.5**	**31.0**		
	125A Fuse Holder	**4**	**35.4**		
Siemens MCB	MCCB 3VA Box Terminal	**1.5-16mm^2= 5 25-50mm^2= 8**	**1.5-16mm^2= 44 25-50mm^2= 70**		
	MCCB 3VA51Lug Terminal	**8**	**70**		
	MCCB 3VA52 Lug Terminal	**20**	**177**		
	MCB 5SY4 Range	**2.5-3.0**	**22.1 – 26.6**		
	MCB 5SY6 Range	**2.0 – 2.5**	**17.7 - 22.1**		
Siemens Contactors	S00 Contactor Relay 3RH2	**0.8 - 1.2**	**7.1 – 10.6**		
	S0Contactor 3RT202	**2.0 - 2.5**	**17.7 - 22.1**		
	S2 Contactor 3RT203	**3.0 – 4.5**	**26.6 – 39.8**		
	S3 Contactor 3RT204	**4.5 – 6.0**	**39.8 – 53.1**		
	S6 Contactor 10541-10566	**10.0 - 14.0**	**90.0-124.0**		
	S10 Contactor 10646-10666	**14.0 - 24.0**	**124.0-210.0**		
	S12 Contactor 10756-10766	**14.0 - 24.0**	**124.0-210.0**		
	Contactor A1/A2&NO/NC	**0.8 – 1.2**	**7 - 10**		

Table 8 - Torque Settings

10.6 Routine Checklist

The below checklist is recommended to be carried out at least once a year or after prolonged usage to assist in the safe / reliable running of the loadbank.

Any areas of concern must be acted upon, or risk failure or damage to the loadbank.

LOADBANK SERIAL NUMBER C_____DATE_____ **ENGINEER_____**

CANOPY/CONTAINER EXTERIOR		MECHANICAL CHECKS	
INLET &OUTLET GRILLES ARE CLEAR & INTACT		CHECK ALL BOLTED **CONNECTIONS** FOR TIGHTNESS	
CHECK FOR **RUST** AND **PERFORATIONS**		CHECK ALL **CABLES & CRIMPS** FOR HEAT/WEAR DAMAGE	
CHECK **LIFTING EYES** ARE SECURE		CHECK **CONTACTORS** FOR OPERATION & WEAR	
CHECK **CASTORS** ARE SECURE & FUNCTIONAL		CHECK ALL **ELEMENTS** FOR DAMAGE/SIGNS OF STRESS	
CHECK **EARTH CONNECTION** IS SECURE		CHECK **ELEMENTS AND CLAMPS** FOR SECURITY & RUSTING	
CHECK **DOOR SEALS** ARE PRESENT & FUNCTIONAL		CHECK **ELEMENT COPPERS** FOR TIGHTNESS	
CHECK **EMERGENCY STOP** IS PRESENT & INTACT		CHECK **FANS** FOR SECURITY & CONNECTIONS	
CHECK ALL **SWITCHES/INDICATORS** FUNCTIONAL		CHECK **FAN PADDLES** ARE CLEAN & FUNCTIONAL	
CHECK ALL **LABELS & RATING PLATE** PRESENT		CHECK CORRECT VALUE **FUSES** ARE FITTED	
GREASE **HINGES** WHERE REQUIRED		CHECK **AUX SUPPLY TERMINALS** FOR WEAR/TIGHTNESS	
REPLACE **AIR FILTERS** WHERE REQUIRED		CHECK **EMKA LATCHES** FOR FUNCTION/TIGHTNESS	

ELECTRICAL DEAD CHECKS		INSULATION RESISTANCE	TEST SUPPLY	AUXILIARY SUPPLY
MEASURE AND RECORD **ELEMENT RESISTANCES**		**RECORD IR @**	**V**	**V**
CHECK **CONTINUITY OF FUSES**		NEUTRAL & EARTH	**MΩ**	**MΩ**
CHECK ALL REMOVABLE **PANELS & DOORS EARTHED**		PHASE L1 & EARTH	**MΩ**	**MΩ**
		PHASE L2 & EARTH	**MΩ**	**MΩ**
		PHASE L3 & EARTH	**MΩ**	**MΩ**

ELECTRICAL CHECKS		OTHER CHECKS	
CHECK FUNCTION **INTERNAL/EXTERNAL SWITCH**		CHECK THE **BATTLE LINK** IS NOT FITTED	
CHECK FUNCTION **EMERGENCY STOP**		CHECK **OVER-LOADS** ARE SET CORRECTLY	
CHECK FUNCTION **RUN/COOLING FAULT LAMPS**		CHECK **PHASE ROTATION RELAYS** ARE SET CORRECTLY	
CHECK FUNCTION **RESET BUTTON**		CHECK **HEATER THERMOSTAT** IS SET CORRECTLY	
CHECK FUNCTION OF **LIGHTS AND ANTI-CON HEATER**		CHECK **SOFTWARE VERSION** IS UP TO DATE	
TEST **EXTEND FUNCTION** WHERE FITTED		CHECK **I/O MODULES** ARE UP TO DATE	
CHECK **FANS** FOR OPERATION &**BEARINGS**		CHECK **PCB & PCB CONNECTORS** ARE SECURE	
CHECK **REACTOR TEMPERATURE SENSORS**		**FINAL CHECKS**	
PERFORM **CONTACTOR BIT TEST**		CLEAN INSIDE LOADBANK	
MEASURE AND RECORD **RESISTIVE POWERS**		ALL DOORS/PANELS ARE SHUT AND SECURE	
MEASURE AND RECORD **REACTIVE POWERS**		SWITCHES ARE IN THE SAME POSITION AS FOUND	
CHECK LOADBANK **INSTRUMENTATION** ACCURACY		SERVICED STICKER APPLIED TO LOADBANK	

COMMENTS AND REPORTED FAULTS

Table 9 - Routine Checklist

11 Contact Details

11.1 Head Office & Sales| Warranty

Crestchic Ltd (Sales & General Enquiries)
2nd Avenue, Centrum 100
Burton-on-Trent. DE14 2WF
United Kingdom
Tel: +44 (0) 1283 531 645
Fax: +44 (0) 1283 510 103
Sales Email: sales@crestchic.co.uk
Warranty Email: warranty@crestchic.co.uk

11.2 Service

Crestchic Ltd
3rd Avenue, Centrum 100
Burton-on-Trent. DE14 2WD
United Kingdom
Tel: +44 (0) 1283 531 645 (Option 1, Option 1)
Fax: +44 (0) 1283 540 029
Service Email: service@crestchic.co.uk

12 Service and Spares

With over 35 years of loadbank manufacturing, Crestchic support their loadbanks of varying sizes and age across the world.

Our service contracts help keep your Crestchic Loadbank in peak condition with regular maintenance and software upgrade visits scheduled at your convenience.

Our data module calibration service ensures that the applied electrical load is accurate over a 12-month period, with traceability to UKAS laboratory standards.

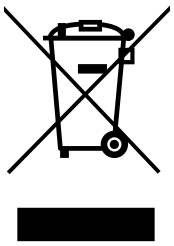
We can also provide:

- Preventative scheduled maintenance
- Priority call outs for contract customers
- Telephone support
- Parts support
- Software support and upgrades
- Major loadbank repair and upgrades
- Data module calibration
- End of life decommissioning

13 Warranty Terms and Claim Form

If you wish to claim on your warranty, please complete the claims form available on our website.
https://crestchicloadbanks.com/wp-content/uploads/2019/02/Warranty_V1.pdf
Crestchic Limited – Warranty Terms are attached.
Warranty Email: warranty@crestchic.co.uk

14 End of Life Product Recycling and Disposal



With proper maintenance Crestchic's loadbanks can be used reliably for many years. We offer a service department who can provide spare parts, maintenance and upgrades for all our loadbanks.

Please contact service@crestchic.co.uk for further details.

If the loadbank is no longer economical to maintain it can be decommissioned for disposal. Crestchic can provide this service if the loadbank is returned to our Head Office in Burton upon Trent and will disassemble the loadbank for correct recycling and disposal.

If you require to dispose of the loadbank locally all the components can be unbolted from the enclosure and separated for recycling.

The main metalwork components of the loadbank are:

- Enclosure: Mild Steel or Stainless Steel.
- Gland Plate: Aluminium.
- Busbar: Tin Plated Copper.

The main electrical components of the loadbank are:

- Elements: Stainless Steel finning surrounding stainless steel tubing filled magnesium oxide and 80/20 nickel chrome resistance wire, and ceramic bushes.
- Reactors: Copper or aluminium wire wound around an iron core and insulating material.
- Cables and electrical connectors.
- Electronic control equipment including; Transformers, Fuses, Contactors, Relays and Switches.
- Printed Circuit Boards.

These devices can be recycled due to their low pollutant content.

It is the responsibility of the loadbank owner to ensure that disposal is carried out in accordance with local regulations. For environmentally friendly recycling and disposal of your electronic waste, please contact a local company certified for the disposal of electronic waste.

15 Certificate of Conformity

CRESTCHIC

EU DECLARATION OF CONFORMITY

PRODUCT

MANUFACTURER

Crestchic Ltd

Second Avenue
Centrum One Hundred
BURTON-ON-TRENT
DE14 2WF

sales@crestchic.co.uk
+44 (0) 1283 531645

www.crestchicloadbanks.com

COUNTRY OF MANUFACTURE United Kingdom

THIS DECLARATION OF CONFORMITY IS ISSUED UNDER THE SOLE RESPONSIBILITY OF THE MANUFACTURER

OBJECT OF THE DECLARATION All containerised and canopy Loadbank types:

Capacitive	D.C
Resistive	Reactive

THE OBJECT OF THE DECLARATION DESCRIBED ABOVE IS IN CONFORMITY WITH THE RELEVANT COMMUNITY HARMONISATION LEGISLATION:

Low Voltage Directive	2014/35/EU
Machinery Directive	2006/42/EC

REFERENCES TO THE RELEVANT STANDARDS USED OR REFERENCES TO THE SPECIFICATIONS IN RELATION TO WHICH CONFORMITY IS DECLARED:

EN 60204-1:2018	EN 60529:1992+A2:2013
EN 61082-1:2015	EN 61439-1&2:2011

BASIS OF SELF ATTESTATION: Quality Assurance to ISO 9001:2015
NQA Registered Firm Certification No: FM 169

ADDITIONAL INFORMATION

SIGNED FOR & ON BEHALF OF: Crestchic Ltd

PLACE AND DATE OF ISSUE BURTON-ON-TRENT, Staffordshire, UK 09 December 2020

NAME & POSITION: Chris Caldwell Manager Director

SIGNATURE

CE

A copy of this declaration accompanies each loadbank for customer retention

Note: Always refer to the applicable Product Legislation for the specific requirements for the Declaration.
If modifications are made to the equipment without prior consultations with us, this declaration becomes invalid.

16 Appendices

16.1 Wiring and GA Diagrams

16.2 Crestchic Control Manuals

16.3 LV ACB

Please note that any ACB fitted are factory set to the maximum current of the loadbank by Crestchic as below. It is the responsibility of the customer to set according to their test parameters and site requirements by competent persons according to local regulation.

Long Time Pickup (Ir)	(Nominal Loadbank current @ design voltage) +5%
Long Time Delay (tr)	2 – 3 Seconds
Short Time Pickup (Isd)	2
Instantaneous Pickup (Ii)	3

16.4 Instrumentation (Power Meter)

Energy meters can be fitted to loadbanks as an optional extra display. These can be used for MODBUS feedback to customer systems if required.

16.5 Other Loadbank Accessories and Option Extra

Test Supply live indication
Auxiliary live indication
Beacons
Lighting
Signals
Trailers
Attenuation

The information given in this literature is, to the best of our knowledge, correct at the time of going to print. However, Crestchic is constantly looking at ways of improving their products and services and therefore reserve the right to change, without prior notice, any
of the data contained in this publication. Any orders placed will be subject to our Standard Conditions of Sale, available on request.

Crestchic is part of the **NBI group** of companies.

www.crestchicloadbanks.com

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CRESTCHIC