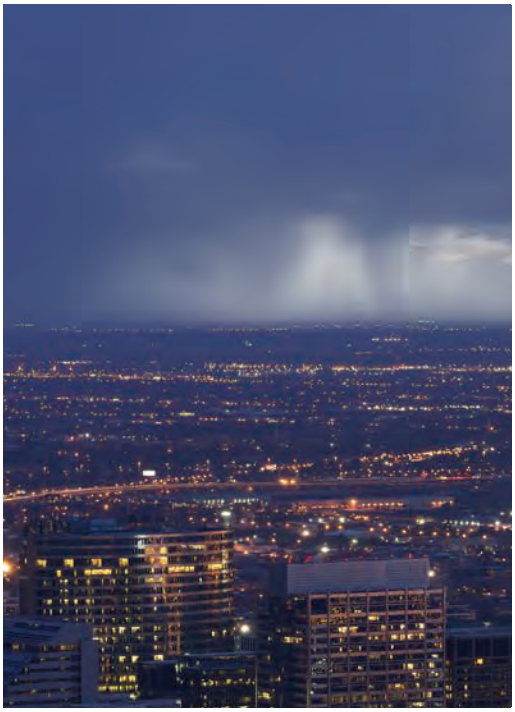
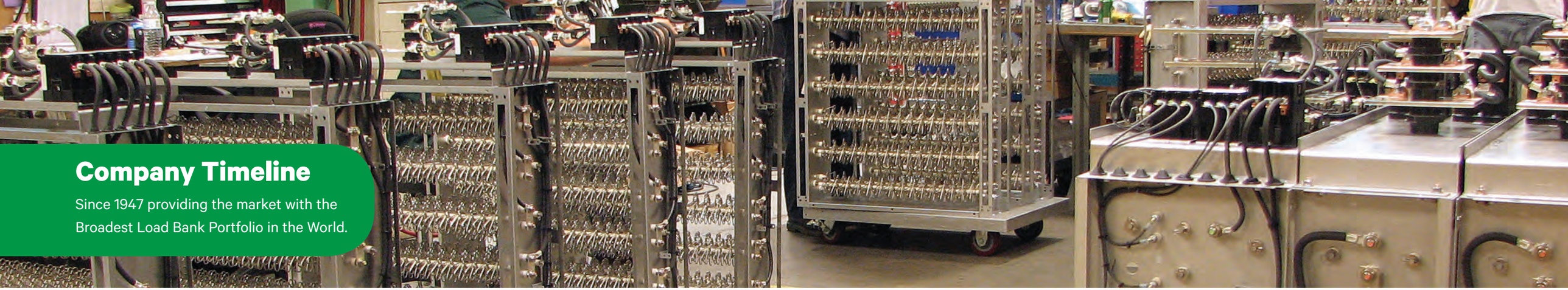
ASCO® LOAD BANKS



AVTRON Froment

ASCO®



Company Timeline

Since 1947 providing the market with the Broadest Load Bank Portfolio in the World.

1947 — Froment founded by N J Froment

1953 — Avtron founded by Dwain Fritz, P.E.

1955 — Avtron begins manufacture of load banks.

1960 — First load bank (250 kW) designed for 400 Hz Jet Aircraft Test Stand

1967 — Developed first multi-voltage (AC & DC), multi-frequency (50, 60, 400 Hz) trailer mounted load bank

1973 — Manufactured first radiator mounted load bank

1979 — Manufactured first high capacity (400 kW) portable load bank

1980 — First high capacity (750 kW) permanent installed load bank

1983 — Introduced the Avtron Heildyne resistive load element

1985 — Froment begins manufacture of load banks

1993 — First to offer UL listed permanent load banks

1994 — Developed first true direct connect (no step down transformer) medium voltage load bank

1995 — First monocoque load banks are launched

1995 — Introduced SIGMA Intelligent Load Bank Control System

1997 — SIGMA Intelligent Hand-Held Terminal launched

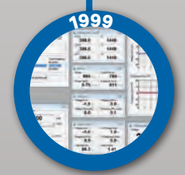
1997 — Began to offer complete line of neutral grounding and industrial resistors

1998 — Manufacture SIGMA Control Resistive/Reactive Container Load Bank

1999 — 5MW, Medium Voltage Load Bank sold to Social Security Administration. The load bank used in conjunction with a backup generator to ensure personal data is secure

2000 — SIGMA Instrumentation System launched for direct supply on test instrumentation

1999 — SIGMA PC Software launched



2001 — After 9/11, the White House chose Avtron portable load bank for their mobile communications activities

2001 — Additional combined (resistive/reactive) Froment models are launched

2002 — Additional user benefits added to SIGMA Hand-Held Terminal

2003 — Introduced line of suitcase-style high capacity portable load banks

2003 — Modbus connectivity launched for load bank

2005 — Released PC based diagnostics, configuration, and calibration application

2007 — USMC awarded Avtron a contract for 300+ portable load banks to help support their world-wide deployments

2008 — SIGMA 2 Control System Released

2009 — Developed first multi-voltage rack server (10 kW) load simulator

2010 — Avtron acquires Froment

2011 — Interactive HMI interface launched for container products

2012 — Avtron and Froment become brands of ASCO Power Technologies

2014 — Introduced Network Capable 150 kW Portable Load Bank

2016 — SIGMA LT Digital Control Platform introduced

2017 — Froment 8800 Step Down Transformer and Load Bank within 20 ft. containerized construction introduced

2017 — SIGMA PC Basic Software launched

2017 — Introduced 500 kW Portable Load Bank with SIGMA LT Networking Platform

1950 · 1960 · 1970 · 1980 · 1990 · 2000 · 2010

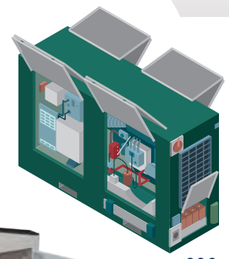
What is a Load Bank?

A load bank is a device that develops an electrical load and applies the load to an electrical power source. Avtron and Froment Brand load banks provide consistent, accurate, measurable, and repeatable electrical loads on a power source.

> *"Running an engine with minimal load causes residual fuel buildup, which decreases the efficiency of the engine and reduces the useful life of critical parts."*
>
> - Christopher Wade, Newmark Grubb Knight Frank

Why use a load bank?

- To help prevent lightly loaded conditions (wet-stacking) on your diesel generator set
- Meet the testing requirements of NFPA 110
- Power systems commissioning and acceptance testing
- Healthcare Compliance
- Long term tests - heat runs
- Transient response tests - block loading
- Test and verification to ISO 8528 - pass or fail
- Battery capacity testing
- AVR (automatic voltage regulator) and governor set up
- New product research and development



Generator electrical power source

Hot Air Exhaust

Power Cables

Elements

Controls

Cool Air Intake

Who should use a load bank?

Any person involved with ensuring proficient operation of a generator or UPS system should use load banks for:

- System set-up
- Periodic maintenance
- Continued verification
- Prolonged product life

Any person involved in the design, manufacture, and sale of generators or UPS systems for:

- Product development
- Final production sign-off
- Customer witness testing

What types of Load Banks are available?

- AC up to 690V
  - Resistive
  - Reactive (Inductive or Capacitive)
  - Combined (Resistive, Inductive and/or Capacitive)
- DC up to 600V
  - Battery capacitive testing
  - 28VDC ground power unit testing
- MV from 3.3 - 15kV
  - Direct Connect
  - Step Down Transformer
  - Integrated Load Bank and Transformer Package

We have 92 years combined experience in the load bank industry.

Why choose Avtron & Froment Load Banks?

- Enhance reliability of the power source
- Help maintain optimum load levels
- Prevents low loading on the power source
- Reduce downtime
- Improves life of generator
- Reduces generator maintenance
- Proven control systems
- Built for rugged and reliable operation
- No cool-down period required
- Aluminized steel construction
- Widest range of voltage and capacity available
- Accurate load tolerance
- Standard off the shelf components
- Continuous duty

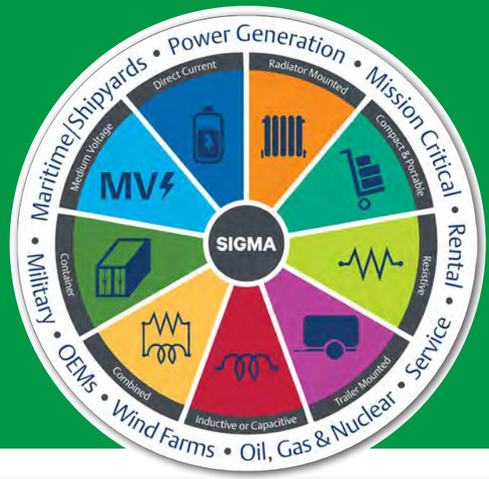
Our Load Banks are built to the highest standards

ISO9001
UL/CUL
CSA
CE
IEC
NFPA

Broadest Load Bank Portfolio in the World

Avtron and Froment brand load banks offer the widest range of load testing solutions available today. From a simple 10 kW portable load to multiple megawatt units, our experience and support make us the worldwide leader in the manufacture of rugged and reliable load banks.

Our Load Banks Revolve around Your Needs



Radiator | Compact & Portable | Resistive | Trailer Mounted | Inductive or Capacitive | Combined | Container | Medium Voltage | Direct Current

SIGMA

Serving Every Application in Every Market

Power Generation

Mission Critical

Rental | Service

Oil, Gas, & Nuclear

Wind Farms

OEMs

Government / Military

Maritime / Shipyards

Serving Every Application in Every Market

Applications Our Load Banks Support...

Power Generation

Commissioning and Validation of Generator

Routine Maintenance

Prevent Wet Stacking

Supplemental Load

Mission Critical

Compliance with State & Federal Testing Regulations

24/7 Reliability, Power Outage Prevention

Healthcare Compliance

DC Battery Service

Black Start Event

HVAC Verification

Rental

Meet Commissioning Requirements

Nameplate Testing

Load Test Data Capture

Ensure Generator Availability when Grid is Unavailable

Service

Validate Output

Meet Commissioning Requirements

All Season and All Weather Performance Testing

Oil, Gas, & Nuclear

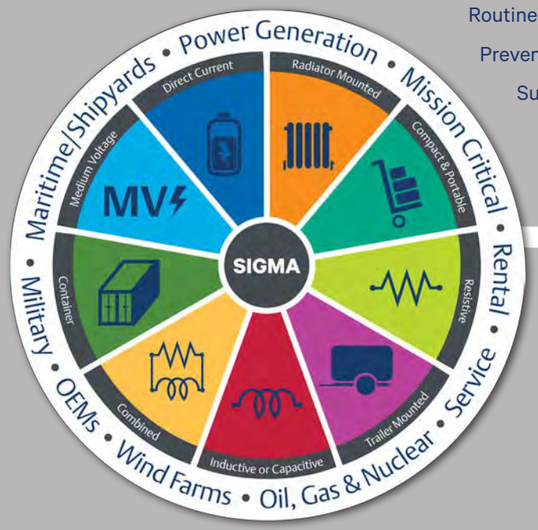
Gas Turbine Commissioning

Supplemental Load

Meet Emission Regulations

Generator Verification

Our Load Banks Achieve...



Wind Farms

Harmonic Testing

Validate Output

Meet Commissioning Requirements

Inverter Testing

OEMs

Meet Emission Regulations

New Product Testing

Quality Control Testing and Verification

Troubleshooting

Ensure Performance Specification

Government/Military

Tactical Generator Testing

Supplemental Load for Deployable Power

Depot Maintenance

Flight Line Testing & Support (400 Hz)

Maritime/Shipyards

Test & Verify Primary & Backup Power

Nameplate Testing of Generators

Meet Commissioning Requirements

Generator Verification

> *"Prior to building turnover, load bank testing helps ensure that electrical generation systems support loads by maintaining voltages and frequencies that meet design criteria. Generally, if they are going to fail, they will fail quickly."*
>
> - Joshua Gepner, Environmental Systems Design, Inc.

Load Bank SERIES Cross Reference

1000 SERIES Resistive Radiator		2000 SERIES Resistive Portable		3000 SERIES Resistive Static or Moveable		4000 SERIES Resistive Permanent		5000 SERIES Resistive Trailer	
Avtron Models		Avtron Models		Froment Models		Avtron Models		Avtron Models	
1100	K711	2100	K490	3010	*new*	4100	LSH	5500	K580/ K675A
1200	K711A	2200	K492	3012	MS12	4500	K675A	5600	K580/ K575A
1500	K711H	2300	SLS10	3020	*new*	4600	K575A	5800	LTV/ K875A
1900	K711L	2400	K571	3024	MS24	4800	K875A	5900	K580HC/ K975A
		2500	LPC100	3044	MS44	4900	K975A		
		2600	LPH25-75	3066	MS66	4950	LSV		
		2700*	LPH100	3103	MS103				
		2705**	*new*	3110	MS110				
		2750	LPH150	3164	MS164				
		2800*	LPH200-400	3220	MS220				
		2805**	*new*						
		2900*	LPV500-700						
		2905**	*new*						

6000 SERIES Inductive or Capacitive or Combined		7000 SERIES Inductive or Capacitive or Combined		8000 SERIES Container		9000 SERIES Medium Voltage	
Froment Models		Avtron Models		Froment Models		Avtron Models	
6045	MC45	7410	K841B	8100	MS1C	9100	K922A
6067	MI66	7700	LPS	8200	MS2C	9200	LSV-MV
6110	MC110	7800	K980	8300	MC1C	9700	LCV-MV
6111	MI110	7900	LCV	8350	*new*	9800	K875-MV
6112	MF110			8400	MC2C		
6164	MC164			8800	*new*		
6180	MC180						

Legend:

NEW Model Name	
Former Model Name	

NOTE: See page 15 for more details.

* Standard Toggle Control

** SIGMA LT Digital Toggle Control

Standard Load Bank Models

As the global leader in load banks, our company goal is superior customer service. Therefore, we have combined the Avtron and Froment brands under our new SERIES categories. These load banks have been organized based on application and model rating. This will simplify your product selection.

"Routine load bank testing ensures generator set performance during an emergency. Such testing means facilities executives may uncover system defects that may not be found otherwise until a power outage. Discovering them during testing allows any necessary repairs to be made before the facility has a critical need."

- Kurt Summers, Austin Generator Service

Broadest Load Bank Portfolio in the World

> *"As per National Fire Protection Association Standard 110 (NFPA 110), if you cannot achieve at least 30% load on a unit, you will build up carbon in the system. When you run the units at the higher load, it creates greater temperatures and burns off any carbon that may have built up."*
>
> - Stewart Allen, Citizens Property Insurance

Radiator
10-1500 kW

1000 SERIES Load Banks

Radiator mounted load banks are designed as supplemental loads to the generator (typically 50-70% kW). We offer models from 10 to 1500 kW and which are ideal for generators that are consistently lightly loaded. ASCO radiator mounted load banks are designed to be fitted directly onto generator sets. The load bank utilizes the engine cooling air from the generator radiator to cool the load elements.

- Indoor and Outdoor Construction
- Remote or Local Controls
- Available Roof Mounted Designs
- Optional Automatic Load Controller

Compact and Portable
5-700 kW

2000 and 3000 SERIES Load Banks

ASCO offers a complete line of compact and portable load banks. They are constructed to the highest standards and designed to resist the vibration encountered during transportation. Our load banks provide high capacity testing, yet maintain a compact and reliable package. Smaller kW models are available with handy carrying cases for protection and most models come with casters for maneuverability in the tightest spaces. Our portable load banks are perfect for operators that are load testing in multiple locations.

- Dual Voltage
- Local Controls
- Standard Data Logging with Digital Metering
- Designed to Fit through Man Doors and on Freight Elevators
- Optional SIGMA Intelligent Controls

Resistive
5-6000 kW

3000 and 4000 SERIES Load Banks

ASCO resistive load banks are ruggedly constructed and designed for continuous outdoor operation. We offer a complete capacity range from 5 kW to over 6000 kW. Our standard resistive load banks are CE approved for Europe and UL approved for use in United States.

- Wide Range of Nominal Voltages and Frequencies
- Optional SIGMA Intelligent Controls
- Remote or Local Controls
- Horizontal or Vertical Air Discharge Designs
- Custom Designs Available

Trailer Mounted
500-5000 kW

3000 and 5000 SERIES Load Banks

Typically used by service and rental companies, ASCO high capacity trailer-mounted load banks are the industry standard. Featuring outdoor weatherproof construction and convenient and easy to use controls, the 3000 and 5000 SERIES are the load banks of choice for maneuverability.

- Various Voltages and Frequencies Available
- DOT Certified Trailers
- Remote or Local Controls
- Optional SIGMA Intelligent Controls
- Vertical or Horizontal Airflow
- Storage Box, Manual or Electric Cable Reels, and Quick Disconnect Receptacles Available

Broadest Load Bank Portfolio in the World

> *"OPS has been buying Froment products for about 8 years. We have over 8 different types across the Froment range from 40kW units to 2.5mVA single units. The quality and reliability of the Froment product has enabled and helped OPS in being the market leader in the UK for load bank testing. "*
>
> - K. Sullivan, Optimum Power Services

Inductive
375-1875* kVAr

Capacitive
75-2000 kVArc

6000 and 7000 SERIES Load Banks

Inductive or capacitive load banks are used in conjunction with existing resistive load banks for testing AC supplies at non-unity power factors. Generating sets are typically rated at 0.8 power factor so both resistive and inductive load are required. Capacitive loads are used when leading power factors are required.

*Additional kVAr available upon request.

- Wide Voltage Range
- Optional SIGMA Intelligent Controls
- Indoor and Outdoor Models
- Can link with existing resistive load banks to perform combined load test.

Combined
200-6000 kVA

6000 and 7000 SERIES Load Banks

ASCO combined load banks test both resistive and inductive loads within a single load bank. Manufactured with the highest quality resistive elements and inductors the combined load banks will give the precision and longevity you need. Our combined load bank models are available from 200-6000 kVA.

- Rugged Construction
- Permanent or Maneuverable
- Wide Range of Nominal Voltages Available
- Optional SIGMA Intelligent Controls

Container
2000 - 6000 kW / 2000 - 6000 kVA

8000 SERIES Load Banks

ASCO container load banks are available in both resistive only and combined resistive/reactive versions. Typical containers are available in 10 and 20 foot lengths and specialized control rooms within to keep the components weather-proof, and to provide the operator with a safe and secure work area. ASCO transportable, containerized load banks are perfect for large capacity load testing.

- ISO Container Construction
- Wide Voltage Range
- 50/60 Hertz Frequency
- Optional SIGMA Intelligent Controls

Medium Voltage
3500-7000 kW

9000 SERIES Load Banks

ASCO is the leading manufacturer of true medium voltage load banks. Our units operate at the actual output voltage of medium voltage generators and do not require large step-down transformers. Conventional load banks with a step-down transformer mounted on common structural skid or within a containerized construction are also available. We offer both resistive and resistive/reactive load configurations with a wide voltage range to suit your needs.

- Direct Connect with NO Transformer
- Voltages of 5-15 kV
- 50/60 Hertz Frequency
- Remote or Local Controls
- Rugged Construction
- Optional Automatic Load Controller

Direct Current
150-3500 Amps

2000 thru 4000 SERIES Load Banks

Direct current load banks are the ideal solution for testing DC generating systems, converters, transformer/rectifier units, and battery systems. The rugged, aluminized steel construction ensures a long life and minimal maintenance. We offer a range of both portable and permanent DC load banks from 150-3500 amps with a wide range of voltages available.

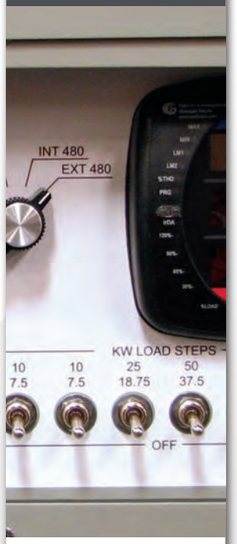
- Permanent and Portable Models
- Aluminized Steel Enclosure for Superior Corrosion Protection

Load Bank Control

> *"The ability to "daisy chain" load banks is a necessity in the rental industry. It enables the use of multiple units in order to reach higher capacities without the addition of larger units."*
> - Joe Stonestreet, Comrent International

FEATURES & BENEFITS

MANUAL TOGGLE SWITCHES



- Simple straight forward operation
- Ideal for remote and extreme locations
- Digital metering is often included for indication of applied load in amps and kW

PLC/DIGITAL CONTROLLER

- Ideal for larger direct connect medium voltage systems
- Pre program a load profile with specific loads and intervals
- Can interface with existing building management system

SIGMA LT DIGITAL TOGGLES

- Electronically controlled digital push buttons
- Display full metered instrumentation on 3 x 7 seg LEDs
- 480/240V

SIGMA LT HAND-HELD

- Color touch screen interface allows simple load selection
- Network up to 25 load banks
- Allows individual load bank control and monitoring
- USB capability
- Robust enclosure

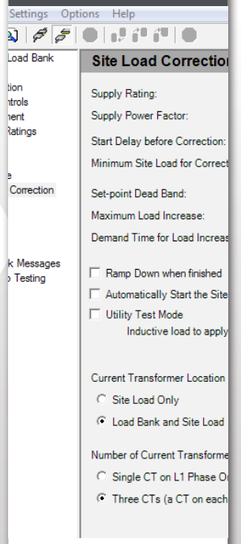
SIGMA PC BASIC

- Use on Windows™ PC, laptop, or tablet
- Network up to 42 load banks
- Graphical instrumentation display
- Control resistive, inductive, capacitive, and combined load banks
- Data logging
- Multi-lingual

SIGMA DECADE SWITCHES

- Load bank mounted decade switches for quick and easy load selection
- Perfect for accepting and rejecting load quickly and simply when at the load bank

SITE LOAD CORRECTION



- Load control automatically preventing the problems associated with light loading
- Maintain minimum load on gen-set
- Quick response times for unity testing

SIGMA MODBUS

- Allows integration with PLC, HMI or SCADA systems and proxy remote controls
- Can be used over TCP/IP for remote control

SIGMA IHT CONTROLLER

- Robust Intelligent Hand-Held Terminal (IHT) for remote load control operation with full 3-phase instrumentation
- Membrane keyboard and back-lit graphic LCD housed in an Industrial polycarbonate/polyamide enclosure providing IP65 protection
- Resistive, combined, inductive, and capacitive testing
- Automatic tests

SIGMA PC SOFTWARE

- Enhanced load control with transient speed instrumentation data acquisition and reporting with graphical displays including real time data such as crest factor, recovery times and % errors
- Customizable front-panel window layouts
- Supply-on-test properties include ratings, alternator, engine, customer and additional notes can be saved with test results for future reference or template creation
- Result data can be printed or exported to other software for further analysis
- Certification to ISO8528

Standard Load Bank Controls

Standard load bank controls are perfect for basic load tests. The toggle switch design ensures reliability.

- Simple easy to use design
- For basic, resistive load testing
- Offers automatic load control: allows permanently installed or radiator mounted load banks to provide load levelling

SIGMA^{LT} Load Bank Controls

SIGMA^{LT} is a multifunctional embedded load control system specifically designed for Avtron and Froment load banks. Flexible, feature rich, and cost effective, it is designed for resistive load banks giving best-in-class capabilities and benefits to users.

- Remote control of load banks
- Touch screen control
- Network and control load banks together
- Individual load control in the network
- USB data logging
- Fast and accurate load control
- Synchronous load changes
- Single or three phase instrumentation
- 1 kW load resolution on selected models
- Simple firmware updates

SIGMA 2 Load Bank Controls

SIGMA load control is the leader in simplicity, ease of use and accuracy. SIGMA brings cost effective solutions to today's power testing requirements which can require high level instrumentation, data capture and verification.

- No need for any pre-calculations
- Automatic detection senses the supply-on-test
- Quick start wizard allows easy setup of load via % load, power factor and time
- Load steps down to 0.1 kW or 0.1 kVAr with adjustable leading and lagging power factor
- Adaptive and Predictive load-correction facility ensures the correct load is applied even if the voltage drops
- Transient load tests, results analysed and reported
- Automatic load control provides multiple timed load steps including cyclic testing
- Manual control via selection of kW, % load, or kVA and power factor
- Link multiple SIGMA load banks and control from one IHT or PC
- Commissioning and verification to ISO8528

Load Bank Quality at Work

Choice

Resistive, Inductive, Combined, Portable, DC, and Medium Voltage models

Custom builds to specifications

Large range of capacities

Huge selection of option adders

Design

Professional and creative design engineers

The best software for superior results

Innovative problem solving skills

Unrivaled product knowledge

Experience

92 years combined experience in manufacture of load banks

Manufactured 1000's of standard & custom load banks

Worldwide presence in all markets

Avtron & Froment Load Banks

We have over 125,000 sq. ft. global production space dedicated to manufacture of load banks.

Build

The latest and greatest construction technology

Superior quality materials

Talented and highly skilled engineers

State-of-the-art production techniques

Knowledge

Rigorously trained staff

Awareness of customer needs

Global sales teams

Product proficiency

Service

Dedicated load bank service department

Global presence

Friendly advice and support

24/7 support

Load Bank Service & Support

24/7/365 Support

Avtron and Froment Services are much more than a "service department". We are a self-sufficient organization offering a broad range of services, products, and solutions.

- Commissioning
- Periodic scheduled maintenance of equipment
- Technology upgrades to legacy systems
- Modifications in system operation
- On-going customer training
- Access to the latest development including parts and equipment

Customer centric service puts your needs first

Industry exclusive 2 year parts & labor warranty

Worldwide Service & Support

We are there when you need us

Help Us to Help You

Please have the following information to supply to your regional sales manager for us to provide you with a fast turnaround on a load bank quote.

- Applied Voltage(s) or Frequency
- Resistive, Reactive, or DC
- Portable or Permanent Installation
- Capacity
- Load Step Resolution
- Blower Voltage Requirements
- Internal and/or External Control Power
- Indoor or Outdoor Service
- Core Dimensions and Air Flow for radiator mounted applications

Load Bank Specifications

Load Bank Connections:
Most Avtron brand load banks are three-wire delta designs. Four wire wye power systems can be easily connected to the standard load bank by connecting phases A, B, and C to their respective input terminals. The standard Avtron brand load bank is a balanced 3-phase load, so the generator's neutral wire is not required.

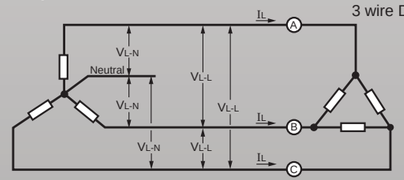
When rating load bank capacities for special applications, refer to the wiring diagrams shown.

Power Information:
The kW rating of the engine-generator set is dependent on the horsepower rating of the prime mover and the electrical rating of the generator.

The kVA rating of the generator is dependent on the current rating of the generator.

CONNECTION DIAGRAM

4 wire Wye Generator — Load Bank 3 wire Delta



$V_{L\text{-}L} = V_{L\text{-}N} \times \sqrt{3}$

$I_L = \frac{kW \times 577}{V_{L\text{-}L}}$

$V_{L\text{-}L}$ = Voltage measured Line to Line

$V_{L\text{-}N}$ = Voltage measured Line to Neutral

I_L = Current in Amps

kW - kilowatts

kVA - kilo volt-amperes

pf - power factor

kVAr - kilo volt-amperes reactive

$kW = kVA \times pf$

$kVA = \frac{kW}{pf}$

$pf = \frac{kW}{kVA}$

$kVAr = \sqrt{kVA^2 - kW^2}$

ASCO® Power Technologies - Avtron Load Banks
6255 Halle Drive
Cleveland, OH 44125
USA
Tel: 216 573 7600
LBsales@ascopower.com

ASCO® Power Technologies - Froment Load Banks
Cliffe Road
Easton-on-the-Hill
Stamford
PE9 3NP
United Kingdom
Tel: +44 (0) 1780 480033
froment.sales@ascopower.com

loadbanks.ascopower.com

customercare@ascopower.com

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