

Door Lock Monitoring System Guide

Design Version Set 1

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System Overview

Introduction

The C. E. Electronics Door Lock Monitoring System (DLMS) was developed to enhance elevator passenger safety. When properly overlaid with existing elevator controller, the DLMS system prevents the elevator from operating (while on normal mode) when the DLM unit detects a jumper in the door lock safety circuit. When properly installed, the DLMS allows elevators to meet all requirements of (A17.3 – 2015) 3.10.12

How the System Works

The CE DLMS uses given inputs to determine the current operational state of the elevator, as well as the integrity of the safety circuit. The state of operation can be viewed on the DLMS Main Board (dual cube display) shown as two digit “Phases”. Outputs are set based on the current “Phase”. LED indicators indicate the state of the output relay (LED ON = Relay Active).

A door sensor is provided for elevator controllers that do not have a clean DCL signal.

When a fault occurs, the elevator will be held at the landing (using OUT1-R1) and the strobe light will illuminate within the machine room space.

Understanding the Phases

Operational Phases are viewed on the “Dual Cube” display on the CE DLMS Main Board. Understanding the phases is the key to understanding our system.

Our system operates by monitoring all inputs. When specific inputs are triggered, we transition into correlating phases. Transitions are determined by the CE DLMS design software.

PHASE LISTING BELOW:

0K == Normal Operation. No issue detected.

1A == Error within Door lock or Gate circuit detected. Door Open outputs active.

1B == Error Mode. Stop operation, Door Open, and light output active.

1C == Double Check Part 1, waiting for doors to close. Error was cleared.

1D == Double Check Part 2, waiting for doors to open. Door open output active.

2A == Inspection Operation and light outputs active.

2B == Fire Phase 2 Operation and light output active.

Resetting the Hardware

Faults are often triggered during installation, locking the unit in error mode. The hardware may need to be reset to continue the installation and testing. Reset is achieved by depressing the green “Reset Button” on the Main Board. The Reset Button must be depressed until the dual cube displays the letters “**RB**” (*reset button active*). If the fault has been rectified the elevator will now return to normal mode, signified by display letters “**OK**” (*normal mode*) on the dual cube display.

Once installation is complete, the unit will automatically clear faults that have been rectified.

NOTE: REMOVING POWER WILL NOT RESET THE STATE OF OPERATION.

Loading New Designs or Software

Different elevator control systems will sometimes require slight modifications for special conditions. In these cases, our engineers will adjust design software remotely and e-mail an update that can be loaded into the CE DLM via USB stick.

Instructions:

1. Download the “.bfo” file that was emailed to you
2. Format a USB stick (as needed)
 - a. USB must be formatted as FAT or FAT32
3. Move the file to the main directory of a USB stick
4. Insert the now loaded USB into the DLM main board
5. Wait for dual cube to display LC or ND.
6. Remove the USB stick
 - a. If “LC” was displayed, the load was complete and the DLMS system will reboot.
 - b. If “ND” was displayed, no data was read and you should try again. If the problem persists, there may be something wrong with the file or USB.
 - i. Make sure the main directory only has one file with the “.bfo” file type
 - ii. Make sure the USB is not password protected

Switching Design Version

DLM units with software version A133.1 or greater have multiple designs loaded. To switch the active design version, complete the following steps:

1. Set DIP switches for desired version (see table below)
2. Depress the green reset button until "RB" shows on display
3. Release the green reset button.
4. Wait for the unit to reboot.

NOTE: Some designs require wiring modification. Instructions are available by scanning the QR Code on the front of the unit or visiting the C.E. Electronics website.

Loaded designs

FILE	DS1-5	DS1-6	DS1-7	Design Version
BFO				DLMS301
BF1	ON			DLMS301_SP_TopLockIN2_2
BF2		ON		DLMS301_SP_SeriesGateLock_ParallelDCL_2DOB
BF3	ON	ON		DLMS301_SP_LuLdMonitoringIN2_2and4_FrontOnlyAccessLockIN1_4_Rev1
BF4			ON	DLMS301_SP_DCLDoesNotTriggerRelays
BF5	ON		ON	DLMS301_SP_IncreasedDCErrorDelay1.5_Rev1
BF6		ON	ON	DLMS301_SP_DOPulse_Single
BF7	ON	ON	ON	DLMS301_SP_FrontOnlyMultiLocks_Rev2

How to choose the correct design file

	Application Notes
BFO	When the door string shows the gate switch followed by ALL the door locks in series. If all door locks are followed by the Gate Switch in series, a minor wiring change is recommended. Information can be found in the DLM Hookup Help document.
BF1	When the top or bottom lock is separated from the other door locks. Locks typically separated by a gate switch.
BF2	When separate door open buttons are required. Typically used in applications with pass-through floors.
BF3	When leveling interacts with the end of the door string. Can only be used if there is not a pass-through floor.
BF4	When the DCL interacts directly with the door string. DCL switch is typically powered by the door string in these cases.
BF5	When a unit needs extra time for all door inputs to make up/drop out. It is recommended to check doors for needed maintenance before using this design.
BF6	When the door operator cannot have the DOB held.
BF7	When a unit has multiple locks. Typically locks are in parallel. Only applicable with 1 gate signal.

Installation

What's in the Box

The DLM box: CE4087 board, 3 wire DFC cable & 24 conductor prewired signal cable, 24V warning light

The diagram on the back side of the panel can be used to connect the DLM unit to the controller. DLMS wires are colored RED and in parenthesis.

The warning light needs to be connected to existing wires in the unit. These wires come with butt-splices and are the same colors as the warning light. Match up red with red and black with black. The light will need to be mounted to the box. This can be done at any time.

The door sensor kit consists of two magnetic reed switches on “L” brackets, and two magnets on straight brackets. A switch and magnet pair need to be mounted on the doors, so the switch activates when the doors are fully closed. The magnets will need to be close to work every time. Make sure there is no mechanical interference when they are attached. If the DLMS unit is mounted in the machine room, 2 to 3 spares in the traveler will be needed to connect the sensor(s) to the DLMS unit. If your unit has a reliable DCL signal, you are not required to use the CE DFC sensors. Refer to the DFC Sensor Install Instructions or the DCL Only Wiring guide found on the C.E. Electronics website. The QR code on the box and power supply will direct the user to the appropriate webpage.

The manila envelope contains parts to mount the light and door sensor along with stickers to help mark-up prints and a note card containing quick facts and final testing instructions.

The Basics

The DLM is a universal overlay. No matter the controller, the methods are always the same.

The DLM uses relays 2/3 to isolate the gate switch from the door locks, effectively placing them in parallel. This allows the DLM to monitor the gate switch and door locks individually to ensure proper functionality. Relays 6/7 are utilized to isolate additional gates or locks when necessary. Relays 0/1 and 4/5 are used to keep the doors open and prevent the car from traveling when a fault occurs.

About the system

The following information should be reviewed before installation begins.

- Inputs can take a range of voltages
 - DLMS1-D takes from 20-150v AC/DC
 - DLMS1-G takes from 90-240v AC/DC
- All inputs need a common. Box is prewired for this.
 - Gates and door locks share a common (IN2-1 included) (9)
 - DFC sensor uses the DLMS unit common
 - All other inputs share a common (11)

- All input signals are assumed active high
- All inputs use a switch (**S2 or S3**) to invert active low signals.
 - Example: If input IN2-5 is active low, S3-5 must be switched ON.
- To not cause an error?
 - **(IN 1)** Inputs 1, 2, 5, 6 need to match up
 - **(IN 1)** Inputs 3, 4, 7, 8 need to match up*
 - *If not using rear doors, **S2-3, 4, 7, 8** must be ON.
 - **(IN 2)** Input 1 must be low when any doors are open
- Errors can only occur when in the door zone
 - **(IN 2)** Input 3 or 4 is ON
- Errors cannot occur if in CTI or Access/Inspection or Fire Phase 2
 - **(IN 2)** Input 5, 6, or 7 is ON
- R0/1 is active in all states except 1B
- R2/3 and R6/7 are active whenever IN1-1 through IN1-8 are OFF (When not in 2A or 2B)
- R4/5 are active in 1B and 1D
- R11 is always active in 1B
 - Intermittent in 2A or 2B
- The DLM only monitors when in normal ("OK") operation.
- There is a timing factor to the unit going into fault
 - Gate, lock and DFC/DCL must activate/deactivate within a 3 second window or the unit will enter the fault phase 1B.
- Testing the gate, door locks and DFC/DCL inputs should only be done in normal operation ("OK")
 - When the DLM is in 2A or 2B, relay 0/1 (run) and relay 11 (strobe) are the only 2 relays that will trigger regardless of the status of any door input.
- R0/1 use can vary. R0/1 can be used to break hall/car calls, DCL, or some necessary signal for car to run (other than door string). R0/1 can also be rewired to activate door hold or independent service.

Wiring

1. Confirm the DLM model is appropriate for the controller.
 - a. DLMS1-D takes from 20-150v AC/DC
 - b. DLMS1-G takes from 90-240v AC/DC
2. Locate wires for all of the inputs show in the example pull sheet below.
3. Determine ground reference for all signals.
 - a. Wiring modifications may be required if they do not share the same ground reference. Signals are grouped with their prewired ground reference in the example pull sheet below.
4. Land power wires. Test.
5. Land signal wires. Test.
6. Land door wires. Test.
7. Land relay wires. Test.

Below is an example of a pull sheet. It is suggested to test each section before moving onto the next section.

CE WIRE			
SIGNAL	#	CONNECTION POINT	NOTES
LINE OR DC NEG	1		Input Voltage: 24-220VAC 24-150VDC
NEUTRAL OR DC POS	2		
GROUND	3		
Test: Cube should read 2B or OK after power up.			
SIGNAL RETURN	11		Used to reference PH2, CTI, Access, DZ, and DCL
FIRE PHASE 2	24		
CAR TOP INSPECTION	22		Input is preset for active low signal.
ACCESS	21		
DOOR ZONE	12		
DOOR ZONE 2	23		
DCL	5		
DCL REAR	4		Input preset for front doors only
DFC SOURCE	RED	SPARE T.C.	CONNECT TO DFC SENSOR (RED)
DFC FRONT	BLK	SPARE T.C.	CONNECT TO DFC SENSOR F (BLACK)
DFC REAR	WHT	SPARE T.C.	Input Preset for front doors only
Test: Activation of Fire Phase 2, Car Top Inspection, Access, Door Zone Sensor(s) and Door Close Limit Switch should turn their corresponding input status LED ON.			
SAFETY STRING RETURN	9		Used to reference Gate Switch, Door Locks, and end of Safety/Door String
SAFETY STRING SOURCE	16		Land on terminal with start of Gate Switch
REAR GATE SWITCH*	7		Inputs preset for front doors only. See FAQ “What is required on front and rear doors?”
REAR DOOR LOCK*	6		
END OF GATE SWITCH	10		Land on terminal where start of DL wire was landed
START OF DOOR LOCK	17		Remove start of DL wire from terminal and connect to 17
END OF DOOR LOCK	8		Remove end of DL wire from terminal and connect to 8
END OF SAFETY STRING	15		Land on terminal where end of DL wire was landed
Note: May need to connect wires 10, 17, 8, or 15 to spares to hoistway J-BOX if gate/door lock in series at J-BOX			
Test: Each door input status LED should be ON when the doors are closed and OFF when the doors are open. If the car does not have rear doors, the rear door inputs should remain ON.			
DOOR OPEN BUTTON	18		DOB Source
	19		DOB Front Return
	20		DOB Rear Return
RUN/STOP	13	Varies	Connection open on fault. Can be rewired to close on fault. Do not place before or after door string.
	14	Varies	
Test – Fault condition should cause doors to remain open and car should not move. Fault should clear automatically when fault condition is removed.			

Refer to the DLM Hook Up Help document found on the C.E. Electronics website for more examples. Some pull sheets are available by contacting C.E. Electronics Support.

Troubleshooting Checklist

The following is a long form list to check each input is wired correctly.

1. Confirm that input signals are being read and inverted properly.
 - a. Turn OFF Car Top Inspection
 - i. **(IN 2)** Input status LED 5 should be OFF.
 1. If the LED is ON and the CTI signal is active low, flip **S3 – 5** to the ON position.
 - b. Turn ON Car Top Inspection
 - i. **(IN 2)** Confirm that input status LED 5 changes state.
 - ii. The cube should say 2A.
 - iii. Leave CTI ON until instructed otherwise.
 - c. Move the elevator to a floor
 - i. **(IN 2)** Input status LED 3 or 4 should be ON when at a floor.
 - ii. **(IN 2)** Input status LED 3 and 4 should be OFF when not at a floor.
 - iii. If your CTI mode removes power to the Door Zone signal, temporarily take the car off CTI to confirm the door zone inputs.
 - d. Close the front doors.
 - i. **(IN 1)** Input status LEDs 1-8 should be ON.
 1. If any of these are off and the signal is active low, use **S2** to invert the corresponding input.
 - ii. **(IN 2)** Input status LED 1 should be ON (assuming rear doors are also closed).
 - e. Open the front doors.
 - i. **(IN 1)** Confirm that inputs 1, 2, 5, 6 changed state from when the doors were closed
 - ii. **(IN 2)** Input status LED 1 should be OFF.
 - f. Close the rear doors. (If applicable)
 - i. **(IN 1)** Input status LEDs 3, 4, 7, 8 should be ON.
 1. If any of these are off and the signal is active low, use **S2** to invert the corresponding input.
 - ii. **(IN 2)** Input status LED 1 should be ON (assuming rear doors are also closed).
 - g. Open the rear doors. (If applicable)
 - i. **(IN 1)** Confirm that inputs 3, 4, 7, 8 change state from when the doors were closed
 - ii. If there are no rear doors, the status should stay off and **S2** 3, 4, 7, 8 should be in the ON position.
 - iii. **(IN 2)** Input status LED 1 should be OFF.
 - h. Turn ON Fire Phase 2 Key Switch
 - i. **(IN 2)** Input status LED 7 should be ON.
 1. If the LED is on and the signal is active low, flip **S2 – 7** to the ON position.
 - i. Turn OFF Fire Phase 2 Key Switch
 - i. **(IN 2)** Confirm that inputs status LED 7 changes state.

Troubleshooting FAQs

- **What does the DLM unit need to see to clear a fault?**
 - Once the DLM unit goes into 1B, the DOB relay on the board will engage, opening the doors.
 - Once the unit sees all the inputs go low that indicate the doors opened (Gate Switch, Door Locks, DFC/DCL, IN2-1 Safety Check), it will go to 1C. In 1C the DOB relay is released.
 - Once the doors reclose and the unit sees all the inputs go high that indicate that the doors are closed, the unit will go to 1D. In 1D the DOB relay engages, reopening the doors.
 - After the doors have reopened, if all the inputs go low to indicate the doors are open, the unit will go back to OK.
- **A signal is active in the controller, but there is no a signal on the board / the LED light isn't coming on?**
 - The best place to start here is double checking where the wires landed and re-checking to make sure that the references to the signals are correct.
 - In a lot of units, there are multiple voltages across the different signals, usually 120VAC & 24VDC and so each of those voltages will have to have their correct reference.
 - Our unit is prewired so that the Gates and Door Locks reference a common (9) and then all other signals reference a different common (11). Sometimes, this is not the case, so isolating signal reference is required.
 - It is important to check prints and confirm with a meter to be sure of the voltage and reference that is required to get a clean signal.
 - Some signals are active low (they are active when deenergized). If this is the case, refer to the next section.
- **What do the dipswitches do and how do they work?**
 - Dipswitch set S1 is for switching which design is used (software version 133.1 and greater), refer to previous section Switching Design Version. Dipswitch set S2 is related to the first set of inputs (Input 1) and dipswitch set S3 is related to the second set of inputs (Input 2). Each number on the individual dipswitches then corresponds to the Input number. For example, S2 (Input 1) dipswitch 1 will correspond to IN1-1 (Gate Switch), S3 (Input 2) dipswitch 7 will correspond to IN2-7 (Fire Phase 2).
 - The S2 and S3 sets of dipswitches determine whether the board sees a signal as active low or active high. If a dipswitch is raised "on", then the signal is considered active low which means it would be active when it doesn't see power and off when it does see power. Conversely, if the dipswitch is down "off", then the signal will be active high, meaning that when it sees power it is active and when it doesn't see power it is off.
 - Some signals, such as car top inspection, are generally active low in most controllers, so our boards are preset with S3 dipswitch 5 in the on/up position.
 - For a unit that has no rear doors, S2 dipswitches 3,4,7,8 are up which tells the board that they are active low and since there's no signal power on the inputs, they are always active. The board now sees the rear gate/locks/dfc/dcl are constantly closed, making them a non-factor in a front only application.

- **When the DLM unit is in normal operation, the DLM starts cycling 1B/1C?**
 - When the DLM cycles from 1B to 1C consistently, this means the unit detects a fault, then immediately detects no fault; but then when the doors close back the unit is not seeing 1 or more of the necessary inputs to tell it that the doors are fully closed.
 - Make sure the Run/Stop wiring (13) and (14) are not wired with a stop switch that feeds the safety string power.
 - Make sure all door inputs (gate switch, door locks, DFC/DCL) are landed.
 - If the doors close but the DFC/DCL (IN1-5, IN1-6 front, IN1-7, IN1-8 rear) inputs never go high, the DFC sensor may need adjusted, or the DCL signal is not switching appropriately.
 - If the gate switch (IN1-1, IN1-3), door locks (IN1-2, IN1-4) or safety check (IN2-1) never go high, it may be that (9) (door lock/gate switch reference) is landed correctly.
 - If the gates and/or door locks never go high, the issue often lies with how (10) and (17) are landed. (10) is the gate switch signal wire and needs to be landed on the terminal with the wire that comes from the end of the gate switch. Usually on that same terminal, there will be a wire that feeds the door locks. That wire will need to be removed from the terminal and spliced with (17), which is a power feed for the door locks. It is quite common for these wires to be confused. It is important to ring these wires properly for confirmation.
 - One potentially easy way to know a gate switch wire from a door lock wire is that a gate switch wire will tend to look like the rest of the traveler wires, while a door lock wire will look like the rest of the hoist way wires (This is assuming that the traveler wires haven't gone through a hoist way junction box or connected to the board elsewhere, first).
 - If there is only 1 wire coming to the end of the gate switch terminal, chances are that the gate wire and door lock wire are tied together somewhere in the hoist way with only 1 wire returning to the controller. That connection will need to be found and the door lock wire will need to be split away and connected to a spare that runs to the machine room where it will splice to (17).
- **The elevator is running fine with the DLM on, but when a gate or lock is jumped it doesn't go into fault?**
 - The CE DLM unit will only go into fault when it is in normal operation ("OK") and the unit sees a Door Zone signal. If the DLM unit is in "2A" (Access/Inspection), "2B" (Fire Phase 2), or "OK" without a Door Zone active signal, it will not register a fault.
- **Are there differences between the 120v and 240v versions of the DLM?**
 - The 240v unit works the same as the standard 120v unit, with component changes made to accommodate the higher voltage.
 - Subsequently, the minimum signal voltage requirement is increased. A standard unit will begin triggering around 12 volts whereas the 240v version will only start triggering around 90 volts.
 - There are added relays for the DFCs.
 - The board still provides 24VDC to the DFC switch, however the DLM input needs to see a voltage higher than 24VDC to activate. The added relays utilize a common line voltage to trigger the input signal on the DLM board when the relay is activated by the DFC(s) closing.

- **What is required on a front and rear unit?**
 - Front and rear inputs in parallel on the controller
 - Check to make sure the unit requires added DLM monitoring. Wire each input individually.
 - Front and rear with no passthrough floors – Gates and Locks in series
 - Leave the gates in series and leave the locks in series, and run the DFCs in series. Treat the gates as a single gate and wire same as a front only system.
 - Front and rear WITH passthrough floors – Gates and Locks in series
 - Leave the gates in series and leave the locks in series like a front only. Run the DFCs in parallel. Refer to software BF2 – DLMS301_SP_SeriesGateLock_ParallelDCL_2DOB and the correlating diagrams.
 - If a unit has front and rear doors where they are unable to have the gates and locks in series, it is advised to provide prints to the DLM Support Team so the required wiring changes/diagrams/software can be compiled.

Support

C.E. Electronics provides free technical support. Support is available during business hours and can be contacted by phone or email. More documentation is available on the C.E. Electronics website. Scanning the QR code on the DLM unit will navigate the user directly to supporting documentation.

Document Version History

Version	Date	Notes
1.0	20250501	Initial Release