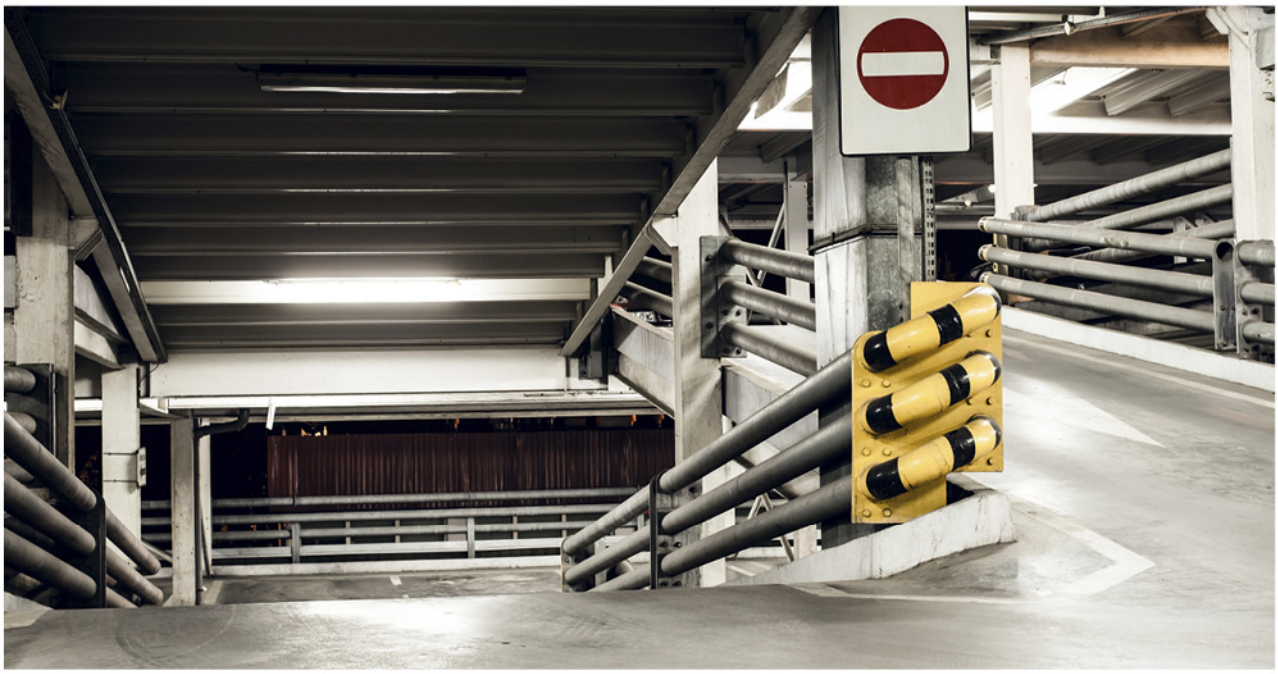
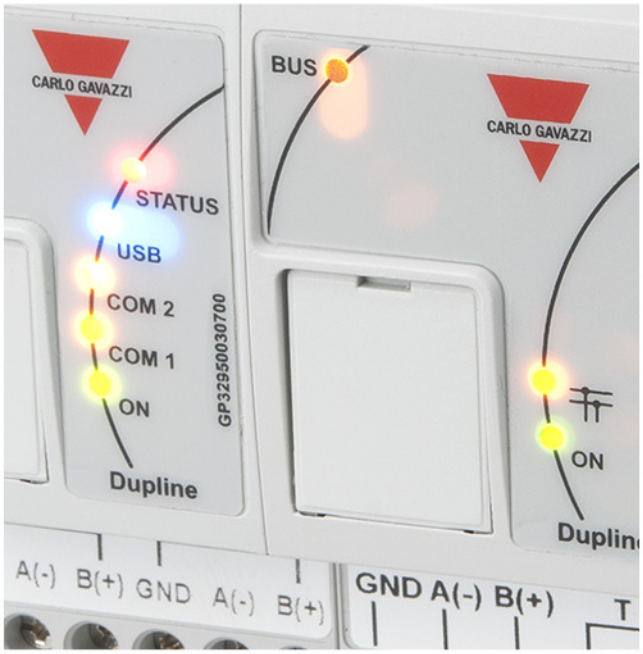
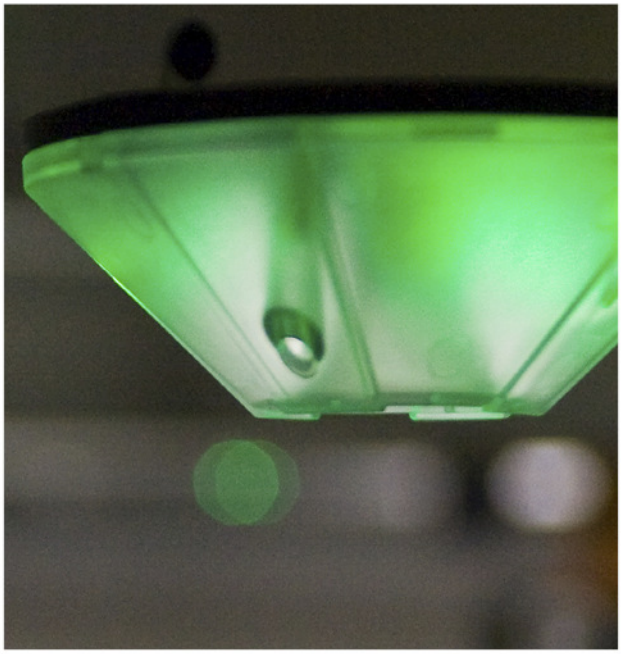
# Dupline®
# Carpark Master Zone Counter
# Design and Installation Guide





# Dupline Carpark Master Zone Counter (MZC)

## Table of Contents

# Introduction

The MZC is part of the Dupline Carpark system. The MZC is a zone count system which has the ability to detect and count cars when they enter and exit zones in the carpark facility and send the information to displays, and to the Dupline Carpark Software for display on a computer.

In order to make the zone count system fully compatible with the single spot detection system, the MZC transmits its zone count values by emulating a number of single spot segments. This means that the values for the displays are transmitted on the L2 bus and the values for the carpark software are transmitted on RS485.

The zone count system is often used in a single spot system to keep track of the cars on the rooftop, where no ultrasonic single spot sensors can be installed, but it can also be used to implement a complete parking guidance system at a lower cost than a single spot system.

# Hardware

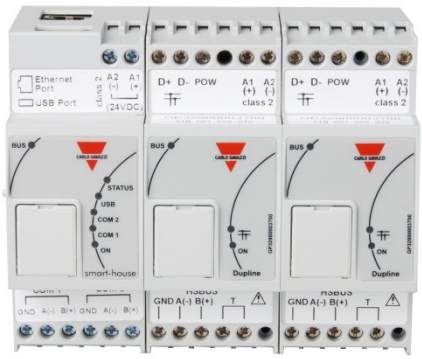
The MZC consists of 3 modules:

1* GP3295 0030 700 - Carpark Counter Module

1* GP3290 0003 700 - Carpark Master Channel Generator (CMCG) for L1

1* GP3290 0003 700 - Carpark Master Channel Generator (CMCG) for L2

Ordering code for complete MZC with all 3 modules is GPMZC-SET




## Carpark Counter Module (GP32950030700) :

The Carpark Counter Module is the intelligent programmable part where the management of the count zones takes place.

The 24 VDC powered module has a standard USB and an Ethernet connection on top of the module, which should be used to communicate with network or local PC. On front of the module - behind the cover - there is a mini USB and a micro SD for internal use only. Do not try to use the mini USB or micro SD-card slot for

standard communication. The two COM ports are both RS485 and are used to transmit data between the server running the carpark software and the MZC.
This is done via the Ethernet-RS485 converter module ETHCONV4, exactly the same way as in the single spot detection system (see overview diagram page 12).

The LEDs on the front indicate the status of the counter module.
All LEDs will turn on for a few seconds during power ON. Depending on what is connected to the counter module, at least the BUS LED and ON LED will be ON.

The BUS LED indicates with an amber LED that the internal bus is running. The internal bus is running via the 6 pin interconnection (See remark on the picture below). This LED will be ON 20 seconds after "Power ON"

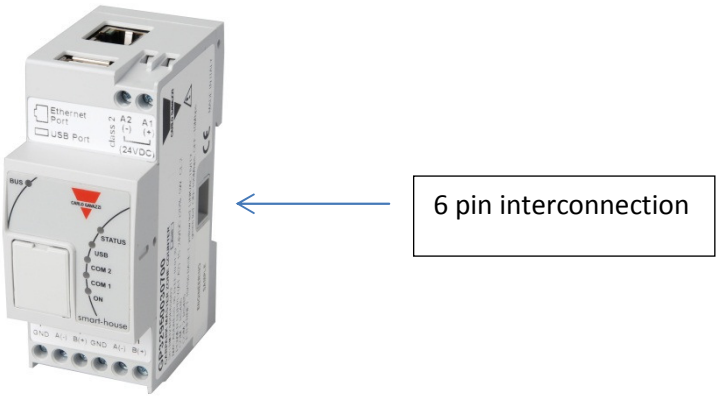
STATUS LED indicates status (red)

USB LED indicates USB in use (blue)

COM2 LED indicates com port 2 in use (amber) (From ID 17 to ID 32)

COM1 LED indicates com port 1 in use (amber) (From ID 1 to ID 16)

ON LED indicates power ON (green) This LED will be ON 20 seconds after "Power ON"




## Carpark Master Channel Generator (GP32900003700) :

To perform its function, the Carpark Counter Module needs two Carpark Master Channel Generators, which are connected through the 6-pin plug on the side of the module. The Carpark Master Generator generates the Dupline 3-wire output (D+, D- and pow) needed for communication and power for the sensors and carpark monitors. One bus output (L1) is used to interface the carpark counter module with the car detection sensors needed for the counting, and this module works same way as a standard Carpark Master Module GP34960005700 used in the single spot system. The other bus (L2) is used to interface the zone count system to the displays, same way as in the single spot system. This module works like a standard Dupline Master Module G34960005700, and this means that it drives the entire L2 bus both in stand-alone count systems and in mixed count/single spot systems (so, no G34960005700 needed for L2 in this case).

Individual power supplies to the Carpark Master Channel Generators are required, as the modules have no galvanic separation to the bus output. However, the Carpark Counter Module GP32950030700, which has

galvanic separation from the power supply, can share the power supply with one of the Master Channel Generator Modules.

Remember to make a power calculation if the L1 or L2 bus is heavily loaded. Refer to page 56 in the Carpark installation manual.

Each Carpark Master Channel Generator has a unique SIN code printed on the side of the module.

A SIN code is built up with 3 groups each consisting of 3 numbers. An example could be: SIN 019.113.001. During configuration, the SIN codes for the L1 and L2 Carpark Master Channel Generators respectively needs to be entered. This allows the Carpark Counter module to determine which module shall be used for bus L1 and which module to be used for bus L2.

The LEDs on the front indicate the status of the Carpark Master Channel Generator.

All LEDs will turn on for a few seconds during power ON. Depending on what is connected to the module, at least the BUS LED and ON LED will be ON.

BUS LED indicates internal bus running (amber). The internal bus is running via the 6 pin interconnection (see remark on the picture below). This LED will be ON 20 seconds after “Power ON”

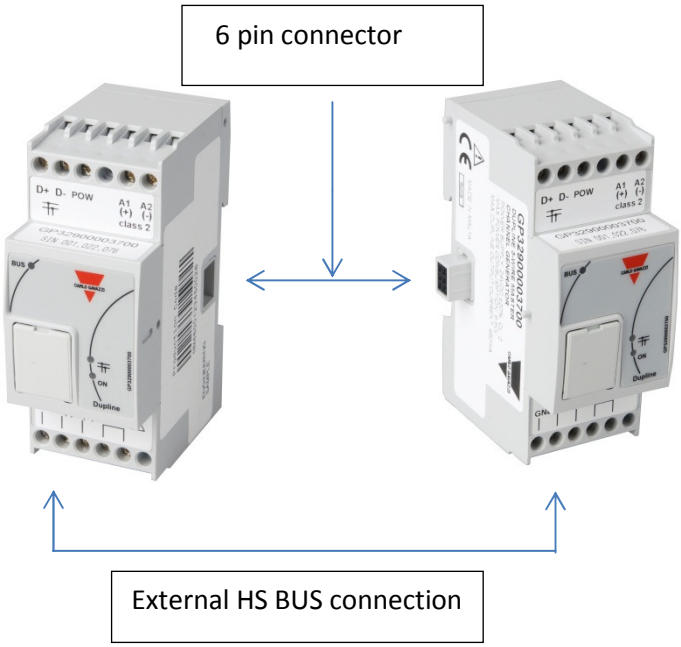
LED indicates 3-wire Dupline bus L1 is running (amber).

ON LED indicates power on the module (green). This LED will be ON 20 seconds after “Power on”.


n). This LED will be ON 20 seconds after “Power ON”

## HS BUS for all module types:

The internal HS bus linking the 3 modules together via the connectors on the sides can also be implemented as an RS485 connection if desired. This allows the 3 modules to be installed in different panels.




# Operating principles of the MZC

The MZC can work as a stand-alone zone count system or in a mixed solution together with the Carpark single spot detection system. In any case the count system consists of a number of count zones, and each of the zones has a certain number of entry and exit points for the cars. These are called detection points (DPO's) and this is where the sensors need to be mounted to detect the passing cars.

In order to make the zone count system fully compatible with the single spot detection system, the MZC transmits its zone count values by emulating a number of single spot segments, depending on the total number of spaces in the zones. This means that the values for the displays are transmitted on L2 and the values for the carpark software are transmitted on RS485.

## Zones

A zone is typically a level of the parking facility, but can also be a part of a level or even the entire carpark. A zone has a certain amount of parking spaces available, and the function of the zone count system is to detect and count the cars entering and leaving the zone and thereby keep track of the number of available spaces. The MZC transmits on the bus L2 the availability number for each zone, and thereby allows them to be read by master carpark monitors controlling local or totalizing displays. Since the slave carpark monitors

of the single spot detection system also send their numbers on the bus L2, it is easy to implement a totalizing display adding numbers from both type of systems.

In order to allow the space availability numbers from the zone count system to be used in the Dupline Carpark Software, the zone availability numbers are also made available via the two RS485 ports of the Carpark Counter Module.

## Detection Points (DPO)

A detection point is a lane or driveway where cars enter or leave a zone. A typical example of a DPO is a ramp between two levels, but could also be the entry point from the street into the carpark, or the exit point. In many cases a detection point is involved in two zones. For example a DPO which is an exit point for level 2 could at the same time be an entry point for level 3.

Each detection point needs sensors, connected to bus L1, to detect the passing cars. Dupline ultrasonic sensors are usually used, but other sensor types like standard photo-electric or loop detectors can also be used. This is done by connecting the sensor output to a Dupline input module.

The MZC provides the option to use either one or two sensors in each DPO. Two sensors with a distance of 2-3 m between them is recommended, because this gives the possibility to detect the direction of the car and also allows more efficient filtering to avoid false detections. Sometimes cars drive in the wrong direction in a uni-directional lane, and in a two sensor solution the MZC is able to manage this, so the count is still right. In bi-directional lanes it is mandatory to use two sensors.

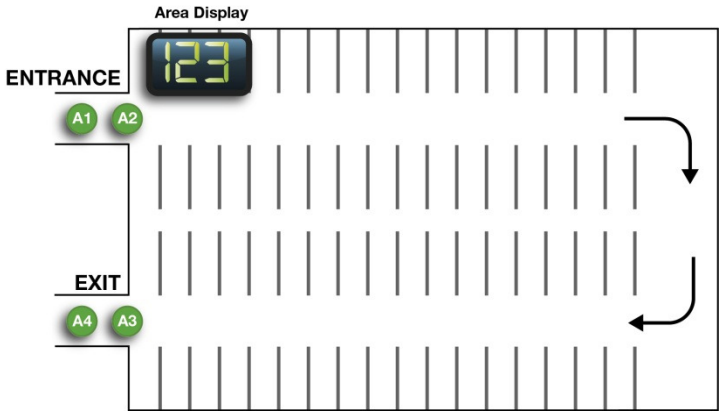
When configuring a detection point there is a possibility to define a time-out value. The time-out is only to be used in case of a long distance (more than 3m) between sensor 1 and sensor 2. The time-out allows a valid car detection as long as the delay from sensor 1 becomes inactive until sensor 2 becomes active is less than the time-out value. With the typical 2-3 m distance between the sensors, 1 s is the recommended value. Too high value increases the risk of detection faults.
Single sensor DPO's are mainly implemented when it is not possible or difficult to use two sensors, this could for example be in an outdoor installation with loop detectors.

## Initialization and adjustment

In the initial configuration the installer has to define the number of spaces in each zone. The actual number of available spaces in each zone at the initial stage must also be defined. From that point, the carpark Counter Module will increment or decrement the zone count values as the cars enter or leave the zones through the relevant detection points. Since any count system has the issue of accumulating detection faults, it is important to have a manual count adjustment facility that can be used from time to time whenever required. In the Dupline carpark count system this manual adjustment is performed though the built-in web server, which can be accessed from a smart phone or a laptop. By using a standard browser, the number of available spaces from each zone can be read and adjusted if needed. The web server is also used for the configuration of the MZC.

# Stand-alone system examples

## A simple parking facility with one entrance and one exit




The minimum requirements for this simple stand-alone system are:

- MZC module

- 2 power supplies

- 2 sensors to detect passing cars at the entrance

- 2 sensors to detect passing cars at the exit

- Configuration unit GP7380 0080

- PC to program the MZC

- Carpark monitor module GP3482 9091 724 programmed as “Master”

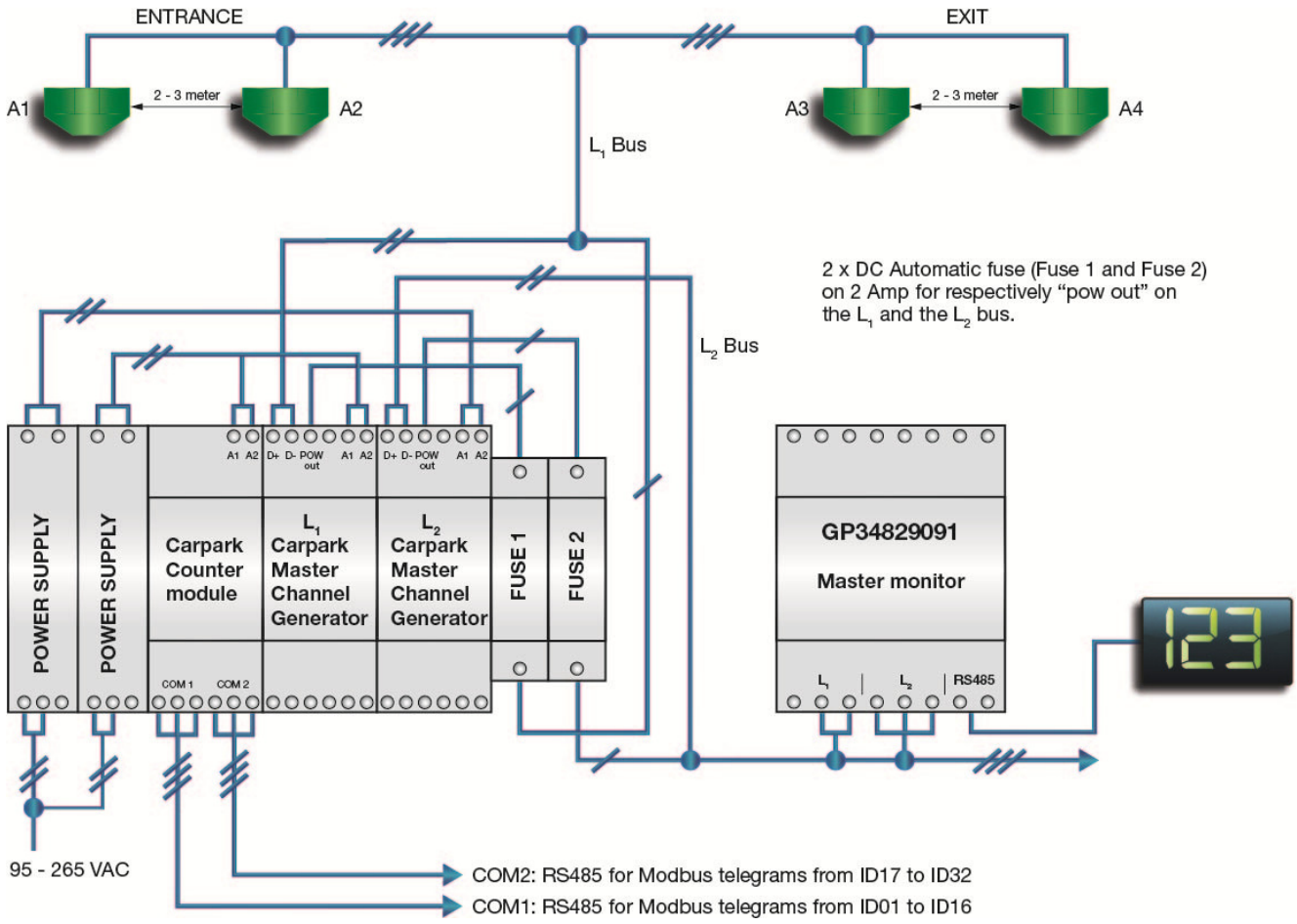
- 2 automatic fuses on each 2Amp DC to protect “pow out” on the L1 and L2 bus

- Displays (optional)

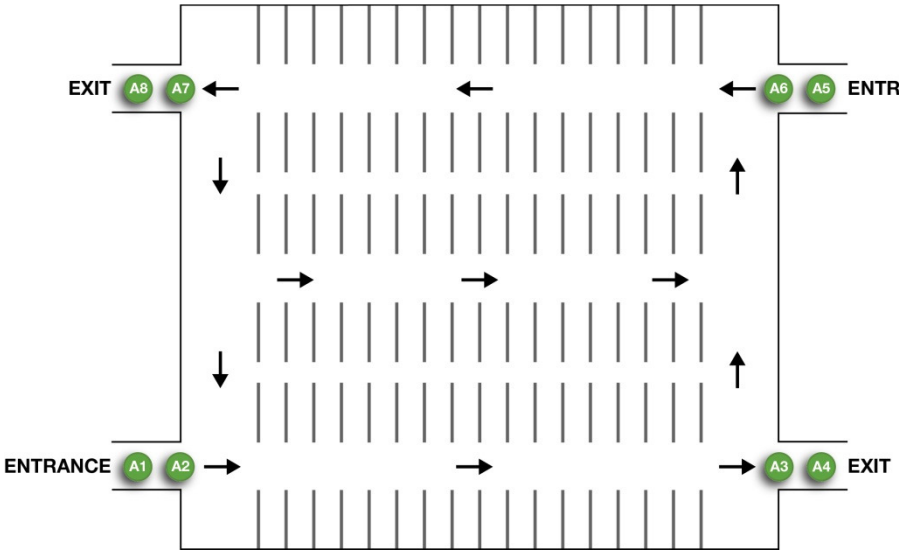
The power supplies used, must be selected with the correct ampere size. Each of the Carpark Master Channel Generators GP3290 0003 700 can supply the third wire with 3 Amp and the output on this module is pulsating. This means that the power supply must be minimum double size (6Amp). The power consumption depends on the number of sensors connected to the L1 bus and the number of monitor modules connected to the L2 bus. We recommend to install a DC automatic fuse on “pow out” for GP3290 0003 700. This is to avoid damaging the module if “pow out” by accident is short-circuited to gnd. See below drawing.

Note: Do not short circuit “pow out” and D+ on the master module GP3290 0003 700. This will cause an irreversible damage on the module. Be sure that wiring is correct prior to connecting power to the system.

**Connection diagram for the simple stand-alone system**

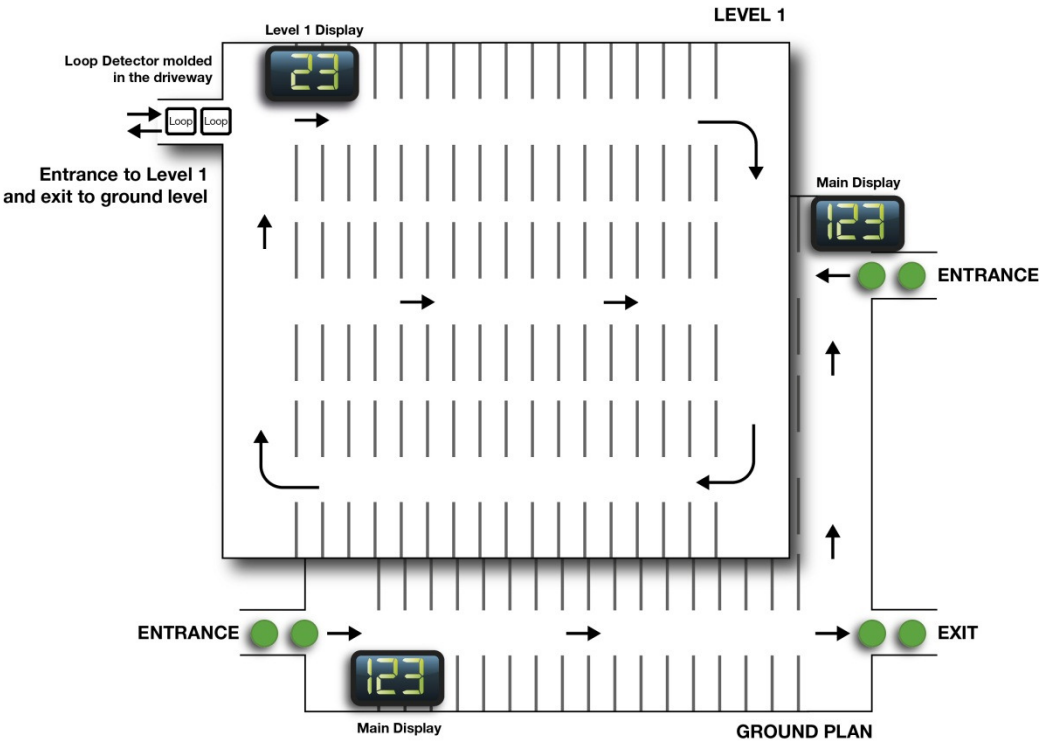



## Carpark with multiple entrances and exits



If we compare the above system with multiple entrances and exits to the simple stand-alone system, it is implemented simply by adding two more Detection Points (DPO's) each with two sensors connected to bus L1.

## Parking facility with multiple zones and multiple detection points




In the example above we have two zones. Ground level and 1 floor level. They will be named Zone 1 and Zone 2 in the following.

Zone 1 has two entrances (DPOs) from ground level and one entrance (DPO) from Zone 2 (the transition from level 1 to ground level is also an entrance). That is three entrances in total.

Zone 1 also has two exits (DPOs). One exit to Main Street and one exit to Zone 2.

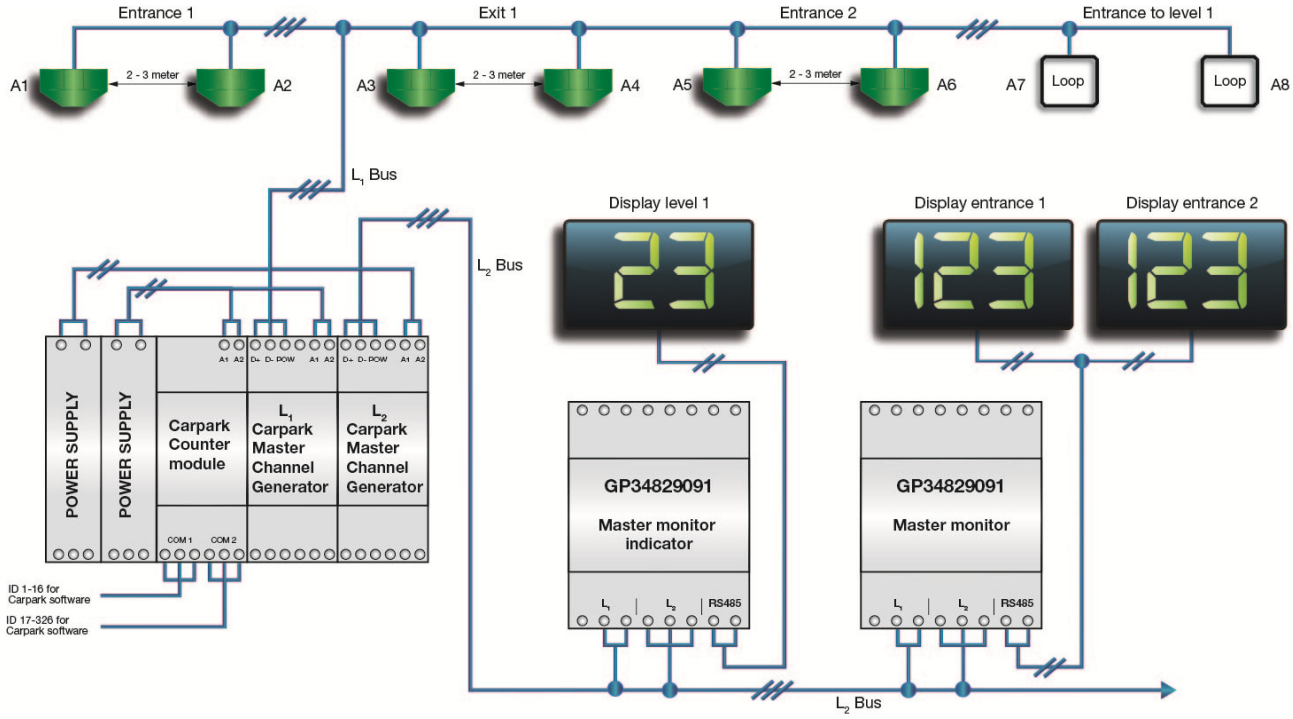
Zone 2 has one entrance (DPO) from Zone 1 and one exit (DPO) to Zone 1.

This information is important and will be used as an example later on in the MZC configuration section.

Each DPO consists of two sensors connected to the L1 bus.

In the example below we have converted the 2 floor installation into modules. We need 6 ultrasonic sensors and 2 loop detectors for the entrances and exits. We use loop detectors because the ultrasonic sensors cannot be used outside on a roof. A MZC with power supplies are needed together with 2 monitor modules. The monitor modules are programmed as master monitor and master monitor indicator respectively.

**Connection diagram for above 2-zone 4-DPO example**



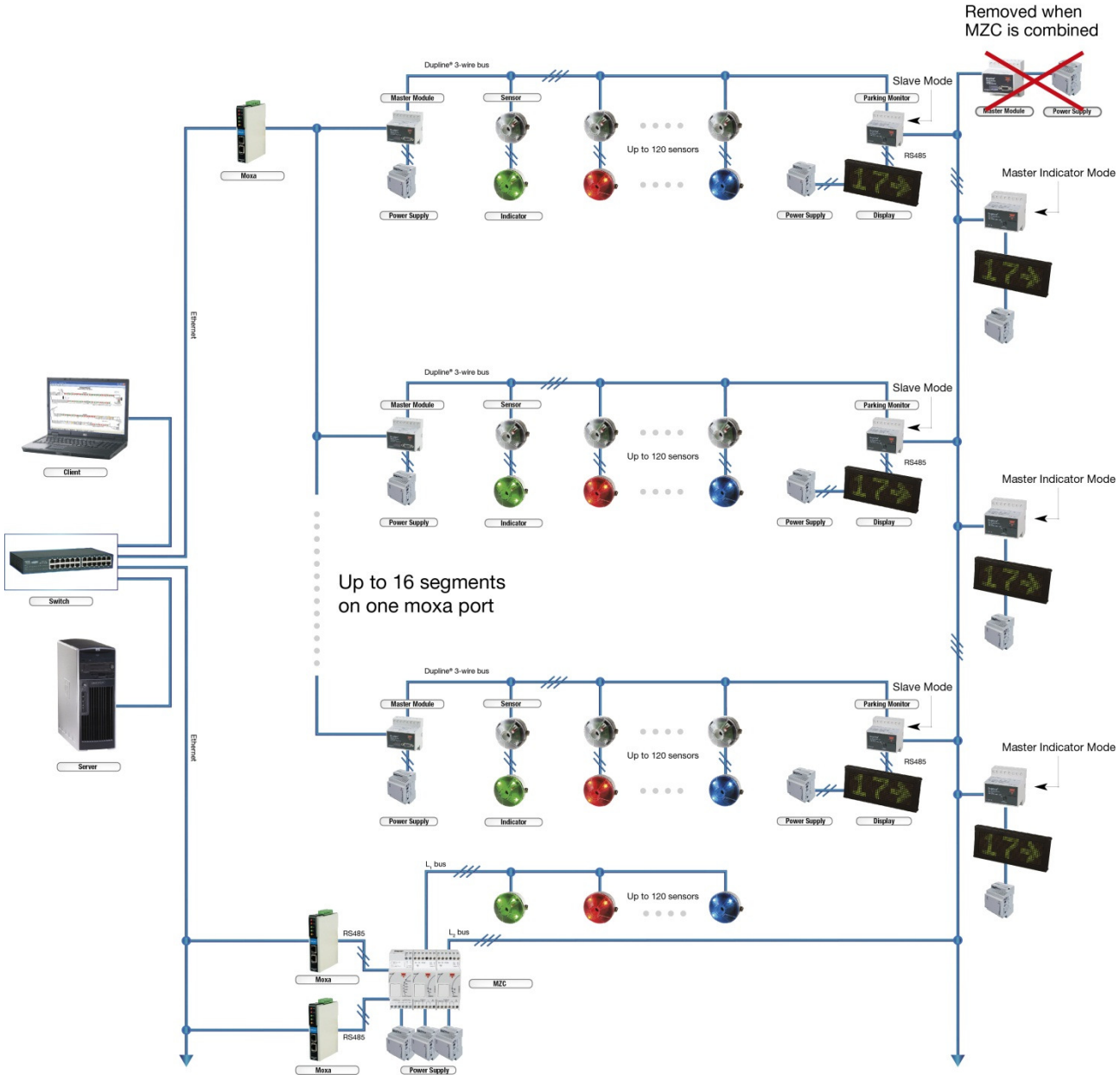

# MZC combined with Single Spot Detection

The MZC can easily be combined with the Single Spot Detection System. The data from the two systems are being sent on the L2 bus in exactly the same way to be read by the master carpark monitors and shown on the displays.

When programming the master carpark monitors controlling the displays, it is necessary to know the L2 ID number for each zone in order to include the right zone(s) for each display. This information is made available in the final MZC report when a project is built (see configuration section). Here it is also possible to define the L2 ID for the first zone, where after the remaining zones will follow in consecutive order.

It is also easy to include the values from the MZC in the optional Carpark Software, because the MZC is able to emulate up to 32 standard GP34960005 Carpark Master Modules on the two RS485 ports (1-16 on port 1, 17-32 on port 2). The standard Carpark Master Module has 6 DIP-switches to select a device address between 0-63. In the MZC these device addresses for the emulated Carpark Master Modules are for simplicity reasons identical to the above mentioned L2 ID's. These ID's are needed when configuring the Carpark Software.

As shown on the diagram below, the Carpark master module G349600005700 on the L2 bus is not needed in this case, because the L2 Carpark Master Channel Generator is driving the L2 bus.




**Single spot detection and count system combined**

## Zone counting system with split between standard and reserved spaces

A common issue with zone count systems in parking facilities is that they are not able to detect the split between standard and reserved spaces, typically used for handicap or VIP spaces. So, even if the signs outside the parking are showing that spaces are available, the driver may find that there are no spaces of the needed category available

The Dupline zone count system offers the option to detect the split between standard and reserved spaces. The reserved spaces are implemented as a single spot system where each space is equipped with a carpark sensor. The accurate reserved space availability information hereby achieved is linked to the Zone Counter, which then can calculate the available standard spaces from the total. The end result is that the signs outside the parking can show how many spaces are available for each category. As a further benefit, the system makes it easier for disabled people to find the handicap spaces, which have individual blue LED indicators. In the case of reserved VIP spaces, the indication could be amber LED's.

When implementing such solution, the MZC needs to know on which L2 slave address it can read the required availability data from the handicap single spot system. So, all the sensors used for handicap spaces need to be connected to the same single spot L1 and then a slave carpark monitor needs to monitor them and send available spaces as a value on a specific L2 ID, which is required when configuring the MZC for such solution (see configuration section)

# Car Detection Sensors:

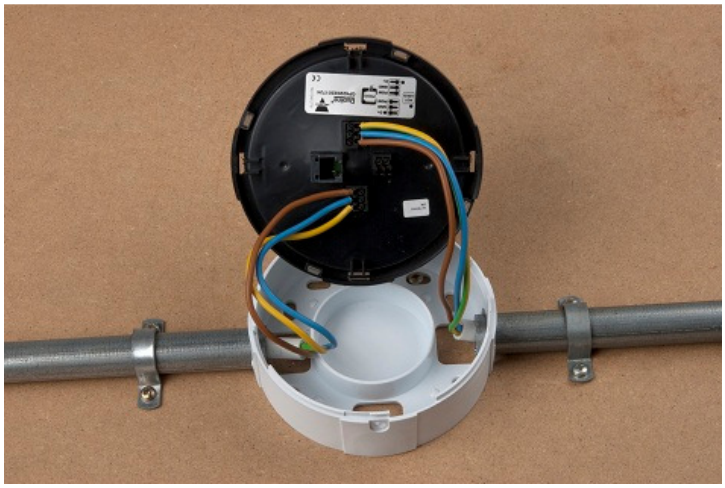
The MZC is the heart and brain of the zone count system - but car detection sensors are also needed in order for the MZC to keep track of the cars passing between zones. The ultrasonic sensor GP62x0 22xx or the GP6220 330x are designed for that purpose, and they can be connected directly to the Dupline L1 bus. The sensor however must be installed indoors or in such a way that water cannot penetrate the housing.

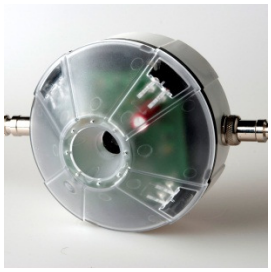
Other sensor types, like for instance optical sensors or loop detectors (suitable for outdoor use), can also be used. They just need to have the sensor output connected to a standard Dupline input module connected to the L1 bus.

## Dupline Ultrasonic Sensor:

All standard Dupline ultrasonic sensors for carpark, with or without LEDs, can be used together with the MZC. However, the sensor has to be programmed to operate in the zone count system, because higher detection speed is needed than in single spot system (see section “Programming of the ultrasonic sensor”).

Example on installation and different sensors





## Sensor Installation at Detection Points:

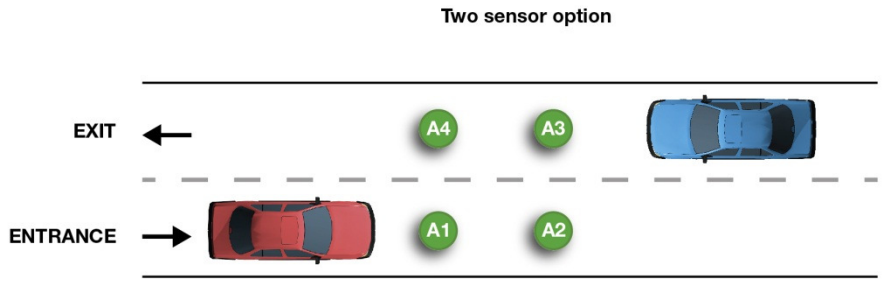
Ultrasonic sensor should be installed in the ceiling or maximum 4.0 m from the floor pointing directly towards the floor, over the driving lane. Sensors must be installed at all detection points (zone entrances and exits) to achieve a correct counting.

The MZC offers the possibility to use one or two sensors in the detection points. It is recommended to use two sensors whenever possible, because this allows the MZC to detect the driving direction of the passing cars and it also provides a better filtering against detection of other objects than cars.

## Detection point with two sensors:

We recommend to use the two-sensor solution whenever possible, because this allows the MZC to get the count right even if a car drives in the wrong direction through an entry or exit point, and this happens frequently in many parking facilities.

Example of a two-sensor solution:




The entrance DPO consists of two sensors, A1 and A2. If A1 becomes activated before A2, the MZC detects the car as driving the correct way through the detection point, and it will decrement the count of available spaces for that zone. Otherwise, if A2 becomes activated before A1, it will increment the number of available spaces, because in that case the car has left the zone.

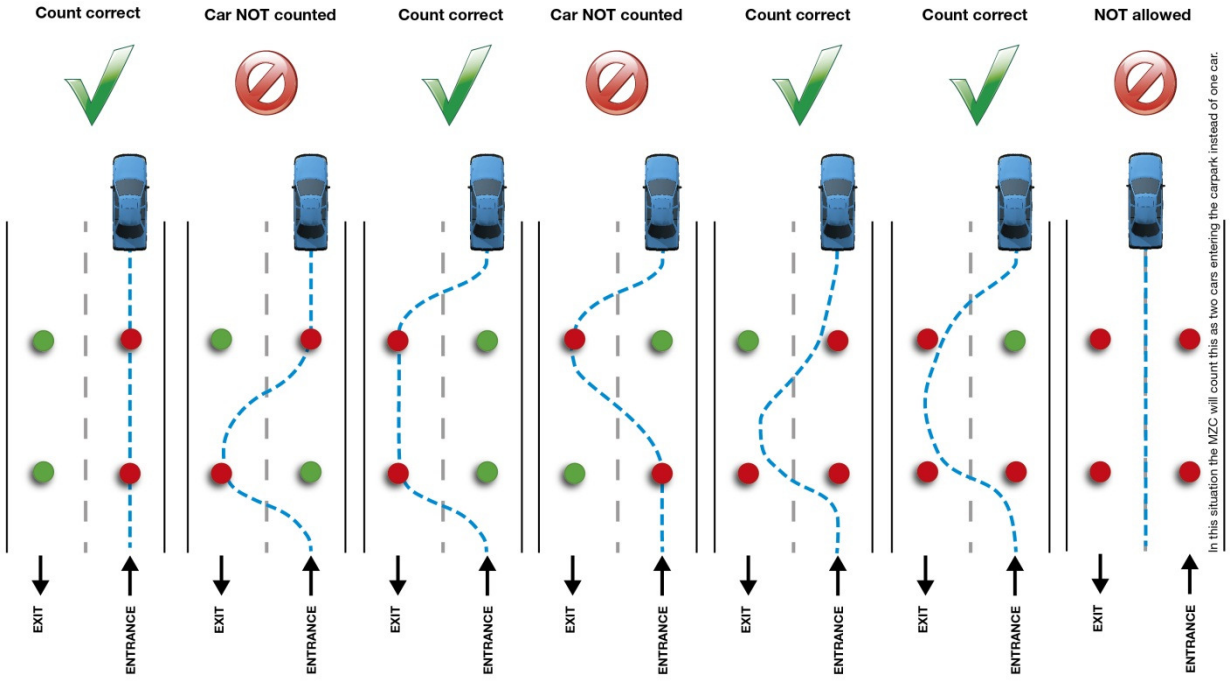
The exit DPO also consists of two sensors, A3 and A4. If A3 becomes activated before A4, the MZC detects the car as driving the correct way through the detection point, and it will increment the count of available spaces for that zone. Otherwise, if A4 becomes activated before A3, it will decrement the number of available spaces, because in that case the car has entered the zone.

As can be seen from above, it is important to make sure that the addresses of the sensors are defined in the correct order according to the expected driving direction through the DPO.

In order for a car to be detected correctly by the MZC count algorithm, it has to be detected by both sensors of the DPO. If for example the car does not drive straight through the DPO on the lane, but crosses over, it will not be used as a valid count. Therefore, in order to optimize accuracy, it is important to consider this when finding the best location to mount the sensors. In some case it can be necessary to install a physical separator between the entry and exit lane.

In the diagram below different situations for the car driving path are shown, and it is indicated which of these will lead to a correct detection (red color indicates that the sensor has detected the car).

**MZC counting rules**




## Detection point with one sensor:

Detection point with only one sensor requires that it can be made sure that the drive path of the car through a DPO is really uni-directional. It is also recommended to use loop detector in this case, because this will not make false detection on a person passing by, like a single ultrasonic sensor might.

## Position of the Sensors:

The distance between the two sensors is very important, both the distance between two sensors in a DPO, but also between the sensor pairs in two DPO's. The installer must be careful to install the sensors correctly.

The sensor can be installed at a height of maximum 4 m above the lane and minimum 2 m. It should preferably be installed in the middle of the lane.

The recommended distance between two sensors in a DPO is 2.5 - 3m. This allows the MZC to detect the sensor activations in the correct order and at the same time it is normally close enough to avoid the car crossing over and only activate one sensor (if not a physical lane separator is needed).

The distance between two DPO sensors pairs should be minimum 2.2m. In this way it can be avoided that a car driving half in one lane, half in the other lane, can activate both sensor pairs (see example on right hand side in above diagram).

## Programming the Ultrasonic Sensor:

The sensor is programmed by using the carpark programmer GP7380 0080.

In order to use the sensor for zone counting it has to be configured for “lane mode”.

Within lane mode there are two further modes “A” and “B”. “A” is to be used on a uni-directional lane with only one DPO sensor-pair. “B” is to be used in a bi-directional lane, where two DPO sensor-pairs are installed next to each other.

The filter level also need to be selected. This level indicates how many measurement cycles are involved in the detection of a car, and it can be selected in the range 1-4. The recommended filter level is “2” as this optimized filtering and detection speed.

Connect the GP7380 0080 to the sensor with the programming cable

- Press read/on
- Press “2” to access “Lane” mode
- Select Status and Calibration address and press ”Yes” to go to next page
- Select “A” or “B” (See tables below)
- Select 1, 2, 3 or 4 (See tables below)
- Press “Yes” to go to next page
- Select if LED shall be “ON” or “OFF” (The LED selected as “ON” will turn on when the sensors are activated, this is useful during testing)
- Press “Yes” to go to next page
- Press “Yes” to program the sensor

The below table indicates how fast a car can drive and still be detected in the DPO, depending on the mode and filter programmed into the sensors.

| | Filter 1 | Filter 2 | Filter 3 | Filter 4 | |
|---|---|---|---|---|---|
| Mode A | 72 Km/h | 36 Km/h | 24 Km/h | 18 Km/h | |
| Mode B | 36 Km/h | 18 Km/h | 12 Km/h | 6 Km/h | |
| | | | | | |

If for example Mode A, Filter 2 has been selected, it is sure that a car driving 36 km/h will be detected.

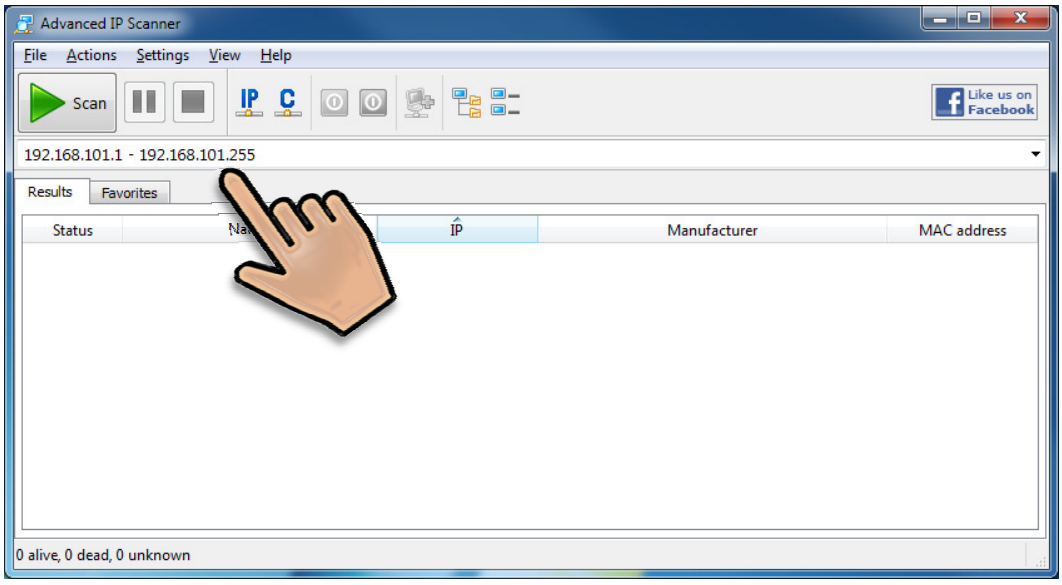
# Accessing the MZC Using Ethernet:

The MZC is factory default delivered as DHCP in the IP settings.

When the MZC is connected to any Ethernet based installation with a DHCP server, the MZC will be assigned with a IP address within the connected subnet. The IP address can then be discovered by using a "search tool".

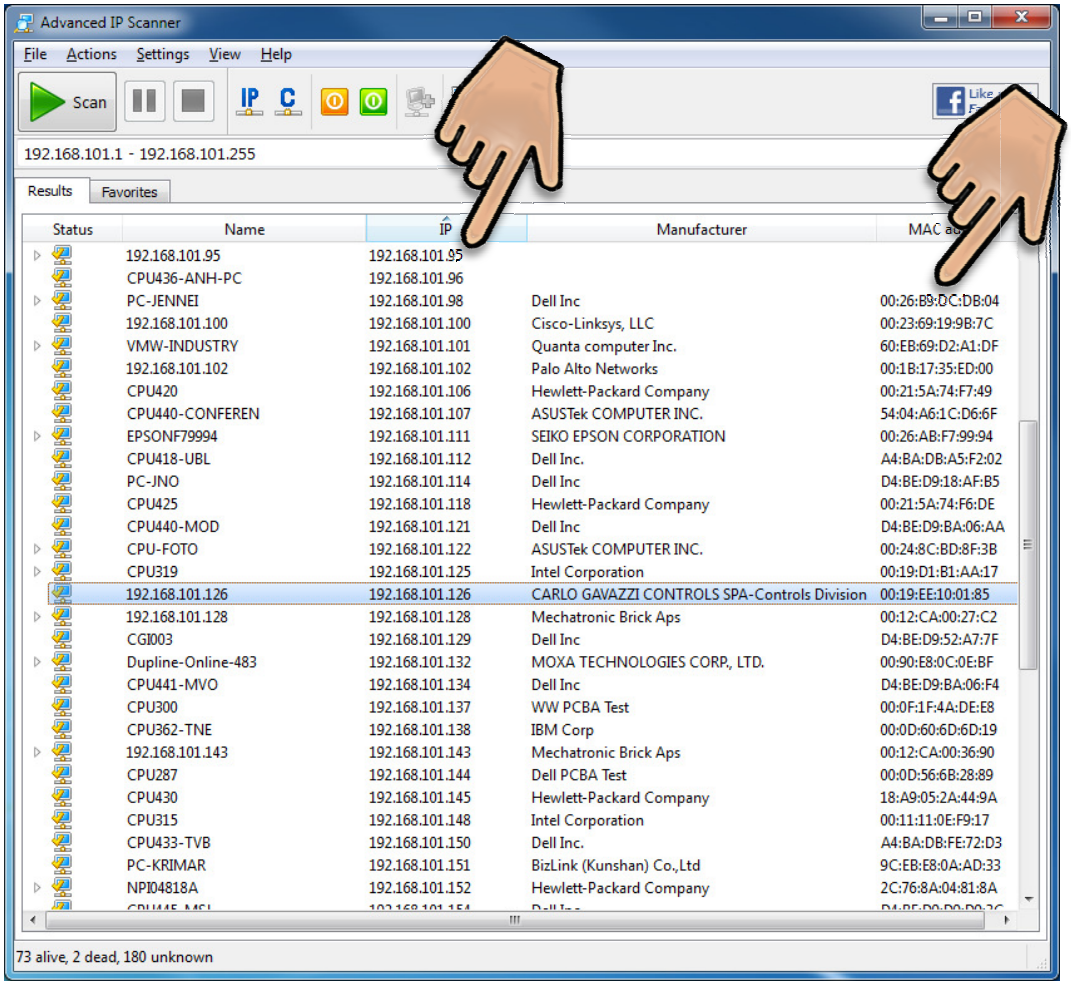
Search tools and IP scanners can be found on the Internet as freeware. In this example we use the freeware tool: http://www.advanced-ip-scanner.com/

The advanced IP scanner looks and works like this:




Type in the IP range to which the MZC is connected. In this example the IP range are: 192.168.101.1 - 192.168.101.255 - and press "SCAN"

The scan time varies, but can last several minutes. A scan result could look like this:




The MZC and its IP-address can be found by identifying in the list the same MAC address as is located on the side label on the Carpark Counter Module. Find the same MAC address in the list above and the corresponding IP address is discovered also.

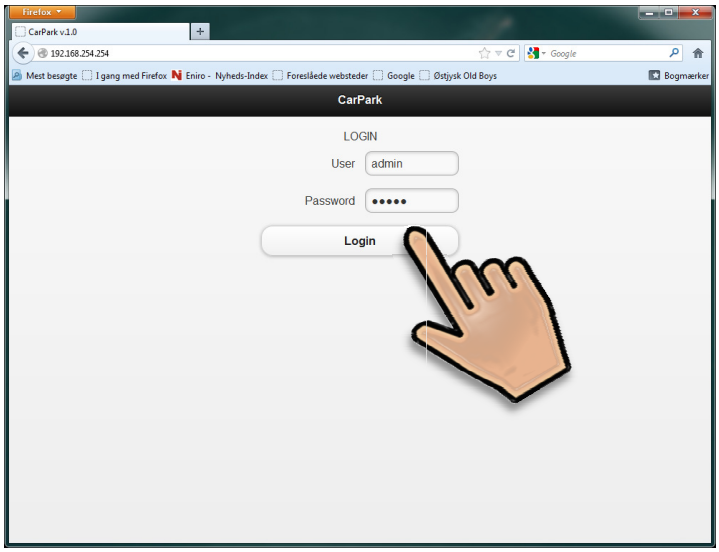
# Programming the MZC:

Open your browser and type in the IP address of the MZC. The menu below will appear.

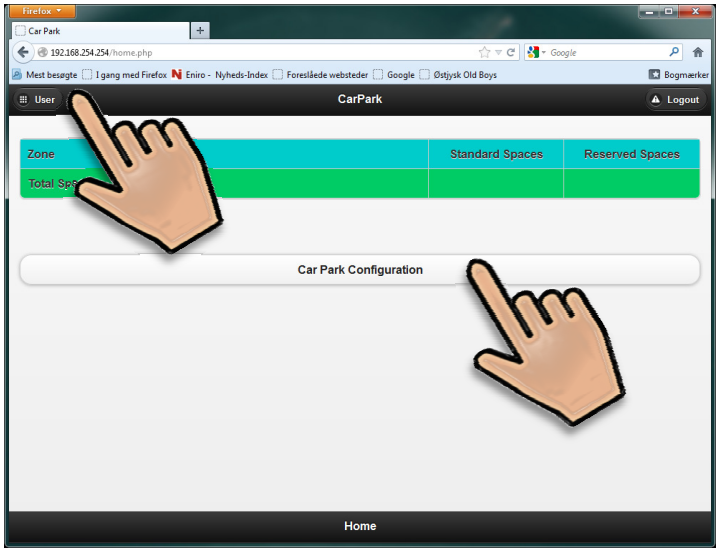
Type in -

**admin** as User and

**admin** as Password the first time and after that, the users own Username and Password.

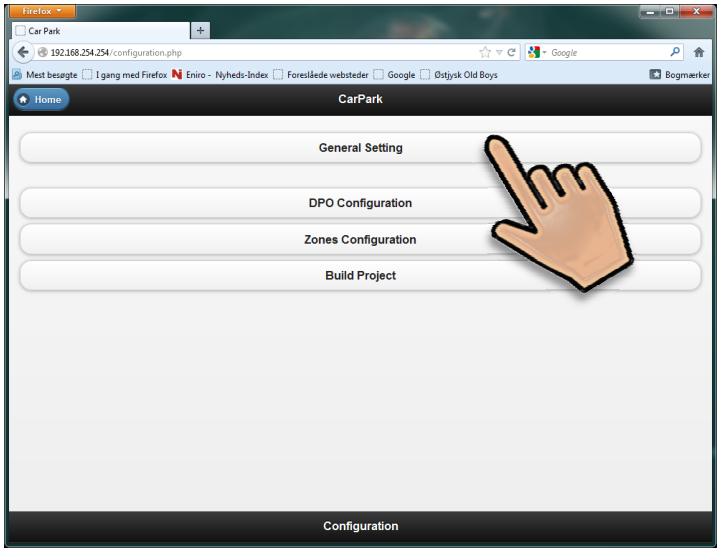



Press “Login” to enter the web server

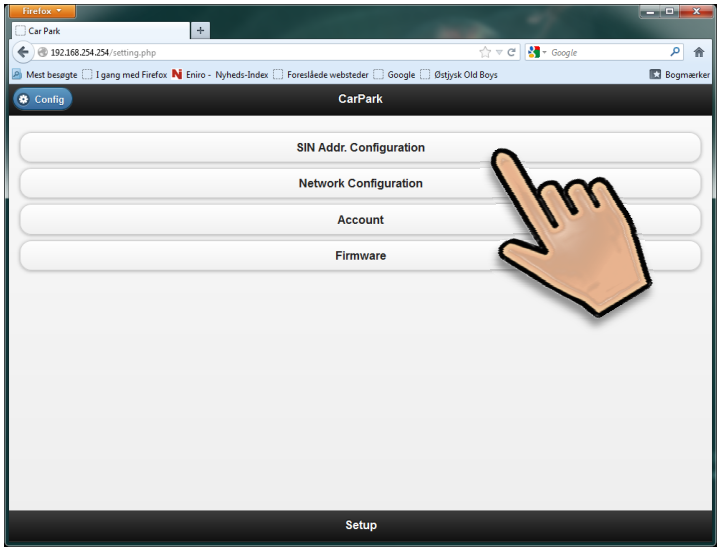


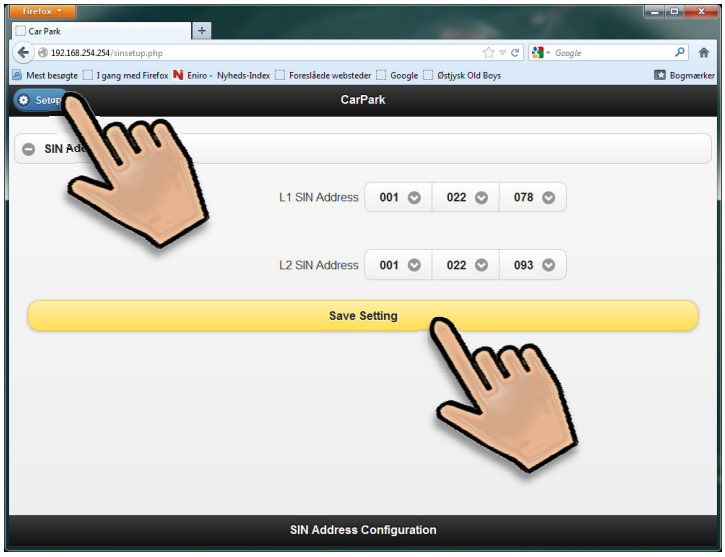

Press” Carpark Configuration” to enter update or programming mode or

Press” User” to monitor movements in Zones and Total Spaces



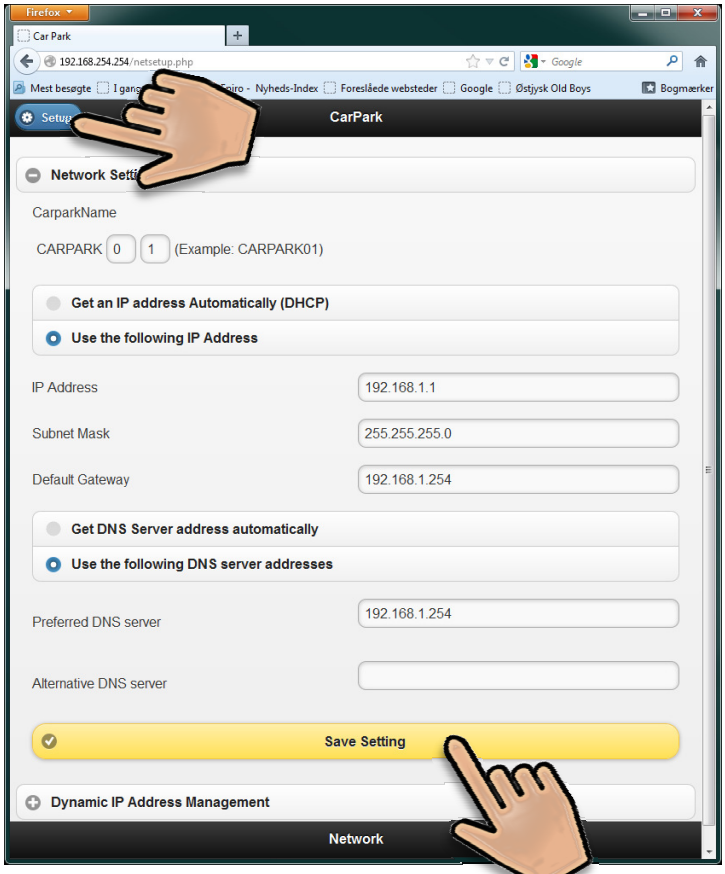

Perform SIN addressing and Network addressing, Account or to update the Firmware. Press “General Setting” to enter this mode




Enter the SIN-addresses for the L1 and L2 Carpark Master Channel Generators.

The SIN addresses can be found on the side of the respective modules

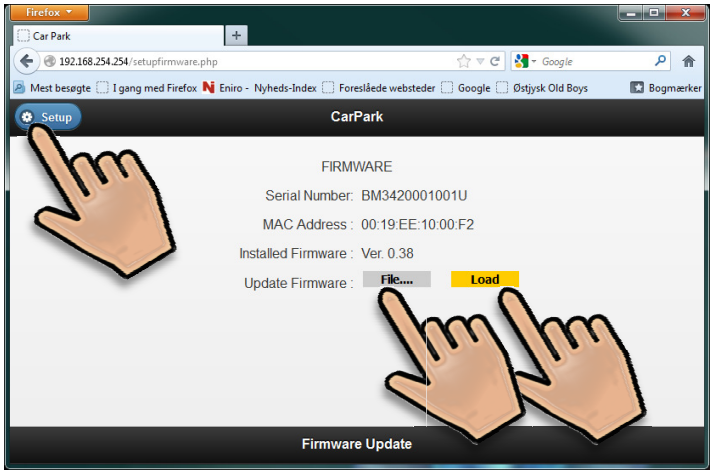



In the network menu the desired IP setting can be entered.

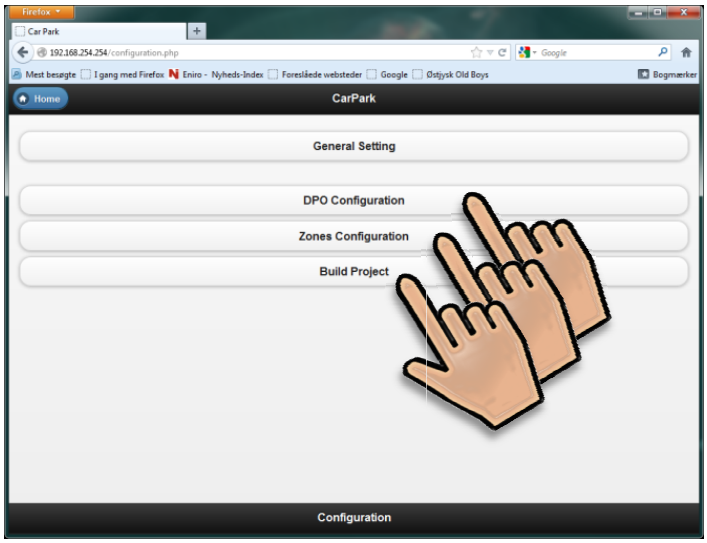

In the Account menu you can change or enter new users with name, login and passwords. Users are allowed to monitor the software but they cannot make any changes in the configuration.

Change or enter new administrators with name, login and passwords. Administrators are allowed to monitor and to make changes in the software.

Press “Save and Log off” if changes has been made, or press “Setup” to go one step back to “Config” mode.




In the Firmware menu, the Serial number, Mac Address or Firmware number can be read in this menu. If the MZC needs an update, it is also possible to update the firmware. Press “File” and find new version of the firmware and press “Load




With all the settings needed under ”General Setting” done, the next step is to configure the MZC with

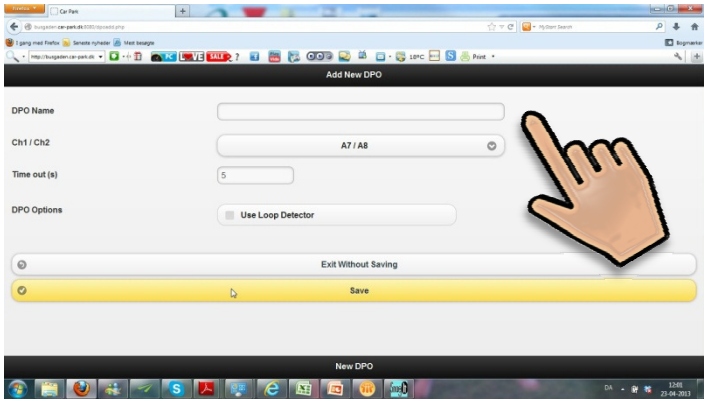
- DPO’s

- Zones

and finally to

- Build the project.

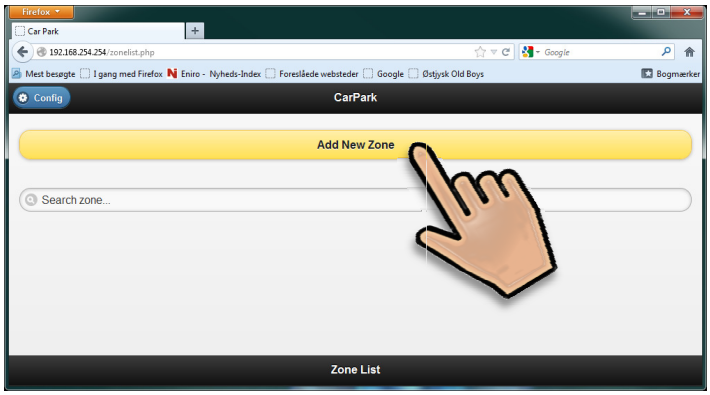

Press “Add new DPO”




Enter a ”Name” for the DPO.

Select the Dupline addresses for the DPO sensor pair (e.g. A1/A2)

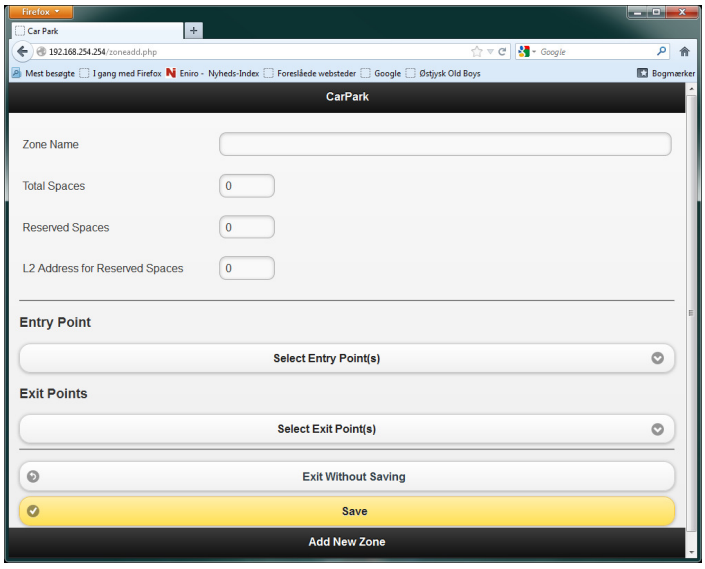
By default, time out is 1 seconds, this is the recommended value (see section “detection points”). Press “Save” if changes have been made or press “Exit without saving” to go one step back to “DPO list”. Enter all the DPO’s, one by one.



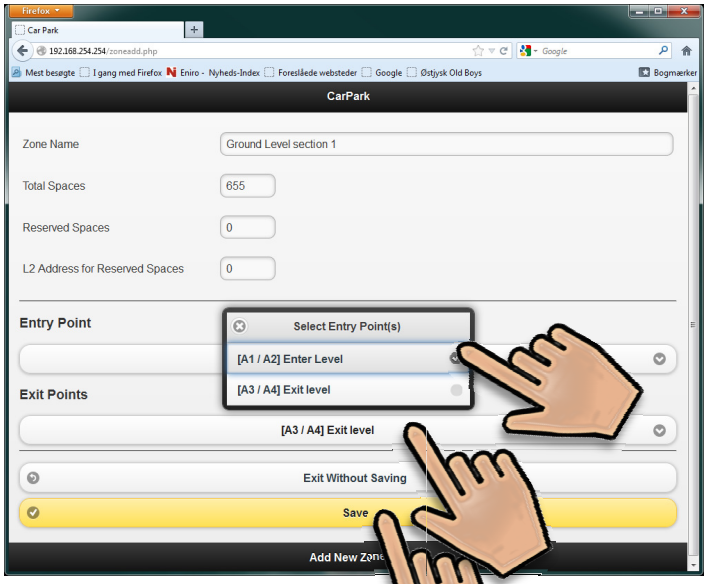

Next step is to define the Zones.

Select “Zones Configurations”

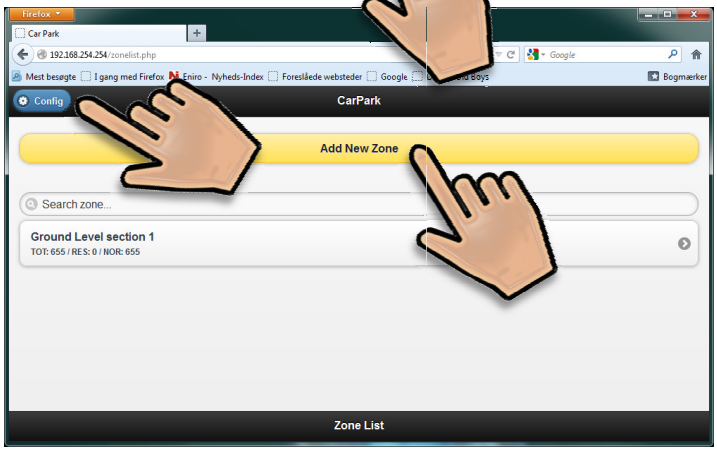
Select “Add new Zone”.




- Define a ”Zone Name”.
- Enter number of “Total Spaces”.
- Define number of “Reserved Spaces” if any (see section “Zone Counting System with split between standard and reserved spaces”)
- Define the “L2 Address for Reserved Spaces”. Only used if “Reserved Spaces” is defined.



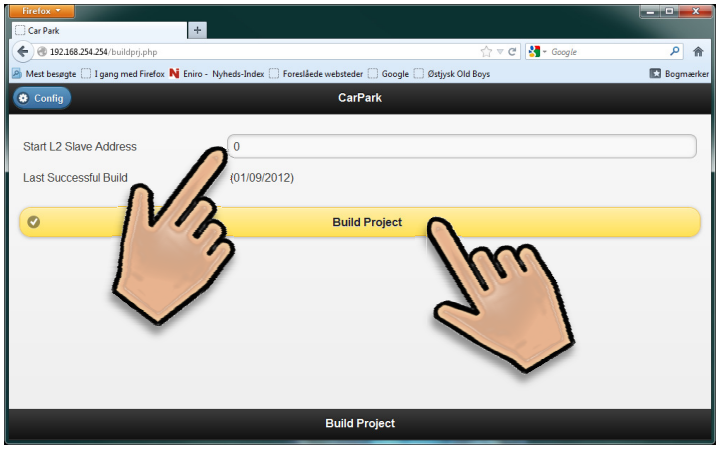

- Select the Entry Points that was defined under DPO. In this example it is A1/A2.
- Select the Exit Points that was defined under DPO. In this example it is A3/A4.
- Press “Save” to confirm changes. This action will open the window “Add new Zone”. See next screenshot.




In the screenshot we can see the result of the previous programming. If programming is ended, press “Config” to go one step back to “Config” mode.

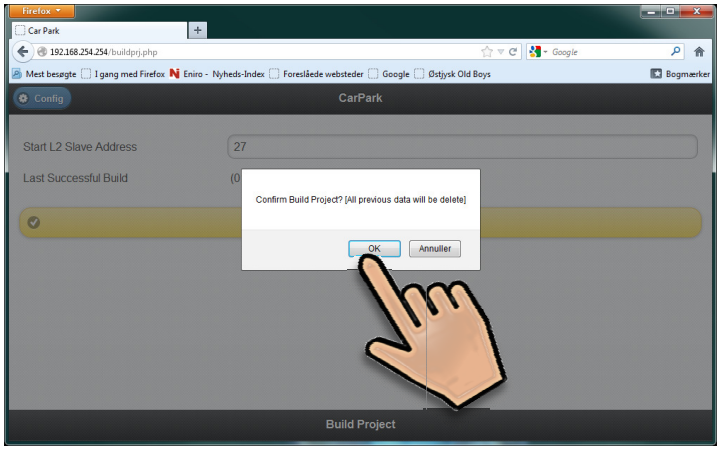
If new Zone is needed. Select “Add New Zone”

Enter all the zones, one by one

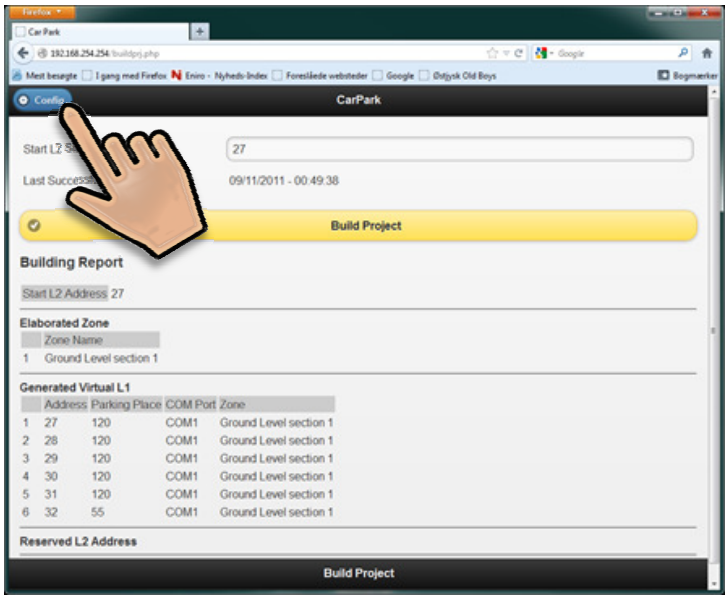



Next step is to “Build the project”. Select “Build Project” in “Config” mode and press “Build Project”.

Note: “Start L2 Slave Address” is the first ID address used in the MZC represented by the ID of the Carpark Dupline Master Module. If the MZC is a simple stand-alone system, the ID will often be “ID 1”. See page 27 regarding “Start L2 Slave Address”



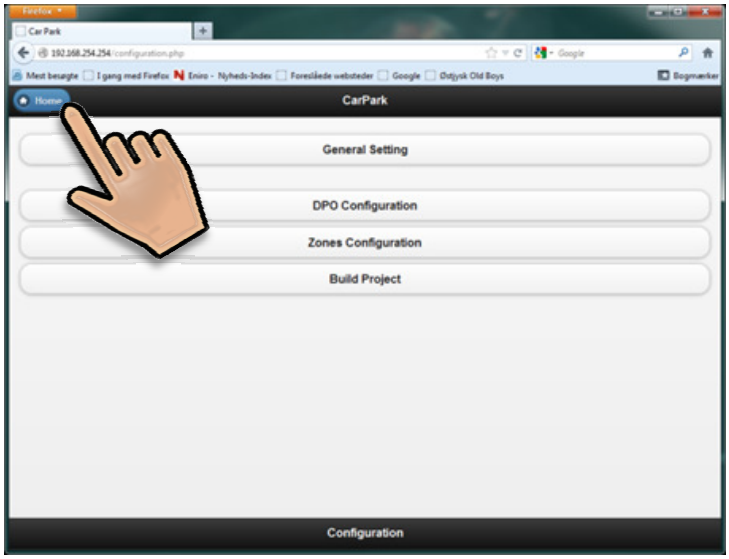

In our example we have selected ID 27 on the L2 bus. Press “Build Project” and you will be asked to confirm this.




The report of the build can be read as following:

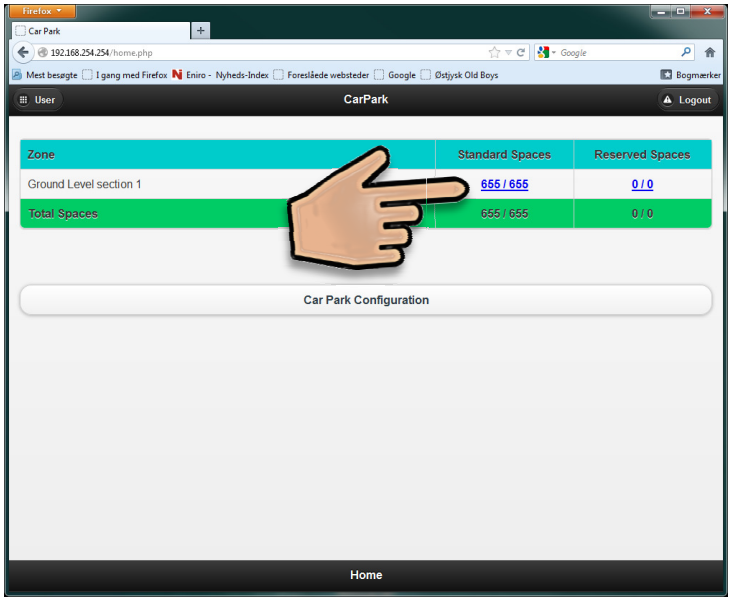
- Start Address on L2 is ID27
- One Zone defined as “Ground Level Section 1”
- The 655 places are split up into 5 virtual DMMs each with 120 places and 1 virtual DMM with 55 places. These data are available on COM 1 on the web server

Press “Config” to go one step back to “Config” mode.



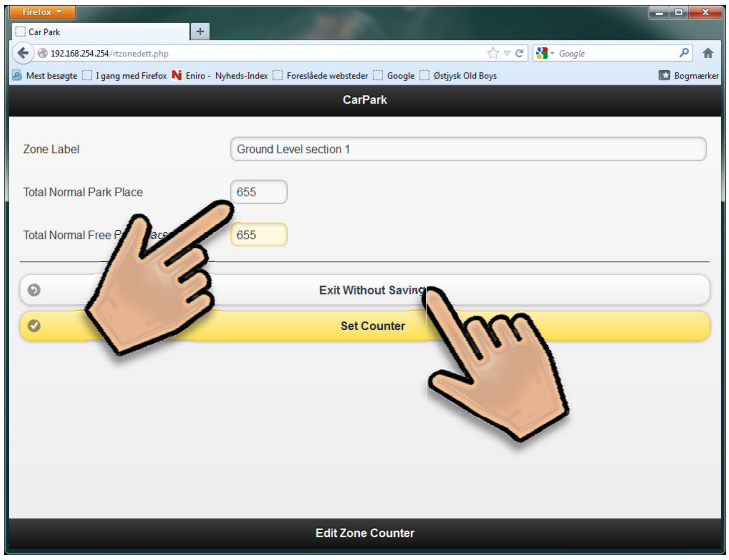

If changes are necessary, it is possible to define or remove either DPOs or Zones.

If programming is OK, press “HOME” to enter “Monitor” mode.




In “Monitor” mode, the user can read the actual available spaces in the MZC system.

If the number of available spaces is inaccurate, it can be adjusted by pressing the numbers under “Standard Spaces”.




Adjustment of the count:

Count the number of available spaces in the Parking Zone. Press “Total Normal Free Park Place” and type in the correct number of available spaces.