

# Electro *GenConnect*<sup>TM</sup>

## AUTOMATIC START

### OPERATIONS & TROUBLESHOOTING GUIDE

This is in addition to the installation guide and installation hookup drawings.

Use this instruction manual for basic setup, after installation wiring, and maintenance/troubleshooting, as required.

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# Safety - Warnings

## **High Voltage – Utility LIVE 240 Voltage Potential (Meter enclosure model)**

The small internal fuses and the wires to the circuit board upper right corner represent utility LOAD voltage and can be dangerous. This means there is a LIVE 240-volt potential at the small fuses and at the circuit board upper right area. The neon indicator lamps (circuit board upper right) are an indication of this live voltage. The fuses protect the wiring and protect against hardware damage and/or fire, but the fuses do not provide protection against human shock. The pulling or removal of the utility meter interrupts this 240 potential.

## **Installing Behind Utility KWh Meter**

The removal of the utility meter seal and KWh meter itself must be handled by authorized electric power company personnel (or their assigned contractor). Where possible turn off all building supply loads when the meter is pulled. This will reduce the arcing from the meter blades/connection. Authorized person should use suitable insulating gloves, protective clothing and eye protection, and be experienced in meter removal/installation.

Top meter lugs are always “Hot” and very dangerous, also the top fuses with the adapter module are always “Hot”.

## **High Voltage – Utility LIVE 240 Voltage Potential (Meter extender model)**

Within the socket extender, 240 volts (L1 and L2) is tapped from the LINE side of the utility service in order to determine outage and provide power for the *GenConnect* power supply. This means there is a LIVE 240 voltage potential at the bottom of the socket extender connector, within the cable, and within the control box itself. Proper caution in troubleshooting and internal examination must be exercised. The neon indicator lamps (circuit board upper right) is an indication of this live voltage. This voltage tap has two fuses within the socket extender (behind the meter itself) for protection against hardware damage and/or fire. But these fuses do not provide protection against human shock. Also fuse terminals are always “Hot”, connected directly to utility LINE terminals.

## **Control Circuit Board, Upper Right Corner**

This potential, very dangerous, LIVE voltage concern can be minimized or removed by disconnecting the cable connector at the bottom of the meter extender or by pulling off the 2-wire cable (red and black) at the control circuit board upper right corner.

## **240-Volt, Hot Terminals**

Since the building LOAD connection and wiring can be fed from either utility or standby generator, the wiring and terminals associated with the LOAD in any compartment may be voltage HOT when either power source is energizing. Use caution when handling or troubleshooting under the enclosure covers, observe the various warning decals at the various components.

## Grounding and Bonding

See appropriate installation manual, hookup drawing and relate to appropriate model series.

### **Warning:** False Generator Starting

There is a power turn on and connection timing consideration. If the battery voltage is connected to the terminal block prior to the utility monitor connection the *GenConnect* logic may also be looking for utility voltage. The system may declare power outage and attempt to start the generator. If the generator has a manual/auto switch, keep in the manual mode until all wiring is complete, *GenConnect* is properly monitoring utility power, and *GenConnect* reset button is pushed.

### **Warning:** Battery live power.

When connecting the generator battery charge wires or connection point to the *GenConnect* control box internal terminal block BATT plus and minus, the battery will probably have 12-volt power and if proper care is not exercised with handling these wires, there is potential for shorting the battery. **Also**, polarity must be maintained and correctly applied. A **reverse** battery polarity on the *GenConnect* plus and minus terminals can result in immediate **destruction** of the *GenConnect* internal power supply circuit board.

### **Comment:** Battery Charger

The standard unit includes a single stage trickle charger. This is for battery maintenance only. This assumes the generator has a fully charged battery. This charger **will not** reestablish a dead battery.

# Operational Guide

## Operational Settings

See Safety – Warnings, page 1.

There is one field adjustment and several factory setups which typically relate to the generator type and end customer system. These factory setups can also be changed but require a PC with special serial port cable and software disk or a handheld analyzer.

### Adjustment – Power Outage/Return Definition

Set the small screwdriver switch to an appropriate number defining the detected power loss/return delay time prior to declaring power outage/return.

0	10 sec.	4	1½ min.
1	30 sec.	5	2 min.
2	45 sec.	6	2½ min.
3	1 min.	7	3 min.

### Setup Parameters

The PC setup parameters are shown on the following screen. PC help file (F1) can provide additional user instructions.

### Handheld Analyzer

The handheld unit can be used in place of PC. See instruction sheet supplied with unit.

# Operator Controls and Monitor

Under the plastic cover the following are accessible to the user:

- Generator output **circuit breaker** – this circuit breaker (size depends upon product model) protects the control box and the wiring path to the meter socket. It also can be a protection for the generator itself. The size shall not be altered because of the wire size capacities within the system. It must be in the up position for the generator to supply power to the building and for the system to detect successful generator start.

## Comment

The generator circuit breaker must also be closed.

- **Test** switch – this small lever switch provides a test sequence with the ability to completely test the generator starting and transfer function. See later section describing the test switch sequence. There is an audible associated with this test switch, it is very important the switch is not left in the up position.
- **Monitor** LED – the generator may be running but not necessarily powering the building. The monitor LED will provide added information. Also this monitor light is a very important tool for troubleshooting.
- **Reset** button – this allows a manual reset of the internal logic system. It should only be pushed if the user definitely suspects there is a major problem and the system seems to be “hung”.

Note: The RESET is disabled during TEST switch function.

## Comments

1. After pressing RESET, release immediately, then wait until monitor LED turns either solid green or solid red before expecting the correct action. If it is in a malfunction or safety HOLD mode, monitor LED will go to green/red alternating.
2. The generator output Voltage Window is a function which samples generator voltage output and expects a voltage window from 210 to 270 volts (2-second sampling delay). If the voltage falls out of this window, the generator relays are immediately opened. Unless otherwise specified, this is factory **Enabled**.
3. After initial installation, monitor LED may be green/red alternating – push RESET, if it does not clear see Maintenance/Troubleshooting section.

## Light Monitor Information – LED next to Circuit Breaker

<u>LED</u>	<u>Function</u>
Off	Both power sources are off.
Green Full	Utility voltage is normal (both legs).
Green Pulsing	10-second delay hold, utility is the source.
Red Full	Generator power is the source and at normal voltage.
Red Pulsing	10-second delay hold, generator is the source.
Green/Red	Refer to the error detection table and other troubleshooting information.

## Internal AA Batteries

This is commonly referred to as “warehouse” battery. These AA batteries keep the internal clock/calendar powered and accurate until the unit is permanently wired. Once there is utility power connected and the outage is not over 4 days, there is no need for these two AA batteries.

Suggest the batteries be removed after the installation is completed.

## Optional Accessories, Hookup Information

Depending upon the options purchased or other items associated with this installation, there may be other various terminal block connections at the control boards. These may also be accompanied by their own instruction sheets.

**INTRPT** – see LD103 associated with interrupting high current loads.

**GEN ALERT** – if the generator you are using has its own contact closure for a problem or alert output, this can be tied into this optional input for use within the next level communication device or in-house monitor. Contact factory for various wiring options, but if it is a true isolated contact closure wire as follows:

“-” – ground.

“+” – Gen. contact.

“V+” – Gen. contact.

**REMOTE** – see appropriate document for *GenTrac*<sup>™</sup> monitor or *GenTrac*<sup>™</sup> relay.

**BATT WARMER** – 120 output at 1-amp maximum for GenSet battery warmer, neon next to terminal block indicates fuse is okay.

**CT** – applies to *GenTrac*<sup>™</sup> monitor.

**LMC** – applies to load shed and load control devices option, see document LD301.

## System Startup or Turn-on

1. If generator hookup is complete and the utility power installation complete, the monitor indication should be:
  - BATT terminal block green LED is on.
  - GEN. START terminal block red LED is off.
  - BATT WARMER (if used) terminal block neon is on.
  - Circuit board top center LED (also called Problem LED) is off.
  - Front panel monitor 2-color LED should be solid green or alternating green/red if there may be a hookup sequence error.
2. Turn off transfer switch control box circuit breaker.
3. Set up the generator for manual (non-automatic) mode and start the generator.
4. Using a volt meter at the circuit breaker input terminals verify voltage at approximately 230 to 250. Also check each leg to neutral, must be  $\frac{1}{2} \pm 3$  volts. If this is not the case, do not proceed and energize this product.
5. Turn off the generator and set up for automatic starting. Also verify fuel source, generator surroundings, etc.
6. If light monitor LED is alternating green/red, push reset.
7. Use Test Sequence section for further verification.

## Test Sequence

The front panel test switch allows the generator start cycle and transfer with minimal power dip or disturbance within the building power system. When the test switch is in the up position, an audible short beep (every 10 seconds) is provided to make sure the user returns the test switch to its down or normal position.

1. Generator start and verification, before utility is disconnected.

2. After generator designated warm-up time and verification of 220 volts or greater, transfer is made to generator power.
3. Continues operation using generator power.
4. Test switch is placed to the down position, transfer is back to utility power source.
5. After the generator cool down delay, generator start is terminated.

### Comments

1. Building loads must not exceed generator capacity.
  - A. Prior to TEST, verify heavy loads such as water heater, dryer, and electric range are either off or their circuit breaker is turned off.
  - B. It is the user's responsibility to regulate the loads within the home at the level of the generator's capability or output.
2. Electro Industries has automatic, interrupt hardware boxes which can be installed at the water heater, electric range circuit breaker, air conditioning control, heat pump control, etc. which can automatically drop these loads when the generator is operating. Contact factory for additional information sheet and details. Document LD103 can provide these details.
3. If enabled, the generator Voltage Window will also be part of the test sequence. In other words, if the generator falls out of its voltage tolerance during the test sequence you will experience a shutdown as described in earlier paragraph.
4. If a utility outage happens when in the test mode, the system continues with the test function. When returning the test switch to the down position (still utility outage) there will be a slight blink, but the system will pick up as an outage and the generator will continue to provide power. All monitor conditions revert to standard outage mode.
5. When initiating or terminating TEST mode, generator warm-up, transfer sequence, and generator cool-down functions are identical to basic outage transfer.

### Possible Non-Operate Conditions

1. Initial installation test, TEST switch up, but no transfer – verify green wire within the cable is grounded, green wire out of the BLP interrupt module is grounded, or green and yellow wire at the BLP interrupt are properly terminated and continuous within cable. The system logic senses transfer action within the BLP interrupt module.
2. Generator did not start – system will shut down, green/red monitor, short beep audible, operator action required.
  - Recovery – return test switch to the down position, press reset, fix generator, then return to TEST after full green.
3. Generator stops – system off, audible beeping.
  - Recovery – return test switch to the down position, press reset, fix generator, then return to TEST after full green.
4. If enabled, the generator Voltage Window failed – same as #3 above.
5. Also see Maintenance/Troubleshooting section.

Front Cover LED	Problem LED	Alarm	Condition
Green	Off	Off	Normal condition prior to TEST switch up.
Red	Off	Short beep	Normal condition, TEST switch up.
G/R	Off	Short beep	Gen. not start, system on HOLD.
G/R	On	Off	Gen. was okay, but stopped, low voltage sensed, system on HOLD.
G/R	On	Off	Transfer error, system on HOLD.
G/R	On	Off	Voltage Window fail, system on HOLD.

# Generator Maintenance Cycle

As setup by the PC screen (previous page) the *GenConnect* controller will automatically start the generator and check its condition for a routine run time (also commonly called maintenance exerciser). This should take place with no building power interruption or no noticeable affect on building power.

This controller also includes a method for the generator powering the building during the maintenance cycle. See Setup PC Screen (Operational Settings section) and fill in “Auto Hot Test” entries.

If failure occurs during this maintenance exerciser mode, the following comments may help or proceed to Troubleshooting section.

1. Maintenance check failure – if the generator did not start (output less than 200 volts during warm-up) LED is alternating green/red. The system is locked in this mode. Fix generator, and press reset to clear. At this point maintenance cycle has ended, re-verify system operation using Test Sequence, see previous section.
2. Generator running, but out of the 210 to 270 volt tolerance window – LED alternating green/red, system is locked in this mode, same as above.
3. Plug in PC or handheld to readout specific recorded error.
4. If you are simulating this condition by changing or advancing the system clock to create the next maintenance cycle, the clock must **pass through midnight**. Suggest setting the system clock at 23:58 and setup the maintenance cycle for the next day at 00:02.
5. If there is an outage during this cycle, maintenance is automatically terminated and normal generator operation continues.

Front Cover LED	Problem LED	Alarm	Condition
Green	Off	Off	Normal, utility present.
Green	Off	Off	During maintenance cycle, if hot test entry is “0” and “00”.
G/R	Off	Short beep	Gen. start relay, but no voltage sensed, system on HOLD.
G/R	Off	Short beep	Gen. was okay, transfer okay, gen. stopped, system on HOLD.
G/R	Off	Short beep	Voltage test window failure, system on HOLD.

# Troubleshooting Guide

See **Safety – Warning**, page 1.

**Monitor Light** – see previous section.

## Typical Sequence

1. The **test** switch is in the down position and the monitor LED is full green – system is monitoring utility power and there is no outage.
2. Power outage – All power is off for the Power Outage/Return Definition time set in the previous paragraph. **Both** 240 legs have dropped to 200 volts or less, see Utility Unstable section for additional problem details.
3. After the Power Outage/Return Definition time, the generator START command is initiated with a setup generator warm-up or run time.
4. Before the utility service is opened, internal logic verifies no LOAD voltage, and generator voltage is above 220 volts.

5. The utility service is opened, system verifies this action, and the generator relays are closed applying generator power to the building.
6. Voltage output of the generator is continuously monitored (if enabled), 210 to 270 volts. If the voltage falls out of this range, LED is alternating green/red and the system is shutdown either in permanent hold or in a 60-second retry.
7. LED is full red when the generator is operating and properly powering the building.
8. The instant utility voltage is returned (both legs must be 100 volts or greater, see Utility Unstable section), LOAD power is automatically interrupted for approximately 2 seconds. This is an internal safety check verifying internal components. With the return of power after the 2 seconds, the building is still being powered by the generator.
9. After the selected Power Outage/Return Definition time (and there has been no further utility interruptions) the power again drops for 2 seconds. During this 2-second drop the transfer is made from the generator back to the utility. Then in another safety check, the voltage must dip and be detected during this transfer.
10. After generator run post delay (pre-setup), the generator start function is terminated.

This is an attempt to both relate the steps and the timing.

### **Warning**

Within the socket extender, 240 volts (L1 and L2) is tapped from the LINE side of the utility service in order to determine outage and provide power for the *GenConnect* power supply. This means there is a LIVE 240 voltage potential at the bottom of the socket extender connector, within the cable, and within the control box itself. Proper caution in troubleshooting and internal examination must be exercised. The neon indicator lamps (circuit board upper right) is an indication of this live voltage. This voltage tap has two fuses within the socket extender (behind the meter itself) for protection against hardware damage and/or fire. But these fuses do not provide protection against human shock.

### **Fuses**

Socket Extender – LINE, 2 8/10 amp, slow blow (do not substitute type, must be specific MDA with 10,000-amp interrupt rating).

## Basic Run Sequence

Sequence	Timing (selection)	Typical Seconds
1. Utility L1 and L2 drop. - Must be both. - Voltage less than 200 volts AC.	0 time.	0
2. Power Outage Definition setup selection switch.	10 seconds to 3 minutes (30).	30
3. START relay contact closes.	0	30
4. Setup – “Generator start delay”.	0 to 999 seconds (30).	60
5. Generator voltage verification, greater than 200.	1	61
6. Open, Utility interrupter.	0	61
7. Verify correct transfer.	1	62
8. Close Gen. power relay, LOAD power.	0	62
9. Verify correct LOAD transfer.	1	63
10. Begin voltage window test activity (if enabled).	0	63

Normal standby generator operation, voltage window verification (if enabled).

1. Utility voltage is sensed. - Must be both. - Voltage greater than 200. - If 1 leg comes back, generator is still interrupted but no transfer takes places.	0	0
2. Voltage dip. - Generator still supplying power.		1
3. Setup Power Outage Definition.	10 seconds to 3 minutes (30).	31
4. Transfer back to Utility and verify.	1	32
5. Setup “Generator run post delay”.	0 to 99 minutes (1).	92
6. Open START relay, Gen. is off.	0	92

### Utility Unstable – Unpredictable or Undefined Operational Conditions

There are potential electric utility power source intermediate conditions and possible non-compliant generator output conditions which may not necessarily result in automatic transfer or the ability for the generator to provide standby power. There are a lot of details behind the following conclusions, if interested in further information ask for internal discussion document LC101. The major reason for the following operational conditions is safety and making sure the Electro *GenConnect* Transfer system does not inadvertently cause danger with the electric utility grid. The Electro *GenConnect* system cannot feasibly or economically include logic for all possible utility service voltages or conditions.

#### Design Ground Rules

1. The definition of “**outage**” is not necessarily the same as “**standby power**”.
2. The loss of utility incoming power (outage) is defined as **either** leg below 100 volts.
  - In a practical real life situation, if one incoming 240 leg is open its voltage will not necessarily be zero volts.
3. **Standby power** activation is not possible unless **both** utility legs are below 30 volts AC.

4. Voltage levels down to approximately 30 volts AC on **either** incoming 240 leg prevents the engagement of the generator relay.
  - Example- 120 volts on L1 and 70 volts on L2 means generator relay cannot be engaged.
  - 120 volts on L2 and 20 volts on L1, still no generator relay activation.
  - 30 volts on L1 and 20 volts on L2, generator relay can be activated.
  - Any leg voltage between 30 and 100 volts, could be in an unpredictable logic state, **but** definitely generator relays will not activated.
5. The positive condition for “clean” generator transfer is **both** incoming 240 legs below 30 volts AC.
6. If outage return is not 110 volts on both legs, generator may be running but no transfer or generator power.
7. The generator output must have **both** 240 legs greater than 110 volts for generator relay activation.

### Comment

The situation outlined above is “best effort” approach, to maintain competitive equipment cost. It is very feasible and possible to add a precision low voltage and L1 and L2 phase detector on the utility L1 and L2 monitor lines. This can control the action of the transfer switch. When the utility drops below a preset 103-volt point or there is a complete loss of L1 or L2 (individually), this optional plug-in detector presents a true outage signal to the standard *GenConnect™* control board. Order option LG-UMON-01.

## Common Troubleshooting Steps

1. **Alarm, Short Beeps** – If you are experiencing this audible alarm, there are two conditions which should be reviewed.
  - Failure within generator maintenance cycle, was there a scheduled maintenance just prior to this alarm? See appropriate section.
  - Utility Unstable, see appropriate section.
  - Generator stopped after normal operation, see paragraph 5 below.
  - Reset is required to remove this HOLD condition.
2. **Verifying Fuses/Utility Monitor Detection** – Utility power monitor L1 and L2 is direct from the socket extender LINE terminals. This is protected within the socket extender (behind the meter) with two 2½-amp fuses. Proper power outage or utility monitor is not possible unless BOTH fuses are okay.
  - Visual verification of this utility L1 and L2 monitor is the neon lamps, circuit board upper right. There are possible conditions where one fuse could be open and still have a glow on the other neon lamp. The only positive verification is the volt meter check, each leg to neutral and across L1 and L2.
  - Volt meter verification of utility L1 and utility L2 monitor can be made on the circuit board upper right tabs marked UL1 and UL2.
3. **Generator Start, Immediately Shutdown** – After the generator start relay closed and the after setup generator start delay (generator warm-up) time, the internal logic system reads the generator voltage prior to making the transfer. If the generator voltage is less than 220 volts, the system goes into temporary hold but the generator start contact is not opened. As soon as generator output is above 220 volts, the transfer cycle continues. After there has been a transfer cycle and the generator is now supplying standby power, this test no longer applies but the 210 to 270 voltage test window may apply (if enabled).
4. **Voltage Window Test** – If enabled (see setup parameter paragraph), the internal logic is continuously monitoring the generator output voltage within a range of 210 to 270 volts. If at any time the generator output (2-second sampling) is either less or greater than these two values the generator relay is opened, interrupting standby power to the building. The monitor LED is red, problem LED is on. After 1 minute, system logic rechecks Voltage Window, if voltage is within range the generator relay is again closed. If the Voltage Window test fails, the generator relay remains open. If after the 1 minute test the Voltage Window continues to be low, system goes to generator stopped, see next paragraph.
5. **Generator Stopped (Typical Out of Gas)** – Typically the control logic will first detect a low voltage window failure (if enabled), which will result in red LED and problem LED on. After a 1 minute

delay, the control logic will verify no voltage and the generator stopped condition is now activated – main LED is off, problem LED off, short beep alarm. If Voltage Window test is disabled the unit will go to the same condition as after the 1 minute delay.

- 6. Monitor Lights and Audible Alarm Conditions** – The following table provides information relating to various monitor light and alarm problem conditions. The “Front Cover LED” is the 2-color LED next to the circuit breaker. The “Problem LED” is inside, circuit board top center and the audible alarm is the white component on the top of the circuit board. The “Problem LED” is only of interest when you have an alternating front green/red LED and audible alarm. This information or these sequences only apply with the TEST switch down or in the off mode.

Front Cover LED	Problem LED	Alarm	Condition
Off	Off	Off	12V battery problem or total failure.
G or R	Off	Off	Normal, LOAD has power.
G or R pulsing	Off	Off	Internal timing, do not touch, wait 10 seconds.
Off (short period)	Off	Off	Internal delay between transfer or immediately after outage.
Off	Off	Short beep	Gen. was okay, transfer okay, Gen. <b>stopped</b> .
G/R	Off	Off	Gen. <b>not start</b> , system on HOLD.
G/R	Off	Short beep	Maint test cycle, but Gen. stopped (HOLD).
G/R	Pulsing	Short beep	Utility unstable, system on HOLD.
G/R	Off**	Pulsing	Transfer error, system on HOLD.
R+	On	Off	Low voltage, 1 min. auto reset.
R+	On	Off	Hi voltage, 1 min. auto reset.
*	Off	Pulsing	Ext. Gen. failure input, separate hookup.

Notes: \* Not applicable, green or red whether power source is Utility or GenSet.  
 + Gen. still running (LED can be red), checks Voltage Window after 60 seconds, if was high will continue to cycle every 1 minute, if was low goes to “Gen. stopped” condition (Code 9). If recovered during 1 min., back tonormal.

**HOLD** Needs RESET for further action, START relay has opened or dropped its action.

Off\*\* Error 1 & 2 = On.

Pulsing – Alarm timeout, 1 min.

- 7. Internal Logic Safety Detection** – The above condition “transfer error, system on HOLD” has six additional internal detection functions relating to various internally detected transfer errors. These can only be interrogated or read out with the PC function or new handheld plug in analyzer. If the “transfer error” condition persists, seek factory assistance and plug in your PC or handheld analyzer for the additional troubleshooting information. The PC message screen provides the details relating to the six conditions.
- 8. Utility Unstable** – See next section for further explanation, but both legs are **not** at zero and LED is alternating green/red, problem LED is pulsing, short beep alarm. This is detected from a normal utility voltage going to an outage condition. However, if the sequence is opposite – generator is powering the building and the utility has come back with one leg only – the generator will remain running but the transfer will not take place back to the utility until both legs are above 100 volts. In this case there is no error condition shown on the monitor lights or recorded error, the safety logic has simply disconnected the generator because it does not “understand” the utility voltage condition and it is in an intermediary hold state. Do not press reset, verify utility L1 and L2 to neutral with volt meter (see Step 1 above).
- 9. Internal Memory Messages** – Connect PC with special software and cable or plug-in handheld to readout internal troubleshooting messages. See PC help screens or handheld instruction sheet.



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