Operation Manual for Door Operation Controller (Drive BLDC)

www.greenfieldcontrol.com
Table of Content

- Symbols used
- Suggestions and Warnings
- Director’s note

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Working Principle</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>All About Door Operation Controller (Drive BLDC)</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Technical Data</td>
<td>19</td>
</tr>
</tbody>
</table>
Symbols used

The points that are important under the safety viewpoint and danger warnings are indicated with these symbols:

👉 Important Suggestions

⚠️ Warnings (Risk of personal injury)

Dear Customer,

Welcome to the GREEN FIELD family and congratulation on choosing a fully digital and high end microcontroller based “Automatic Door Operator Controller” the DYNAMIC CAR DOOR MECHANISM & DYNAMIC LANDING DOOR MECHANISM.

Like all the previous products from us, Automatic Door Operator Controller has been designed to fulfill all your needs & expectation for controlling the automatic doors. That’s why it comes with some exclusive features like self-learning initialization process, so many programmable parameters etc. to make it suitable for any type of automatic doors.

The EEPROM provided inside avoids any battery related problems and the tight algorithm for writing to the memory & reading from the memory makes it free from all memory related problems likes battery low, memory corruption etc. for battery backed RAMs & conventional methodology for handling memory.

The watchdog timer prevents any type of malfunctioning of the unit in highly noisy industrial environment where the EMI/RFI filters could not prevent the noise interference.

Please do not hesitate to get in touch with your dealer for service center for any advice or further help you may require.

We are just a phone call away.

We wish you a very long fruitful utilization of DYNAMIC CAR DOOR MECHANISM & DYNAMIC LANDING DOOR MECHANISM.

Sincerely,

For, GREEN FIELD CONTROL SYSTEM (I) PVT. LTD.
Suggestions and Warnings

Suggestions:

✓ Before starting the installation of this product, we hope you will read all the information contained in this document carefully.

✓ In this manual, you will find important warnings about what not to do during installation and what are the correct ways for installation and how to assemble and maintain the product in good operating conditions and how to get the maximum of your investment.

✓ You will also find important information concerning the product care and maintenance which are an important factor to ensure safety at all times.

✓ Before installation work begins, it is in your own interests to clarify what are the structural conditions available for installation work, so that you can see which installation procedures should/must be carried out. Therefore it is recommended that all circumstances be taken into consideration.

✓ This document is an integral part of the supply and should be available in the lift power room at all times.

✓ We hope you will get full satisfaction from this our product.
Warnings:

- In order to prevent any injury to persons and damage to property, the handling, installation, adjustment and maintenance must be carried out by suitably trained personnel, using appropriate clothing and equipment.

- Any masonry work connected with the correct installation of the product must be executed in a workmanlike manner according to the applicable laws.

- The connection of the electric/electronic units to the local power supply must be executed in a workmanlike manner according to the applicable laws.

- All metal parts supporting the electric/electronic units must be connected to an earth system in a workmanlike manner according to the applicable laws.

- Before connecting the product to the power supply check that the product’s requirement corresponds with the power supply available.

- Before starting any work on the electric/electronic components disconnect power from the system.

- Keep the material in the original packing, protected from bad weather and direct exposure to sun during the storage period in order to avoid the accumulation of water/condensation inside the packing material.

- Never dispose of packing material in the environment.

- Whenever possible, re-cycling is preferable to disposal in dump sites.

- Before re-cycling check the nature of the various materials and re-cycle in the appropriate way.
Director’s note

Green Field control system (I) Pvt. Ltd was founded in 1997 at Gandhinagar, capital city of the Gujarat, INDIA with a main focus on providing an automation solution by research, development and production of **Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism**. We have been in this industry since 10 years with the reputed name as **GREENFIELD CONTROL SYSTEM (I) PVT. LTD**. Believe that company is interested to developed relationship with their customers not only as professional but company would also like to develop “Devotional relationship”.

We have taken every care to make this Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism - a reliable and efficient one and will give you a long trouble free service. Using good quality of raw materials and production techniques, our range of products are most durable and effective.

As per the requirement of customers every time company came with improved ideas along with the great kind of services for the products after sales.

Using our vast knowledge of this industry, we have revolutionized the concept of Remote Operated Gates and Door. To cater to our clients effectively, we have integrated production facility and well-equipped with modern machines. We also ensure to manufacture this range as per the contemporary trends used by customers. With several design and sizes, our products can also be customized to meet varied requirements of our clients.

GANPATLAL D. PATEL (DIRECTOR),

**GREENFIELD CONTROL SYSTEM (I) PVT. LTD.**
Introduction

**Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism** is a fully digital and high end microcontroller based Mechatronics product.

This mechanism has been designed to fulfill all your needs and expectation for Passenger lift as well as Goods carriage lift.

**Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism** made by three basic parts: Car Door Mechanism, Landing Door Mechanism and Dynamic Door Operation Drive.

**Car Door Mechanism** is a vertically moving part of the product; the **Dynamic Door Operation Drive** circuitry attached with car door mechanism which controls the whole the operation of mechanism, by the software code programmed in the Micro-controller IC of drives.

The Car Door Mechanism moving vertically in the entire building and make an alignment with one of the Landing Door Mechanism among all.

When the alignment becomes perfect, an appropriate task will be executed, as programmed in the micro-controller IC.

**Landing Door Mechanism** is not a moving part, but it is installed on every floor of the building.

In this way a single Car Door Mechanism & a single Dynamic Door Operation Drive are required per set, and set may include more than one Landing door mechanism, depends on the number of floors of the entire building.

There are two basic kinds of mechanism: **Centre Opening & Side Opening (Telescopic).**

In the center opening mechanism, the drives open the door from center, whereas in the telescopic opening mechanism, the drive open the door either from the left side or from the right side, depends on the two sub types of Telescopic, left side and right side, respectively.
Some **Exclusive features** of Door Operation Controller (BLDC Drive) are mentioned below:

- The unit will operate on normal 220-230v AC (50/60 Hz)
- Smooth mechanism of opening and closing of the doors
- The unit is controlled by a Micro-controller which has a right mix of peripherals to interface with the various components of the Digital Motor Control hardware like the ADC, PWM, Hall Sensor Interface, etc.
- LED Indicates current status of Door Operation
- The watchdog timer prevents any type of malfunctioning of the unit in highly noisy industrial environment
- Function switches to select the desire Functional Parameters
- Input Commands: Door Open, Door Close, Photo Sensor
- Output Signals: Door fully Opened, Door fully Closed, Mechanical Obstruction, Photo Detection
- During first installation, or at the time of changes in functional parameters, drive will go for Self Learning Test to measure the span of opening. It will store that data in its memory, and set the operational profile i.e. it will not execute Self Learning Test every time the Power On.
- The speed is adjusted by programming software, we’ve calibrate that parameter as company default value; also it has some range to adjust different speed of opening/closing profile curve

**A Dynamic Door Operation Controller** controls the **BLDC Motor**. **Brushless DC (BLDC) motors** are referred to as **Brushless Permanent Magnet**. Permanent Magnet motors, Permanent Magnet Synchronous Motors, etc.

**Key characteristics of BLDC Motor:**

- A rotor with permanent magnets and a stator with windings
- A Brushes and commutator have been eliminated and the windings are connected to the control electronics, so motor is less noisy
- Potentially cleaner, faster, more efficient, less noisy and more reliable
- Rotor has permanent magnets vs. coils thus lighter less inertia: easier to start/stop
- Linear torque/current relationship smooth acceleration or constant torque
- Speed proportionate to line frequency (50 or 60 Hz)
Working Principle

The Dynamic Car Door Mechanism and Drives are mounted inside the lift. When lift is moving vertically inside the building, the first task to be executed is the making of an alignment between Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism, on each floor for that the command was given from the lift. After the detection of the perfect alignment between these headers, some specific task of door operation will be executed, as programmed in the micro-controller IC.

The closing and opening of the doors of all the lifts are also monitored and controlled by a master controller, mounted at the Control Panel. The Control panel is placed somewhere into the building which monitor and control the doors of all the lifts of entire building.

This Master controller gives the appropriate commands to operate the doors across the entire building. The master controller communicates to any particular lift, to operate the door, through the Microcontroller of drives of Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism. The drive accept the input commands from the master controller to open and close the doors, then it does as the command given by, and after closing/opening the door it will acknowledge the master by generating its own command like: Door fully closed/Door fully opened.

There is also a provision to connect the Photo sensor to detect the Obstruction between the doors of lift. When any obstruction is detected, the door is opened again by the command given by the Microcontroller of drive of Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism itself, if the mechanism is configured in Master mode. Otherwise, when any obstruction is detected, the command of obstruction of object is transmitted towards the master, and then master will generate and transmit the command to reopen the door, if the mechanism is configured in a Slave mode.

In this way, Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism perform the task of closing/opening the door and indicates what it does by turning on the appropriate LEDs.

The status message of what it is doing shown by a Seven Segment display, and also a specific LED glows for that particular task.

The user can also change some programmable parameters of different function by selecting the function key. Upper & lower arrow keys are used to change the value of selected function’s parameter.
All about Door Operation Controller (Drive BLDC)

The heart of the product is Dynamic Door Operation Drive. Drives itself contains the micro-controller IC in which the software code is programmed to drive the mechanism as we desire. One can connect their inputs and outputs at the specific terminals.

Terminal Details

This chapter briefly explains about the terminal connection that is classified into two segments:

1. The terminal connection for power supply &
2. The terminal connection for Input and Output

1) The terminal connection for power supply:

Figure shows how to connect the Power supply to the terminals of the Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism. It also indicates the status of Fuse and Power. The unit Turn On switch is also given on the front side of the Power supply unit of Dynamic Car Door Mechanism & Dynamic Landing Door Mechanism.

The unit will operate on 230 V AC (+/- 15 %, 50/60Hz). It will draw approximately 750 mA from the mains supply.

For the safety & galvanic isolation, the transformer is kept between the Mains supply & Door controller Unit. So the mains supply is not directly given to the Unit but it is applied via transformer.
2) The terminal connection for Input and Output:

![Diagram showing terminal connections and labels](image)

*Fig.: The Terminal details of input and output*

- **Input Terminals:**

  - **LEFT LOWER TERMINALS - CONTROL TERMINALS**
    - 13: DOOR OPEN
    - 14: DOOR CLOSE
    - 15: IN
    - 16: PHOTO SENSOR
    - 17: COM
    - 18: PHOTO SENSOR Rx SUPPLY
    - 19: +
    - 20: -
    - 21: PHOTO SENSOR Tx SUPPLY
    - 22: +

  - **RIGHT LOWER TERMINALS - POWER TERMINALS**
    - 0-15 (BLUE)
    - 0-15 (BLACK)
    - 0-24 (YELLOW / GREY)
OPEN INPUT (TERMINAL NO.-13):
It is a potential free (Volt Free) contact input with reference to the common input terminal (Ter. No. 14) to give the opening command to the door controller unit.

COMMON INPUT (TERMINAL NO.-14, 15):
It is a reference terminal with reference to which the Open & Close inputs are applied.

CLOSE INPUT (TERMINAL NO.-16):
It is a potential free (Volt Free) contact input with reference to the common input terminal (Ter. No. 15) to give the closing command to the door controller unit.

CONNECTING PHOTO SENSOR TO THE UNIT:
For the safety purpose for automatic door operator controller “photo sensor” is used. The operation of almost all the photo sensor is on 11-30 VDC. The door controller unit has got the inbuilt capability to interface almost all type of photo sensor without any extra power supply.
Refer the following figure for connecting the PHOTO SENSOR.

CONNECTING PHOTO SENSOR TO THE UNIT (NPN O/P TYPE):
Follow the Connection Diagram to interface the “Photo Sensor” having NPN output.

CONNECTING PHOTO SENSOR TO THE UNIT (PNP O/P TYPE):
Follow the Connection Diagram to interface the “Photo Sensor” having PNP output.

CONNECTING PHOTO SENSOR TO THE UNIT (RELAY O/P TYPE):
Follow the Connection Diagram to interface the “Photo Sensor” having RELAY output.
OUTPUT TERMINALS:

Output Relays have been provided to give information of the status of the doors to the main controller. One 3 Amp., 220 V AC rated Relay contact & LED indications are provided for the status like Door Fully Opened, Door Fully closed, Photo sensor Detection & Obstruction in the doors.

- **FULLY OPENED:**
  The Relay activates & LED glows when the door is fully opened.

- **FULLY CLOSED:**
  The Relay activates & LED glows when the door is fully closed.
- **PHOTO SENSOR:**
  The Relay activates & LED glows when the object has been detected by the photo.

- **OBSTRUCTION:**
  The Relay activates & LED glows when any obstacle is detected that stops the door from closing. The signal will reset when the doors reach the fully opened or fully closed position.

- **MOTOR TERMINALS:**
  The connections for driving the Synchronous Motor & Encoder are provided with self-locking connectors.
PROGRAMMABLE PARAMETERS:

DYNAMIC CAR DOOR MECHANISM & DYNAMIC LANDING DOOR MECHANISM is programmable door controller to suit any type of automatic doors. Following is the list of programmable parameters.

<table>
<thead>
<tr>
<th>Field Settable Parameters</th>
<th>Open Fast Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Close Fast Speed</td>
</tr>
<tr>
<td></td>
<td>Open Slow Speed</td>
</tr>
<tr>
<td></td>
<td>Close Slow Speed</td>
</tr>
<tr>
<td></td>
<td>Open Slow Located Distance</td>
</tr>
<tr>
<td></td>
<td>Close Slow Located Distance</td>
</tr>
<tr>
<td></td>
<td>Open Brake Slope</td>
</tr>
<tr>
<td></td>
<td>Close Brake Slope</td>
</tr>
<tr>
<td></td>
<td>Close Safety Force (for Obstruction Detection)</td>
</tr>
<tr>
<td></td>
<td>Close Holding Force</td>
</tr>
</tbody>
</table>

- **PARAMETER 1: OPEN FAST SPEED**
  It is the speed at which the doors will be opened in its full speed range.

- **PARAMETER 2: CLOSE FAST SPEED**
  It is the speed at which the doors will be closed in its full speed range.

- **PARAMETER 3: OPEN SLOW SPEED**
  It is the speed at which the doors will be opened after its slow located distance.

- **PARAMETER 4: CLOSE SLOW SPEED**
  It is the speed at which the doors will be closed after its slow located distance.

- **PARAMETER 5: OPEN SLOW LOCATED DISTANCE**
  It is a distance from fully opened position and from there the doors will open with a slow speed.
• **PARAMETER 6: CLOSE SLOW LOCATED DISTANCE**
  It is a distance from fully closed position and from there the doors will close with the slow speed.

• **PARAMETER 7 & 8: OPEN & CLOSE BRAKE SLOPE**
  This parameter varies the time of changing the doors’ speed from full speed to slow speed.
  That gives the smooth changeover of the doors’ speed and prevents doors banging.

• **PARAMETER 9: CLOSE SAFETY FORCE**
  It is the maximum force (closing pressure) on any obstacle while closing the doors, if Obstacle’s pressure is more, then the doors will be reopened and the obstruction relay-LED will be on.

• **PARAMETER 0: CLOSE HOLDING FORCE**
  After a fully close operation, sometimes the doors slightly reopen due to the doors mechanism; to prevent this some holding force is required to hold the doors in the closed position. This parameter decides how much holding force to be applied to the doors to keep it close.
DIP SWITCHES (OPERATION MODE SETTING)

DESCRIPTION OF SWITCHES

The “LIFT MASTER” may be programmed for different operating modes using the DIP Switches provided on the front of the unit.

If any change is made to the switch selection, the mains power to the Unit must be switched OFF & ON again to read the new/operating modes.

- **SWITCH -1. (AUTOMATIC SKATE RELEASE/NO SKATE RELEASE)**
  - **ON: AUTOMATIC SKATE RELEASE**
    The skate will release automatically in case of Power Cut.
  - **OFF: NO SKATE RELEASE**
    The skate will not release automatically in case of Power Cut.

- **SWITCH -2. AUOTMATIC/SEMI-AUTOMATIC**
  - **ON: AUOTMATIC**
    Operate with skate. In this mode the special movement is made for locking & unlocking the skate.
  - **OFF: SEMI-AUOTMATIC**
    Operate without skate. In this mode the no special movement is made for locking & unlocking the skate.

- **SWITCH -3. OPENING DIRECTION ALTERATION**
• **ON**: One Direction of opening
  The Motor will rotate in one direction.
  
  The Direction of the opening depends on the way you have fixed the doors hanger with the belt & your door operator mechanism.

• **OFF**: Other direction of opening
  The Motor will rotate in opposite direction.

➤ **SWITCH -4. MASTER/SLAVE MODE**

• **ON**: MASTER
  The Door control unit will execute the instructions directly (Locally).

  **Example**: If the Photo sensor input is active while closing the door, the door reopen process will start without waiting for the open command from the main controller. The unit will also give output of the “photo cell” to the main controller.

• **OFF**: SLAVE
  There is no automatic re-opening of the door directly.

  **Example**: If the Photo sensor input is active while closing the door the door reopens process will not start automatically, but the unit will give output of the “photocell” to the main controller & after receiving the command from the main controller it will start the door re-opening process.
## Technical Data

<table>
<thead>
<tr>
<th>The Unit</th>
<th>Microcontroller based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input supply voltage</td>
<td>230 V AC (+/- 15 %, 50/60Hz)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>180 W Max</td>
</tr>
<tr>
<td>Overall dimension</td>
<td>Size: 1460x475x110 mm, for Dynamic Car Door Mechanism &amp; 1500x205x74 mm, for Dynamic Landing Door Mechanism</td>
</tr>
<tr>
<td>Weight capacity</td>
<td>100 Kg per one and 200 Kg for the panel</td>
</tr>
</tbody>
</table>