EDKO Automatic Gate Operator Electrical Repairs

When the Control Board in your Gate Operator Fails, How to repair your system

By Joe Mehaffey Revision 6, January 16, 2011

Applies to EDKO Models MSW, SSL and SSW and likely also to

RSL MSL ML SLG GSL CSW ASW HSW and BAR Models

Gate and door operators have been around for a long time. Older units of all brands are often replaced simply because the internal controller circuit board is defective and no replacement is available whereas the unit is OK mechanically. Total replacement of a gate or door operator can cost from $1000 for a simple residential gate operator to $2000 for a light industrial gate operator to much larger prices for heavy duty industrial gate openers. This is a large price to pay when what is needed is a general purpose programmable "industrial duty" replacement gate controller at a reasonable price. This article describes a general purpose controller that includes a bidirectional single phase gate controller that can be used to control gate/door motors requiring up to about 30 amps at 240 volts. It should be possible to retrofit this controller into virtually any gate system with either single swing or dual swinging gates or in sliding gates or vertical doors. In other words, this design is configured to be "general purpose" and it is also USER PROGRAMMABLE should special needs arise not covered by the configuration described below. Now to the design.

I awoke one morning at the end of August to find that one of my two EDKO gate operators had failed. One gate failed to open and the other worked fine. I investigated and then got on the phone and called EDKO to get a replacement circuit board. Oops! I found they had gone out of business! Apparently in 2009, they sold out to Chamberlain and there is little trace (and no electronic spare parts available) on the web or elsewhere for older units as far as I can tell.

Figure 1: View with gates OPEN Figure 2: View with gates CLOSED Figure 3: Post with Control Boxes

Since the mechanisms of my gate openers were in excellent shape (even after 17 years of service!), it seemed a shame to spend $3800 plus installation to replace the two heavy duty gate operators. So.. Since I am a circuit designer by education and a Building Automation Engineer by recent experience, I set about to "fix it". I already had a programmable Automation Controller at my gate to activate the EDKO motor units as well as for other purposes. I decided that the best (and most economical approach) was to just design a relay interlock unit for the EDKO motor units (to prevent the Automation Controller from ever commanding the motors to run both ways at once) and then program the existing Automation Controller to do all the logic operations involved with operation of the gate. As you read the article, you will discover that this new Gate Operator Controller has dramatically increased features as compared with any Gate Operator on the market. The entire design is described below. Using this design, the upgrade/repair cost was

dramatically less than replacement. The design, prototyping of two Relay Modules, rewiring, and then programming /debugging the UUC8 Automation Controller program took just 4 days total. I figure a day or two would be enough to replicate my effort on another dual gate system now that the design is complete. Installation for a single gate system might take a day.

In the above Figures 1 &2 the finished product is shown. Figure 3 shows the control boxes located on the gate post. The upper box contains the vehicle loop sensors along with the Chamberlain Garage Door Radio Receiver used for remote control unlocking should the gate be closed when a user approaches the locked gate at night. The upper box also mounts the OPEN/CLOSE/STOP manual push button assembly. To the right, mounted on the fence, is the (optional for others) Davis Rain Guage which is also connected to the Automation Controller which transmits the data to the central controller in the house for display. The lower junction box contains the HI Solutions UUC8 Automation Controller which is used as the logic controller for the two gates and for other related control features described below. I can furnish parts for replicating this installation OR you can "do your own thing". The UUC8 is ideal for this control functionality, operates in the gasketed plastic junction box from about -10F to 140F, and its inputs and outputs all include voltage transient protection. Even so, if you run input or output wires from the UUC8 board more than maybe 20ft from the controller in an outdoor environment, a 100vac transorb transient snubber is HIGHLY recommended on any I/O wire going more than maybe 20ft away from the UUC8. On short runs such as between gateposts, I have not had a problem. A transient suppressor on the 120vac power line is required for long term security of the AC power source. You could use some other "programmable controller" instead of the UUC8 but make SURE it has transient protection and is rated for outside environments so it can survive in the cold/hot of the out-of-doors. Boards that are not conformal coated and otherwise protected do not last long in harsh environments.

Features included in the new system design Note: **Features are optional on any particular installation. ****Features may require simple program modification.

1) The new design includes a replacement circuit board for the old EDKO (or other brand) board inside each Gate Operator.

2) The new design removes the old (if any) obstruction module and 24vac transformer in the Gate Operator housing.

3) The new design uses the old OPEN LIMIT, CLOSED LIMIT , and OBSTRUCTION (all SPDT) microswitches in the EDKO or other Gate Operator unit.

4) Provision is made for manual OPEN/CLOSE/STOP switch inputs for local gate control.

5) **Provision is made for an outside vehicle loop sensor plus an inside loop sensor in case you want separate logic for the two cases to detect direction of travel for vehicles. OR: You can use one vehicle loop sensor input for operation if you want to do the same operation sequence independent of a vehicle coming or going.

6) **Provision is included for a daily schedule of OPEN/CLOSED times if desired. If you wish NOT to use a day/night schedule, a lock out strap is required.

7) **The UUC8 internal clock loses/gains about one minute a month. About once a year, you will need to connect a PC to the controller and set the correct time.

8) ****Provision is made for disable of the VEHICLE SENSOR(s) so as to just use a single contact closure from a Garage Door Radio Receiver to open or close (toggle) the gate.

9) **Provision is made for a 24vac triac output to drive a relay to turn on Post Lights when a vehicle arrives at the gate and is sensed by the vehicle loop sensor.

10)**Provision is made for a 24vac triac output from the Automation Controller (plus a transmission to the Central Controller if equipped) to signal for turning on of other outside lighting when a vehicle arrives at the gate going in the direction of the house.

11)**Provision is made to accept toggling switch outputs from a Davis Rain Guage and to totalize the rainfall information and send it to the Central Controller (if equipped).

12)**Provision is made to accept a contact closure (MSEN) (from a mailbox mounted switch or Visonic Transmitter/Receiver) to signal mailbox door opening and status. This is used in conjunction with vehicle loop detection to provide information that a) The mail has arrived today (gatepost light turns ON when mail has arrived and then vehicle sits on sensor loop) and b) Mail has been picked up already today or has not arrived today (gatepost light does not turn ON when vehicle sits on loop in these cases.) This has proved very handy over the years! If a Central Controller is attached, the mail's arrival is also signaled to the house.

Note: If you DON'T want to use the optional features noted **, then you simply do not make connections to those inputs/outputs on the automation controller and these features are automatically inoperative. There are no programming changes needed to disable these optional features! And no software to add if you WANT them!

Now to the circuit designs. I am a circuit designer who believes in LONG LIFE designs. This design uses 40amp encapsulated solid state relays instead of the 10amp Triacs as in the original EDKO design. Everything else is voltage and power derated by 50% or more to insure long life. The schematic of the module I designed for the replacement of the circuity board and obstruction modules in existing EDKO SSL, SSW, and MSW units is shown below. Holes in the actual board allow the new board to mount on the same plastic standoff supports as used for the SSL, SSW, and MSW boards which I had. About other models, I do not have mounting information. As to applicability of this design for a specific Gate/Door Operator system, you can examine the wiring diagram for your model unit (or email the wiring diagram to me) to check for: a) a SPDT microswitch for sensing when the gate is OPEN, b) Another SPDT microswitch for sensing when the gate is CLOSED and c) Probably a third SPDT microswitch sensing when the gate has struck an obstruction. d) The motor drive needs to be as shown in figure 4 below with a common neutral and motor drives right or left depending on which side of the split capacitor motor winding is fed with AC power. IF your Gate Operator has all these features, then it should be capable of being "updated" to use the controller design included in this document. The circuit diagram for the replacement module in the EDKO Gate Operator and ALL of the associated wiring INSIDE of the Gate Operator cabinet is shown below in figure 4.

Circuit of Printed Circuit Board (top) and rewired limit switches (bottom) Photo of finished Replacement Circuit Board

(With holes to mount on existing standoff posts)

Figure 4 Note: JPG image of figure 4 can be viewed HERE

Note: I have had several inquiries about the possibility of making a PWB that could DIRECTLY replace the old EDKO board. Frankly, I do not like the negative voltage logic used in the old EDKO design, but it would be quite easy to add a few parts and design a circuit board to replace the old board using modern CMOS positive logic components. I could produce ten such boards to sell for about $80 each IF there was sufficient interest. I note that most people seem happy to just replace their EDKO gate control units with new. Anybody got an old EDKO SSW or MSW gearbox/motor unit they want to get rid of? I would like to have a spare mechanical assembly.

Relay Module and Limit Switch Operating Descriptions for EDKO Operators:

The 7-pin connector shown at the bottom of the page uses 7 pins of the EXISTING "outside world" terminal strip inside the EDKO SSL/SSW/MSW or other Gate Operator. Note Carefully: The Gate Operator Motor Unit is rewired completely to connect as shown above in figure 4. Leave NO OLD WIRING deviating from the above drawing in place. Pin 1 is Common Ground, Pin 2 is the STOP SWITCH input, Pin 3 is the OBStruction Switch output (switch closes momentarily to GND on gate hitting obstruction), pin 4 is the CLOSED LIMIT switch output (pin 4 is connected to GND when gate fully CLOSED), pin 5 is the 24vac (or DC) OPEN COMMAND signal to the gate relay module, Pin 6 is the 24vac (or DC) CLOSE COMMAND to the gate relay module and Pin 7 is the OPEN LIMIT switch output (pin 7 closed to GND when gate fully OPEN). Note: A seven conductor cable from the Gate Operator to the Automation Controller is required..

The relay module circuity is designed so that it is not possible to command the OPEN and CLOSE relays at the same time which could cause a fuse to blow or even motor failure. . If a wiring error or other malfunction should erroneously command OPEN and CLOSE at the same time, the CLOSE command will not be allowed and the OPEN command will take precedence. Note: NEVER swap input (open to the closed terminal and vice versa) wires on the Relay module connector to obtain opposite motor directions as this will cause the limit stops to work improperly.. Wire it just like the drawing.

Gate Operator Notes:

1) Although a 15amp AC line fuse was shown on my SSW/MSW wiring diagrams, no such fuse was found in the Gate Operator itself. A fuse IS recommended.

2) The Gate Operator Motors must must be wired differently depending on if the Gate Operator is on the LEFT side of the gate or on the RIGHT side of the gate. This applies to both single and dual gate operator systems. Since I can never remember which way is which, here is how you test. a) BEFORE you connect up the wires to the 3 pin motor connector, Turn the AC Power toggle switch in the gate operator to OFF, Connect up the neutral wire to the WHITE wire from the AC power source. then temporarily connect the BLACK wire going to the Gate Operator Motor to the BLACK wire coming from the AC Power source. While MAKING SURE you are not about to be hurt by the gate or actuator arm!!!,

JUST MOMENTARILY flip the AC power toggle switch to ON then IMMEDIATELY back to OFF. The gate actuator arm will "lurch" one way or the other. c) Decide if the "lurch" was in the OPEN or CLOSED direction. Then the BLACK wire going into the motor is to be labeled as "that direction" (ie: OPEN or CLOSE) and connected either to pin #1 (OPEN direction) or pin #3 (CLOSE direction) as appropriate on the 3 pin connector going to the Relay Module. For a system with two gate controllers the BLACK "should" be the opposite on the "other" side. I recommend testing to be sure! The (on my unit) PINK wire from the motor should be labeled the "other" direction and so connected to the appropriate pin in the 3 pin motor connector going to the Relay Module.

Testing the Relay Module after it is installed into the Gate Operator and wired

After you install the Relay Module and wire up all the limit switches and in fact, complete ALL the wiring inside the Gate Operator-- Check every wire! for correct connection on both ends. When you are satisfied that the wiring is right, and power is available at the EDKO unit, proceed as follows BEFORE you connect the EDKO to the UUC8 Automation Controller.

1) In every case, BE SURE that IF the motor moves when it should not, YOU and your TOOLS are out of harm's way!

2) Start with the Gate Operator AC power switch turned OFF.

3) Both pin 1 (OPEN) and pin 2 (CLOSE) of the Relay module (Pin 5 and Pin 6 on the rewired EDKO terminal strip)should be at ZERO volts AC or DC.

4) Use your ohmmeter to verify that at least ONE (OR BOTH) of Relay Module Pins 3&4, Pin 3 (goes to the OPEN limit switch) or Pin 4 (goes to CLOSED limit switch) is in the CLOSED (zero ohms to the GND pin) position. Note that if you have it wired right and the operator has driven to the OPEN position, then the OPEN LIMIT switch (on Relay Module pin 3) should be OPEN. Conversely, if the gate operator has been driven to the CLOSED position, then the CLOSED LIMIT switch (on Relay Module pin 4) should be OPEN. In between the limits BOTH switches will be closed and both of pin 3 and pin 4 on the Relay Module connector should be CLOSED to GND when tested with an ohmmeter.

5) Then MOMENTARILY turn the AC Switch to ON then immediately back to OFF.. The Gate Operator SHOULD NOT move. If it does check the voltages and wiring on the Relay Module OPEN and CLOSE inputs. No voltages should be present on these terminals.

6) In the following steps, be prepared to jerk the 12vdc or 24vac power off the terminal if the motor runs the wrong way, moves beyond where the close or open STOP limit should be or something else happens that is unexpected!! Be SAFE.

7) For this test, the STOP input (Pin 2 on the EDKO main terminal strip) should be connected to GND (pin 1 of the same strip) if it is not already connected through the STOP switch as shown in the system wiring diagram. Now take a 12vdc battery (or a 24vac transformer output) and ground the battery negative (or one side of the 24vac) to the EDKO Terminal Strip Pin 1 BLACK (GND) terminal.

8) Then (Use care now!) touch the 12vdc positive terminal (or the 24vac wire) to the OPEN INPUT (EDKO Main Terminal Strip Pin 5). The Gate Operator should run to the OPEN position and stop when the OPEN limit switch opens. Adjust the OPEN Mechanical Limit nut per manual if needed. Take the 12vdc/24vac off Pin 5 when the gate stops.

9) While the operator arm is at the OPEN position, use your ohmmeter to check from the EDKO Terminal Strip Pin 1 (BLACK=GND) to OPEN LIMIT Terminal Strip Pin 7. You should read ~ zero ohms. Then measure from GND to Pin 4 (ORANGE=CLOSED LIMIT). You should read an open circuit.

10) Then touch the +12vdc (or 24vac) lead to the CLOSE INPUT (EDKO Terminal strip Pin 6). The motor should run the Gate Operator to the CLOSED position and stop. Adjust the CLOSED Mechanical Limit nut per manual if needed.

11) While the operator is in the CLOSED position, use your ohmmeter to check from EDKO Terminal Strip Pin 1 (BLACK=GND) to OPEN LIMIT Pin 7. You should read an open circuit. Then move your ohmmeter probe to EDKO Terminal Strip Pin 6 (CLOSED LIMIT). You should read ~zero ohms. This completes the Gate Operator testing except for the Obstruction Switch which we will test when we have the Automation Controller connected.

The HI Solutions UUC8 Unitary Automation Controller

The Automation Controller I used is the model UUC-8 manufactured by HI Solutions, a well known Building Automation manufacturing company in Georgia. They make automation equipment for Cutler Hammer, Eaton, and other manufacturers. They have their equipment installed in perhaps 10,000 large buildings in the USA alone. Below is a photo of the UUC-8 which I used as my "embedded controller" for the EDKO Gate Operator system redesign. Other embedded controllers may be found to be suitable as well.

Figure 5

Notes on UUC8 Pinouts and Pin Functionality for this application.

1) Important! The 5 pin "plug on" connectors used with the UUC8 are numbered left to right 1,2,3,4,5. OFTEN these numbers have NO BEARING on the pinout IDs used on the UUC8 board itself. Always use the pin numbers printed on the circuit board! Refer to the MANUAL for details or to the photograph above for UUC8 pinout functionality.

2) The AO (Analog Outputs) connector is shown on the lower left of Figure 5 isnot used in this design. The UI/AI Universal/Analog Inputs 1 thru 8 are next in clockwise rotation on Figure 5 (we use several AI/UI inputs as DIGITAL SWITCH INPUTS as shown in the following wiring diagram). The next connector in rotation is the connector for L-/L+ (where the board is part of a ULAN NETWORK, then Ground and 24vac power, Ground, Then there are the two DIGITAL OUTput connectors. We use DO1 (pin 5) as OPEN1 command to the EDKO Relay Module, DO2 (pin 4) as CLOSE1 to the same EDKO Relay Module, pin 3 (X) is 24vac input, DO3 (pin 2) is OPEN2 to the second EDKO Relay Module (if equipped), DO4 (pin 5) is CLOSE2 to the second EDKO Relay Module (if equipped). Then optionally for the second OUTPUT connector, DO5 (pin 5) is 24vac output to an optional relay to turn on outside lights when the Automation Controller vehicle sensing loops sense an INCOMING VISITOR. A relay can also be connected to the gatepost light output on output DO6 if desired. This relay can be used to turn on a gatepost light upon vehicle trip of one of the vehicle loop sensors or when the radio signal unlocks the gate.

EDKO Operator to UUC8 Interconnect Wiring

The Interconnect wiring between the two EDKO Gate Operator units and the rest of the system hardware including the UUC-8 Automation Controller and other components such as a) manual OPEN/CLOSE/STOP switch module, b) Inside vehicle sensor SOUT, c) Outside vehicle Sensor NORT, and d) Mailbox Sensor Switch contacts (MSEN) (if desired). The overall system interconnect wiring follows. A PDF image of this drawing is HERE.

Figure 6 - System Interconnect wiring between the Relay Module(s) , UUC8 controller and the various sensors and control inputs.

Parts Availability: By October 2010, I will have a finished printed circuit board for the Relay Circuit Board shown in Figure 4. I can furnish a Relay Module board including all parts and tested for $80 each including USA shipping. I can also provide UUC8 controllers already programmed with the program detailed below or you can buy the UUC8 directly from HI Solutions if you wish to buy the $160 programming adapter from HI Solutions and "program it yourself". A single UUC8 will control ONE or TWO gates as needed without any modifications. If needed, I will charge the cost of the card plus $50 to program the card for you if you prefer a "ready to install" package.. This would include making the OPENING/CLOSING schedule to your needs if requested. A UUC8 board comes in several models. The lowest cost model UUC8-x24 is suitable for this application and sells for about $400. The unprogrammed board can be purchased from HI Solutions, Kennesaw, Ga. OR> If you want to "do it yourself" you can use any embedded controller with suitable inputs and outputs and adapt the program as needed.

A powerful Caveat: There are NO WARRANTIES OF ANY KIND provided that this design and/or equipment will work in YOUR application. That decision depends solely on YOUR expertise and judgement. All the above modifications ARE straightforward IF you know what you are doing! A good Electric Gate Operator Technician should be able to get his first system changed out in a day or two IF he clearly understands the wiring diagrams and discussion contained herein. If you do not understand the technical information provided, DON'T START THE WIRING or injury to people and your equipment could result!

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UUC8 Database for Controlling the Gate Operator(s) and Accessories

The OPERATING PROGRAM for the UUC8 to operate this system is found HERE. As you can tell, the programming language is "sort of" like BASIC programming for the MONITORS. And the Monitors and "Alarm" commands are "where the action is". You can use these commands in the listing to program your own UUC8 or I can provide a UUC8 already programmed with this application program if you prefer.

In any event, hopefully this writeup and a day or so of hard work will give you success in getting your broken EDKO back into service. The modification of each Gate Operator took me about 4 hours and then rewiring the Automation Controller box took me another 5 hours. The software program debug time, I will not go into! :) Luckily, once software is properly tested, it replicates nicely. So the conversion time is not too long if you get all of your parts and tools

together before you start. It would be possible for me to get the UUC8 fitted into a junction box with the necessary AC and low voltage wiring and terminal strips so just hooking up seven wires from each Gate Operator plus wires from outside accessories would be all that was required in the field. But I suggest you do this yourself. It is really pretty easy and straightforward and "doing it yourself" will insure that you can fix it later.

Overall System Checkout and Operation with Relay Module(s), Vehicle Loop, Radio Control, and Manual Push Button Inputs

Testing of the completely wired system is pretty simple and requires maybe half an hour. Don't skip any steps except for those testing features not implemented in your particular installation. As is normal for gate equipment, a periodic functional test of the gate and safety features should be done to insure that all is well. The following steps will test your entire control and motor drive system.

1) This procedure assumes that you have successfully completed the tests under the paragraph, "Testing the Relay Module" and that all tests were successful. It is also assumed that all of the applicable wiring shown above in Once the relay module test are completed, proceed as follows.

2) Initially turn OFF the 120vac power to the Gate Operator(s) so that the motors will not run while we do the initial checks of the wiring and the UUC8 Automation Controller.

3) Plug in UUC8 Power/ULAN connector (labeled L-/L+/GND/24v common/24vac) in Figure 5 above. Leave the other already wired connectors installed. Now turn ON the 24vac to the UUC8. At this point, at least one LED light should show on the UUC8, and you should be able to measure 24vac from the 24vac Common connection on the power transformer to both of the #3 pins on the DIGITAL OUTput connectors and to the 24vac pin on the Power/GND/ULAN connector. You should measure ZERO volts AC on all of the DIGITAL OUTputs 1 through 8.

4) Now turn the AC Power ON in each of your connected GATE OPERATORS. The operators should NOT move, if they do something is miswired. Assuming they do not move, plug the Digital Output 1, 2, 3, 4 connector (with BRN/Yel/Brn/Yel wires in it), onto the five pin DO1>DO4 header. The gate still should not move.

5) At this point momentarily push your MANUAL OPEN BUTTON and AI/UI pin 5 should go to GND and 24vac should be found on DO1 and DO3 pins (OPEN SIGNAL) and the gates should go to the OPEN state and stop automatically. The first and 3rd LEDs on the LED pack closest to the DO connectors should turn ON while the gates are running and should turn OFF immediately when the limit switches close and in not more than 20 seconds based on a timer. The first LED is closest to the UNITARY CONTROLLER lettering on the card.

6) Check to insure that the STOP signal from the OPEN LIMIT SWITCH#1 has grounded pin Digital Input 1 (DI1) and if a second gate operator is equipped, also that the OPEN LIMIT SWITCH #2 has grounded pin DI5. If the limit switch inputs are NOT grounded, check your wiring from the limit switches to the inputs. These will be the first and fifth LEDs

7) Now we test CLOSE operation. Momentarily press the MANUAL CLOSE switch button. The gate(s) should close and come to a stop at the closed limit stop position. This time, LEDs 2 and 4 on the DO LED strip should come on and remain on while the gates are moving and immediately go off at the end of travel if the CLOSE LIMIT STOP signals are properly connected. When the gate comes to a stop, check that Digital Input DI2 is grounded, that DI LED #2 is ON and if you have a second gate, that also DI6 is grounded and that DI LED#6 is ON. If this is correct, then you have completed the limit stop and OPEN?CLOSE gate control tests.

8) The EDKO gates have an OBStruction switch. If you start the gate to CLOSEing and then hold the gate with moderate force to retard its closing, you should hear a "CLICK" sound in the Gate Operator and the gate(s) should IMMEDIATELY reverse and go to the OPEN position. If you have two gates, run this test with both gates. The OBStruction switches are momentary contact (Normally OPEN) so the DI LEDs #3 and #7 barely "wink" on. If the obstruction stops do not work, check by momentarily grounding DI input 3 or DI input 6 while the gate is closing. The gate should stop and reopen immediately. Assuming it does, check the OBStruction switches and wiring against the drawings.

The Radio, Loop Sensors, MSEN, and other switch wiring should be straightforward. When either of the LOOP SENSOR inputs is grounded, the gates should open and stay open for 20 seconds following the vehicle clearance. If the gate is LOCKED by the night schedule, a momentary contact on the RADIO input will UNLOCK the gate for as long as the vehicle is on the loop sensor plus 20 seconds.

8) If you want to use the "mail has arrived" feature, request the test procedure for this special feature. The program already is installed.

9) If you wish to NOT use the scheduler to LOCK the gate, then you must GROUND pin AI/UI 4-1:17I and the scheduler will be disabled.

9) If you want to use the Gatepost night light feature, connect a 24VAC relay coil to DO5, ground the other side of the coil and place the contacts in series with your 120vac light. The light will turn on when a car triggers one of the loop sensors and the gate is closed, the light will come on for the duration of the gate open sequence.