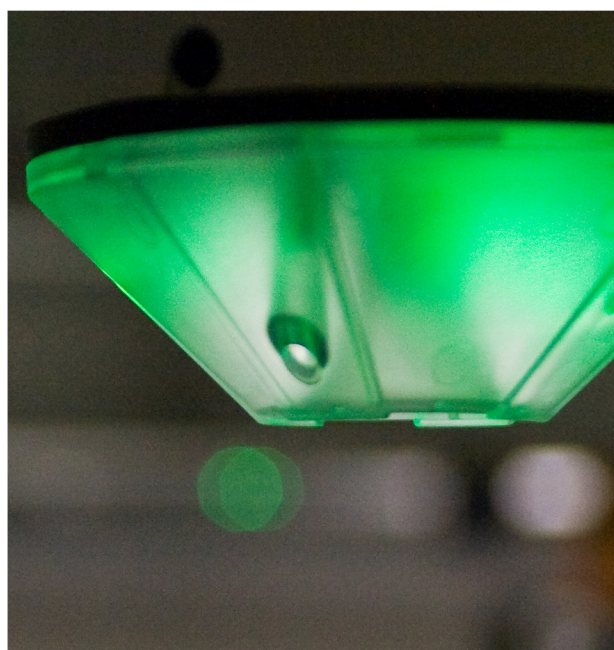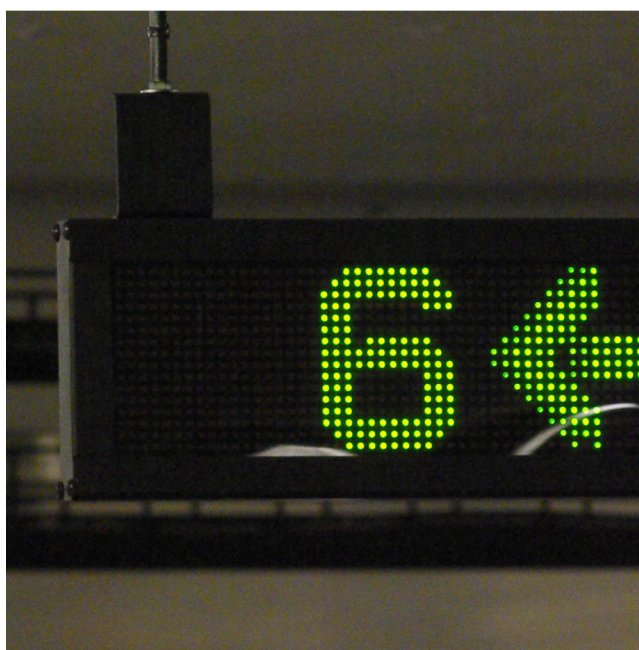# CARLO GAVAZZI
Automation Components

Dupline®
Parking Guidance System
Design and Installation Guide

CARLO GAVAZZI

(15.06.2015)

Contents

List of Abbreviations Used in this Manual

Abbreviation	Key	Part number
MZC	Master Zone Counter	1 x GP3295 0030 700 2 x GP32900003700
DMM	Dupline® Master Module	GP34960005700
CPM	Carpark Monitor	GP34829091724
DPO	Detection point	
PGS	Parking Guidance System	

List of Images

1. Introduction

The Dupline® Parking Guidance system saves time and reduces stress for drivers.

Dynamic displays strategically positioned throughout the facility provide "space available" counts and efficiently guide the driver to open spaces with clear and bright green arrows pointing the way.

If there are no open parking spaces in an area, the sign will display a bright red cross to discourage the drivers from entering this area. Other displays can be made to display the total number of open spaces on a particular level or in the entire parking facility. Dynamic message displays can also be used in the facility to provide additional information to drivers. Some examples could be Caution; Construction Ahead; Buckle-Up, and any other message that needs to be communicated to the drivers in the facility.

In the parking space
Each parking space is equipped with a clear indicator light, which is green when the space is open and red when it is occupied. If the space is for handicap parking, the colours become blue and red. The bright LED indicators provide a visual reference as drivers seek out open parking from a distance. The indicator lights are combined with an ultrasonic sensor as a complete set.

The Dupline® Parking sensors utilize a special ultrasonic frequency, much like a bat uses to search for flying insects. A sophisticated microprocessor contained in the sensor knows how much time that it should take for a sound wave to "bounce" from the floor back to the sensor. If a vehicle is parked in the space, this time is measurably shortened and the logic in the microprocessor determines that a vehicle is present in the space. Once detection has been confirmed, the indicator lights will switch from green or blue to red and the displays and the software counts will be accurately updated as well.

Master Zone Counter "MZC"
This installation manual does not describe the MZC in details. The MZC has its own installation manual which describes in details the programming of the MZC, programming and installation of the sensors, using the configuration unit, installation examples and a lot more. This manual informs about the overall features of the MZC and in which Carpark installations it can be used. Moreover, it will describe how to combine spot detection and counting.

The Software…
The Dupline® Parking Guidance System is inherently robust and a stand-alone system. This system does not require a PC to run. However, optional software makes it possible to monitor the real-time situation of each parking space or level in a facility. It also has a full alarm component that can provide logging and indication of a variety of conditions exceeding user-defined limits.

Some typical alarm functions include time-limits for individual spaces, occupied levels, and maximum occupied indications. Additionally, the software graphically displays tables and graphs showing the occupancy rates for the areas, the floors and the entire facility.

The software is also a tremendous tool for data logging and historical trending and analysis. Data can be stored and utilized for multiple facilities, a single facility, a level, or even to an individual space.

The software allows authorized operators to book or reserve spaces. When an open space is booked, the associated indicator light in the parking space will turn red and it will provide a connection to the software's overview where the corresponding virtual indicator light turns red.

2. Planning a Dupline® Parking Guidance System (PGS)

As with any good system, the majority of the time and effort should be spent in the "planning." An ancient proverb says, "A good plan today is better than a perfect plan tomorrow."
This section breaks the system planning into 5-distinct phases. These 5-phases should be completely understood and completed before moving onto the actual Installation.

5-Phases for planning a Dupline® Parking Guidance System

2.1. Phase 1: Gather Tools and Information

- Technical drawings / information / layout of the parking system from integrator / customer. The drawings used must always be latest version to avoid any mistakes in the work that follows.

- The drawings should consist of lanes, cross-sections, parking spaces—for both regular and handicap, display placement, cabinet size and placement, available power and location, and the equipment room where the software server will be installed.

- Traffic flow: Single Direction or Bi-Directional.

- A true to scale CAD drawing with information of the parking structure including lane distances for determining the cable runs and maximum allowable sensors per DMM.

- Parking space dimensions: length, width, and the distance from the floor to the ceiling. The relationship between the floor and ceiling angle is also critical.

- The dimension from centre line to centre line of the spaces.

Fig. 1: Example of a basic facility
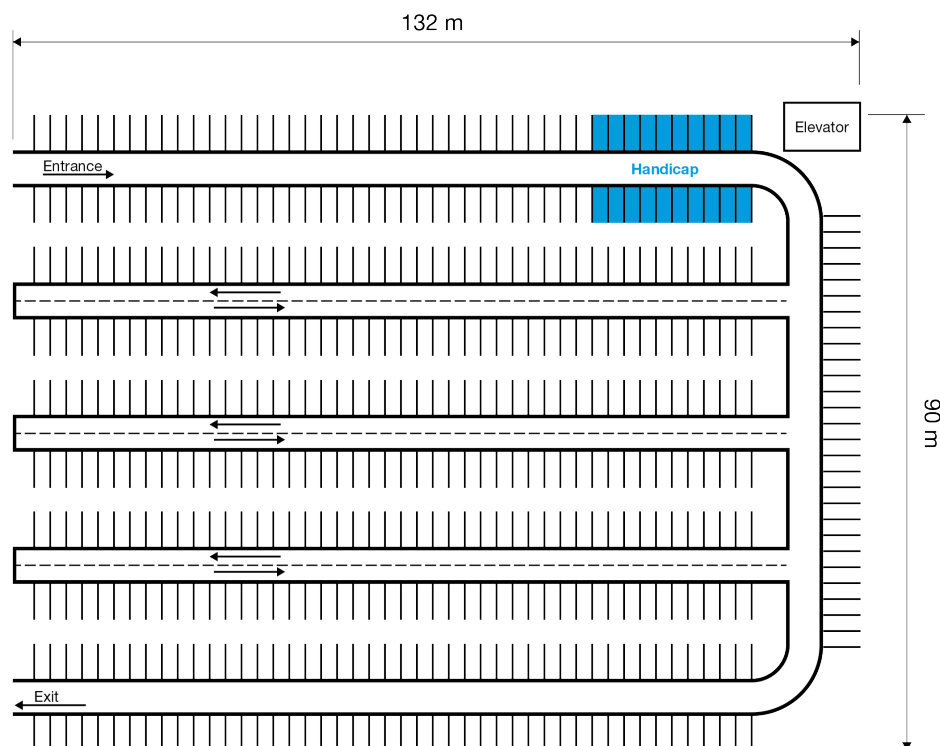
- Any information about using existing (or new if it a new building) cable trays to pull wires for sensors.

- Prevalent codes governing the installation need to be confirmed as it will become necessary for making a proper and legal installation.

2.2. Phase 2: Display Placement, Segment Definition, Sensor Mounting

- Define the number of displays based on the natural flow of cars in the parking and in cooperation with the customer and the installer. The best way to do it is making a joint walk-through and drive-through.

- Confirm any architectural considerations with the customer regarding signals, finding one's way and any other equipment to be installed in the parking facility for compliance.

- Split the parking into segments and use the lanes as a natural part of these segments. Try to put all the spaces belonging to the same local display in the same segment.

- Define the type of displays. Should they simply display an "arrow" and "red-cross" or should they display space availability counts as well? It all depends on the natural flow and the customer's requests and needs.

- Determine the necessary environmental ratings of the displays in relation to the intended use and installation. Also take into consideration the accidental intrusion of water from plumbing leaks and wind-blown rain or snow.

- Decide if there will be one or more multi-level "Tower" or "Monument" sign installed at the entrance to the parking structure providing a snapshot of all available spaces by level.

- What should the displays show? Several available spaces from many segments (master indicator) or just local available spaces from a single segment (slave Carpark monitor).

- A maximum of 70 sensors and a maximum of 200 m wire in a branch. A maximum of 120 sensors per segment. General rules based on 1,5 mm^2 cable.

- Decide whether 3-colour sensors or 3-colour led indicators should be used. In general, the 3-coulour solution is used in combination with the Dupline® Carpark Software for designing special areas for VIP, guests or other sorts of customers.

- Determine if the sensor must be mounted direct on ceiling, on tray or lowered. Always try to select the most functional and aesthetic solution from an economic point of view.

- Decide if an external LED indicator is necessary. This solution is often necessary when existing posts or piping obstruct the view of the LED indicator mounted directly in the centre of the parking space. If the multicoloured LED indicator is used, it must be connected directly to the Dupline® bus.

- Decide which spaces to be used as disabled parking spaces. Disabled parking spaces are normally placed close to escalators and elevators and are determined in number in accordance with regulatory laws.

- Determine the number and placement of the cabinets. Ideally they should be placed so that the loads of the sensors are equal in all directions. They should be accessible only by ladder or cherry picker to be protected from tampering. The enclosures should be rated at a minimum of NEMA 3R or IP54.

Fig. 2: Example of a parking level with Phase 2 considerations:
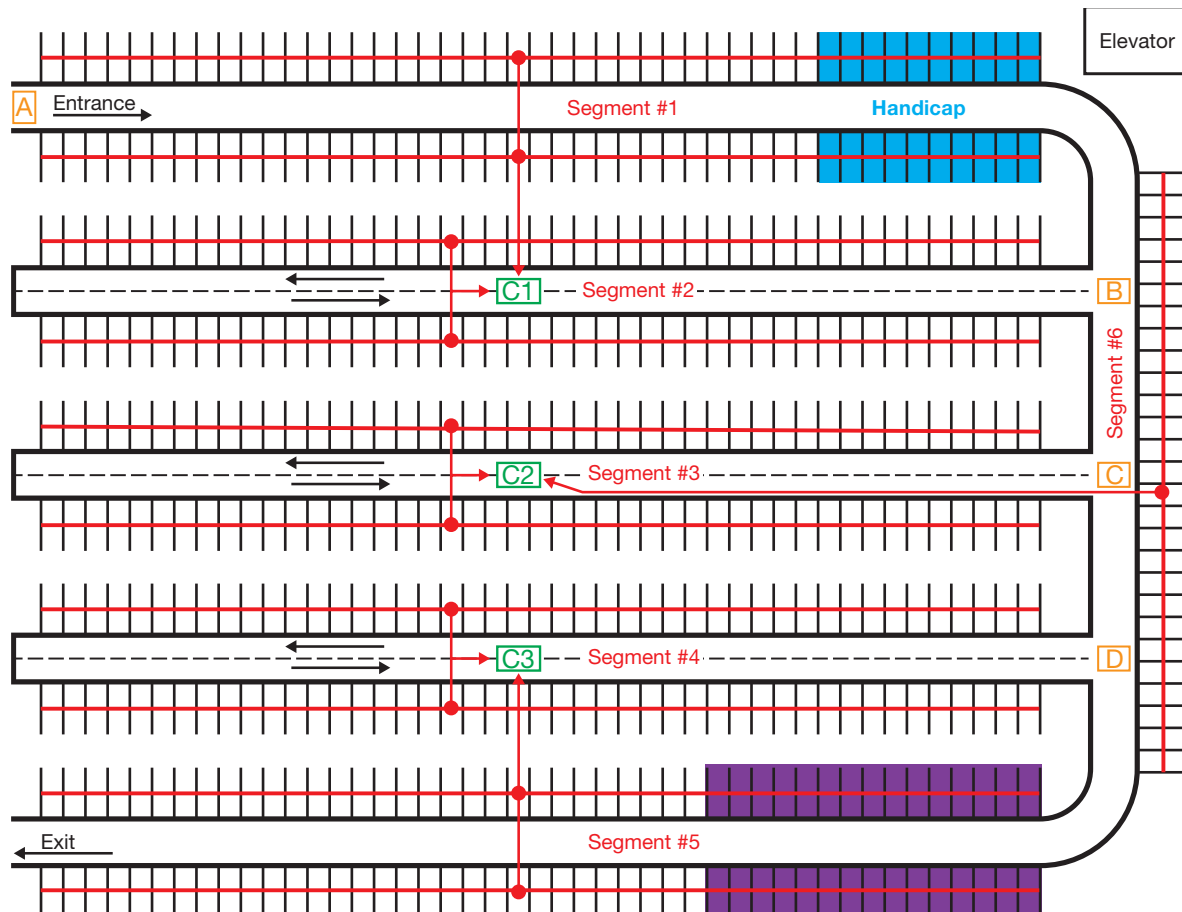
A, B, C and D is where displays are located.
Segments 1 to segment 5 are based on the lanes and the open spaces on each side of the lanes.
44 spaces on each side of the lane (88 in total). In segment 6 are only 29 spaces.

Disabled parking spaces (blue spaces) are placed close to the elevator.

Cabinets C1, C2 and C3 are logically placed in the middle of the wiring between the sensors.

VIP area. 3-colour sensor used with the Carpark software.

2.3. Phase 3: Design One Segment (…and Build From There)

- As a rule-of-thumb, there is a maximum of 70 sensors and 200 m (660 feet) of wire in a branch. The wire should be a 14-16 AWG and unshielded. There should be a maximum of 120 sensors per segment. If the branch has less than 65 sensors and the wire length is longer than 200 m (660 feet), please refer to the voltage drop calculation described in details in section 14.

- Power supply calculation (The number of sensors determines the size of the power supply). Always use a double size power supply with power out on 28 VDC. This is caused by the pulsating output from the Dupline® Master Module, or DMM, GP34960005700. When using a 28 VDC/2.5 Amp power supply, 60 sensors can be installed. When using a 28 VDC / 5 Amp power supply, 120 sensors can be installed.

- Programming of sensors must always be in consecutive order and starting from A1. (Always start from A1 in each new segment. This is mandatory when using the Dupline® Parking Guidance System software). The calibration channel is P1.

- Design of the placement of sensors, indicators, cable trays and cabinets.

- If the ceiling is taller than 4 m (13.2 feet), it is important that the sensor is lowered by means of ceiling mounting brackets.

- The sensor must be mounted <=5° in relation to the floor.

Fig. 3: Example of approved/not approved cable length
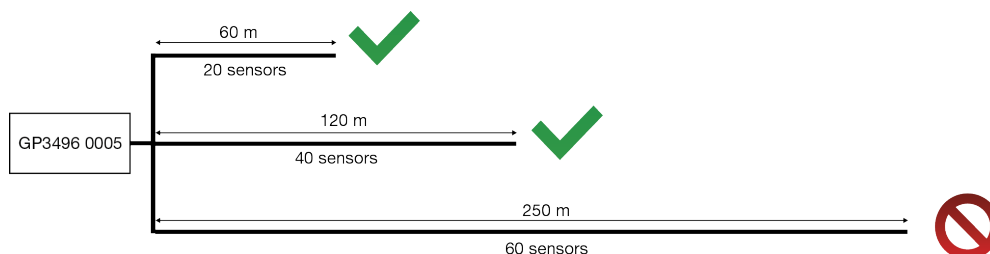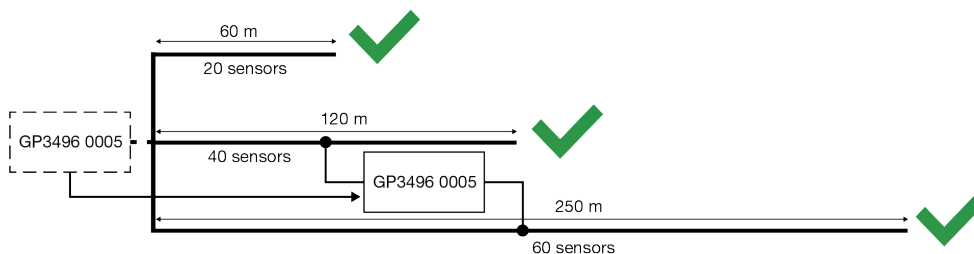
2.3.1. Design One Segment with the 3-Colour Booking Option

If the 3-colour sensor/LED Indicator is selected, please be aware that only 60 sensors /indicators can be mounted in the same segment. Each sensor/ indicator occupies two Dupline® addresses: 120/2 = 60 modules. This is described in section 11.7.
The above mentioned rules in section 2.3 must be obeyed in the design phase, as there is no difference between 2 colours or 3 colours in the power consumption calculation and the load calculation.

2.4. Phase 4: Linking the Segments to the L2 Bus

- L2 bus must be connected to all CPM (Car Park Monitor) modules in the system.

- Max. 50 pieces of the GP34829091 on a branch on the L2 bus if the same L2 bus is up to 500 m (1650 feet) or 500 CPM modules in total.

- Power supply calculation (The number of CPM modules determines the size of the power supply). When using a 28 VDC/2,5 Amp power supply, 150 sensors can be installed. When using a 28 VDC / 5 Amp power supply, 300 CPMs on the L2 bus can be installed.

- Place the DMM (Dupline® Master Module) in the centre of the L2 bus to have a uniform load. Use G34960005700 on the L2 bus.

Fig. 4: CPM modules connected to bus L2

Schema

Length	Number of CPM
500 meter	50
600 meter	42
700 meter	36
800 meter	32
900 meter	28
1000 meter	25
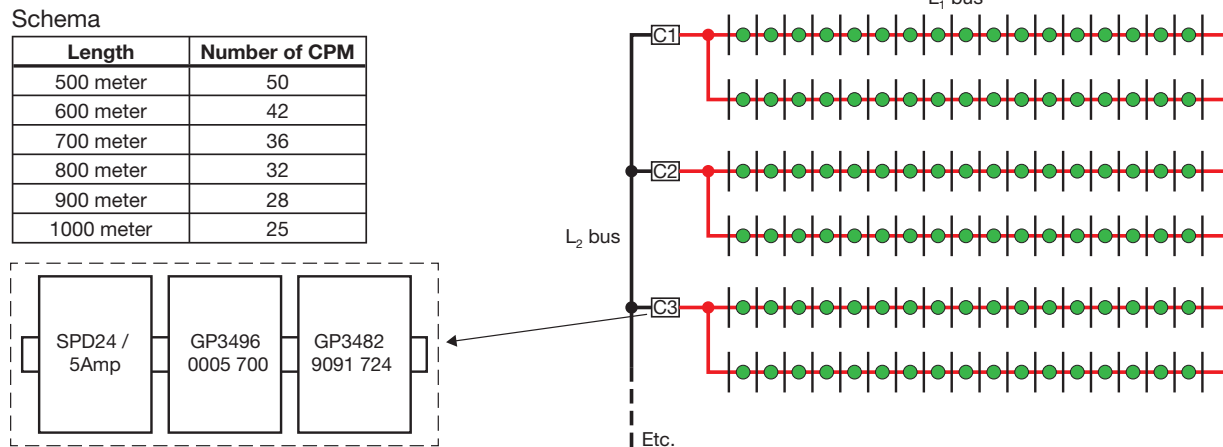
2.5. Phase 5: Dupline® Parking Guidance Software

- Use an existing IP network or create a new TCP/IP network.

- Determine the number of spaces to be monitored on each level and in total.

- Ethernet/RS485 converters. We suggest the ENTCONV3 or 4 (Moxa).

- 16 pieces of GP3496 0005 DMM can be multi-dropped to a single Ethernet converter.

- All DMMs have a unique ID number. These DMM modules are multi-dropped to the converter. The available and occupied spaces from the parking lot are transmitted via the DMM to the converter and then to the software client.

2.6. Secondary Considerations

- Different kinds of building automation components like the CO2 sensor, light sensors or movement sensors could easily be built into a Parking Guidance System (PGS) system. By selecting the MCG G3800x0xx, the customer will have a various number of flexible solutions at a lower cost.

- It is also important to consider the installation costs, especially the man-hours needed, but also the costs of cables and wall boxes. We recommend the use of inexpensive standard 3-wire unshielded 1.5 mm^2 (14-16AWG) cables for the Carlo Gavazzi Dupline® Parking Guidance System. In order to reduce the man-hours for the installation, we have designed the sensor in such a way that it can be wired easily and quickly without the use of screwdrivers. The sensors can be addressed or programmed off-line before physical installation - thus saving time and physically demanding work - often atop a cherry picker or ladder.

2.6.1. One-Floor System Example

The diagram (*Fig. 4: Placing the sensors*) is a theoretical example of how to implement 469 sensors on a single floor. Additional floors would be configured, installed, and brought on-line in exactly the same way. Refer to example (*Fig. 5: Example of a PGS with multiple floors*).

In the planning process, displays are positioned at the entrance and at each branch. Once the displays are placed, we can determine the segments.

The entrance display (A) will show all available spaces on the floor. The first branch display (B) will show available spaces on that particular segment and the displays C and D will also show available spaces from their segments.

Design of the segments can be made in many ways. We will always suggest an easy structure with a good overview having a conservative, extra margin for voltage drop, power consumption and any future installation.

- In this example we have 6 segments. Each lane/branch is selected as a segment. Segments 1, 2, 3, 4, and 5 each have two rows with 44 spaces per row, totalling 88 sensors per segment.
- The length has been calculated to 132 m (435 feet), so there is plenty of a margin for both voltage drop and power consumption calculations. The last segment 6 only has 29 spaces.
- Placement of the cabinets is in close proximity to the B, C and D displays providing us with the shortest practical distance between the segments.

Car Park Monitor Modules
- Master Indicator CPM for display A collects data of available spaces from segments 1-6 (All segments)
- Slave CPM for display B collects data of available spaces from segments 2
- Slave CPM for display C collects data of available spaces from segments 3
- Slave CPM for display D collects data of available spaces from segments 4

Cabinets
The three cabinets C1, C2 and C3 should be mounted as shown in the scheme. If this is not possible, then find an alternative placement. ***It is important that the distance between the cabinet and the sensors does not exceed a voltage drop of 3.5 V.***

- C1 should contain power supplies for segments 1, 2
    - Displays A and B.
    - Dupline® Master Module (DMM) for segments 1 and 2, and the CPM slave modules for segment 1 and 2.
    - Master module CPM for display A and a standard Dupline® Master module for the L2 bus.
- C2 should contain modules for segments 3 and 6.
- C3 should contain modules for segments 4 and 5.

Additional floors would be managed in the same way.

Fig. 5: Placing the cabinets

Fig. 5: Placing the cabinets
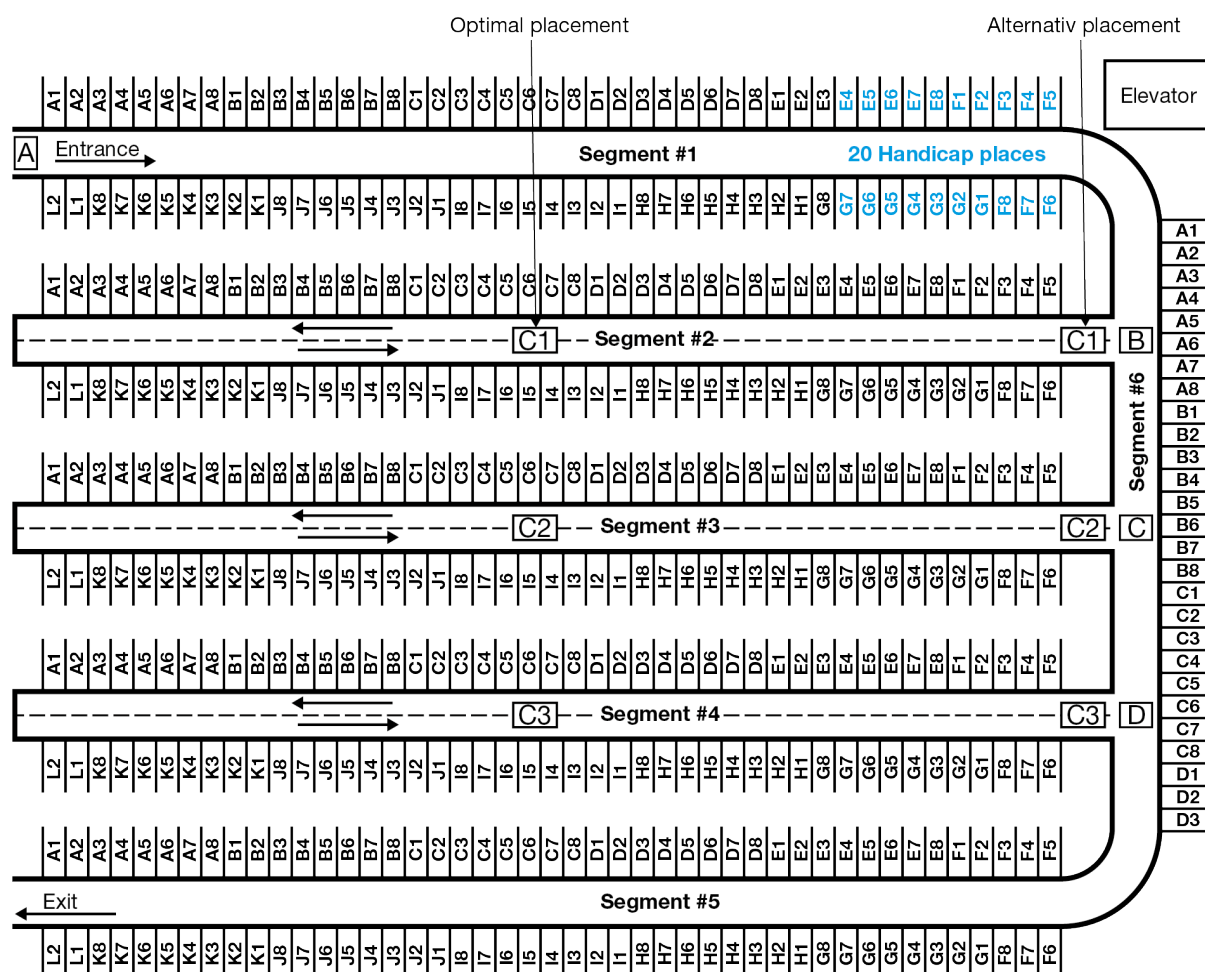
2.6.2. Addressing Standard and Disabled parking spaces

Disabled parking spaces must have their own CPM slave if the customer wants available spaces for disabled people shown on a display. The CPM slave modules for disabled spaces and similar purposes are suggested to have the ID number selected last in line. In this example it will be ID 7.

Addressing the spaces must always start from A1 and consecutive for **each** segment.

In segment 1 we will start with A1 at the entrance and end with L2. In the example (*fig. 4*), the disabled parking spaces are part of segment 1 and therefore they do not have their own CPM modules or their own display. If it is decided that the disabled parking spaces should have their own display, it will be necessary to split the segment into two segments. This means that the new segment (ID7) must also start from A1 and end at C4. The original segment 1 skips E4 to H7 (Refer to drawing *Fig. 4: Placing the sensors*) and then continues with E4 where G8 is placed and ends at I6.

In segment 2 we also start with A1 and end with L2. In this segment there are no disabled parking spaces.

2.6.3. Example of a PGS for Multiple Floors

Planning a Parking Guidance System, or PGS, with multiple floors implies the same considerations when planning one floor only. Determine displays, segments, natural car flow in the Parking Guidance System and of course all the other phases in the process.

Cable lengths of L1, L2, and RS485 connections between the DMM Dupline® Master modules, Serial to Ethernet converters, and Ethernet runs, must be carefully considered.

After finishing the planning process, the CPM slave modules must be assigned to a unique ID number. Furthermore, it is suggested to split the segments into groups where the ID numbers are in consecutive order. This will help to make a clean and simple installation.

This is exactly the same procedure as in the "One-Floor System Example" on *fig. 2*. When the ID numbers are in consecutive order, it is much easier to collect the information of available spaces and send it to the displays.

Example:

Level one:

> 4 normal lanes (segments) with 40 spaces each and 20 spaces with a separate disabled spaces segment

Level two:

> 5 normal lanes (segments) with 45 spaces each

Level three:

> 4 normal lanes (segments) with 40 spaces each and 36 spaces with disabled spaces as a separate segment

- All the "normal" lanes are connected to a CPM slave module with a unique ID number.

- The disabled parking spaces on level 1 and level 3 also have their own CPM slave module with a unique ID number.

- Outside the Parking Guidance System house, there are two displays that show the total number of available spaces for all three levels and disabled parking spaces respectively.

- The display that shows available spaces on all the "normal" lanes (segments) is also connected to a CPM module programmed as "Master". This CPM module monitors the segments 1, 2, 3, 4 (level 1), 5, 6, 7, 8, 9 (level 2), 10, 11, 12, 13 (level 3).

- The display that shows available spaces on all the disabled parking spaces is connected to a CPM module programmed as "Master indicator". This CPM module monitors the segments 14 (level1) and 15 (level 3).

- In this example we have 15 CPM modules programmed as slaves and 2 CPM modules programmed as Master and Master indicator respectively.

- The best installations have a well-thought-out signing scheme as too many signs become counter-productive due to confusion from information overload.

- In level 3 we could have a display at the entrance that shows available spaces at this level only. Disabled parking spaces not included. Refer to L31.

- A CPM module programmed as "Master indicator" is connected to this display. The CPM module monitors the segments: 10, 11, 12 and 13.

Fig. 6 : Example of a PGS with multiples floors
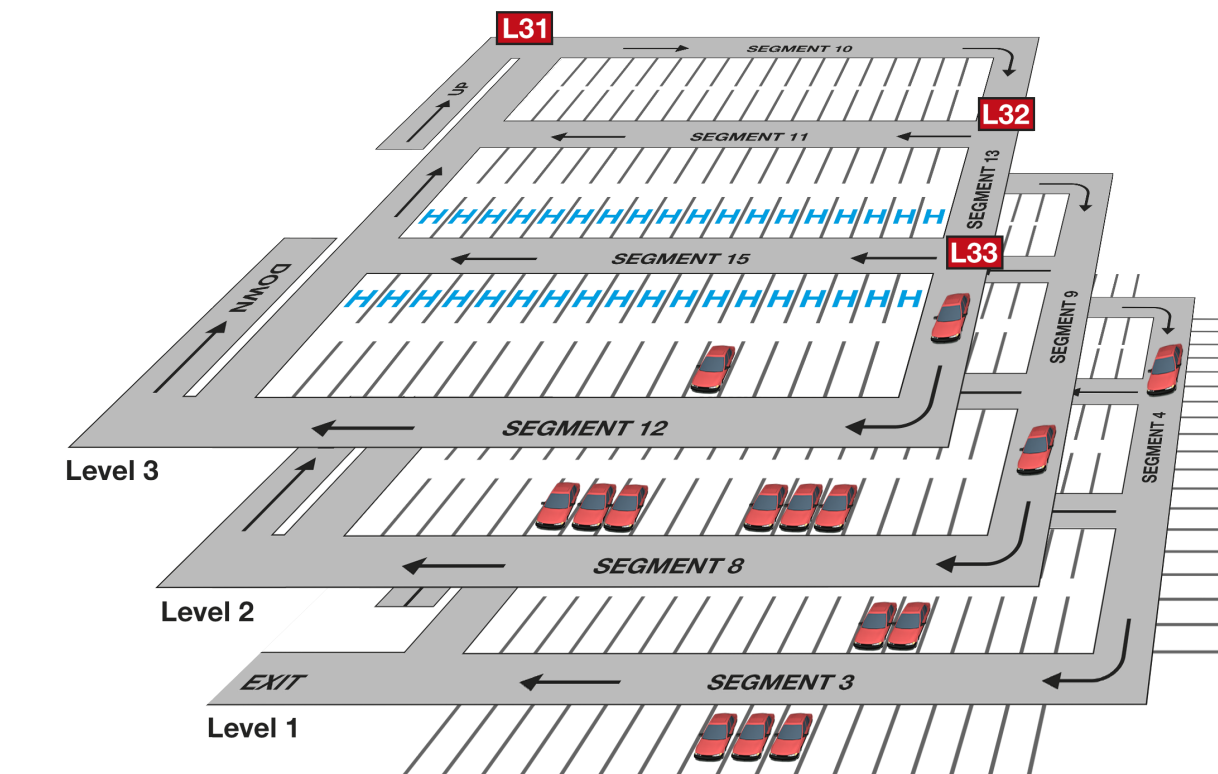
- A simple display L32 which shows a green arrow / red cross is placed at the entrance to segment 11. A CPM module programmed as "Master indicator" is connected to this display. The CPM module only monitors segment 11.

- The last display L33 on this level is also a simple display which shows a green arrow / red cross. It is placed at the entrance to segment 15 and shows available disabled parking spaces in this segment. A CPM module programmed as "Master indicator" is connected to this display. The CPM module only monitors segment 15.

3. Master Zone Counter - "MZC"

3.1. 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. It can also be used to implement a complete parking guidance system at a lower cost than a single spot system.

3.2. 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

Fig. 7: Master Zone Counter (MZC)
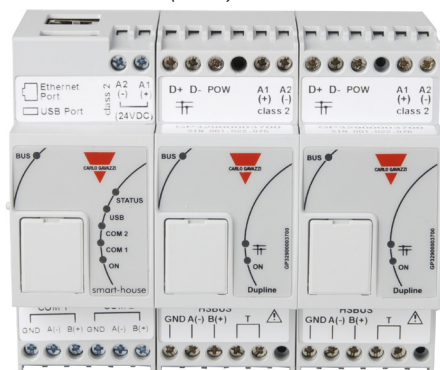
Ordering code for a complete MZC with all 3 modules is GPMZC-SET

3.3. Carpark Counter Module (GP32950030700)

The Carpark Counter Module is the intelligent programmable part where 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, in exactly the same way as with the single spot detection system.

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 (Refer to remark Fig. 7). 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"

Fig. 8: GP32950030700

6 pin Interconnection
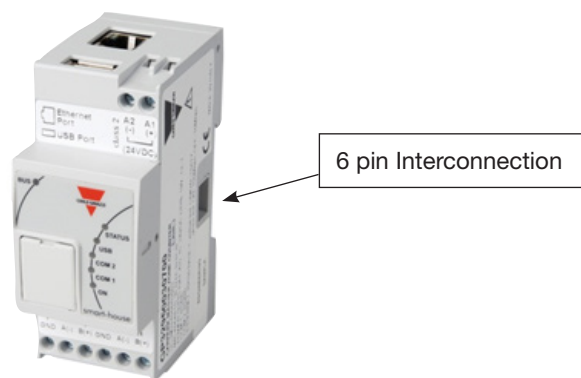
3.4. Carpark Master Channel Generator (GP32900003700)

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. The Carpark Master Channel Generator works the 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 since 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 to 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 (Refer to remark *Fig. 9*). 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".

Fig. 9: GP32900003700 - LEDs
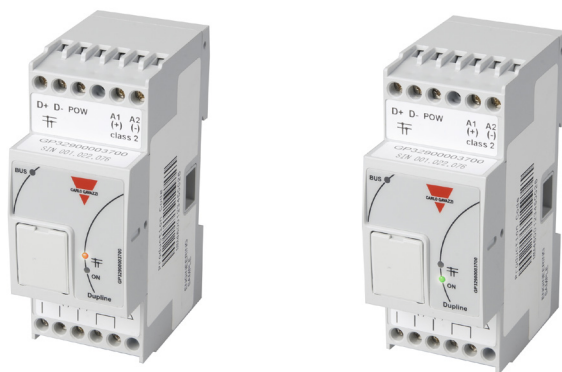
3.5. HS BUS for all module types

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.

Fig. 10: Internal or external HS Bus connection

6 pin connector

External HS BUS connection
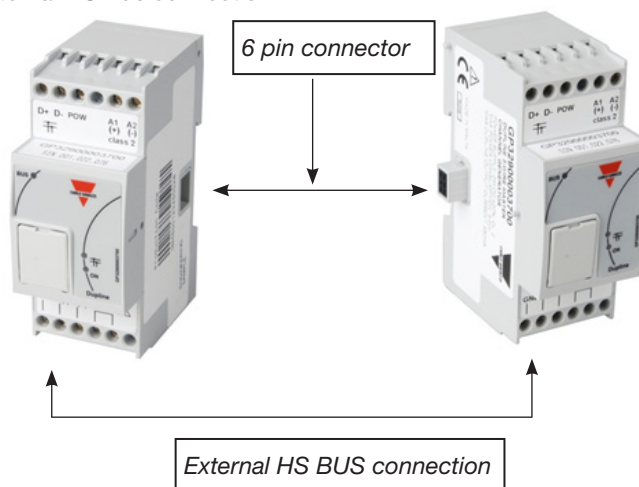
3.6. Operating principles of the MZC

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 (DPOs) and this is where the sensors must 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.

3.7. Zones

Typically, a zone is 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 keeping 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.

3.8. 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. The connection 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 makes it possible to detect the direction of the car. Furthermore, it allows a 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 that the counting is still right. In bi-directional lanes it is mandatory to use two sensors. When configuring a detection point it is possible to define a time-out value. The timeout is only to be used in case of a long distance (more than 3 m) between sensor 1 and sensor 2. The timeout allows a valid car detection if the delay from the time when sensor 1 deactivates until the time when sensor 2 activates is shorter than the timeout value. With a typical distance of 2-3 m between the sensors, 1 s is the recommended value. Too high a value will increase the risk of detection faults.
Single sensor DPOs are mainly implemented where the use of two sensors is impossible or difficult, for example in outdoor installations with loop detectors.

3.9. 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 necessary. The web server is also used for the configuration of the MZC.

Fig. 11: A simple parking facility with one entrance and one exit
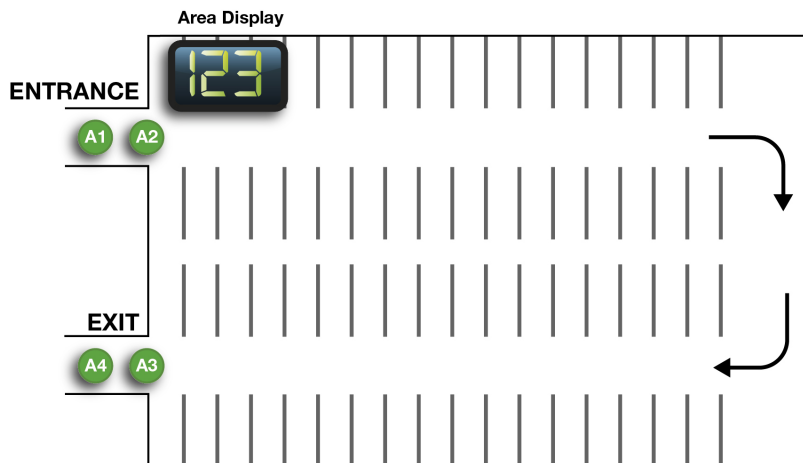
The minimum requirements for this simple stand-alone system are:

- 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 of the GP3290 0003 700 is pulsating. This means that the power supply must be at least twice the 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 by accident "pow out" is short-circuited to gnd. Refer to diagram *Fig. 11*.

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

Fig. 12: Connection diagram for the simple stand-alone system
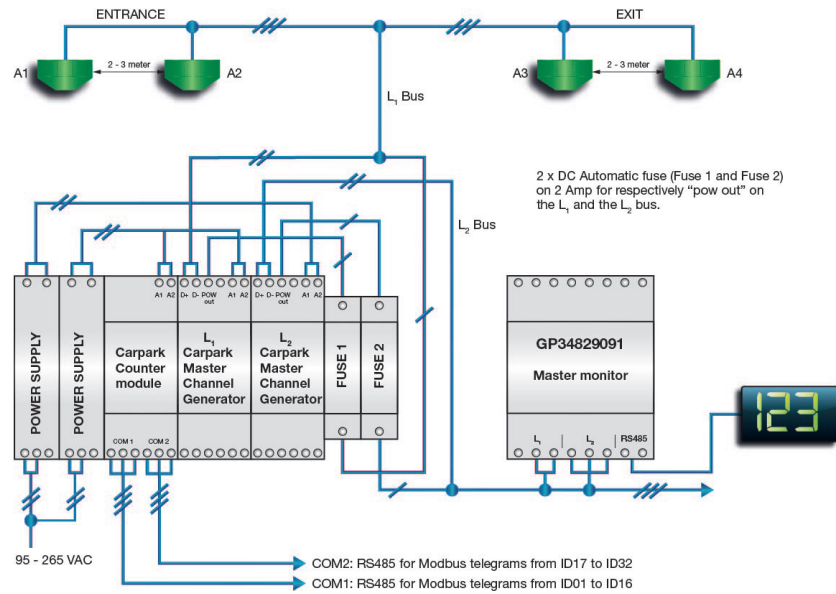
Fig. 13: Carpark with multiple entrances and exits
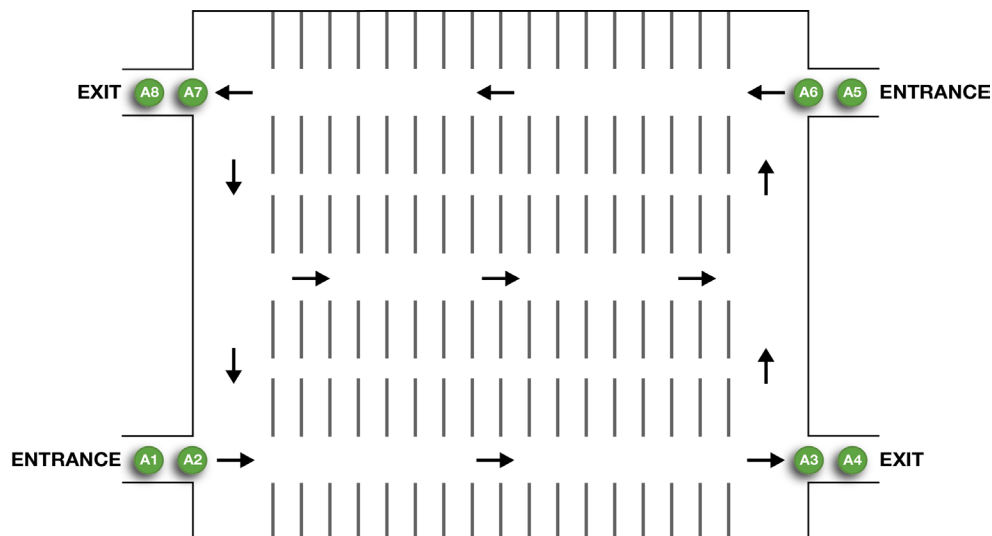
If we compare the above system with multiple entrances and exits to the simple stand-alone system, it is implemented simply by adding two more Detection Points (DPOs), each with two sensors connected to bus L1.

In the example *(Fig. 13)* 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). This is three entrances in total.

Fig. 14: Parking facility with multiple zones and multiple exits
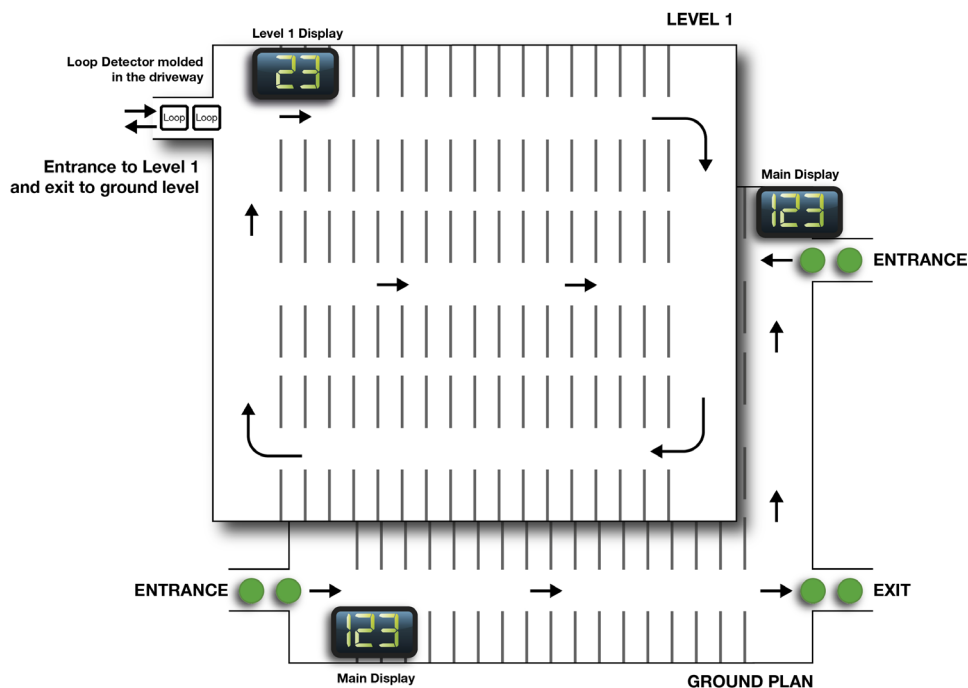
Zone 1 also has two exits (DPOs). One exit to Main Street and one exit to Zone 2.

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

This information is needed when configuring the MZC (Refer to Design and Installation Guide for Carpark Zone Counter).

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

In the example (*Fig. 14*) 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 two power supplies are needed together with two CPMs. The CPMs are programmed as master monitor and master monitor indicator respectively.

4. 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.

Fig. 15: Connection diagram for 2-zone 4-DPO example
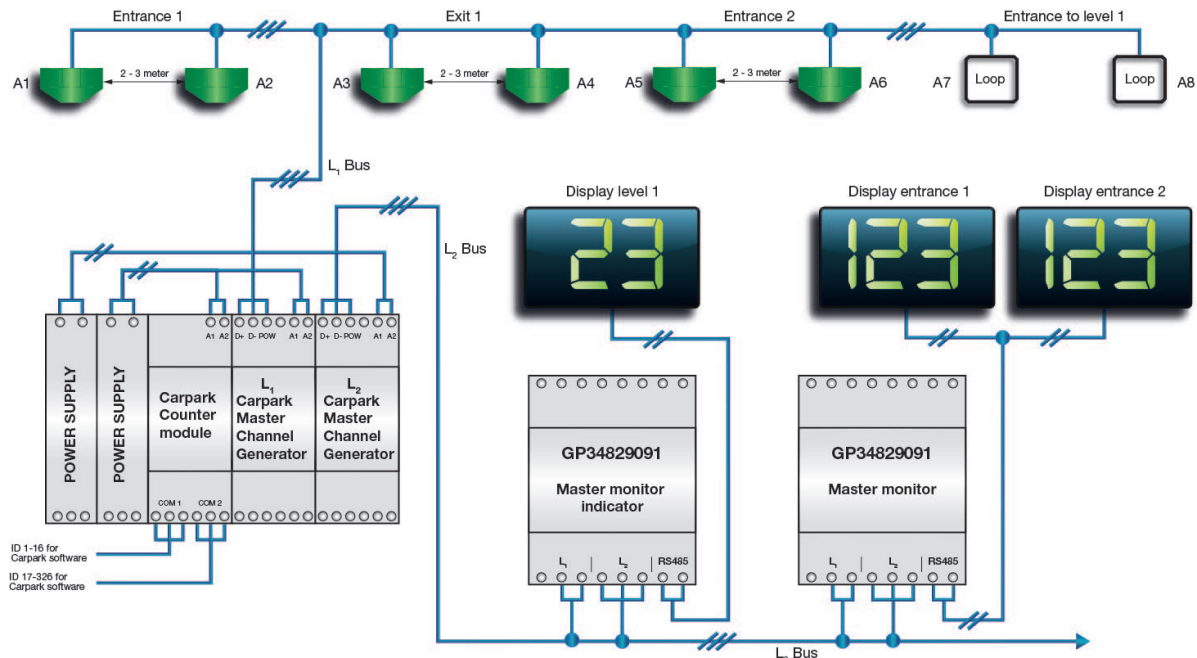
When programming the master Carpark monitors controlling the displays, it is necessary to know the L2 ID number for each zone in order to include the right zone(s) for each display. This information is made available in the final MZC report when a project is built (Refer to Design and Installation Guide for Carpark Zone Counter). Here it is also possible to define the L2 ID for the first zone, and then 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 (ID 1-16 on port COM1, ID 17-32 on port COM2). 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 IDs. These IDs are needed when configuring the Carpark Software.

As shown on the diagram next page, 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.

4.1. Zone Counting System With a Split Between Standard and Reserved Spaces

It is a commonly known issue with zone count systems in parking facilities that they are not able to detect the split between standard and reserved spaces, typically used for disabled 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 in the required category available.

The Dupline® zone count system offers the option to detect the split between standard and reserved

Fig. 16: Single spot detection and count system combined

Removed when
MZC is combined

Up to 16 segments
on one moxa port
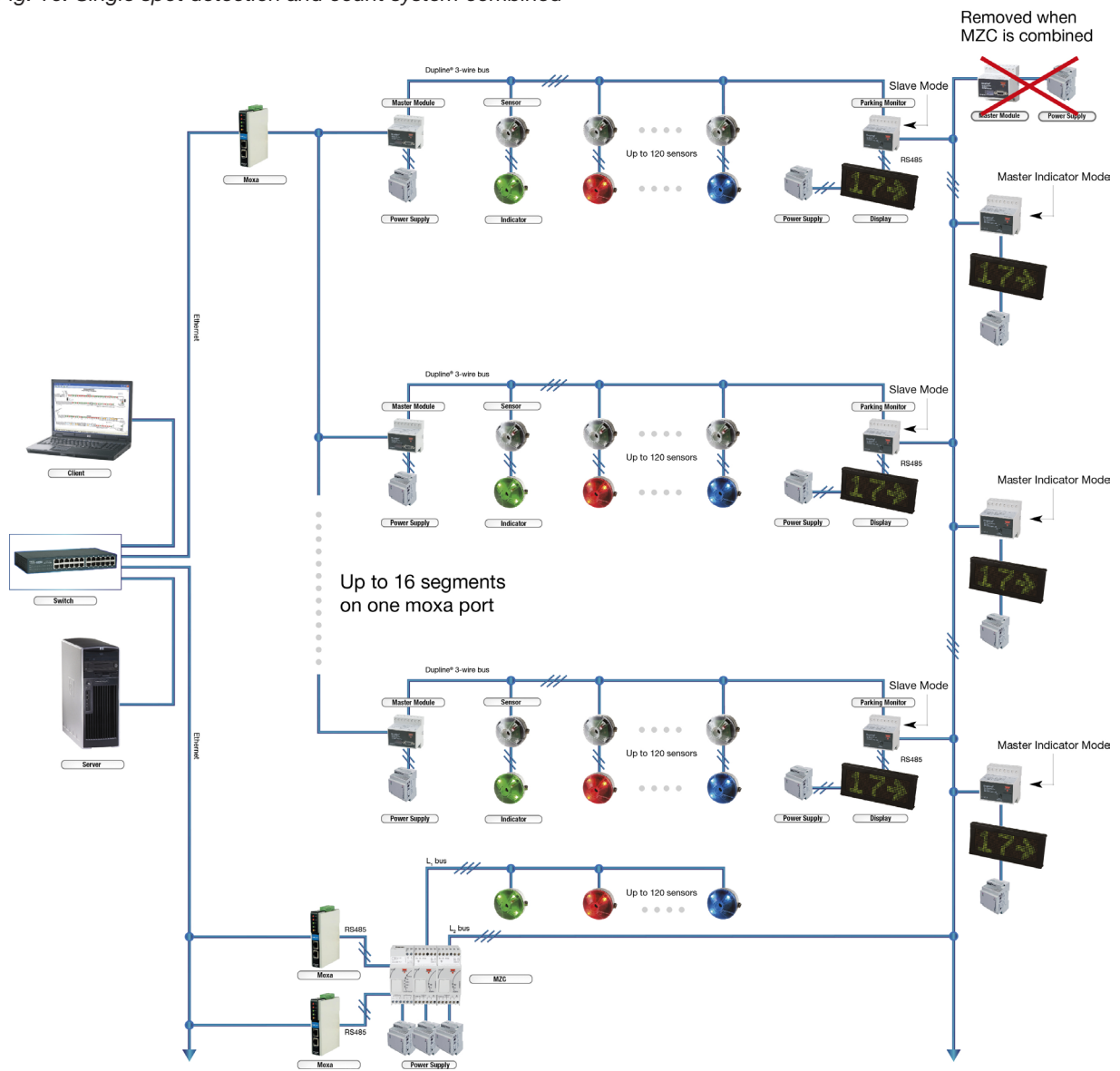
spaces. The reserved spaces are implemented as a single spot system where each space is equipped with a Carpark sensor. The accurate reserved space availability information hereby achieved is linked to the Zone Counter which can calculate the available standard spaces from the total amount. The end result 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 disabled parking spaces, which have individual blue LED indicators. In the case of reserved VIP spaces, the indication could be amber LED indicators.

When implementing this solution, the MZC needs to know on which L2 slave address can be read the required available data from the disabled single spot system. So, all sensors used for disabled parking spaces must be connected to the same single spot L1, and a slave Carpark monitor has to monitor these sensors and send the number of available spaces as a value on a specific L2 ID which is required when the MZC for this solution is configured.

5. Installation of the Standard Spot Detection System

5.1. Short Installation

The idea of this short installation section is to give the installer a tool to answer most questions when performing the installation of cables, sensors etc. Now the planning has ended, and we move forward towards the installation process starting with:

5.1.1. Sensors

- Preprogram the sensors before mounting on the ceiling. Refer to 11. *General Installation*.

- Sensors must be installed at a distance of minimum 1.5 m (4.95 feet) and maximum 4.0 m (13.2 feet) from the floor.

- Use e.g. cable trays to mount the sensors and save labour costs.

- Sensors must be mounted in the middle of the Parking Guidance System space directly above the car.

- For aesthetic reasons, it is best to mount the sensors in a straight line and at the same height over each Parking Guidance System space.

- Mount sensors so that they point directly down to the ground with a maximum angle of 5 degrees.

- When mounting the wires into the push wire connectors on the sensors and the LED indicators:

  - cut the isolation carefully so the conductor is not damaged.

  - cut only 1 cm (.394 or 25/64 inches) of the inner isolation on the conductor that is to be pressed in the push wire connector. Refer to section 11. *General Installation* for a more firm description.

- If using the new 3-colour sensor, the same precautions as with the 2-coloured sensor should be taken.

5.1.2. LED Indicators

- When indicators are used separately from the sensors for maximum viewing, the LED indicators should be installed outside the Parking Guidance System place in the drive lane.

- They should be mounted in the ceiling, in an aesthetic straight line and in the same height over the floor.

- When using the new 3-colour Dupline® Bus powered LED indicator, the same precautions should be taken as for the 2-coloured LED indicator. However, this new type must be connected to the Dupline® L1 bus (same L1 bus as the sensors). Refer to section 11.8.

5.1.3. Car Park Monitor (CPM) Modules

The CPM modules have three different functions (modes). They can be slave, master indicator or master CPM.

Slaves

- Connect the L1 bus on the CPM module to the sensors. Each slave is a segment. Use 1.5 mm^2 (14-16AWG) wire.

- Maximum 120 sensors in a segment, maximum 70 sensors and maximum 200 meter (660 feet) of wire in a branch.

- Connect the L2 to all other CPM modules in the entire system. Use 1.5 mm^2 (14-16AWG) wire.

- Connect RS485 to display if such display is selected. Refer to *2. Planning a Dupline® Parking Guidance System (PGS).*

Master Indicator and Master CPM

- There can be an infinite number of master indicators to show open spaces in many combinations of segments. There can be only one master CPM in each system. Refer to *11. General Installation*.

- Connect the L2 to all other CPM modules in the entire system. Use 1.5 mm^2, (14-16AWG) wire.

- Connect RS485 to display if display is selected. The display will show available spaces from a variety of segments and not just one segment. Refer to *11. General Installation*.

5.1.4. Dupline® Master Modules (DMM)

- The DMM, Dupline® Master Module named GP34960005700, is used in all segments to supply sensors and slave CPM. Connect to the L1 bus only.

- The DMM, Dupline® Master Module named G34960005700 (and not GP34960005700), is used only to supply the L2 bus on all CPM modules in the system. There is only one module in an entire system.

- Use double size power supply because of the pulsating output on the DMM.

5.1.5. Cabling

- Use a 3 conductor, 1.5 mm^2 (14-16AWG) unshielded single core wire for the sensors.

- Use a 2 conductor, 0.5 mm^2 (18AWG) unshielded single core wire for the LED indicators.

- Use a 2 conductor, 0.7 mm^2 (18AWG) twisted and shielded cable for RS485 to the display and for RS485 to the GP34960005700 if the Parking Guidance System software is used.

- Use 2 conductor 1.0 mm^2 (14AWG) unshielded cable for power to the display.

5.1.6. Cabinets

- Place the cabinets according to the plan.

- Use larger cabinets for future installations but also to avoid heat dissipation.

- Use a 1.5 mm^2 (14-16AWG) stranded wire for internal wiring.

5.2. Programming

5.2.1. 2-Colour Sensor

- Always start with A1 for the first sensor in each segment. The next is A2 etc.

- Program sensors in consecutive order.

- Calibration channel is **always** P1.

- If there is a lane sensor in the installation, always use the **last** Dupline® address in the segment for it. If for instance the address of the last sensor in normal mode is H4, then the address of the lane sensor is H5.

- Preprogram all sensors before they are mounted in the ceiling to reduce labor cost.

5.2.2. 3-Colour Sensor

- If using the new 3-colour sensor, the same precautions should be taken as with the 2-coloured sensor.

- Featuring 3 colours, this sensor takes up two Dupline® addresses. Therefore only 60 3-coloured sensors can be programmed to each Dupline® Carpark segment. Refer to section *11.6*.

5.2.3. CPM Modules

Slaves

- Select a unique ID number for each (segment) slave CPM.

- Select P1 for "Calibration channel".

- If no "Lane" sensor is present, select "X". Or else select the last Dupline® address for "Lane" sensor, e.g. O8.

- Highlight all Dupline® addresses used in the segment. Leave all other addresses unmarked.

- If offset spaces are not used, select "0" (Default). Then press "Program" unit.

Master Indicator and Master CPM

- Select "Master indicator" for collecting several segments into *one* display.

- Select "Master mode" for collecting several segments into *one* display and for being synchronizer in the entire system. There can only be *one* master mode in a system.

- Select "Gate Function" 1: Yes 2: No. – This function will set an output on A6 on the L2 bus when all spaces are occupied.

- Select "Small system" (Default). "Large system" is for systems bigger than 25000 spaces.

- Select the segment range that the master indicator is going to monitor. The range must be in consecutive order. E.g. 5-9 are segments 5, 6, 7, 8 and 9.

- If offset spaces are not used, select "0" (Default). Then press "Program" unit.

(DMM) Dupline® Master Module GP34960005700

- If Carpark software is used in the Parking Guidance System system, the dip switches must be set according to the specification in the datasheet.

5.2.4. 3-Colour LED Indicator

- Decide whether to use the LED indicator in single or multiple channel mode.

- In single mode the LED indicator can be used in either 2- or 3-colour mode. The LED CH1 always follows the Status address, starting from A1 and forward. LED CH2 can be deselected (press xx) or used together with the Carpark software, in which it is used as the colour for booking.

- If LED CH2 is deselected, the option "Freespace Colour" appears. The installer can select the colour that is going to indicate a vacant space. Next option is "Occupied Colour". The installer can select "Red" or "No Light" to indicate that the space is occupied.

- In Multiple Channel Mode, one LED indicator can monitor several sensors. It is possible to program up to 120 addresses into the LED indicator.

- Also in Multiple Channel Mode, the option "Occupied Colour" can be chosen. The installer can select "Red" or "No Light" to indicate that the space is occupied.

6. The Dupline® Fieldbus

6.1. General Information on the Fieldbus

The bus system that links the sensors and CPMs together is the Dupline® fieldbus. This highly reliable, robust bus system has been proven in more than 150,000 installations worldwide in a wide range of building automation applications such as water distribution, mining, railways, parking systems and many other areas.

6.1.1. Dupline® Bus Features

The strength of the Dupline® system lies in a unique set of features that enables elegant, flexible and cost-effective solutions. Most of these features originate from the effective time-division multiplex technology used. The efficiency of the protocol allows a low carrier frequency of 1 kHz, providing long transmission distances and a superior noise immunity. Hence, Dupline® is capable of transmitting multiple digital and analogue signals over distances of up to 10 km via a non-shielded, non-twisted 2-wire cable, without using repeaters. These unique Dupline® features provide considerable cost savings in many installations.

6.1.2. Dupline® Basic Elements

A Dupline® network consists of 4 basic elements: The master module, input modules, output modules and a 2-wire cable. The master module controls the communication on the Dupline® bus. It sends out the Dupline® carrier signal and coordinates all transmission between input and output modules.

Input modules connect to contacts, voltages and analogue signal sources etc. and transmit this information via the 2-wire cable. In the parking system the ultrasonic sensors can be regarded as input modules because they use the Dupline® bus to send status information to the CPMs.
Output modules connect to loads like lights, roller blinds, motor contactors, valves etc. In the parking system, the CPM can be regarded as an output module controlling the display based on the information received from the sensors via the Dupline® bus.

Fig. 17: Example of a basic Dupline® system
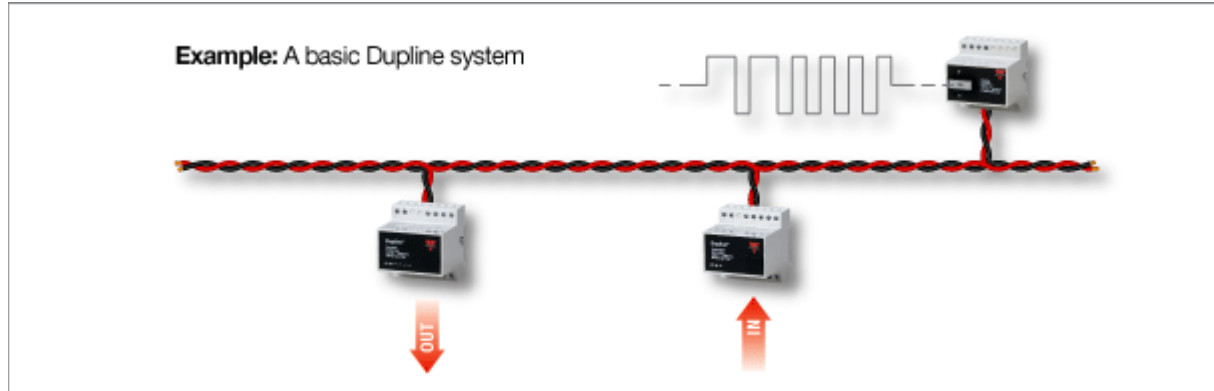
6.1.3. Dupline® Bus Including a 3'rd wire

The parking guidance system uses an expanded version of Dupline® in which a 24 VDC power supply is included as a 3rd wire. The reason being that a power supply is needed for the sensors on the bus. The power supply must be synchronized with the Dupline® bus, and this is taken care of by the specific master module for the parking system.

One master module, driving one segment of the basic Dupline® fieldbus, can manage up to 128 addresses - which basically means 128 signals - because each signal in this segment must be assigned an address. In the parking guidance system, however, 8 of these addresses are reserved, so that 120 sensors is the maximum in one segment. The addresses are named by a combination of a letter and a number. The letter indicates the group (A ... P), and within each group there are 8 addresses indicated by a number. So, the 128 addresses have the following names: A1, A2, A3, A4…..A8, B1, B2…..B8, C1…P8.

6.1.4. Dupline® Extra Features

The wide range of Dupline® products for building and industrial applications are fully compatible with the parking guidance system making it possible to extend the functionality to include e.g. control of lighting and ventilation based on presence of persons, CO_2 levels and time of the day. Yet another option is to record the energy consumption in power distribution panels throughout the building in a central place using energymeters directly connected to the bus.

7. System Description

In this chapter you will get an overview of the structure of the parking guidance system. There is a short description of the basic elements of the system, followed by a description of the structure of a system segment. Then is described how the individual segments can be linked together to create a large parking guidance system with thousands of potential spaces. Also, the network structure required to link the system to a PC with the Parking Guidance software installed is defined. Finally, the sensor calibration, sensor operation modes, and CPM operation modes are described.

7.1. Basic Modules

7.1.1. Parking Guidance System Sensors

With built-in LED indicator light, (red–green)   GP 6220 2201 724
With built-in LED indicator light, (red–blue)   GP 6220 2202 724
Without indicator light   GP 6240 2224 724

New products

With built-in LED indicator light, (Red–Green-Amber) GP 6220 3301 724
With built in LED indicator light, (Red–Green-Blue)   GP 6220 3302 724
With built in LED indicator light, (Red–Blue-Amber) GP 6220 3303 724

Fig. 18: Sensors with built-in LEDs

Each parking space must be equipped with one of these ultrasonic sensors which detects if a car is present or not. There are several versions of the sensor, one with built-in red/green indication, one with built-in red/blue indication and one without indication. The new sensors have 3 colours in various models. These sensors are designed to be used together with the Carpark software and they enable the Carpark operator to control the colour of each sensor. This is useful if the Carpark installation offer VIP spaces, family spaces etc. There are 3 versions of the sensor; one with built-in red/green indication, one with built-in red/blue indication and one without indication. The latter device is used in cases where pillars and walls make it difficult or impossible to see the light in the sensor from the driveway, because the sensor has to be installed in the middle of the parking space. In these cases external indicator lights are connected to the sensors and mounted beside the driveways where they are much more visible for drivers. This is why it is the most common solution in parking guidance systems.

Fig. 19: Driveway with external indicator lights providing a clear view

The red-blue indication is used for parking spaces for disabled people.
The product consists of two parts, the sensor itself and a holder to be mounted on the ceiling, cable tray or installation box. The sensor is detachable from the holder, which makes replacement of the sensor easy. Once locked to its hind part, the sensor is secured using a safety pin (included).

7.1.2. Indicator Lights

Red-green   GP 6289 0001
Blue-green   GP 6289 0002

New products
LED indicator lights, Dupline® bus powered

Red-Green-Amber   GP6265 2301 724
Red-Green-Blue   GP6265 2301 724
Red-Blue-Amber   GP6265 2303 724

The indicator lights are implemented in exactly the same housing and holder as the sensors, and they are mounted in the same way. There is a simple two-wire point-to-point connection between the sensor and the indicator light.
The new 3-coloured Dupline® powered LED Indicator must be connected to the same L1 bus as the sensor. Do not connect this LED indicator GP6265 230x directly to the sensor with a 2-wire point to point as this will not work.

7.1.3. Master / Slave CPM

Fig. 20: Car Park Monitor - GP 3482 9091 724 and GP3482 9091 724-1

This DIN-rail mounted configurable device is the intelligent part of the system. The purpose of the CPM is to monitor via the Dupline® bus a configurable range of sensors, detect the number of available spaces and send the result to be shown on the connected display. Normally, a CPM is needed for every display, but in case two or more displays must show the same information, it is possible to use the same CPM for these displays.

The version GP3482 9091 724-1 is used in installations where 3-colour sensors are required. When this version is selected, only 3-colour sensors are applicable in this segment. Max. 60 sensors can be installed because each sensor occupies two Dupline® addresses when the Dupline® Carpark Software is used. If 2-coloured sensors are required, they must be installed in a segment without 3-coloured sensors and version GP3482 9091 724 is used.

7.1.4. Parking Guidance System Displays

1 Arrow   GP6763 0106 (A) (A = outdoor version)

1 Arrow + HCP (icon) (Right)	GP6763 0107 (A) (A = outdoor version)
1 Arrow + HCP (icon) (Left)	GP6763 0108 (A) (A = outdoor version)
1 Arrow + 2 Digits	GP6763 0109 (A) (A = outdoor version)
1 Arrow +1 Digit + HCP (icon) (Right)	GP6763 0110 (A) (A = outdoor version)
1 Arrow +1 Digit + HCP (icon) (Left)	GP6763 0111 (A) (A = outdoor version)
8 Characters	GP6763 0112 (A) (A = outdoor version)

Fig. 21: Display

8 Characters + HCP (icon) (Right)	GP6763 0113 (A) (A = outdoor version)
8 Characters + HCP (icon) (Left)	GP6763 0114 (A) (A = outdoor version)
9 Characters	GP6763 0115 (A) (A = outdoor version)
3 Characters + Arrow	GP6763 0116 (A) (A = outdoor version)

These are the official displays we have in our range. If other display types are needed, high bright displays, displays with special text or even combined displays, please contact Dupline® support or feel free to contact our display supplier directly.

There are several types of displays available for the parking guidance system. The number of digits varies, some have the symbol for disabled people, some can show text (e.g. "FULL") and some are designed for outdoor installations. Which one to choose depends on the location, task and budget. As mentioned earlier, it is the CPM that sends the number of available spaces to the display via a RS485 2-wire connection. Most displays are configurable in terms of how to display the values, but normally "0" open spaces are indicated with red crosses on the display. In case there are available spaces, the number is shown on the display together with a dynamic green arrow pointing in the right direction.

7.1.5. Dupline® Master Module (DMM)

Fig. 22: Dupline® Master Module (DMM) for parking systems - GP34960005700

The purpose of the master Module is to generate the 1 kHz Dupline® carrier signal that enables all the

devices on the bus to communicate with each other. Furthermore, it synchronizes the power supply for the sensors with the Dupline® bus signal in order to achieve a 3-wire bus with communication and power. Finally, it acts as a RS485 Modbus interface in order to deliver the sensors' status data to the RS485 and TCP/IP network collecting the data for the Parking Software.

The MCG comes in two versions. Basically, they are almost identical, but a few differences make them unique.

G3496 0005 700 is the original MCG and is used to send power and Dupline® bus to the L2 bus on the Carpark Spot Detection System. Today, we have developed a Carpark Count System that features a new integrated master channel generator, so that if a Carpark has a combined system with both spot detection and count system together, the G3496 0005 700 must be removed. Please refer to section 4. *MZC Combined with Single Spot Detection*.

The second version of the MCG is **GP3496 0005 700** which is used to send power and the Dupline® bus to the L1 bus on the Carpark Spot Detection System. This version is also used to communicate between the sensors and the Carpark Software using the RS485 connection.

7.1.6. Test and Configuration Unit

Fig. 23: Parking guidance test and configuration unit - GP 7380 0080 709

The Parking Guidance System Configuration unit is the system's configuration and test unit. It is a simple handheld tool designed to configure sensors and CPMs, and furthermore it can be used as a test device able to read and simulate any sensor. The Parking Guidance System Configuration unit can also be used to trigger a simultaneous calibration of multiple sensors.
Note: If the Configuration unit is used with the new 3-colour sensor /LED indicator or with the sensors for the MZC system, please note that the version must be newer as MN01 xxxxx

7.1.7. Optional Units

The Dupline® Repeater and the power supply coupler operate as a set, and they are only needed in those rare cases where the limitations in cable voltage drop makes it necessary to regenerate the Dupline® signal carrier on one bus. Contact Carlo Gavazzi for further information on this option.

Dupline® Bus Repeater   D3892 0000 xxx
(For expanding the system)

Power coupler   G3485 0000 700
(Used together with D3892 0000 to synchronize power supply)

8. System Structure

At first sight, you may presume that it is a complex task to design a Dupline® parking guidance system for a parking facility with hundreds or thousands of parking spaces. But when you understand the basic structure of the system, you will realize that it is simply composed by a number of identically structured system segments linked together to create a big system. In this chapter, at first the structure of the basic system segment is defined. Then we describe how the segments can be linked together to create the overall system, including a network for central parking facilities monitoring software.

8.1. Definition of a One-Segment System

In fig. 23 a drawing of a single system segment is shown. A system segment is a local Dupline® 3-wire bus with sensors, indicators and display(s), typically monitoring one lane in the parking facility.

Fig. 24: One-segment system
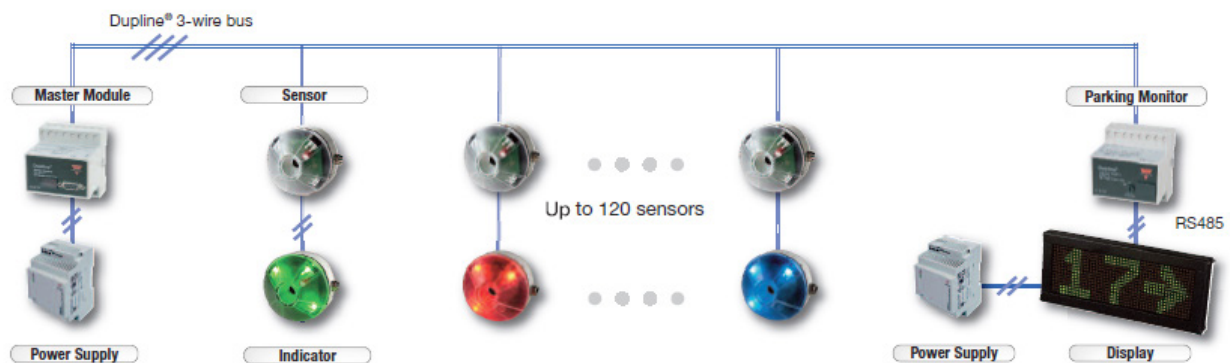
The elements of the structure are the following:

8.1.1. The Dupline® Master Module with DC Power Supply

This unit generates the Dupline® carrier signal and DC power supply synchronization needed to create the 3-wire bus linking all the sensors and CPMs in the segment together. In a given segment you will always find one - but only one - master module. A Dupline® 3-wire bus at segment level is referred to as an L1 bus.

8.1.2. Sensors and Indicators

Each parking space belonging to the segment needs one sensor and one indicator (unless the sensor with built-in indicator is used). Each sensor must be connected to the 3-wire bus and it must have one of the 120 addresses in the range A1...O8 assigned to it for transmission of the sensor status (occupied / not occupied) on the bus. The 8 Dupline® addresses in group P are reserved for system purposes and cannot be used for sensors. The sensor is mounted in the middle of the parking space and the indicator is mounted at the entrance to the parking space, where it will clearly indicate to the drivers if the parking space is available or not. The two units are connected with 2 wires.

8.1.3. Car Park Monitor(s) (CPM) with Display(s)

Each display is controlled by a CPM, which must always be configured to operate in slave mode when it is connected to a segment bus (L1). In slave mode, the CPM monitors a user-defined range of parking spaces within one segment, which essentially means a range of sensor addresses (e.g. A1, A2, and A3...A7). By reading the status of these sensor addresses, the CPM calculates the number of open parking spaces. It sends via RS485 the result to the display, which then displays the number and shows a dynamic green arrow. Unless of course the number is "0". In that case red crosses will be shown. It is possible to have several CPM modules with displays within one segment.

Another example of a 1-segment system is when we are using the 3-coloured sensor or 3-coloured LED indicator. In general, the 2 and 3-coloured sensor types are alike, but the 3-coloured LED indicator is different compared to the 2-coloured LED Indicator. The 3-coloured LED indicators are Dupline® bus powered just like the sensors.
The function of the 3-coloured LED is equal to the 2-coloured LED but the new indicator/sensor enables the manager to use part of the Carpark for special parking, like for instance VIP, guest and perhaps family parking.
This is done by using Carpark software to book these areas for special purposes. Then the drivers are in position to find the parking places by navigating by the colours of the sensors/LED indicators.

Fig. 25: LED indicators powered by bus or sensor

The 1-segment system in fig. 24 manages an area of the parking facility and provides local guidance for that area with its displays and indicators. In order to extend the system to provide guidance at a more "global" level as well, it is necessary to link all the CPMs from the various system segments together.

8.1.4. Segments Linked Together via L2 Bus for Totalizing

The L2 bus is used to collect data from all the segments (L1 buses) and distribute the data to displays that show the numbers of available spaces. The CPM module GP34829091 which is programmed in master mode has the option of showing numbers of available spaces from specific segments in numerical order, e.g. ID5, ID6, ID7 etc. Also, the CPM modules are able to show the total number of available spaces in a Parking Guidance System system. Then all segment ID numbers must be selected to accomplish this. The number of CPM modules which can be installed in "master Indicator mode" is unlimited. The module does not use or occupy addresses but only collects data from the L1 buses (segments).

On the L2 bus there must always be one CPM module programmed as "master". The master has the same function as the "master indicator" but it also functions as a provider of multiplex signals in the system. Only one "master" can be present on the L2 bus.

The two buses, L1 and L2 are galvanically separated from each other, which means that if one or several segments (L1 buses) are suddenly malfunctioning, the rest of the system will continue working without any problems. When the defective segments have been repaired, they will automatically be reintegrated in the system without the need of resetting or restarting the system. This will not in any way affect the user.

If the L2 bus is malfunctioning, only the displays will be affected. All the segments (L1 buses) will continue working without any problems. The software will also continue working because all the information to the software is provided from the GP34960005700 Dupline® master module on the L1 bus.

The example fig. 25 shows three segments (L1 buses) connected to the L2 bus. The example has a "master" which provides the system with multiplex signals and a display which shows the total number of available spaces in the system. The two monitor modules are programmed as "master indicators". They produce no multiplex signal but they are able to show available spaces from one or several segments (L1 buses).

The example also shows that all the displays have their own power supply. This is to avoid mixing the galvanic separation between the two buses L1 and L2.

Fig. 26: Three segments connected to Bus L2

9. Software Network Added

With the Dupline® Parking Guidance System Guidance System software it is possible to monitor and control the parking system from one or several central locations. Features include monitoring of real-time status based on graphical images and key figures for the various user defined areas, monitoring of alarms, and the possibility to book spaces in the parking system. In order to provide useful statistical information, all parking events are stored in the database. On the basis of these data historical reports e.g. for occupancy rates, place rotation frequencies, place popularity rates and alarms can be obtained.

The Dupline® Parking Guidance software is a true client/server software using the latest technologies from Microsoft for client/server communication. This enables users to monitor and control the Dupline® Parking Guidance System from anywhere in the world provided that the computer running the Parking Guidance System Server software is accessible on the Internet.

Fig. 27: Parking Guidance System overview
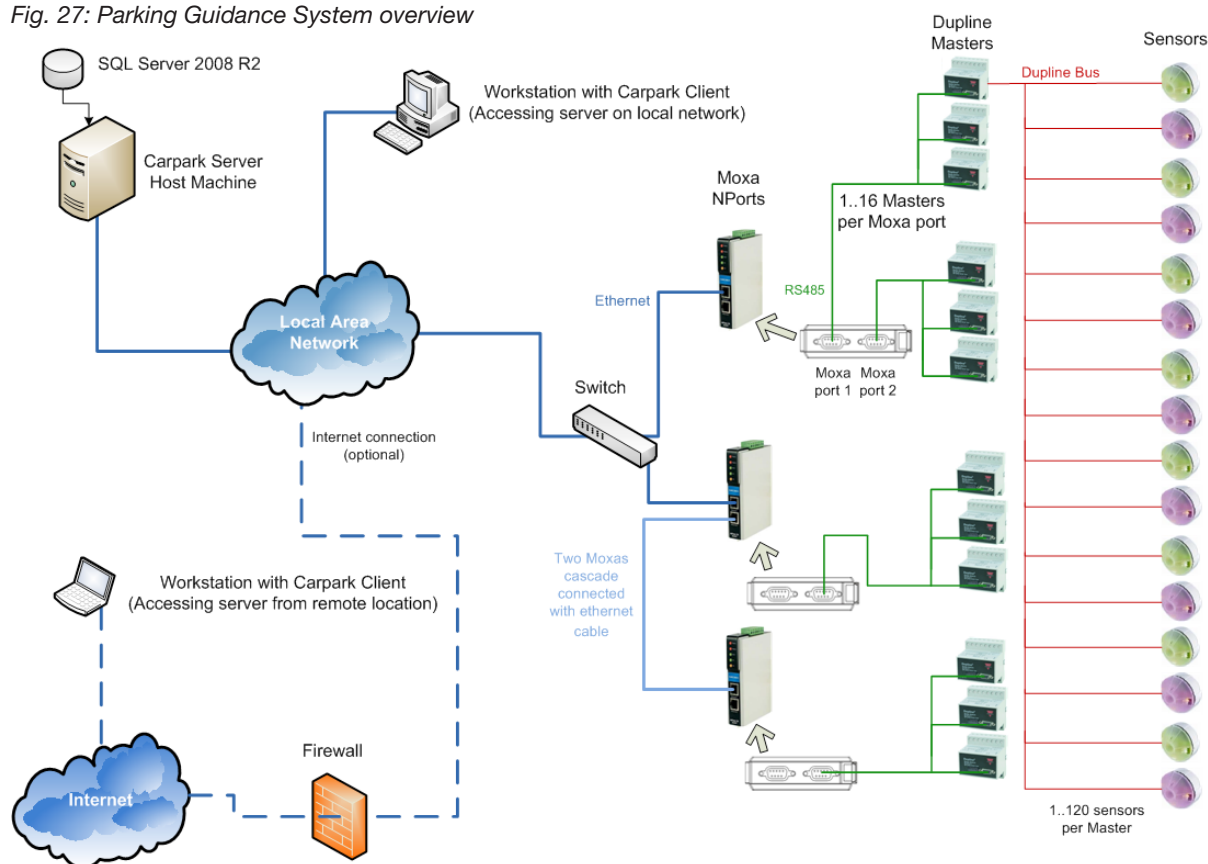
The latest SQL Server 2008 from Microsoft is used by the Parking Guidance System Server software to store all data acquired from the Dupline® Parking Guidance System for presentation in the Parking Guidance System Client software.

Dupline® Master Modules (DMMs) can be connected to up to 120 sensors. Each sensor is assigned a Dupline® channel (which corresponds to a Dupline® address in the software). DMMs can in turn be connected to Moxa NPorts using RS485 cables.

Each port on a moxa can support up to 16 parallel-connected DMMs. A device like the Moxa NPort IA-5250 could, if need be, support up to 32 DMMs, hence 3840 place sensors. The moxa devices convert RS485 data into Ethernet data. By connecting the moxas to the same network as the Parking Guidance System Server host machine, the Parking Guidance System Server software will be able to monitor the state of the place sensors (assuming the system has been properly configured). Moxas can be connected to the network using a switch. Alternatively, you can choose to connect only a single moxa to the network and then cascade connect the rest as shown in the diagram (fig. 26). To help you configure your moxa devices, we provide the Parking Guidance System Moxa NPort Configuration software. Its use is explained on www.Car-Park.dk

Workstations connected to the same network as the Parking Guidance System Server host machine can connect to it using the Parking Guidance System Client software. If the system administrator gives a web address to the Parking Guidance System Server host machine, off-site users will also be able to connect to it via the Internet.

If for instance the server breaks down, the Parking Guidance System will automatically continue working as a "Stand Alone" system. This means that the drivers will not be affected. When the server is back online, it will automatically synchronize into the system. The operator will then be able to make bookings and statistics and in any other way work with the system.

9.1. System requirements

9.1.1. Carpark Client

Operating Systems: Windows XP; Windows Vista; Windows 7
Processor: Follow Operation System requirement
RAM: Follow Operation System requirement
Hard Disk: Minimum 1 GB of available space
Display: 1024 x 768 high colour, 32-bit (Minimum); 1600 x 1200 high colour, 32-bit
Suggested: 24" monitor, with a resolution capable of 1600 x 1200 pixels in high colour.

9.1.2. Carpark Server

Operating Systems: Windows Server 2003; Windows Server 2008; Windows XP;
Windows Vista; Windows 7
Processor: Core 2 Duo 2GHz Pentium processor or equivalent (Suggested)
RAM: 2 GB (Minimum); 4 GB (Suggested)
Hard Disk: Minimum 10 GB of available space
Display: 1024 x 768 high colour, 32-bit (Minimum); 1600 x 1200 high colour, 32-bit

10. Parking Guidance System Modules and Modes Explanation

10.1. Sensor Calibration

The Parking Guidance System sensor GP62x0 22xx is an ultrasonic sensor that transmits a 40Hz signal. The sensor receives the signal again with a certain time delay and based on this delay it determines the distance from floor to sensor. If a car is present, the signal changes.

Fig. 28: Calibration of a sensor (local)

Press the button smoothly for 3 seconds and move away from the sensing area while the sensor is calibrating
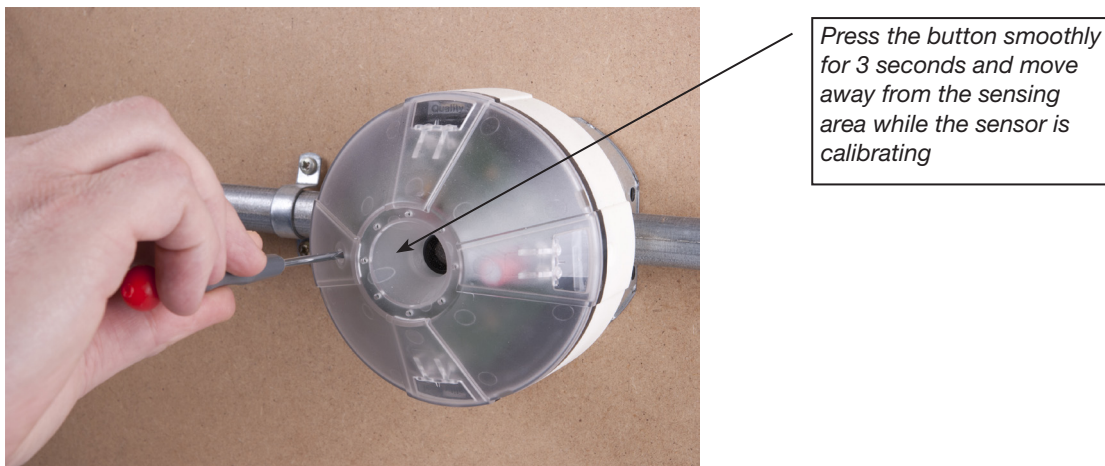
There are two ways of calibrating the sensor: Local or global calibration.

The sensor is self-calibrating. It is important to perform the calibration when the parking space is empty. Manual calibration is a local calibration of the individual sensor.

- Push the button on the outside of the sensor. The green LED flashes for 30 seconds at 1 Hz. (The technician has time to get clear of the sensor before the calibration starts).

- The calibration starts when the green LED flashes for 6 seconds at 4 Hz.

- If the calibration is OK, the LED will respond with a constant green light.

Global calibration can be performed by means of the Configuration unit GP73800080. The GS7380 0080 is connected to the segment (L1 bus) in GTU8 mode. Selecting "global calibration" enables simultaneous calibration of all the sensors connected to the segment.
The parking space must be empty during the calibration process. The procedure for global calibration is the same as for local calibration.

Fig. 29: Global calibration of sensors

© Carlo Gavazzi A/S
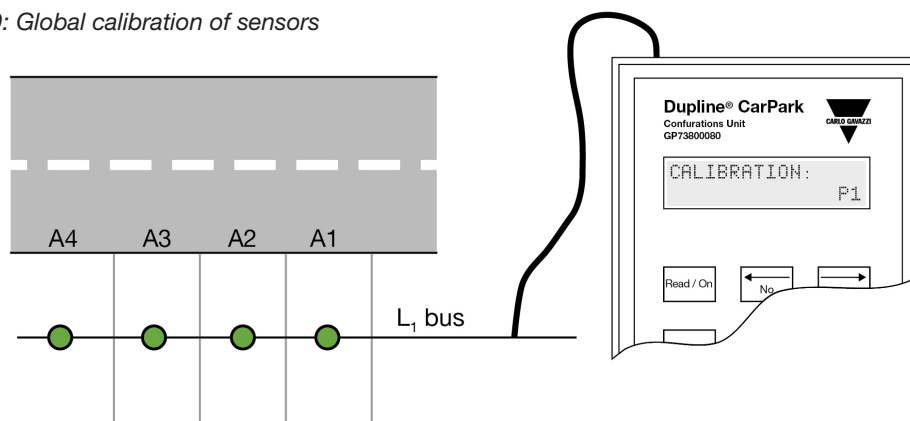
Fig. 30: Vacant/occupied signalling
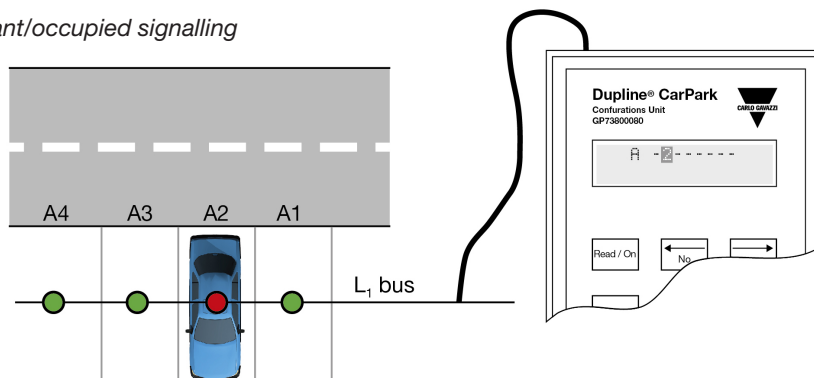
10.2. Sensor Modes

The sensor has two modes. Normal mode or Lane mode.

In **Normal mode**, the two-colour sensor detects the presence of a car in the parking space and turns on the red LED. Refer to *Fig. 29*
At the same time the sensor sends out a signal on the Dupline® 3-wire L1 bus.

When the parking space is empty, the LED will change to green and also send out a signal on the Dupline® 3-wire L1 bus.

The sensor will not react to objects lower than 0.3 m. To avoid a weak signal, the sensor must be installed pointing directly at a hard surface, like for instance concrete. A soft or uneven surface will reduce the signal.

In **Normal mode**, the 3-colour sensor has an extra mode that makes it possible to program the LED Ch1 and LED Ch2 to a Dupline® address. This address has to be unique. The 3-coloured sensor is designed to be used with the Dupline® Carpark Software which enables control of the colour on each connected sensor. Refer to section *11.6*.

In **Lane mode**, the sensor is designed to be mounted on the ceiling above the lane. The sensor is able to detect moving cars with a maximum speed of 20 km/hour. Refer to *Fig. 30: Global/local display*.

When the sensor detects a moving car, it sends a signal to the parking guidance system which reduces the total amount of available spaces, and shows the reduced amount on the local display but also on the display which shows the total amount of available spaces. This is to prevent too many moving cars in a specific parking guidance system area. The sensor does not show the actual status on the LEDs. The LEDs only work as feedback during calibration, start-up and they show the error status.

When the timer for lane mode has timed out, the displays will add up to the present value again.

Fig. 31: Global/local display

Global Display

8974

↓

8973

Local Display

018

↓

017

Lane Sensor
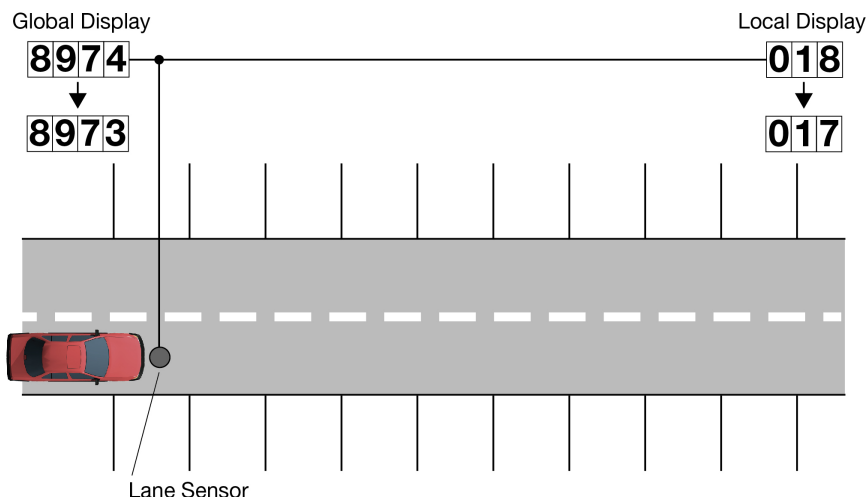
10.3. Car Park Monitor Modes

The unit has four different configurable modes:

10.3.1. Slave Mode

In slave mode the unit can collect data from a maximum of 120 sensors connected on the L1 bus (segment).
Addressing of the sensors is performed with the parking guidance system Configuration unit , GP7380 0080. The number of available parking spaces is transmitted to the L2 bus in order to allow CPMs in master mode or master indicator mode to read the information. It is possible to have up to 480 slave CPMs on the L1 bus. All slaves are programmed with a unique ID number.

10.3.2. Master Mode

This mode is the master mode. Only one master CPM is allowed in the entire system. The master provides the system with the multiplex signal. It also has the possibility to read and summarize on L2 the total of available parking spaces transmitted from selected slaves.

10.3.3. Master Indicator Mode

In master Indicator mode the unit is only connected to the Dupline® net L2. The master Indicator reads and summarizes on L2 the number of open parking spaces transmitted from selected slaves.
The master Indicator mode is e.g. used to summarize the total amount of open spaces on one floor by adding the numbers from the slaves on the particular floor. All CPMs are identified with a unique ID number. In master indicator mode, the CPM can be used to monitor a range of specified IDs from the multiplexer (example ID 50 to 200). This means that the CPM collects all the open parking spaces from ID 50 to ID 200 and sends the information to the Display via RS485. There is no limit to the amount of master indicators on the L2 bus.

11. General Installation

11.1. Cable

The 3-wire cable used in the Carpark system supplies both Dupline® signals and power to the sensors.

To avoid voltage drop at the far end of the cable or to avoid reflections in the cable, we require a cable that meets the following specifications:

3-conductor, 1.5 mm², (14-16AWG), non-shielded, single-core. If multi-core cable is used, the technician must connect a ferrule on each wire end, because the connections on the sensors are all "push connectors".

*Fig. 32: 3 * 1,5 mm² multi-core wire with ferrule*
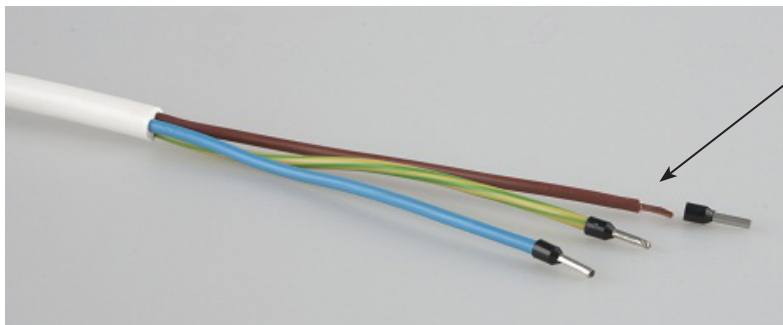
Mounting the ferrules on the multi core wire

*Fig. 33: 3 * 1,5 mm² (14-16AWG) single-core wire*
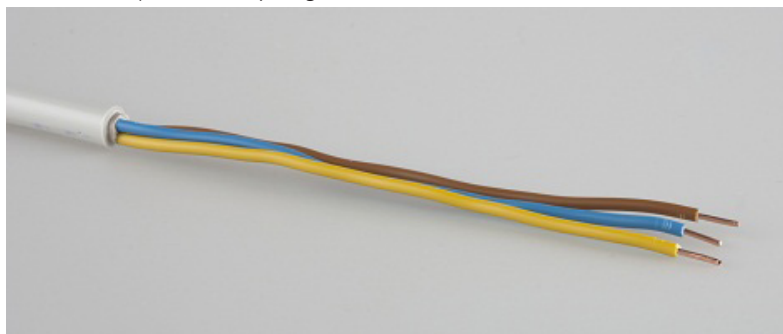
11.2. Practical Cabling Techniques

The following issues must be taken into consideration when installing the Dupline® bus cable.

- Do not mount the Dupline® bus cable close to high voltage installations such as:
  - Motors
  - High voltage cable
  - Inverters
  - Breakers

- Be sure that water cannot penetrate the Dupline® bus cable or junction boxes. Water can cause poor connections and random activations of the sensors.

- If the cable is installed close to high voltage cables or equipment, use shielded cable.

11.3. Placing the Sensor

When installing sensors it is important to investigate what kind of technique is the best in the specific installation.

The sensors operate at distances between 1.5 m (4.95 feet) and 4.0 m (13.2 feet). In the planning stage decisions should be made as to where and how to mount the sensors. The decisions based on physical conditions will include:

- On the ceiling

- On a cable tray

- As a lowered sensor

Fig. 34: Placing the sensor

Max. 4 m
Min. 1.5 m

0.3 m
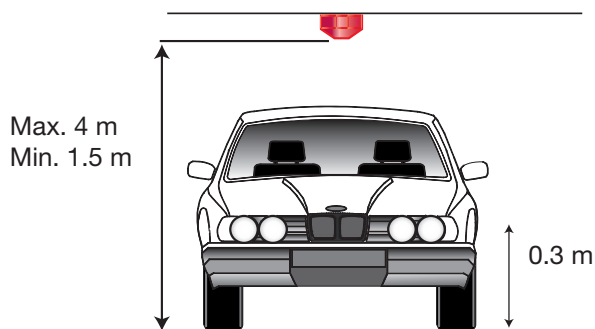
The sensor will not react to objects lower than 0.3 m

Each technique can be used, but installation time, price and aesthetic considerations must be taken into account.

In our experience, cable tray installation is a very quick installation. In addition it is cheap (in Europe because of the labour) and it has a nice (aesthetic) appearance. In Asia experience has shown that customers prefer the lowered sensor installation.

Fig. 35: Sensors mounted on a cable tray

Fig. 36: Sensors mounted on the ceiling

Fig. 37: Lowered sensor installation

11.4. Positioning the Sensor

The sensor must be installed pointing directly towards a hard and straight surface. The sensor angle must be <5 degree.

Fig. 38: Installing a ceiling sensor
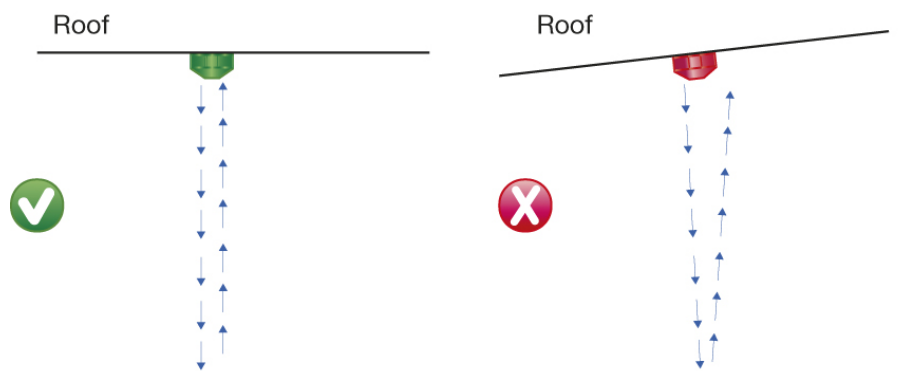
The sensor sends out a 30 kHz ultrasonic signal and it is important that the receiver inside the sensor is able to detect the returning signal without problems. If the angle is difficult or the surface has a poor quality, the signal can be interrupted resulting in the sensor's flashing red.

The sensor must be mounted in the middle of the parking space to ensure a perfect and reliable signal.

Fig. 39: Mounting in a parking space
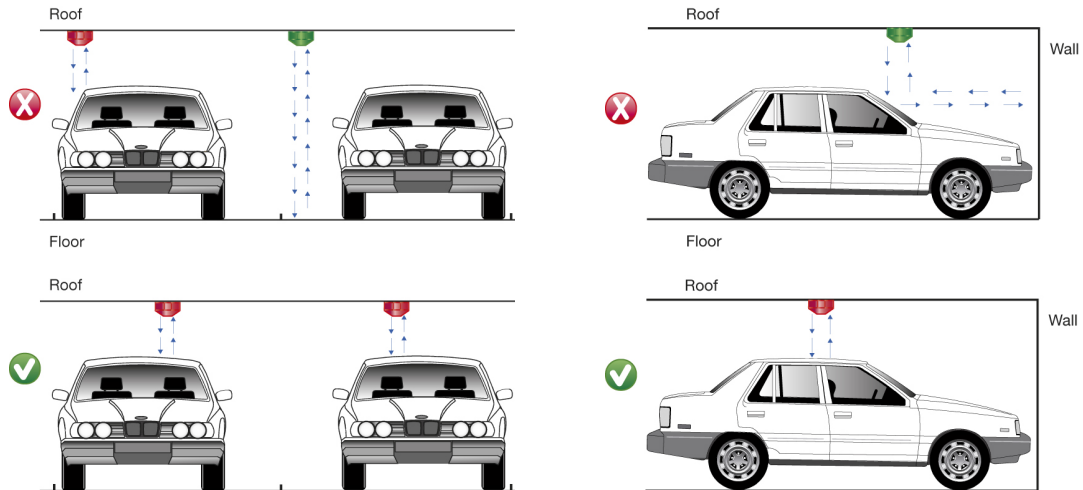
The sensor can be programmed as "Normal sensor" or "Lane sensor". "Lane sensor" is used to monitor cars that enter the main entrance or areas in the Parking Guidance System Centre. It is necessary to mount the "Lane sensor" directly over the lane. All Parking Guidance System sensors, "Normal sensor" and "Lane sensor" must be mounted following the same rules.

11.5. Wiring the Sensor

The wires can be connected to the sensor connectors without the use of tools because the "push connector technique" is used. Just press the stripped single core wire into the connector and it will be excellently connected on the inside.

To release the wire from the push connector; press the release button and pull the wire.

Fig. 40

Mount the wire by pushing the wire into the connector

Fig. 41

Dismount the wire by pulling it while at the same time push the release button.
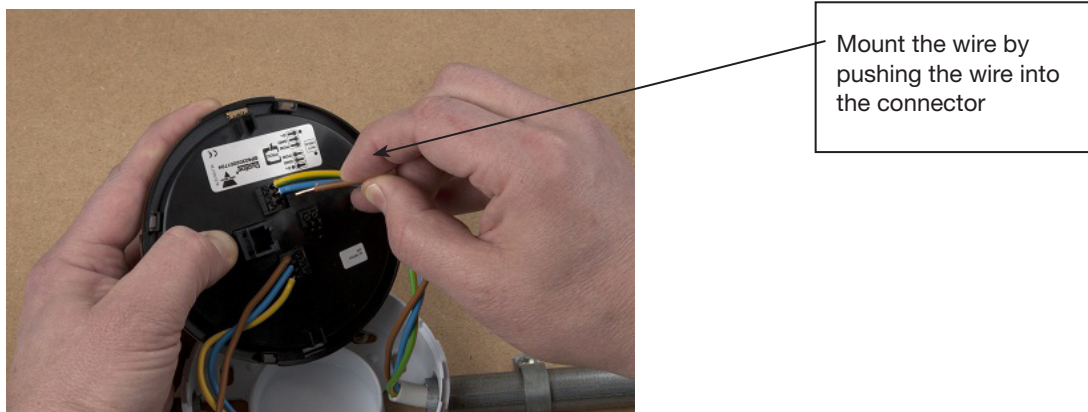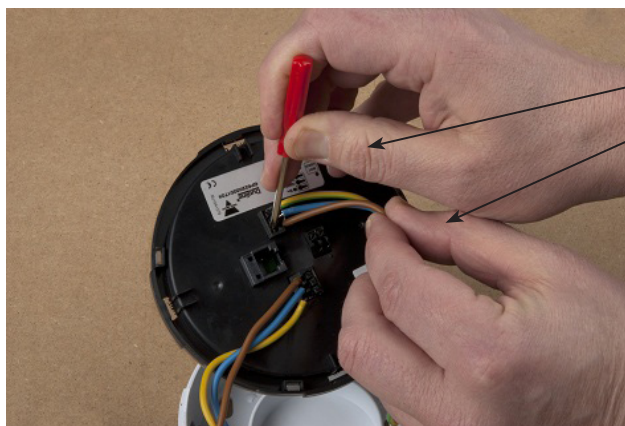
Leave 20 cm or 8 inches of extra wire for making the connections to the sensor. This extra wire not only makes it easier to connect the sensors, but it also prevents stress to the connections due to extreme radii.

Fig. 42

It is advisable to add 20 cm (8 in) of wire for physical sensor connections.

To mount the sensor to the back housing, press the two parts together and turn the sensor counter-clockwise just a few cm (3/4 inch). The edges of the sensor must follow the edges of the back part to be completely mounted, like a bayonet mounting configuration.

Fig. 43

Press the two parts together and twist the upper part counter-clockwise by 2 cm (3/4 in) so that their two edges are aligned in a bayonet style.

Use the plastic retaining pin to unite the two parts.

Fig. 44
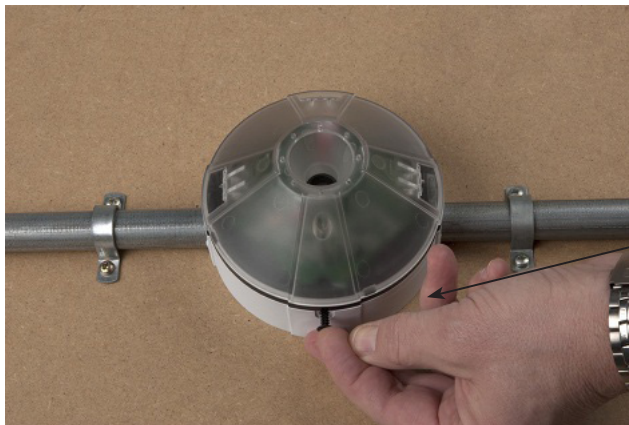
11.6. Programming the 2-Colour Sensor

The flowchart (fig. 45) describes the complete programming of the sensors GP62x0 22xx 724-x. It concerns 2-colour sensors with LED Indication and sensors without LED indication. The functions of these sensors are identical.

Each programming window is thoroughly explained in the following pages by means of references. Basically, the sensors operate in two modes; "Normal" and "Lane" mode. Normal mode is used when the sensors are used for standard space detection, where each parking space has its own sensor.

Lane mode is used to detect the number of cars driving in a Carpark area. If a timer is used, the number of available spaces for a specified time is reduced. This is to avoid car jam.

Lane mode is also used in count systems together with the MZC system to count cars driving in and out a Carpark area and to send the information on available spaces to a display or to the Dupline Carpark Software.

By means of the programming tool GP7380 0080 the installer can program and test the sensors.

Fig. 45: Sensor and programmer GP7380 0080

Fig. 46: 2-colour flowchart

2-Colour Sensor

The sensors do not need power during programming. The power is supplied from the programmer GP7380 0080. This means that it is possible to program not only sensors that are already installed but also sensors not yet installed. The sensors can be preprogrammed before installation and the address can be written on the back of the sensor with a permanent pen. This will be a time saving advantage during installation.

11.6.1: "Config Unit". Start-up of the programmer. Press the "Read/On" button and the programmer will respond with this window:

11.6.2: "Mode selection". Decide if the sensor is going to be used as "Normal" or "Lane" sensor. The standard sensor mode - "normal mode" - detects the presence of a car in the parking space, turns on the red LED and sends out a signal on the L1 bus. If the parking space is empty, the LED will change to green and send out a signal on the L1 bus. In "Lane mode" the sensor is placed on the ceiling above the lane and detects the car as it enters the parking area. The Parking Guidance System will reduce the total number of available spaces because of the moving car and show the reduced number on the display. This is to prevent too many moving cars in a specific Parking Guidance System area. When the built-in timer runs out, the car driver expectedly found a parking space and the display will once again increase the number by one. The options in "Lane Mode" are designed for the Carpark Count System and are described in the "Installation Manual for the MZC system". If the installer cannot see these options, the revision of the programmer GP7380 0080 or the sensor GP62x0 xxxx predates June 2013.

11.6.3: "Status Calibrate". Select the status address, always starting from A1 onwards in chronological order. The calibration address must always be the same for all the sensors and we recommend to use address P1.

11.6.4: "Send data to unit". When the programming has ended, press "Yes" on the programmer to accept the changes, or "No" to exit the programming and returning to mode selection.

11.6.5: "Lane Mode". CNT_ A should be selected as an option for "Lane Mode" when the sensor is used as "Lane Sensor" in Standard Space Detection. CNT_B must be used only when the sensor is used as a "Count "sensor. Please refer to the MZC installation manual.

11.6.6: "Filter Strength". The filter refers to the section 11.6.5 and to the speed of the car. If CNT_A and filter 2 is selected, the sensor can detect cars driving up to 36 km/hour.

Fig. 47: Filter 2 will be the most common filter to use.

	Filter 1	Filter 2	Filter 3	Filter 4
Mode A	<=136mSec	272mSec	408mSec	680mSec

	Filter 1	Filter 2	Filter 3	Filter 4
Mode A	72 Km/t	36 Km/t	24 Km/t	18 Km/t

11.6.7: "Test LED Active" is used during installation to see if the sensor reacts to a car driving under it. When the installation is finished, it will be natural to change the LED to "No". When the LED is deselected, it will still be working even if the sensor fails during calibration or becomes defective. Select an address far away from the last sensor address in the segment where the Lane Sensor is mounted. It is recommended to use addresses in the O-area, e.g. O1 onwards.

11.7. Programming the 3-Colour Sensor

The flowchart (fig. 48) describes the complete programming of the 3-Colour sensors GP62x0 33xx 724-x. Each programming window is explained firmly on the following pages by means of references.

The 3-colour sensor is programmed in the same way as the 2-Colour Sensor described in section 11.6. However. The 3-colour sensor is designed to work with the Dupline Carpark Software, and the third colour can be used for e.g. booking, VIP parking etc. This sensor is not likely to be used as Lane or as Count Sensor but the functions are described anyway.

Basically, the sensors operate in two modes; "Normal" and "Lane" mode. Normal mode is used when the sensors are used for standard space detection, where each parking space has its own sensor. Lane mode is used to detect the number of cars driving in a Carpark area. If a timer is used, ithe number of available spaces for a specified time is reduced. This is to avoid car jam.
Also Lane mode is used in count systems -together with the MZC system - to count cars driving in and out a Carpark area and send the information of available spaces to a display or to the Dupline Carpark Software.
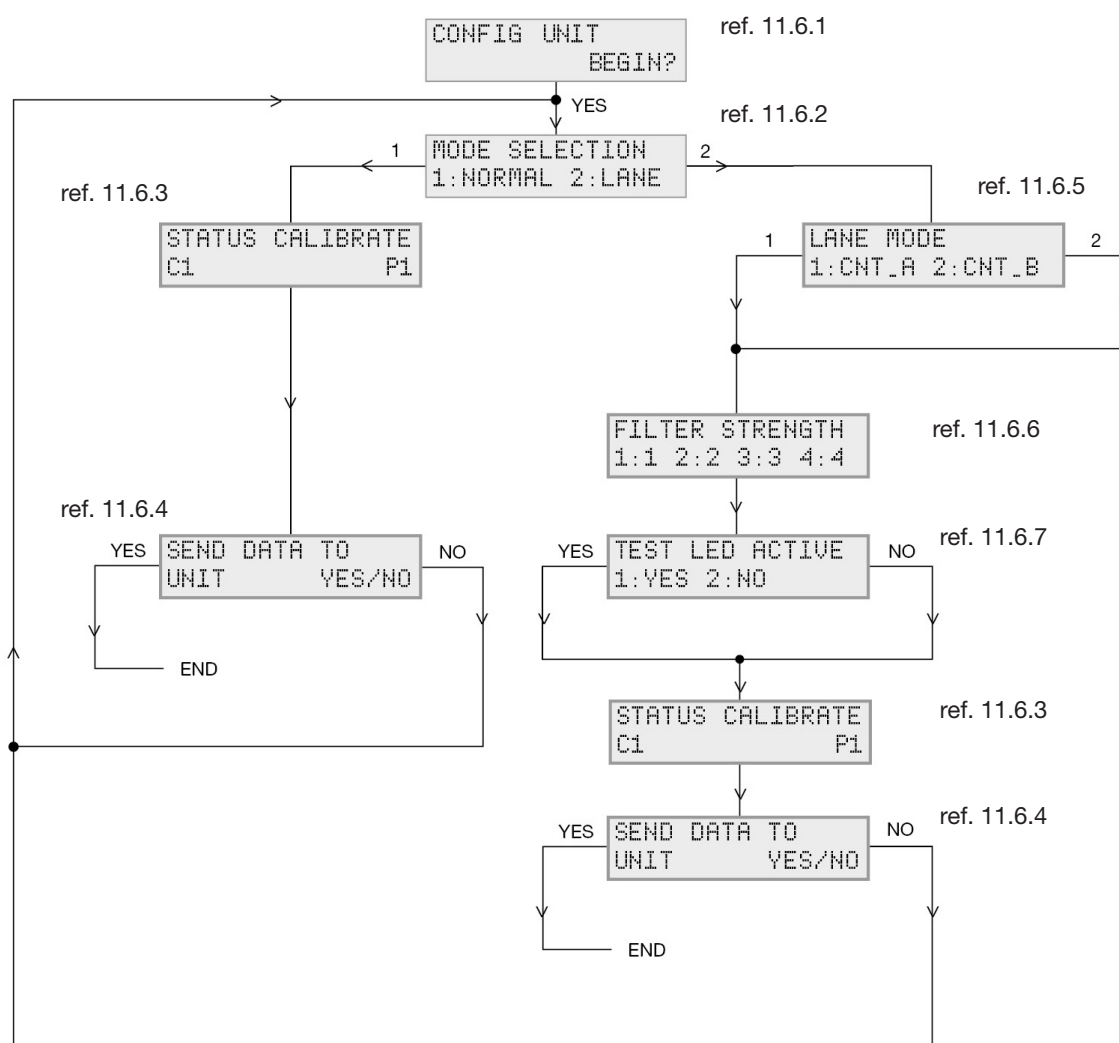
By using the programming tool GP7380 0080 the installer can program and test the sensors.

Fig. 48: Sensor and programmer GP7380 0080

The sensors do not need power during programming. The power is supplied from the programmer GP7380 0080. This means that it is possible to program not only sensors that are already installed but also sensors not yet installed. The sensors can be preprogrammed before installation and the address can be written on the back of the sensor with a permanent pen. This will be a time saving advantage during installation.

Fig. 49: 3-colour sensor flowchart

3-Colour Sensor

```
┌─────────────────┐
│ CONFIG UNIT     │   ref. 11.7.1
│           BEGIN?│
└─────────────────┘
          │ YES
     ┌─────────────────┐
   1 │ MODE SELECTION  │   ref. 11.7.2
  ◄──│ 1:NORMAL 2:LANE │
     └─────────────────┘
```

ref. 11.7.3

```
┌─────────────────┐
│ STATUS CALIBRATE│
│ C1           P1 │
└─────────────────┘
```

ref. 11.7.6

```
        ┌─────────────────┐
      1 │ LANE MODE       │ 2
        │ 1:CNT_A 2:CNT_B │
        └─────────────────┘
```

ref. 11.7.4

```
┌─────────────────┐
│ LED CH1  LED CH2│
│ C1           C2 │
└─────────────────┘
```

ref. 11.7.7

```
┌─────────────────┐
│ FILTER STRENGTH │
│ 1:1 2:2 3:3 4:4 │
└─────────────────┘
```

ref. 11.7.5

```
        ┌─────────────────┐
   YES  │ SEND DATA TO    │  NO
        │ UNIT     YES/NO │
        └─────────────────┘

              END
```

ref. 11.7.8

```
        ┌─────────────────┐
   YES  │ TEST LED ACTIVE │  NO
        │ 1:YES 2:NO      │
        └─────────────────┘
```

ref. 11.7.3

```
┌─────────────────┐
│ STATUS CALIBRATE│
│ C1           P1 │
└─────────────────┘
```

ref. 11.7.5

```
        ┌─────────────────┐
   YES  │ SEND DATA TO    │  NO
        │ UNIT     YES/NO │
        └─────────────────┘

              END
```
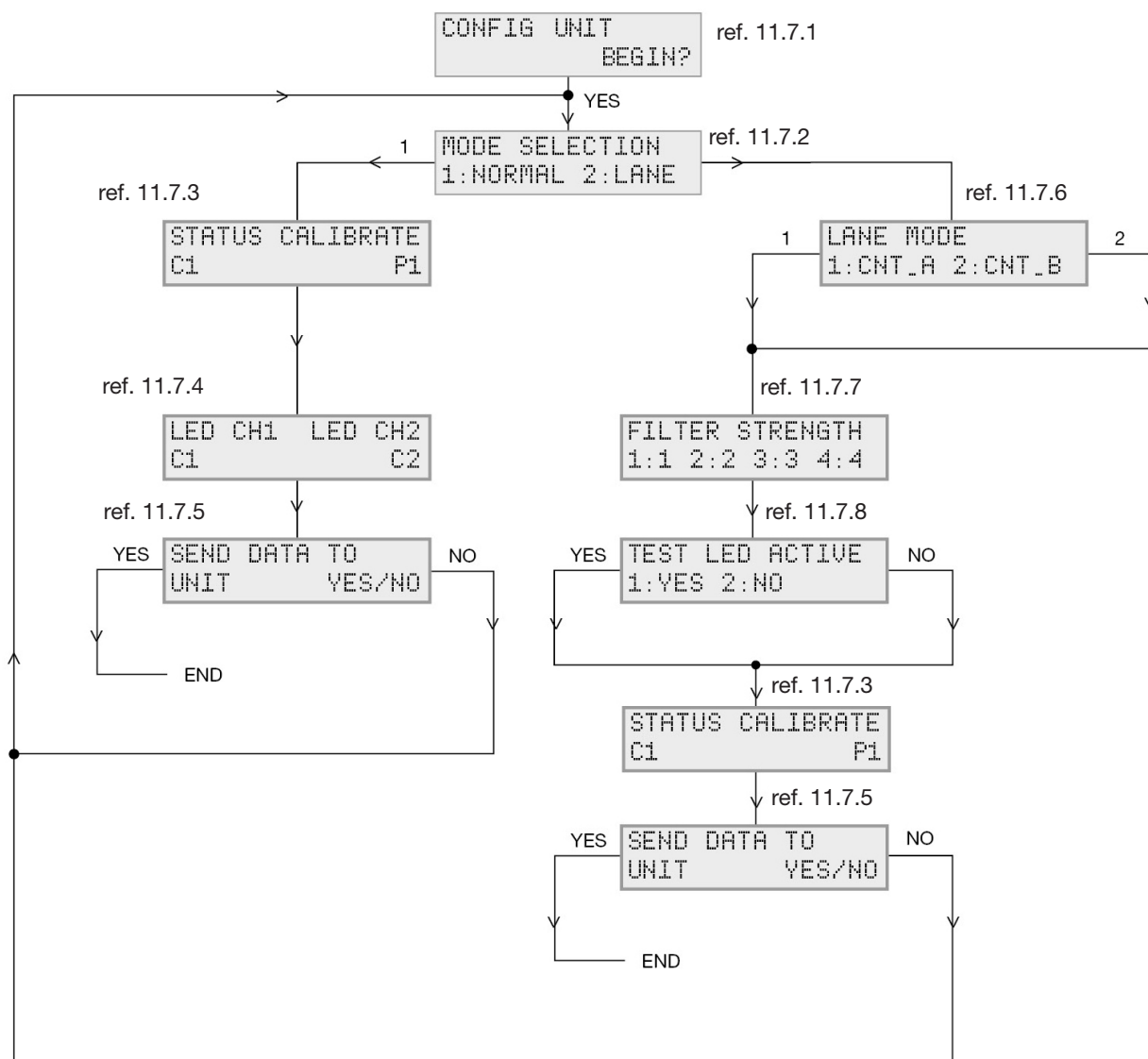
11.7.1: Config Unit". Start-up of the programmer. Press the "Read/On" button and the programmer will respond with this window.

11.7.2: "Mode selection". Decide if the sensor is used as a "Normal" or "Lane" sensor. The standard sensor mode - "normal mode" - detects the presence of a car in the parking space, turns on the red LED and sends out a signal on the L1 bus. If the parking space is empty, the LED will change to green and send out a signal on the L1 bus.
In Lane mode the sensor is placed on the ceiling above the lane and detects the car before it enters the parking area. The Parking Guidance System will reduce the total number of available spaces

because of the moving car and show the reduced number on the display. This is to prevent too many moving cars in a specific Parking Guidance System area. When the built-in timer runs out, we expect that the car driver has found a parking space, and the display will once again increase the number by one. The options in "Lane Mode" are designed for the Carpark Count System and are described in the "Installation Manual for the MZC system". If the installer cannot see these options, the revision of the programmer GP7380 0080 or the sensor GP62x0 xxxx predates June 2013.

11.7.3: "Status Calibrate". Select the status address, always starting from A1 onward in chronological order. The calibration address must always be the same for all the sensors and we recommend to use address P1.

11.7.4: "LED CH1 LED CH2". LED CH1 and LED CH2 are used to control the different LED colours in the 3-colour sensor. This is normally done in the Dupline Carpark Software. Thereby, the Carpark operator has the option of booking/controlling the individual parking space for different purposes using different colours. Please refer to the Dupline Carpark Software Programming Guide. This can be found on the website www.Car-Park.dk.
In section 13 a programming example of a 3-colour sensor booking is shown.

11.7.5: "Send data to unit". When the programming is finished, press "Yes" on the programmer to accept the changes, or "No" to exit the programming and returning to mode selection.

11.6.6: "Lane Mode". CNT_ A should be selected as an option for "Lane Mode" when the sensor is used as a "Lane Sensor" in Standard Space Detection. CNT_B must only be used when the sensor is used as a "Count "sensor. Please refer to the MZC installation manual.

11.7.6: "Filter Strength". The filter refers to the section 11.6.5 and to the speed of the car. If CNT_A and filter 2 is selected, the sensor can detect cars driving up to 36 km/hour.

Fig. 50: Filter 2 will be the most common filter to use.

	Filter 1	Filter 2	Filter 3	Filter 4
Mode A	<=136mSec	272mSec	408mSec	680mSec

	Filter 1	Filter 2	Filter 3	Filter 4
Mode A	72 Km/t	36 Km/t	24 Km/t	18 Km/t

11.7.8: "Test LED Active" is used during installation to see if the sensor reacts to a car running under it. When the installation is finished, it will be natural to change the LED to "No". When the LED is deselected, it will still be working even if the sensor fails during calibration or becomes defective. Select an address far away from the last sensor address in the segment where the Lane Sensor is mounted. It is recommended to use addresses in the O-area, e.g. O1 onwards.

11.8. Programming the 3-Colour LED Indicator

The flowchart (fig. 50) describes the complete programming of the 3-Coloured LED Indicators GP6265 23xx-x Each programming window is thoroughly explained on the following pages by means of references.

The 3-colour LED indicator is powered by the same bus as the sensors and therefore it needs programming in order to be connected to the correct sensor. Connect the programmer GP7380 0080 to the 3-colour LED indicator GP6265 xxxx. It may be an advantage to preprogram the indicators before installation. The programmers have a built-in battery, which is why power is not necessary to program the indicators.

The LED indicators can operate as 2- or 3-colour LED indicators. In the 2-colour version, the indicator just indicates if the space is vacant or occupied. In the 3-colour version, the indicator's third colour can be controlled from the Dupline Carpark Software.

Fig. 51: 3-colour LED indicator flowchart

3-Colour LED Indicator
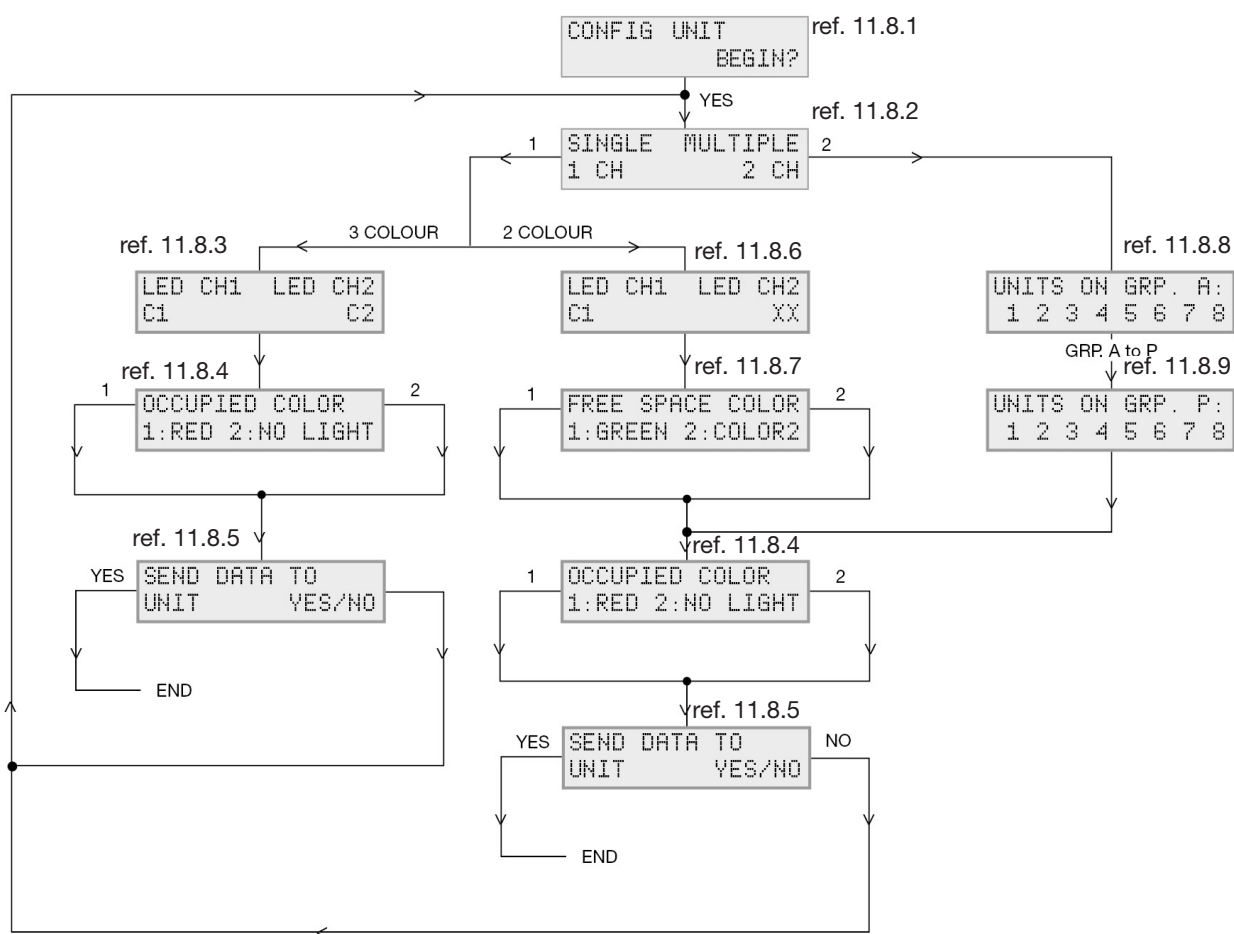
11.8.1: "Config Unit". Start-up of the programmer. Press the "Read/On" button and the programmer will respond with this window.

11.8.2: "Single Multiple". Select if the 3-colour LED indicator is in combination with only one sensor or multiple sensors (up to 120 sensors).

Fig. 52: Single

3 colour LED indicator

Fig. 53: Multiple
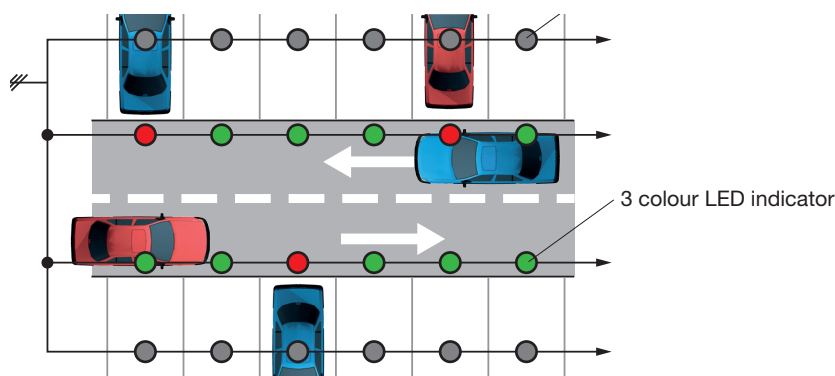
3 colour LED indicator
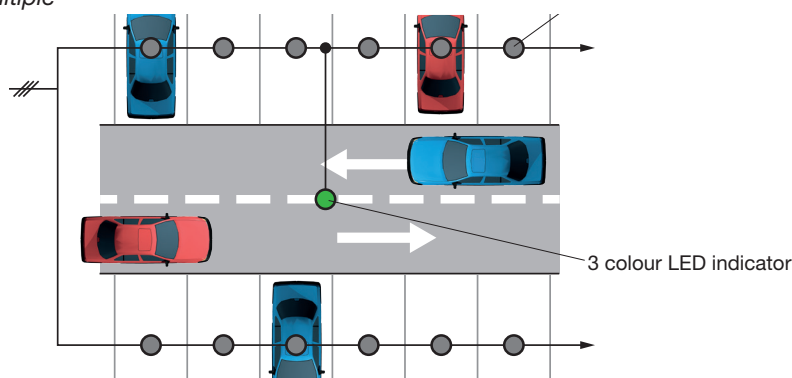
In "Single" mode a sensor has been installed in each parking space and an additional 3-colour LED indicator outside the space. The sensor and the LED indicator are connected to the same L1 bus.

In "Multiple" mode a sensor has been installed in each parking space. The LED Indicator can be programmed to monitor x numbers of spaces using an integrated OR-function in the LED indicator. The sensors and the LED indicator are connected to the same L1 bus.

11.8.3: "LED CH1 LED CH2". LED CH1 and LED CH2, the two LED channels are freely programmable in a 3-colour system and must be programmed according to the matrix in section 13: "Booking with the 3-Colour LED Indicator".

11.8.4: "Occupied Colour". This option of choosing between "red" or "no color" (no light) to indicate space occupied.

11.8.5: "Send data to unit". When the programming is finished, press "Yes" on the programmer to accept the changes, or "No" to exit the programming and returning to "Single/Multiple" selection.

11.8.6: "LED CH1 LED CH2". If the 3-colour LED indicator is used as a 2-colour LED indicator, the LED CH1 must be programmed with the same address as the "Status Channel" for the sensor, and the LED CH2 must be deselected by means of the tactile key "X".

11.8.7: "Free Space Color". The installer can choose between "Green" and "Color2". Color2 is determined by the type of 3-color LED Indicator used. In 2-color mode, the installer can freely determine the colour to indicate a vacant space.

11.8.8: "Units on Grp. A:. If the 3-colour LED indicator is used in combination with multiple sensors. Select the addresses to be monitored by the LED indicator by pressing the tactile keys 1-8. The installer has the option of choosing between A1 and O8 or all the addresses (120).

Example: Sensor addresses B1, B2, B3, B4, E7, E8, F1 and F2 are going to be monitored by one LED indicator.
- Select 2 for multiple channels
- Select Grp. B
- Select 1, 2, 3 and 4
- Select Grp. E
- Select 7 and 8
- Select Grp. F
- Select 1 and 2

11.8.9: "Units of Grp. P:". Refers to section 11.7.8. Programming of the addresses from GrpA to Grp.P. In total 120 addresses.

11.9. Programming the CPM Module GP3482 9091 724
Only for 2-colour indication systems.
Refer to section 11.10 for 3-colour indication systems.

The flowchart (fig. 53) describes the complete programming of the CPM Module GP3482 9091 724. Each programming window is thoroughly explained on the following pages by means of references.

The function of the GP3482 9091 724 CPM Module is to send the number of available spaces on the RS485 port to e.g. displays with the integrated RS485 protocol. The CPM modules do not require power during programming. The power is supplied from the programmer GP7380 0080 when in program mode.

Fig. 54
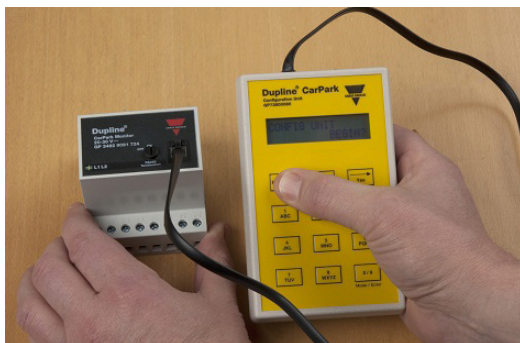
The CPM module can be programmed to:
• Slave mode (used with sensors on the L1 bus)
• Master indicator mode (used to collect data from the selected segments on the L1 bus to the L2 bus)
• Master mode (Same as master indicator mode yet transmits also the multiplex signal to the entire Parking Guidance System network)

11.9.1: "Config Unit". Start-up of the programmer. Press the "Read/On" button and the programmer will respond with this window.

11.9.2: "Mode Selection". Selection between Master and Slave. Refer to 11.9.3 for an explanation of Master mode.

Fig. 55: GP34829091724 flowchart

GP34829091724


```
CONFIG UNIT                  ref. 11.9.1
            BEGIN?
                    │ YES
                    ▼
          MODE SELECTION        ref. 11.9.2
    1     1:MASTER 2:SLAVE    2

ref. 11.9.3                          ref. 11.9.9
    YES  MASTER INDICATOR  NO        DEVICE ID:
         1:YES 2:NO                        (XX)

                                     ref. 11.9.10
ref. 11.9.4                          CALIBRATION:
    YES  GATE FUNKTION   NO                    P1
         1:YES 2:NO
                                     ref. 11.9.11
                                     LANE DETECTION:
ref. 11.9.5                                      XX
    1    SYSTEM SIZE       2
         1:SMALL 2:LARGE            ref. 11.9.12
                                     OF DELAY LANE
                                         (  5)8
ref. 11.9.6
         ID START: END:             ref. 11.9.13
            (  1 - 480)             UNITS ON GRP. A:
                                     1 2 3 4 5 6 7 8

                                          GRP. A to P
ref. 11.9.7                          ref. 11.9.14
         OFFSET SPACES              UNITS ON GRP. P:
                 (  21)             1 2 3 4 5 6 7 8

                                     ref. 11.9.15
ref. 11.9.8                          OFFSET SPACES
    YES  SEND DATA TO     NO                  (  0)
         UNIT     YES/NO
                                     ref. 11.9.16
                                     SEND DATA TO     NO
                                     UNIT     YES/NO
         END                              YES
                                          END
```

In Slave mode, the CPM module is connected directly to all the sensors in the segment. Up to 120 sensors can be connected with a unique address. The segment to which the sensors are connected is named the L1 bus. The information from each of the segments (L1 buses) are collected in the CPM Module and transmitted on the L2 bus, where the CPM Modules that are programmed as "Master Indicators" can send information about available spaces to the RS485 port.

11.9.3: "Master Indicator". In Master mode the user can select " NO" in the indicator mode (press 2 and then Enter), and the master will produce the multiplex signal for the entire system. Only one master is allowed in a system. The master is also able to show the total number of available parking spaces or selected segments only. If "YES" is selected, the master will work as an indicator. This means it will work in the same way as the master, except that the master indicator cannot generate a multiplex signal.

11.9.4: "Gate Function". The installer has a "Gate Function". When selected, address A7 on the L2 bus will be activated when all the programmed spaces are occupied. This provides the ability to control a gate or other indicators to show that the parking spaces are occupied.

11.9.5: "System Size". In both Master and Master Indicator mode, the user must select if the system is a "small" or a "large" system. A small system has less than 240 slave CPMs connected. If a large system is selected, more than 240 slave CPMs are connected. A maximum of 480 slave CPMs can be connected to the system.

11.9.6: "ID Start : End:". By inserting the ID for the "Start" address and "End" address, the master (or master indicator) is able to monitor a specific area in the Parking Guidance System system. If e.g. 101 and 200 are selected for the specific master CPM, then it is possible to see available parking spaces in the area from slave CPM number 101 to slave CPM number 200 and all slave CPMs in between. This way it is possible to observe 100 * 120 = 12000 parking spaces.

11.9.7: "Offset Spaces". An "Offset space" for the master (or master indicator) can be selected. The maximum number of "Offset" is 9999.
Example: If the display indicates 100 spaces and the installer wants 5 spaces to be permanently available, it is possible to use the offset function. Select 5 for offset function and the display will show "0" but 5 available spaces will remain in the Carpark. "Offset" is used to prevent car jam and to make a smooth parking experience for the driver.

11.9.8: "Send data to unit". When the programming is finished, press "Yes" on the programmer to accept the changes, or "No" to exit the programming and return to "Mode Selection".

11.9.9: "Device ID". Each CPM Module in slave mode must have a unique ID number. Up to 480 numbers can be selected.

11.9.10: "Calibration". It is possible to change/see the "calibration" address for the specific slave. The calibration address is suggested as address P1 and should be the same for all sensors in the entire system.

11.9.11: "Lane Detection". In "Slave Mode" the user must know if a lane sensor is used on the L1 segment. If the user does not use a lane sensor, the address with two crosses "XX" has to be disabled by pressing the tactile key "8". When used, the installer is recommended to choose an address at the end of the programming e.g. O1 and up to O8. When a car runs under the lane sensor, the Parking Guidance System reduces the number of available parking spaces with one, in the set period of time. When this time runs out, the Parking Guidance System will go back to the previous value until next time the lane sensor is activated. Refer to section 11.10.3 regarding selection of time delay.

11.9.12: "Off Delay Lane". If the lane detector sensor is selected, it is possible to implement an "off delay" of maximum 120 sec.

11.9.13 "Units of Grp. A.". The installer can select the sensors that need to be monitored in the segment. The slave CPMs is monitoring the L1 segment with a maximum of 120 Sensors, from A1 to O8. The installer can see/select the channels for each connected sensor. If one of the numbers is replaced with L or C, the address is occupied for e.g. a lane sensor or for "Calibration".

11.9.14: "Units of Grp. P.". The end of the sensors selection.

11.9.15: "Offset Spaces". The installer can implement an "Offset Space" from 0 to 10 cars on each of the slave CPMs. This allows the system to always have a maximum of 10 spaces open for each of the slave CPMs. This is to prevent car jam in the parking area and to offer the user some extra available spaces.

Note:
If, for some reason, the transmission fails, the configuration unit will respond with "Send failed Try again". The user then has to find out what has caused the failed transmission before trying again.

Fig. 56


```
SEND FAILED
TRY AGAIN    YES/NO
```

Please check cable or battery in the configuration unit for potential problems.

11.10. Programming the CPM Module GP34829091 724-1
Only for 3-colour indication systems.
Refer to section 11.9 for 2-colour indication systems.

The flowchart (fig. 54) describes the complete programming of the CPM Module GP3482 9091 724-1. Each programming window is thoroughly explained on the following pages by means of references. The function of the GP3482 9091 724-1 CPM module is to send the number of available spaces on the RS485 port to e.g. displays with the integrated RS485 protocol. Furthermore, this module version is fdesigned to work only with 3-colour sensors. If 2-colour sensors are used, they must all be connected to the other CPM module named GP3482 9091 724. The CPM modules do not require power during programming. The power is supplied from the programmer GP7380 0080 when in program mode.
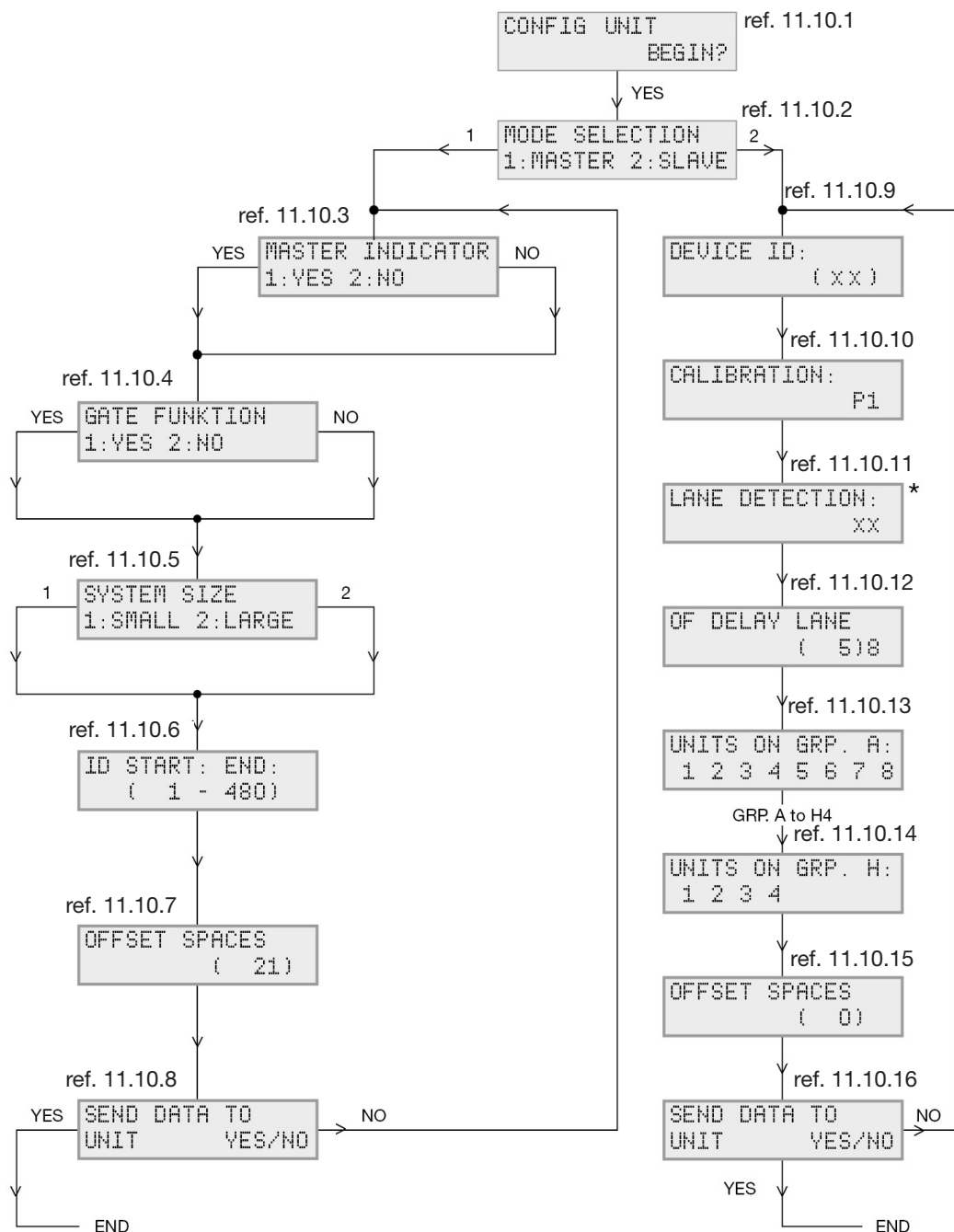
Fig. 57

The CPM module can be programmed to:

• Slave mode (used with sensors on the L1 bus)
• Master indicator mode (used to collect data from the selected segments on the L1 bus to the L2 bus)
• Master mode (Same as master indicator mode yet transmits also the multiplex signal to the entire Parking Guidance System network)

Fig. 58: GP34829091724-1 flowchart

GP34829091724-1

```
CONFIG UNIT          ref. 11.10.1
         BEGIN?
```
| YES
```
                                    ref. 11.10.2
1   MODE SELECTION   2
    1:MASTER 2:SLAVE
                                    ref. 11.10.9
ref. 11.10.3
YES   MASTER INDICATOR   NO      DEVICE ID:
      1:YES 2:NO                         (XX)
                                    ref. 11.10.10
ref. 11.10.4
YES   GATE FUNKTION     NO       CALIBRATION:
      1:YES 2:NO                            P1
                                    ref. 11.10.11
                                 LANE DETECTION:  *
ref. 11.10.5                                XX
1    SYSTEM SIZE     2               ref. 11.10.12
     1:SMALL 2:LARGE             OF DELAY LANE
                                        ( 5)8
                                    ref. 11.10.13
ref. 11.10.6
     ID START: END:              UNITS ON GRP. A:
        ( 1 - 480)                1 2 3 4 5 6 7 8

                                 GRP. A to H4
                                    ref. 11.10.14
ref. 11.10.7                     UNITS ON GRP. H:
     OFFSET SPACES                1 2 3 4
           ( 21)
                                    ref. 11.10.15
                                 OFFSET SPACES
                                        ( O)
ref. 11.10.8
YES  SEND DATA TO    NO              ref. 11.10.16
     UNIT     YES/NO             SEND DATA TO    NO
                                 UNIT     YES/NO
                                 YES
        END                         END
```

11.10.1: "Config Unit". Start-up of the programmer. Press the "Read/On" button and the programmer will respond with this window.

11.10.2: "Mode Selection". Selection between Master and Slave. Refer to 11.10.3 for further details of the Master mode.
The slave CPM is connected directly to the 3-colour sensors. Each slave can handle up to 60 3-colour

sensors because each of the sensors uses two Dupline® addresses. Only 3-colour sensors can be used together with the GP3482 9091 724-1. If 2-colour sensors are required, use the standard version GP3482 9091-724. The segment to which the sensors are connected is named the L1 bus. The information from each of the segments (L1 buses) are collected in the CPM Module and transmitted on the L2 bus, where the CPM Module, that are programmed as "Master Indicators", can send the information of available spaces to the RS485 port.

11.10.3: "Master Indicator". In Master mode " NO" in the indicator mode can be selected (press 2 and then Enter), and the master will produce the multiplex signal for the entire system. Only one master is allowed in a system. The master is also able to show the total number of open parking spaces or selected segments only. If "YES" is selected, the master will work as an indicator. This means it will work in the same way as the master except that the master indicator cannot generate a multiplex signal.

11.10.4: "Gate Function". When this function is selected, address A7 on the L2 bus will be activated when all spaces are occupied. This provides the ability to control a gate or other indicators to show that the parking places are full.

11.10.5: "System Size". In both Master and Master Indicator mode, the user must select if the system is a "small" or a "large" system. A small system has less than 240 slave CPMs connected. If a large system is selected, more than 240 slave CPMs are connected. A maximum of 480 slave CPMs can be connected to the system.

11.10.6: "ID Start : End:". By inserting the ID for the "Start" address and "End" address, the master (or master indicator) is able to monitor a specific area in the Parking Guidance System system. If e.g. 101 and 200 are selected for the specific master CPM, it is possible to see open parking spaces in the area from slave CPM number 101 to slave CPM number 200 and all slave CPMs in between. This way it is possible to observe 100 * 120 = 12000 parking spaces.

11.10.7: "Offset Spaces". An "Offset space" for the master (or master indicator) can be selected. The maximum number of "Offset" is 9999.
Example: If the display indicates 100 spaces and the installer wants always 5 available spaces, it is possible to use the offset function. Select 5 for offset function and the display will show "0" but there will remain 5 available spaces in the Carpark. "Offset" is used to prevent car jam and to make a smooth parking experience for the driver.

11.10.8: "Send data to unit". When the programming has ended, press "Yes" on the programmer to accept the changes, or "No" to exit the programming and returning to "Mode Selection".

11.10.9: "Device ID". Each CPM Module in slave mode must have a unique ID number. Up to 480 numbers can be selected.

11.10.10: "Calibration". It is possible to change/see the "calibration" address for the specific slave. The calibration address is suggested as address P1 and should be the same on all sensors in the entire system.

11.11.11: "Lane Detection". In "Slave Mode" the user must know if a lane sensor is used on the L1 segment. If the user does not use a lane sensor, the address with two crosses, "XX", has to be disabled by pressing tactile key "8". When used, the installer is recommended to use an address at the end of the programming e.g. H1 and forward to H4. When a car runs under the lane sensor, the Parking Guidance System reduces the number of available parking spaces with one, in the selected period of time. When this time runs out, the Parking Guidance System will go back to the previous value until next time the lane sensor is activated. Refer to section 11.11.3 for further details of the *time delay*.

11.10.12: "Off Delay Lane". If the lane detector sensor is selected, it is possible to implement an "off delay" of maximum 120 sec.

11.10.13: "Units of Grp. A.". The installer can select the sensors that need to be monitored in the segment. The slave CPMs is monitoring the L1 segment with a maximum of 60 sensors in consecutive order starting from A1 to H4. The installer can see/select the channels for each connected sensor.
If one of the numbers is replaced with L or C, the address is occupied for e.g. a lane sensor or for "Calibration".

11.10.14: "Units of Grp. H.". The end of the sensors selection.

11.10.15: "Offset Spaces". The installer can implement an "Offset Space" from 0 to 10 cars on each of the slave CPMs. This allows the system to always have a maximum of 10 spaces available for each of the slave CPMs. This is to prevent car jam in the parking area and to offer the user some extra available spaces.

Note:
If, for some reason, transmission fails, the configuration unit will respond with "Send failed Try again". In this case, the user has to find out what caused the failed transmission before trying again.

Fig. 59


```
SEND FAILED
TRY AGAIN    YES/NO
```

Please check cable or battery in the configuration unit for potential problems.

12. Installation Examples

The cabinet(s) for all the DIN rail mounted Parking Guidance System modules is(are) suggested to be placed in the middle of the system in order to have a uniform load. It is an advantage as well (only a few cabinets are used) and the length of cable to the sensors is reduced. This subject was discussed earlier in *2.2. Phase 2*.
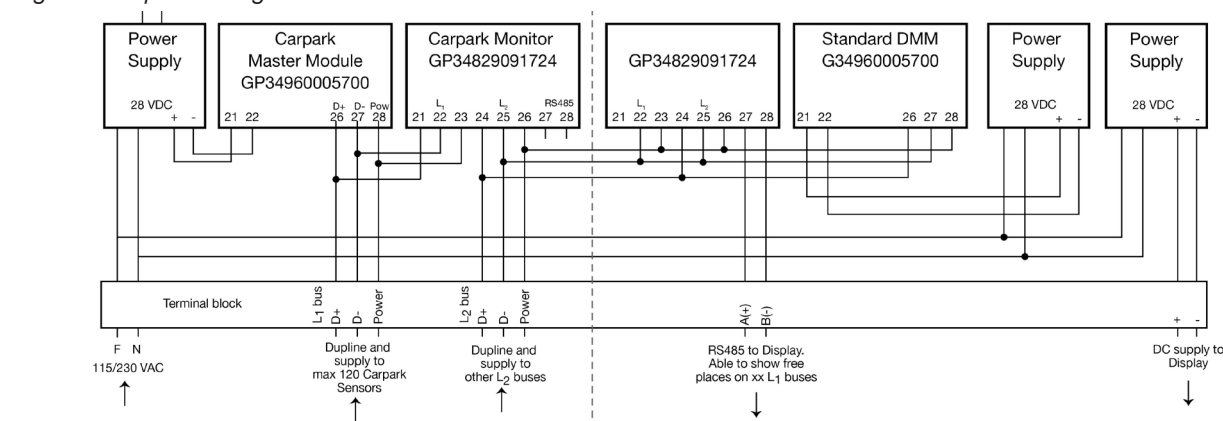
Reducing the length of cable to the sensors means that it is possible to mount more sensors on the same L1 bus. As a consequence, the number of CPM modules etc. can be reduced.
However, if requested, the cabinet(s) can be installed away from the system or simply at the end of the system. If the rules mentioned in *2.2. Phase two* are not obeyed, it is important to perform a load and voltage drop calculation. Refer to section *14. System Calculation*.

12.1. Simple Stand-alone Wiring

The diagram example (Fig. 55) shows how to configure a simple stand-alone wiring.
The simple stand-alone system consists of two CPMs programmed as slave and master respectively.
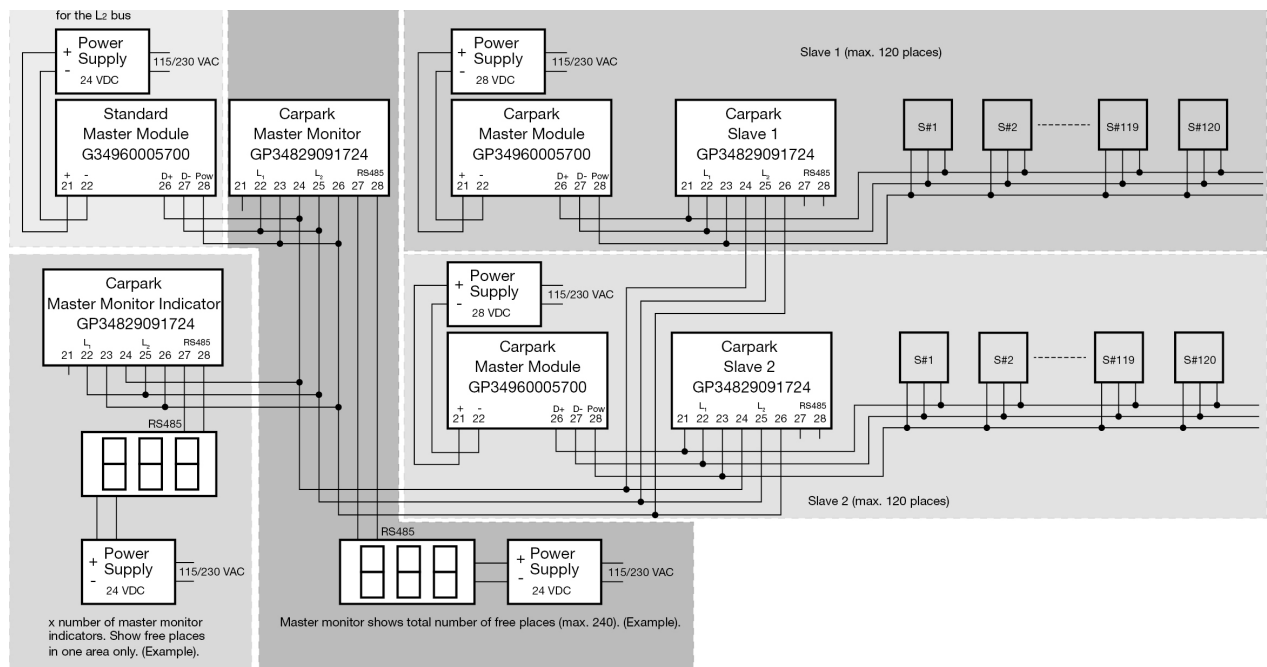
Fig. 60: Carpark Wiring with Cabinet

© Carlo Gavazzi A/S

The Parking Guidance System DMM provides power and Dupline® signal (1 kHz) on the L1 bus. The standard DMM provides power and Dupline® signal for the L2 bus.

The L1 and L2 bus each has their own power supply because of the galvanic separation between the two buses. The power supply on the right side of the diagram is for the display.

This simple stand-alone system can handle up to 120 sensors and send information on available spaces either as
- RS485 Modbus information on the Parking Guidance System DMM, or
- RS485 on the slave CPM to a local display, or
- RS485 on the master CPM to a global display
The simple stand-alone example can be extended with many L1 buses monitoring up to 120 sensors on each L1 bus.

Fig. 61: Simple guidance system with two CPM slaves

It is possible to install an unlimited number of the CPM modules named "master monitor indicator". The function of the master monitor indicator is to show available spaces on the displays and nothing else. The "master monitor" function has the same function as the "master monitor indicator", except that it supplies also the entire L2 bus system with the multiplex signal. The multiplex signal is used to secure that the number on the displays is counted and showed correctly.

The below diagram also shows a simple stand-alone Parking Guidance System but with 2 slave CPMs (shows up to 240 spaces). One master CPM and additionally one master CPM indicator module. Both master modules are connected to displays. The master display shows the total number of available spaces. The master CPM indicator only shows available spaces for one of the slave CPMs.

12.2. Wiring for the Parking Guidance System Software Solution

Pairing the simple stand-alone Parking Guidance System with a software solution just requires a daisy chained RS485 connection between all Parking Guidance System DMM modules in the entire system. On the front side of the GP34960005700 modules a DP9 connector can be found for this purpose.
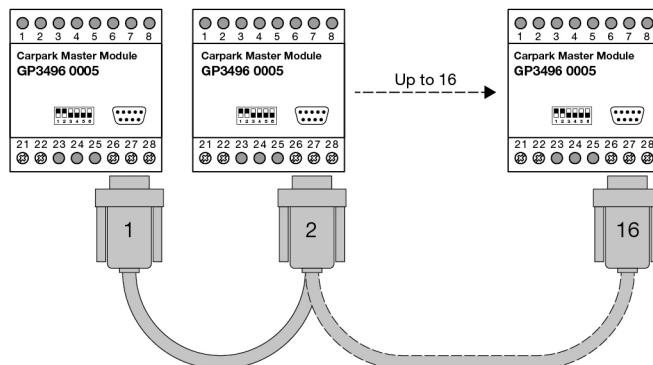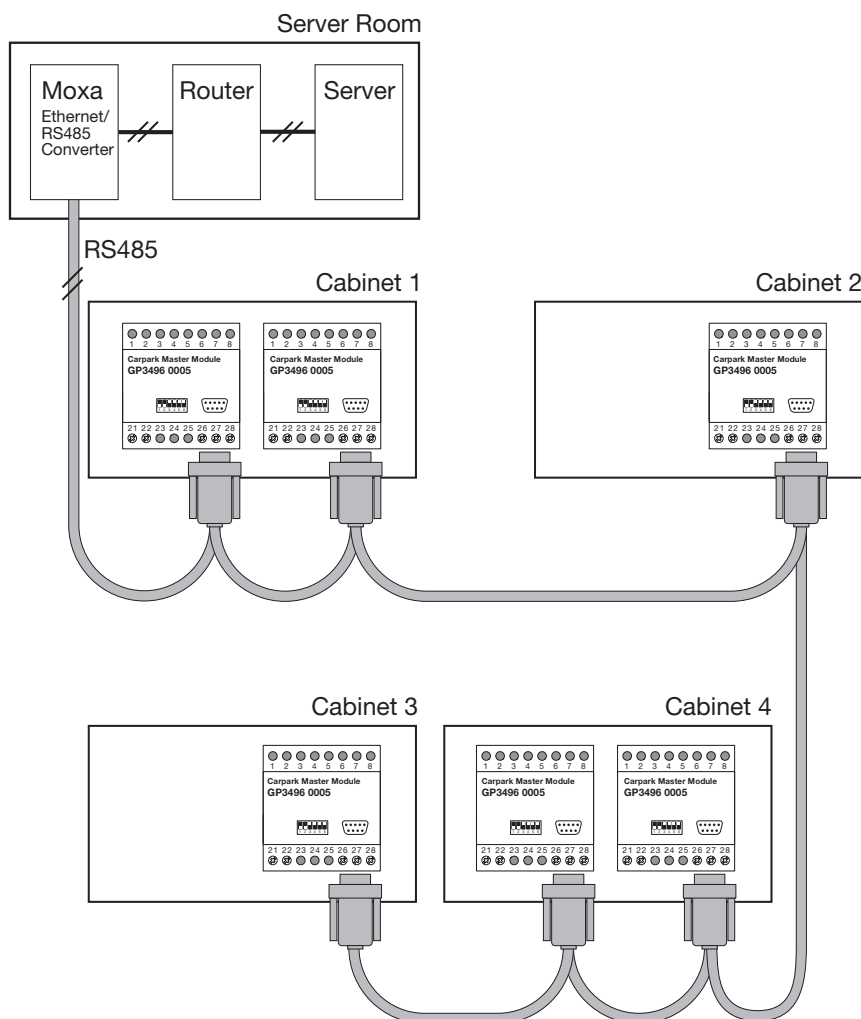
Fig. 62: Wiring

Fig. 63: Extended wiring

The RS485 is a robust bus which can transmit reliable signals up to 1200 m without problems. The RS485 signal is transmitted to a RS485 / Ethernet converter (ETHCONV4) that must be located less than 100 m away from the Ethernet router or the server for the Parking Guidance System software. If this is not possible, an optical solution can be used.

13. Programming Examples

13.1. Booking with the 3-Colour Sensor/LED Indicator

This mode is used only if the installer uses the 3-colour sensor or the 3-colour LED indicator together with the Carpark Software or a third party Carpark Software.
Generally, the 3-colour idea is to enable the Carpark operator to perform a booking command in the software for a specific space or an area (many spaces) on the client screen that communicates with the 3-colour sensor or 3-colour LED indicator. The Dupline address for e.g. LED CH1 and LED CH2 must be programmed according to the below matrices.
If the 3-colour sensors GP6220 330x 724 and the 3-colour LED indicator GP6265 2301 724-1 are used, the matrix looks like this:

GP6220 330x 724 and GP6265 2301 724-1		
Status address	LED CH1	LED CH2
A1	A1	H5
A2	A2	H6
A3	A3	H7
A4	A4	H8
A5	A5	I1
A6	A6	I2
A7	A7	I3
A8	A8	I4
B1	B1	I5
B2	B2	I6
...	...	...
...	...	...
H3	H3	O7
H4	H4	O8

Using this combination, the installer has 60 Dupline® addresses (A1 to H4) at his disposal. This means that 60 3-colour sensors or 3-colour LED indicators can be installed in the segment. The segment with 3-colour sensors/ 3-colour LED indicators cannot have 2-colour sensors mounted at the same time. An extra segment must be added to accomplish this.

If, for some reason, the Carpark Software server is defective or not connected to the Carpark system, the 3-colour sensors and the 3-colour LED indicator will be still working as a 2-colour system until the server is back on.
In order to make the 3-colour function start working, the installer must check the box "3-colour" in the Carpark Server. Please read the Dupline® Carpark Software manual. The manual is available on the website www.Car-Park.dk.

If the 3-colour LED indicator GP6265 2301 724, GP6265 2302 724 and GP62656 2303 724 are used, the matrix looks like this:

Using this combination, the installer has only 60 Dupline® addresses (A1 to H4) at his disposal. This means that 60 3-colour sensors or 3-colour LED indicators can be installed in the segment. The segment with 3-colour sensors/3-colour LED indicators cannot have 2-colour sensors mounted at the same time. In this case an extra segment will have to be added.
The installer can control all Dupline® addresses by means of a third party software.
In order to make the 3-colour function start working, the installer must check the box "3-colour" in the Carpark Server. Please read the Dupline® Carpark Software manual. The manual is available on www.Car-Park.dk.

Example of a Booking:

In this example we use the 3-colour sensor but the 3-colour LED Indicator could have been used as well. The process is identical.

Fig. 64
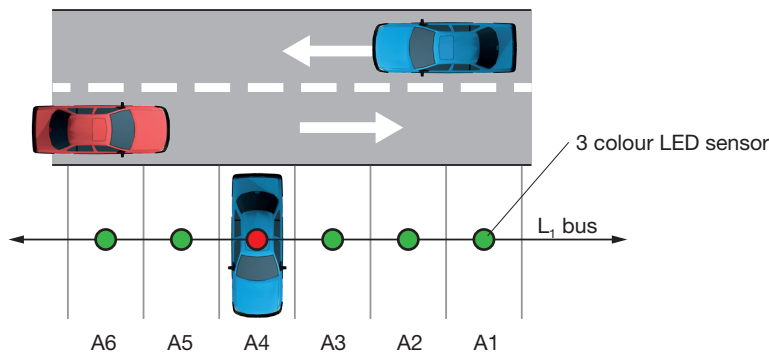
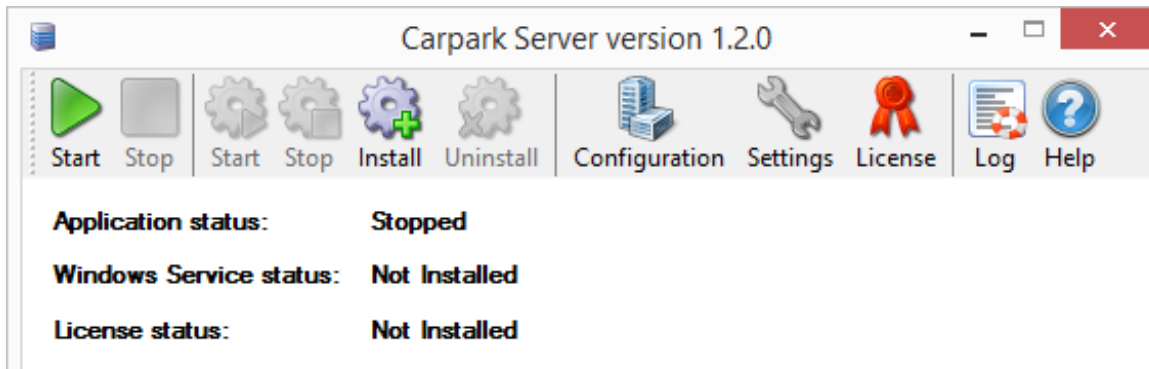

Programming the sensors:
Sensor 1 (A1) Refer to the above matrix.
- Status channel to A1
- Calibration channel to P1
- LED CH1 programmed like the status channel to A1
- LED CH2 programmed to H5

Sensor 2 (A2)
- Status channel to A2
- Calibration channel to P1
- LED CH1 programmed like the status channel to A2
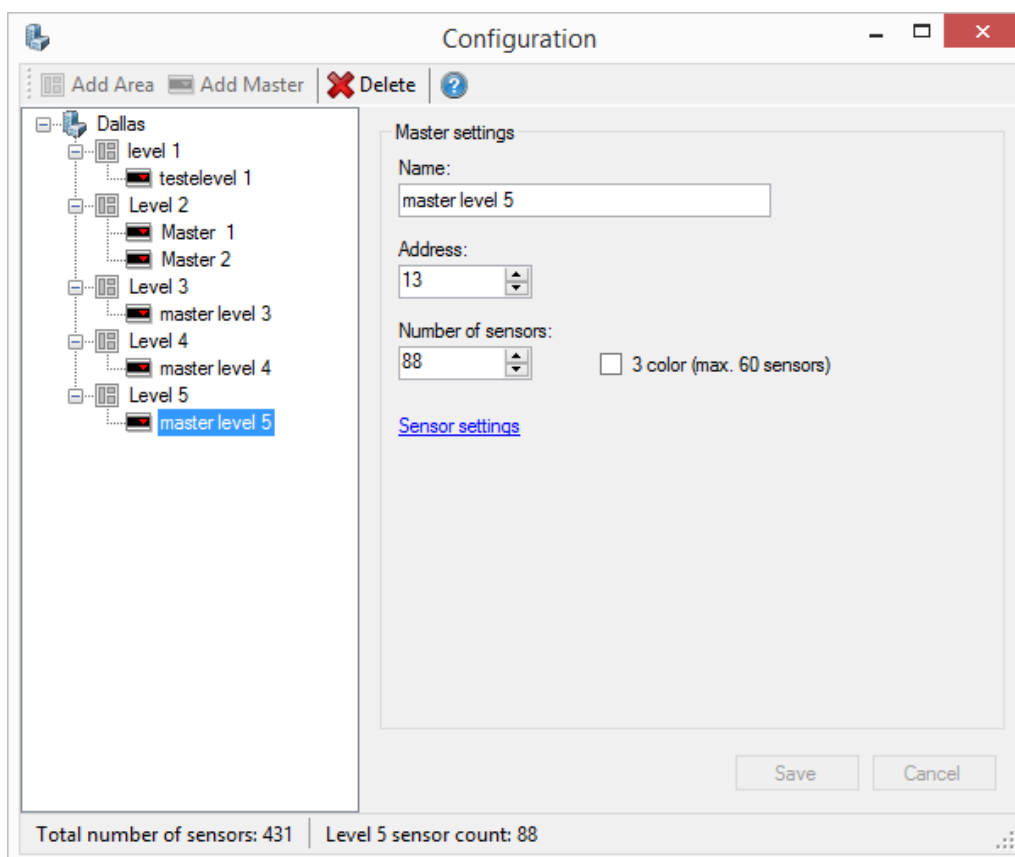- LED CH2 programmed to H6

Fig. 65

Program the sensors next in line in the same way.

When all sensors are programmed, the command is sent to the Carpark software, where the installer must prepare the software for the 3-colour selection.

Open the Server software and select "Configuration".

Fig. 66

Select Master or "Add" a new Master for the segment in which the 3-colour sensor/indicator should be placed. Please keep in mind that in a segment with 3-colour sensors/indicators, no 2-colour sensors can be connected at the same time.
Check the box "3-color" and press "Save".

When the box is checked, "Sensor settings" is not selectable anymore. The addresses are automated so that A1 will follow H5, A2 will follow H6 and so on.
Now the programming is finished and the 3-colour sensors are accessible from the client.

Programming the client will not be shown in this manual. This information can be found in the "Carpark Software Manual" which is available on www.Car-Park.dk.

14. System Calculation

The two calculation examples below show how it is possible to determine the number of sensors or the length of cable.

Calculation example 1: How to find the maximum cable length in a system

Example of a slave monitor with 100 sensors connected:

- Current consumption of the sensor is: 20 mA max.
- Max. voltage drop on the far end sensor is 4.0 V (When using 28 V DC on the GP3496 0005)
- Cable resistance is 13 Ω/Km with the use of 1.5 mm^2, (14-16AWG)

Maximum current in a system is 20 * 100 = 2.0 A

Internal resistance is 4.0 / 2.0 = 2.0 Ω

Maximum wire length is 2.0 /13/km = 154 m (508 ft)

Calculation example 2: How to find the maximum number of sensors with a known cable length

Example of a slave CPM with 200 m of wire to sensors:

- Current consumption of the sensor is: 20 mA max.
- Max. voltage drop on the far end Sensor is 4.0 V (When using 28 V DC on the GP3496 0005)
- Cable resistance is 13 Ω per km with the use of 1.5 mm^2, (14-16AWG)
- Wire length is 200 m with 1.5 mm^2, (14-16AWG)

Total wire resistance is 0.2 * 13 Ω per km = 2.6 Ω

Maximum current consumption is 4.0 / 2.6 = 1.54 A

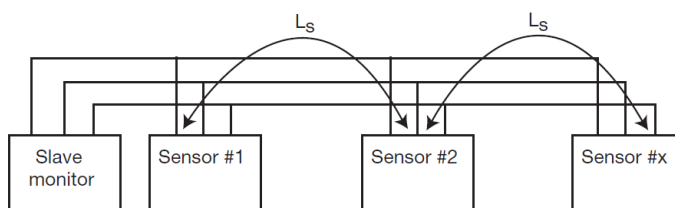Maximum number of sensors is 1.54 / 0.020 = 77 sensors

It is possible to calculate in an easy way for instance the "total number of sensors" by using the following equations:

Equation 1

$$x = \frac{116}{\sqrt{L_S}}$$

x="Max. number of sensors connected to one Dupline Master Module (GP34960005)"
L_S="Cable length between the sensors"

Example 1

L_S= 3 m between sensors

$$x = \frac{116}{\sqrt{3}} = \underline{67 \text{ sensors}}$$

Example 2

x= 45 sensors

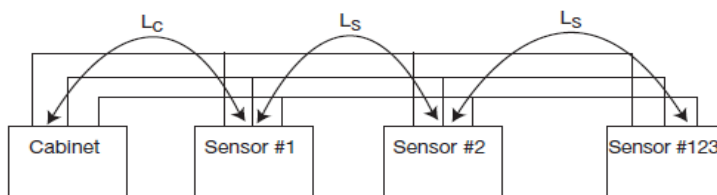$$L_S = \left(\frac{116}{45}\right)^2 = \underline{6.6 \text{ m}}$$

Equation 2

$$L_s \cdot x^2 + xL_c - 13460 = 0$$

x = "Max. number of sensors connected to one Dupline Master Module (GP34960005)"
L_s = Cable length between sensors
L_c = Cable length from cabinet to the first sensor in line

Example 1

$$L_S = \frac{13460 - xL_c}{x^2}$$

$$x = 55$$
$$L_c = 35$$

$$L_s = \frac{13460 - (55 \cdot 35)}{55^2} = \frac{11535}{3025} = 3.8 \text{ m}$$

The length between the sensors must not exceed 3.8 m when there are 55 sensors in a system and 35 m cable from the cabinet to the first sensor in line.

$$L_c = \frac{13460 - L_c x^2}{x}$$

Rule-of-thumb:
For each 200 m, 77 sensors can be placed when using a 1.5 mm² cable without a repeater installed.

15. Test and Troubleshooting of the System

No amber LED on the GP3482 9091 724 or GP34960005700 could be caused by

- Short circuit of the Dupline® bus.
- No power on the GP34960005700.
- No connection.
- Power off.

Red sensor LED flashes:

- Needs calibration.
- Sensor not aligned according to datasheet.
- Short-circuit of the Dupline® bus.
- Dupline® bus disconnected or wire broken.
- No multiplex on the Dupline® bus P5, P6, P7 and P8.
- Sensor head defective. Replace Parking Guidance System sensor.

LED indicates incorrect colour or does not work (GP6289 000x version only)

- The two wires from sensor to LED broken or not connected.
- Indicator is not connected.
- The two wires between the sensor and the LED indicator must be swapped.

Configuration unit not working or no connection to Parking Guidance System modules

- Battery defective.
- Cable defective.

- Wrong firmware version. If using configuration unit to 3-colour sensor / 3-colour LED indicator or sensors for MZC, only versions produced from MN01xxxxx and forward will work correctly.

Display is blank

- RS485 is incorrectly connected or not connected. Reverse the wires.
- Power off.
- Settings for DIP switch D2 on the display is incorrect.
- L2 bus is not working correctly.

Display shows incorrect number and arrow

- Settings for DIP switches D2 and D3 on the display is incorrect.
- Wrong programming of the CPM GP3482 9091 724.
- Wrong addressing of the sensors GP62x0 22xx.
- L2 bus is not working correctly.
-

No communication from Parking Guidance System software to sensors

- Check DIP switch address in the local GP3496 0005 to which the sensors are connected.
- Check TCP-IP on the moxa.
- Check if port address on the moxa is open for incoming and outgoing signals.
- Use the moxa configuration unit which is downloadable from www.Car-Park.dk.
- Check power on the moxa, CPM (Carpark M, DMM (Dupline® Master Module) and the sensors.

16. Hints

- Use 1.5 mm^2 (14-16AWG) single core wires for the sensors and LED indicators in a system. If the installer uses multi-core or stranded, the wires must be mounted with ferrules because of the push connectors in the sensor.
- To avoid large voltage drops at the far end of the sensors, be sure to have at least 28 V DC power to the GP34960005700.
- If the system requires an enlargement which contains the repeater D3892 0000 xxx, please contact your closest Carlo Gavazzi sales company.
- If two or more slave CPMs have the same ID number, the sensors will not be shown correctly. The sensors will get identical addresses which will cause a conflict.
- Use the Parking Guidance System Configuration unit GP7380 0080 in GTU8 mode to simulate the presence of sensors during installation or troubleshooting.
- If the two wires on the X, Y on the GP6589 0000 are reversed, the LED will shine with the wrong colour. Red for available and green for occupied.

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