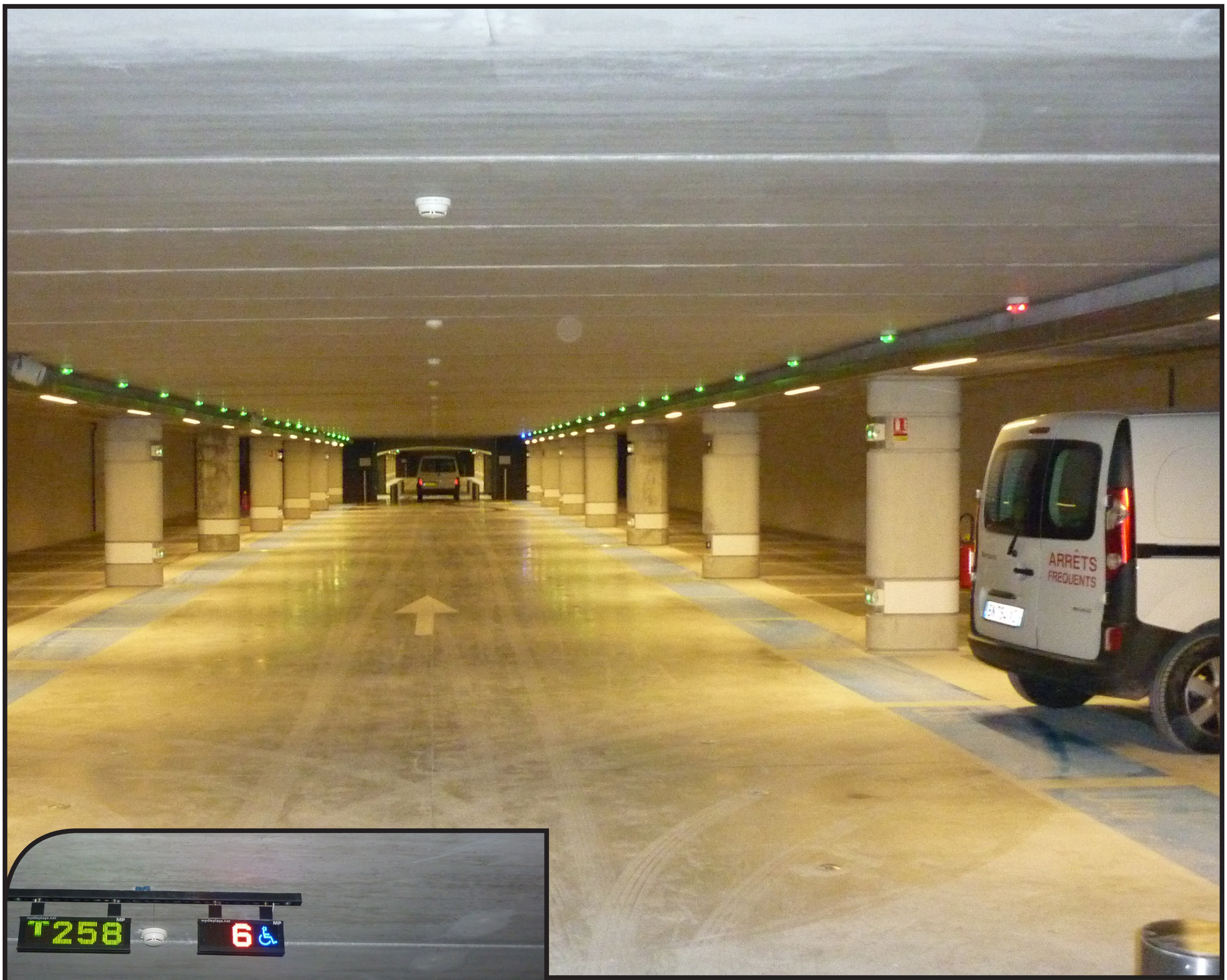


Parking Guidance System by Carlo Gavazzi

Contents

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 colors 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.

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 will turn red and it will provide a graphical link to the software.

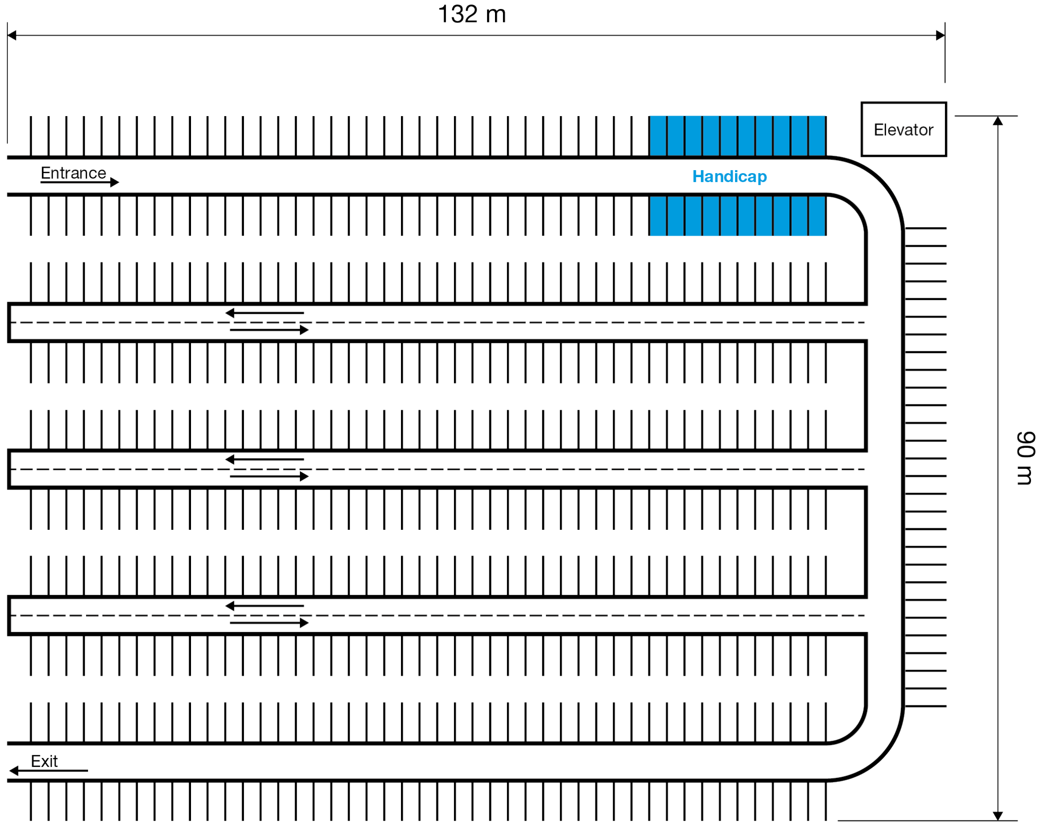
Planning a Dupline® Parking Guidance System

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

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 CAD scaled drawing with information of the parking structure including lane distances for determining the cable runs and maximum allowable sensors per master module.
- Parking space dimensions: length, width, and the distance from the floor to the ceiling. The relationship of the floor and ceiling angle is also critical.
- The dimension from center line to center line of the spaces.
- 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.

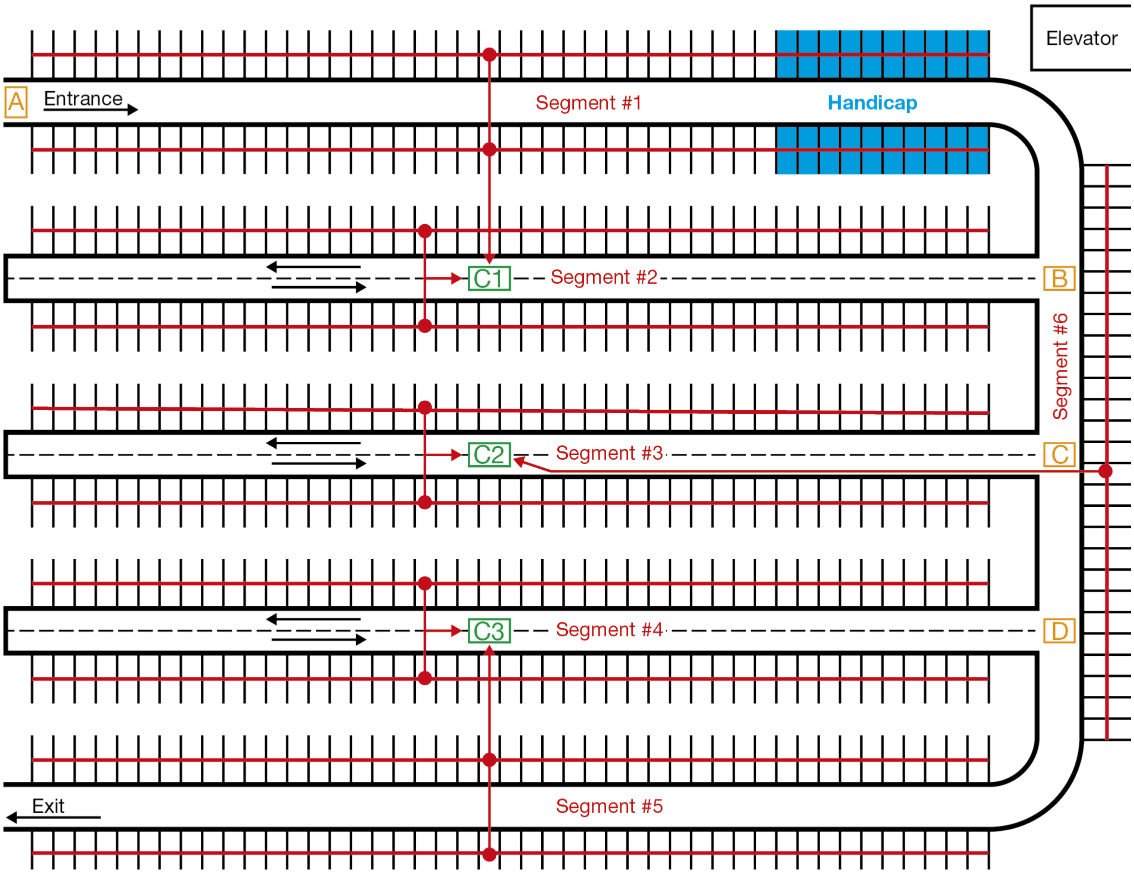


Example of a basic facility drawing

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 co-operation with the customer and the installer. This is best decided by making a joint walk-through and drive-through.
- Confirm any architectural considerations with the customer regarding signage, way finding, or 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 is all dependent upon the natural flow and the customer’s wants and needs.
- Determine the necessary environmental ratings of the displays in relation to the intended use and installation. Also take into consideration the accidental or unintended ingress 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 CPM).
- Max. 70 sensors and max. 200 m of wire in a branch. Max 120 sensors pr. segment. General rules based on 1,5 mm^2 cable.
- Determine if the sensor shall 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 shall be used. This is often necessary when existing posts or piping obstruct the view of the LED indicator mounted directly in the center of the parking space.
- Decide which spaces to be used as handicap spaces. Handicap 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 the loads of the sensors are equal in all directions. They should also be accessible by ladder or lift only. This keeps them up and away from curious people and vandals. The enclosures should be rated at a minimum of NEMA 3R or IP54.

Example Drawing of Parking Level with Phase 2 Considerations:



A, B, C and D are placement of displays
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) and in segment 6 are only 29 spaces.

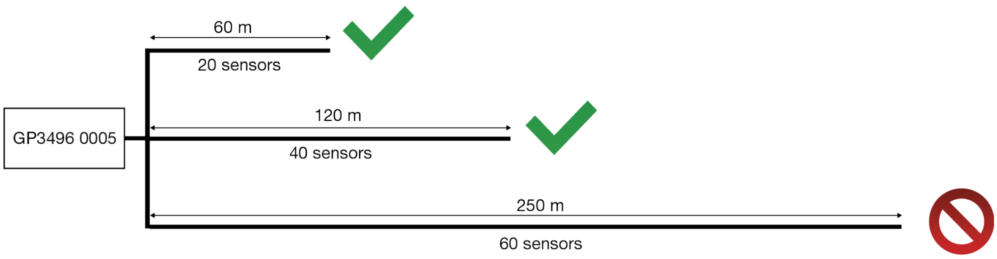
Handicap spaces (blue spaces) are placed close to the elevator.

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

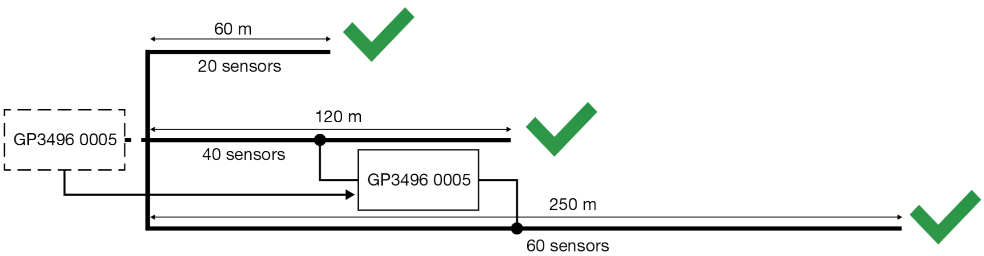
Phase 3: Design One Segment (…and Build From There)

- 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 14-16AWG 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 detailed on page xxx.
- Power supply calculation (The number of sensors determine the size of the power supply). Always use double size power supply with power out on 28VDC. This is caused by the pulsating output from the Dupline® Master Module, or DMM, GP34960005700. When using 28VDC/2,5Amp power supply, the installer can have 60 sensors and 120 sensors when using 28VDC / 5Amp power supply.

- Programming of sensors must always be in consecutive order and starting from A1. (Always start from A1 in each new segment. This is a demand according in 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 using a ceiling mount.
- The sensor must be mounted <=5° in relation to the floor.



Move the GP3496 0005 halfway on the
third branch to compliance with the distance

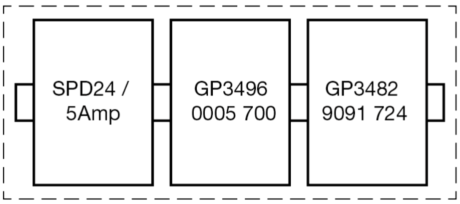


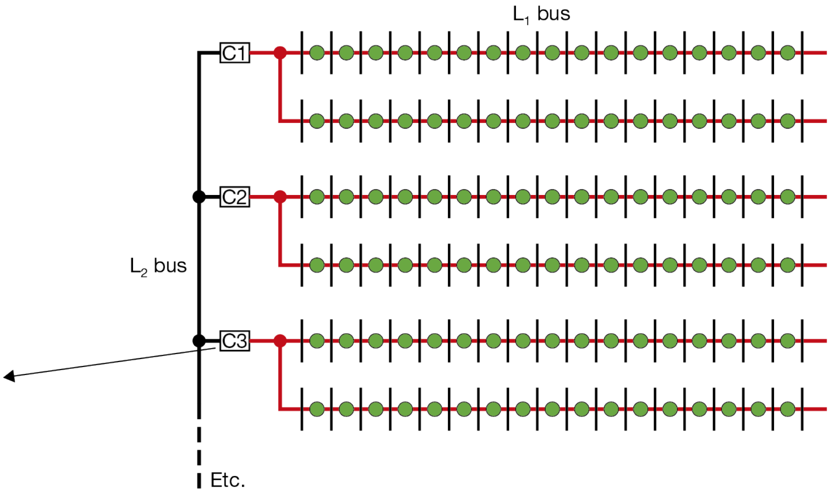
Phase 4: Linking the Segments to the L2 Bus

- L2 bus must be connected to all CPM (Car Park Monitor) modules in the system.
- Max. 50 pieces of the GP34829091on a branch on the L2 bus if the same L2 bus is up to 500 m (1650 feet) or 500 CPM modules in total. See scheme below.
- Power supply calculation (The number of CPM modules determine the size of the power supply). Using 28 VDC / 2.5 Amp power supply, the installer can have 150 CPMs. Using 28 VDC / 5 Amp, the installer can have 300 CPMs on the L2 bus.
- Placing the DMM (Dupline® Master Module) in center on the L2 bus to have a uniform load. Use G34960005700 on the L2 bus.
- An explanation of the L2 bus can be found in the picture on page 10.

Schema

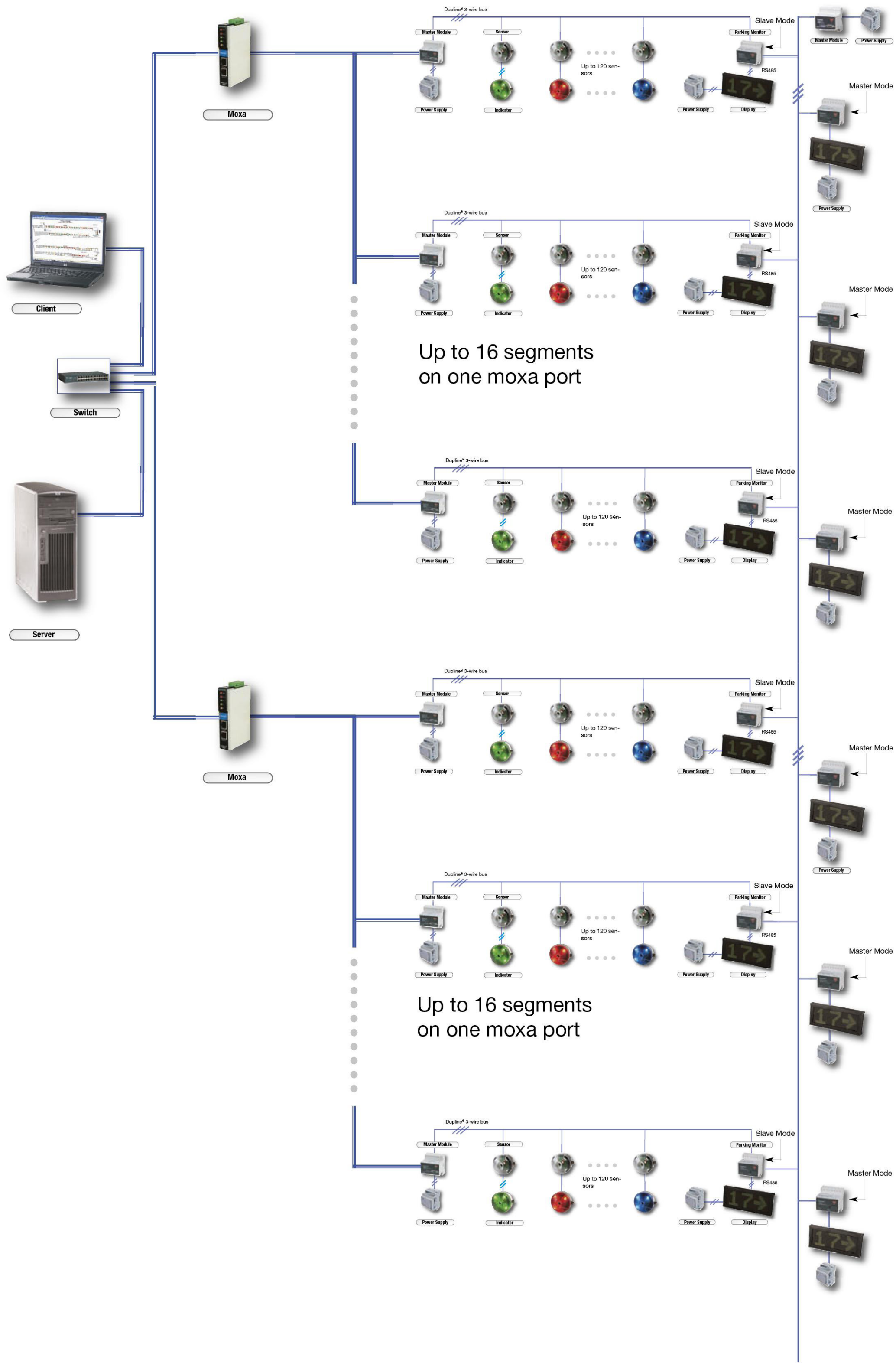
Length	Number of CPM
500 meter	50
600 meter	42
700 meter	36
800 meter	32
900 meter	28
1000 meter	25





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 Dupline® DMM have a unique ID number. These DMM modules are multi-dropped to the converter. The open and occupied spaces from the parking spaces are transmitted via the DMM to the converter and then to the software client.


Moxa
Client
Switch
Server
Dupline® 3-wire bus
Master Module
Sensor
Parking Monitor
Slave Mode
Master Mode
Up to 120 sensors
RS485
Power Supply
Indicator
Display
Up to 16 segments on one moxa port
Moxa
Up to 16 segments on one moxa port

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 specify the use of std. inexpensive 3-wire unshielded 1.5-mm2 (14-16AWG) cables for the Carlo Gavazzi Dupline® Parking Guidance System. In order to reduce the man-hours needed for 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 on time consuming and physically tedious work during the installation, often atop a lift or ladder.

One-Floor System Example

The diagram below is a theoretical example on how to implement 469 sensors on a single floor. Additional floors would be configured, installed, and brought on-line exactly the same way. See example “system for several 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 bBranch display (B) will show available spaces on that particular segment and the displays C and D will also show available spaces from their segments.

The 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 future installation, if any.

- 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 totaling 88 sensors per segment.
- The length is 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 are in close proximity to the B, C and D displays providing us with the shortest practical distance between the segments.

Car Park Monitor Modules

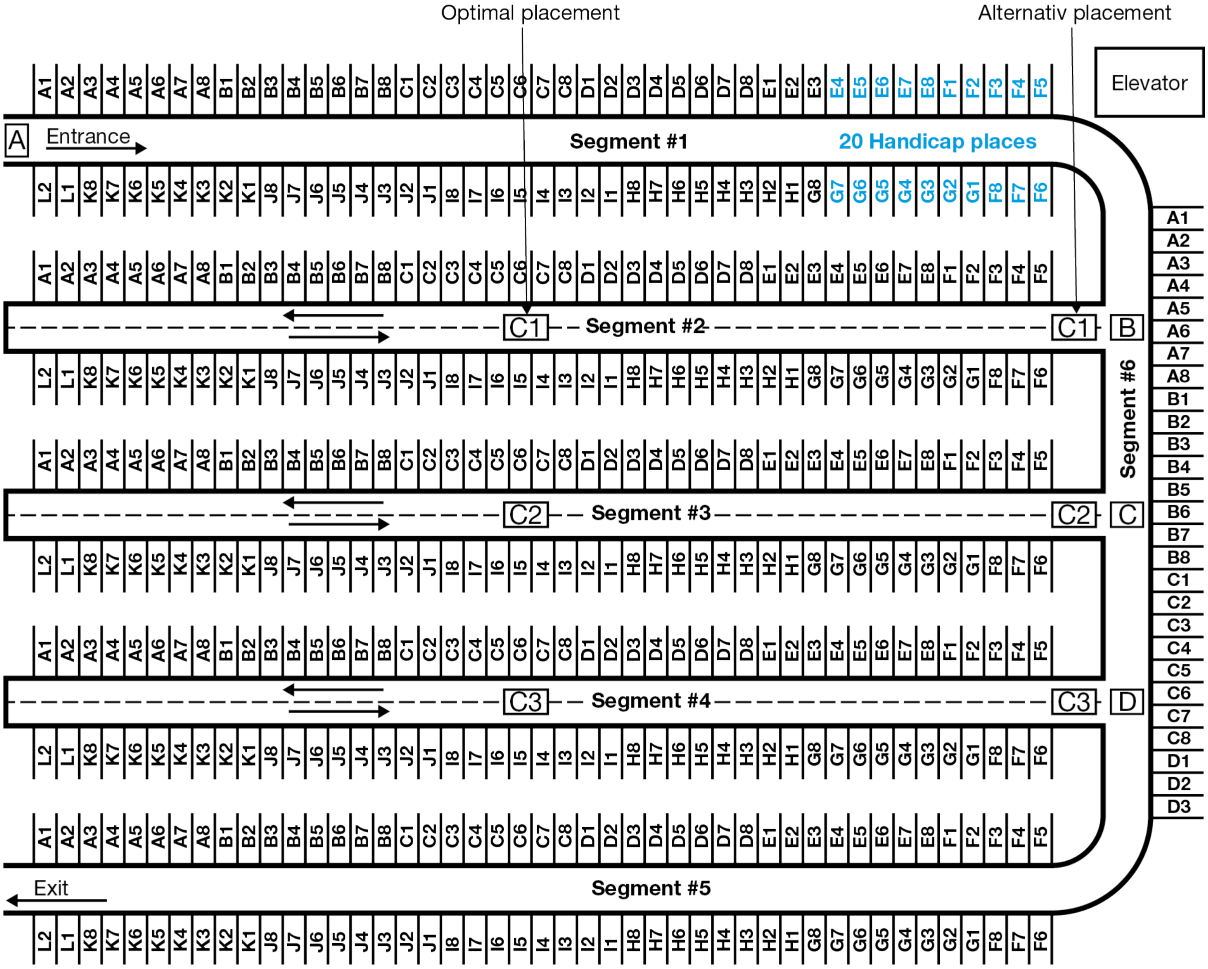
- Master CPM Indicator for display A collects data of available spaces from segments 1-6 (All segments)
- Slave CPM for display B collects data of available spaces from segments 2
- Slave CPM for display C collects data of available spaces from segments 3
- Slave CPM for display D collects data of available 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 do not exceed a voltage drop of 3.5 V.***

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

Additional floors would be managed in the same way.



Addressing Standard and Handicap Spaces

Handicap spaces must have their own CPM slave if the customer wants the open spaces for handicap shown on a display. The CPM slave modules for handicap and similar purposes are suggested to have the ID number selected last in line. In this example it will have 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 above example, the handicap spaces are part of segment 1 and therefore they do not have their own CPM modules or own display. If it is decided that the handicap 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 (see drawing) 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 handicap spaces.

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. Additional car should be taken in the planning process as outlined below.

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, we suggest 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 example” on page xxxx. When the ID numbers are in consecutive order, it is much more simple to collect the information of available spaces and send it to the displays.

Example:

Level one:

4 normal lanes (segments) having 40 spaces each and 20 spaces with a separate handicap segment

Level two:

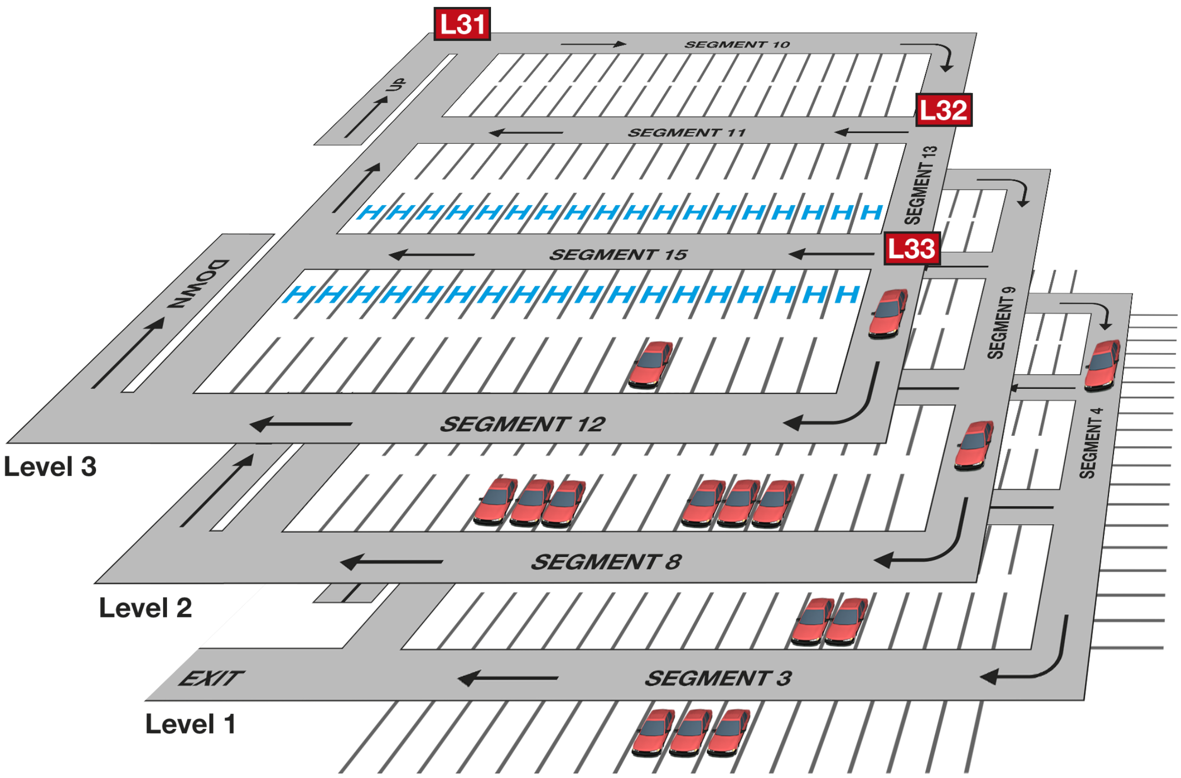
5 normal lanes (segments) with 45 spaces each

Level three:

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

- All the “normal” lanes are connected to a CPM slave module with a unique ID number.
- The handicap 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 total open spaces for all three levels and handicap spaces respectively.
- The display that shows open 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 open spaces on all the handicap 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 open spaces at this level only. Handicap spaces not included. See L31.
- A CPM module programmed as “Master indicator” is connected to this display. The CPM module monitors the segments: 10, 11, 12 and 13.
- 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 monitors the segment 11 only.
- 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 open handicap spaces in this segment. A CPM module programmed as “Master indicator” is connected to this display. The CPM module monitors the segments 15 only.

Installation

Short Installation

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

Sensors

- Pre-program sensors before mounting in ceiling. See Programming section below.
- Sensors must be installed minimum 1.5 m (4.95 feet) and maximum 4.0 m (13.2 feet) in distance from the floor.
- Use e.g. cable trays to mount the sensors and save labor costs.
- Sensors must be mounted in the middle of the Parking Guidance System space directly over the car.
- For aesthetics, it is best to mount the sensors aesthetically in a straight line in 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. See "General Installation" below for a more firm description.

LED Indicators

- When using indicators separate from the sensors for maximum viewing, the LED indicators should be installed outside the Parking Guidance System place in the drive lane.
- It should be mounted in the ceiling, in an aesthetic straight line and in the same height over the floor.

CPM (Car Park Monitor) Modules

The CPM modules have three different functions (modes). They can be slaves, 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 and max. 70 sensors and max. 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. See planning section.

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. See programming section.
- Connect the L2 to all other CPM modules in the entire system. Use 1.5 mm², (14-16AWG) wire.
- Connect RS485 to display if such a display is selected. Display will show open spaces from a variety of segments and not just one segment. See programming section.

Dupline® Master Modules

- The DMM, Dupline® master module named GP34960005700, is used in all segments to supply sensors and the 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 single module in an entire system.
- Use double size power supply because of pulsating output on the DMM.

Cabling

- Use 3 conductor, 1.5 mm² (14-16AWG) unshielded single core wire for the sensors.
- Use 2 conductor, 0.5 mm² (18AWG) unshielded single core wire for the LED indicators.
- Use 2 conductor, 0.7 mm² (18AWG) twisted and shielded cable for RS485 to display and the RS485 to the GP34960005700 if Parking Guidance System software is used.
- Use 2 conductor 1.0 mm² (14AWG) unshielded cable for power to the display.

Cabinets

- Place the cabinets in accordance with the plan.
- Use cabinets that have a bigger size for future installation but also to avoid heat dissipation.
- Use 1.5 mm², (14-16AWG) wire for internal wiring.

Programming

Sensors

- 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, use the ***last*** Dupline® address in the segment on which to program the lane sensor. E.g. last “normal sensor” is H4, then lane sensors are H5.
- Pre-program all sensors before they are mounted in the ceiling to reduce labor cost.

CPM Modules

Slaves

- Select a unique ID number for each (segment) slave CPM.
- Select “Normal” mode and P1 for “Calibration channel”.
- If no “Lane” sensor is present select “X”. 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" to collect several segments into *one* display.
- Select "Master mode" to collect several segments into *one* display and to be synchronizer in the entire system. There can only be *one* master mode in a system.
- 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 consecutives order. E.g. 5-9 is 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 software is used in the Parking Guidance System system, the dipswitches must be set according to the specification in the datasheet.

The Dupline® Fieldbus

General Information on the Fieldbus

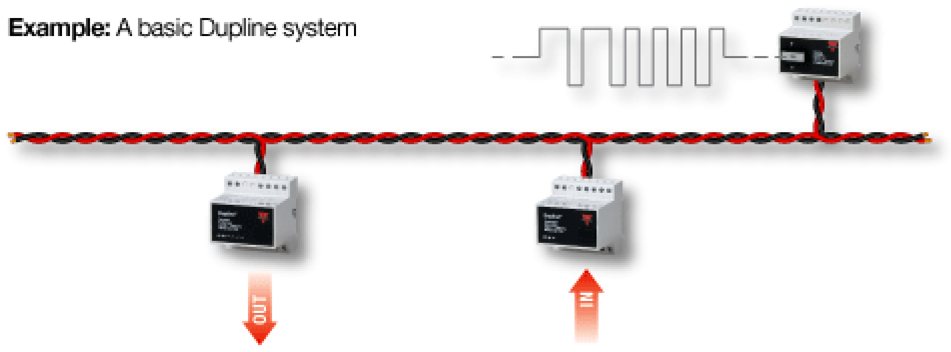
The bus system that links the sensors and CPMs together is the Dupline® fieldbus. This highly reliable, robust bus system has been proven in more than 150,000 installations worldwide in a wide range of building automation applications such as water distribution, mining, railways, parking systems and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

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 distance and 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.

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.

Dupline® Bus Including a 3'rd wire

The parking guidance system is using an expanded version of Dupline®, in which a 24 VDC power supply is included as a 3'rd wire. The reason is that a power supply is needed for the sensors on the bus. The power supply needs to 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 that segment needs to 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.

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 expand the functionality to e.g. include control of lighting and ventilation based on presence of people, CO_2 levels and time of the day. Another option is to record centrally the energy consumption in power distribution panels throughout the building using energy-m connected directly to the bus.

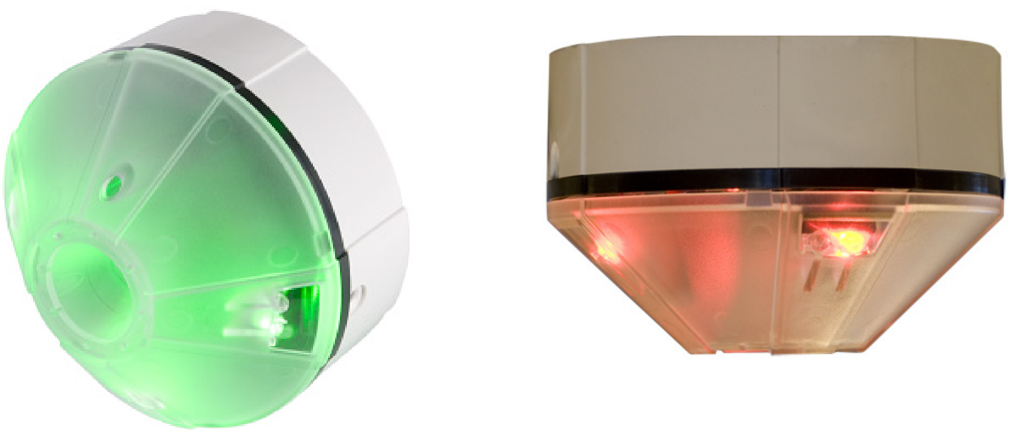
System Description

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 one system segment. Thereafter is described how the individual segments can be linked together to create a big parking guidance system with potentially thousands of 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.

Basic Modules

Parking Guidance System Sensors and LED Indicators

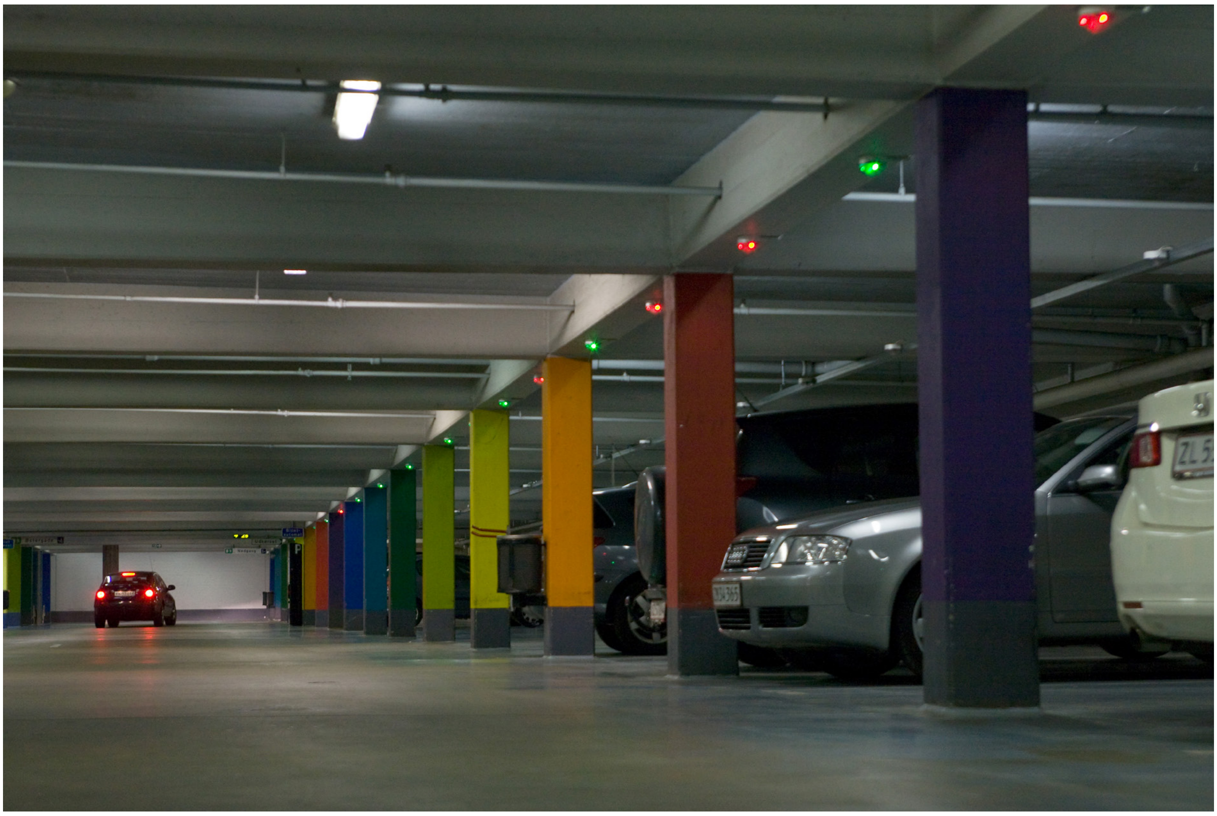
With built-in LED indicator light, (red–green)	GP 6220 2201 724
With built-in LED indicator light, (red–blue)	GP 6220 2202 724
Without indicator light	GP 6240 2224 724
Indicator light, red-green	GP 6289 0001
Indicator light, blue-green	GP 6289 0002



PRODUCT PICTURE (GP62202201724 and GP62890001*)*

The indicator lights are implemented in exactly the same housing and holder as the sensors, and are mounted the same way. There is a simple two-wire point-to-point connection between the sensor and the indicator light.

Each parking space must be equipped with one of these ultrasonic sensors detecting if a car is present or not. 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 those cases where pillars and walls make it difficult or impossible to see from the driveway the light in the sensor, which must be installed in the middle of the parking space. In these cases external indicator lights are connected to the sensors and mounted at the side of the driveways where they are much more clear and visible for the drivers. This is why it is the most common solution in parking guidance systems.



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 sensors itself and a holder to be mounted on the ceiling, cable tray or installation box. The sensor is detachable from the holder making sensor replacement easy. The sensor can be locked to the holder through a small plug (included).

Master / Slave CPM

Car Park Monitor GP 3482 9091 724

PRODUCT PICTURE (GP 3482 9091 724)

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 open 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 shall show the same information it is possible to use the same CPM for these.

Parking Guidance System Displays

1 Arrow	GP6763 0106 (A) (A = outdoor version)
1 Arrow + HCP (Right)	GP6763 0107 (A) (A = outdoor version)
1 Arrow + HCP (Left)	GP6763 0108 (A) (A = outdoor version)
1 Arrow + 2 Digits	GP6763 0109 (A) (A = outdoor version)
1 Arrow +1 Digit + HCP (Right)	GP6763 0110 (A) (A = outdoor version)
1 Arrow +1 Digit + HCP (Left)	GP6763 0111 (A) (A = outdoor version)
8 Characters	GP6763 0112 (A) (A = outdoor version)
8 Characters + HCP (Right)	GP6763 0113 (A) (A = outdoor version)
8 Characters + HCP (Left)	GP6763 0114 (A) (A = outdoor version)
9 Characters	GP6763 0115 (A) (A = outdoor version)
3 Characters + Arrow	GP6763 0116 (A) (A = outdoor version)

There are several types of displays available for the parking guidance system. The number of digits varies, some are with symbol for disabled people, some can show text (e.g. “FULL”) and some are for outdoor installation. Which one to choose depends on the location, task and budget?

PRODUCT PICTURE (GP67630116)

As mentioned earlier, it is the CPM which sends the number of open spaces to the display via a RS485 2-wire connection. Most of the displays are configurable in terms of how to display the values, but normally “0” open spaces are indicated with red crosses on the display, and in case there are open spaces the number is shown on the display together with a dynamic green arrow pointing in the right direction.

Dupline® Master Module

Dupline® master module for parking systems GP34960005700

PRODUCT PICTURE (GP34960005700)

The purpose of the master Module is to generate the Dupline® carrier signal making it possible for 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.

Test and Configuration Unit

Parking Guidance System Configurator, GP 7380 0080 709

The Parking Guidance Systen ration and test unit. It is a simple

PRODUCT PICTURE (GP73800080709)

handheld tool designed to configure sensors and CPM's, and furthermore it can be used as a test device able to read and simulate any sensor. The Parking Guidance System Configurator can also be used to trigger a simultaneous calibration of multiple sensors.

Optional Units

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

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

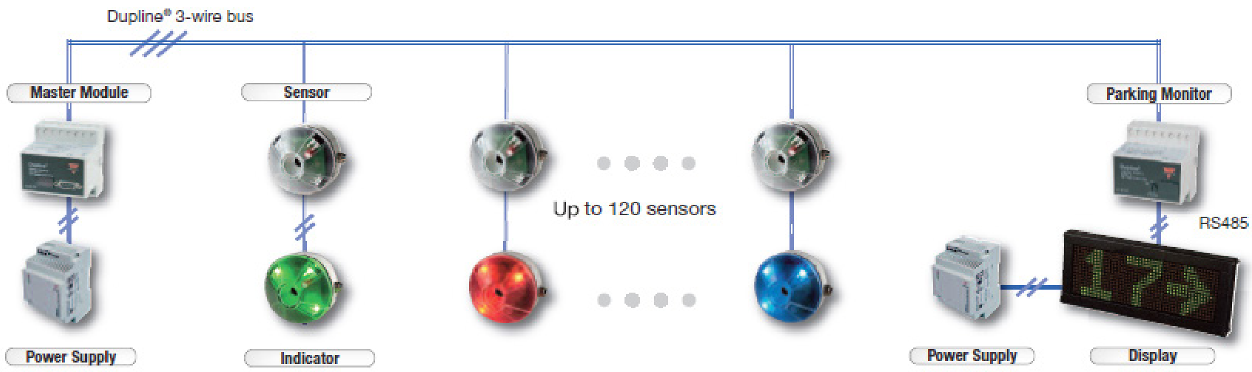
Power coupler G3485 0000 700
(Used together with D3892 0000 to synchronize power supply)

System structure

At first hand, you may assume 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, which are linked together to create a big system. In this chapter the structure of the basic system segment is first defined, where after it is described how the segments can be linked together to create the overall system, including a network for central parking facility monitoring software.

Definition of One System Segment

In below 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.
The elements of the structure are the following:



PRODUCT PICTURE (One segment)

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 CPM's 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.

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 needs to 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 entry 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.

Car Park Monitor(s) 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 it will show red crosses. It is possible to have several CPM modules with displays within one segment. For example the system segment could be used to monitor 2 lanes each with a CPM and a display and usually there are 1-3 sets within a segment.

The above described single system segment manages an area of the parking facility and provides local guidance for that area with its displays and indicators. In order to expand 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.

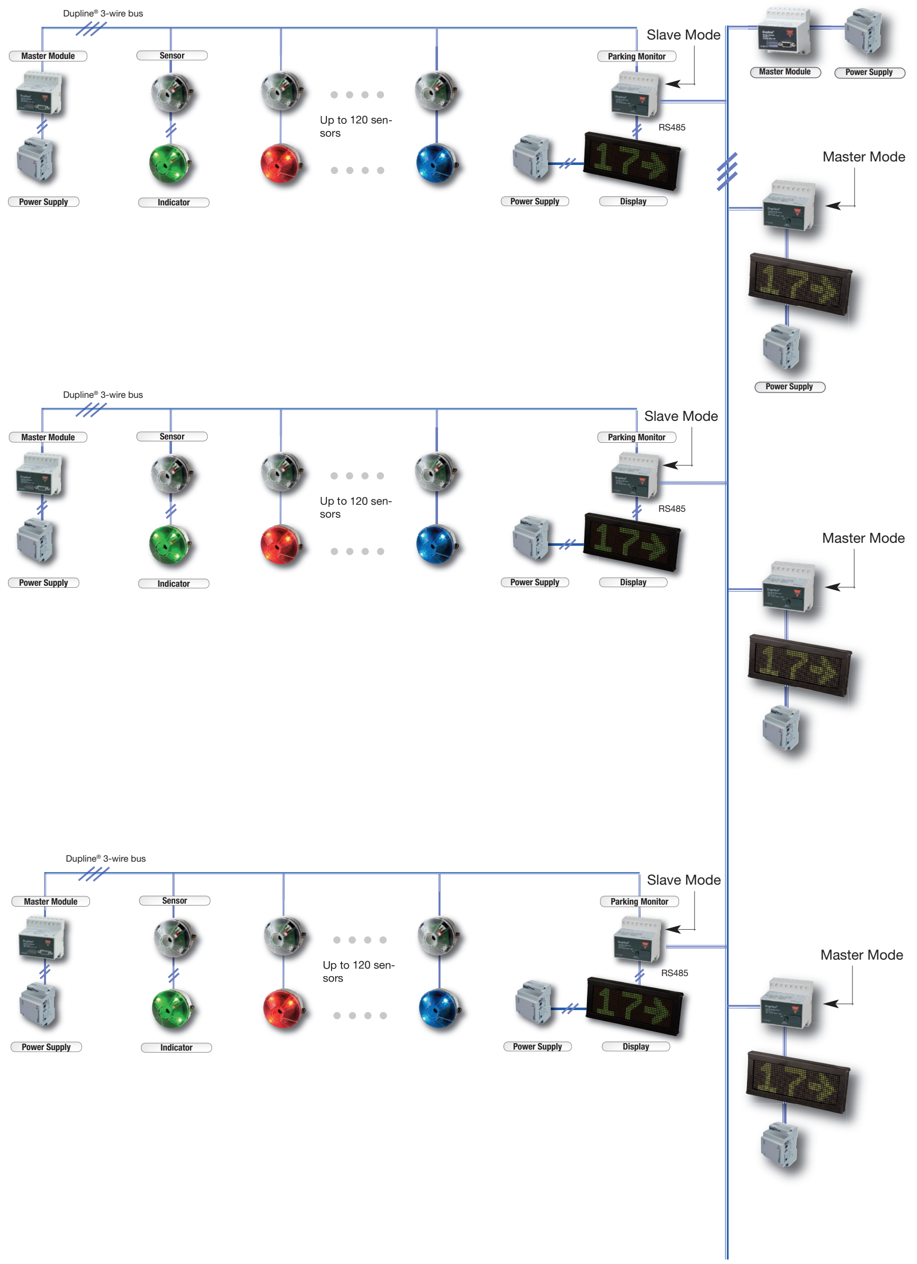
Segments Linked Together via L2 Bus for Totalizing

The L2 bus is used to collect data from all the segments (L1 buses) and distribute the data to displays that shows the numbers of open spaces. The CPM module GP34829091 which is programmed in master mode, have the possibility to show numbers of open spaces from specific segments in number order e.g. ID5, ID6, ID7 etc. etc. Also the CPM modules are able to show the total number of open spaces in a Parking Guidance System system. Then all segment ID numbers must be selected to accomplish this. There is no limit in installing as many CPM modules in "master Indicator mode". The module does not use or occupy addresses but collect only data from the L1 busses (segments).
On the L2 bus there must always be one' CPM module programmed as "master". The master have the same function as the "master Indicator" but it has also the function to provide sync in the system. There can only be one' "master" on the L2 bus.
The two busses, L1 and L2 are galvanic separated from each other, which means, if one or several segments (L1 busses) suddenly malfunction, the rest of the system keeps working without any problems. When the defect segments are repaired they will automatically be integrated in the system again, without reset or any restart of the system. This will not affect the user in any kind.
If the L2 bus malfunctions, only the displays will be affected. All the segments (L1 busses) will con-

tinue 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 which is on the L1 bus.

Below example shows 3 segments (L1 busses) connected to the L2 bus. The example has a “master” that provides the system with a sync signal and a display which shows the total number of open spaces in the system. The two below master modules are programmed as “master Indicators”. They do not have any sync signal but are able to show open spaces from one or several segments (L1 busses).

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

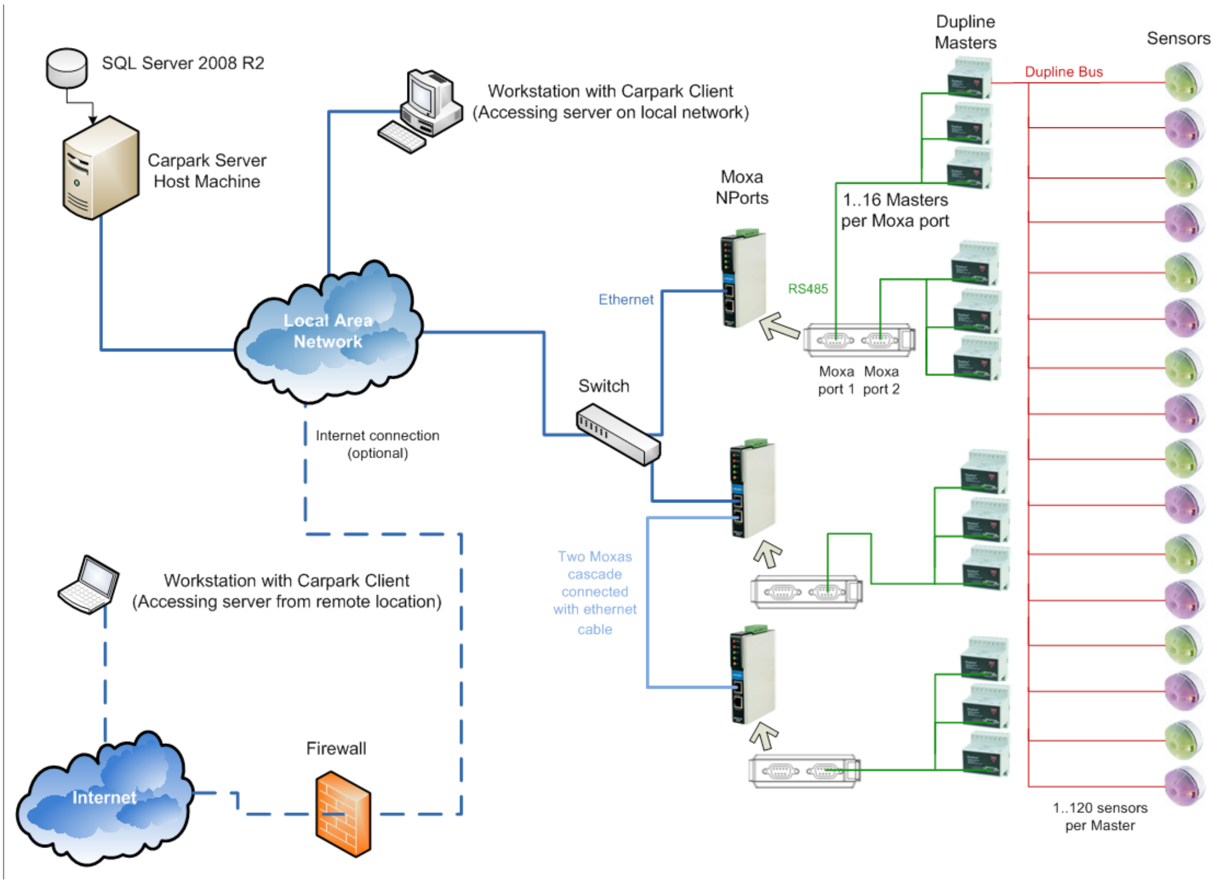


Software Network Added

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 optained.

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.

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. So 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 only connect a single moxa to the network, and then cascade connect the rest, as shown in the diagram (see above). To help you configure your moxa devices, we provide the Parking Guidance System Moxa NPort Configuration software. Its use is explained on the homepage: 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 the Parking Guidance System Server host machine a web address, off-site users will also be able to connect to it via the Internet.

If an accident occurs and the server breaks down, the Parking Guidance System will automatically continue working as a “Stand Alone” system. This means that the customers will not be affected at any time. When the server is back online, it will automatically synchronize into the system. The operator will then be able to make bookings, trend protocols and in other ways work with the system.

System requirements

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 color, 32-bit (Minimum); 1600 x 1200 high color, 32-bit
Suggested: 24” monitor, with a resolution capable of 1600 x 1200 pixels in high color.

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 color, 32-bit (Minimum); 1600 x 1200 high color, 32-bit

Parking Guidance System Modules and Modes Explanation

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.

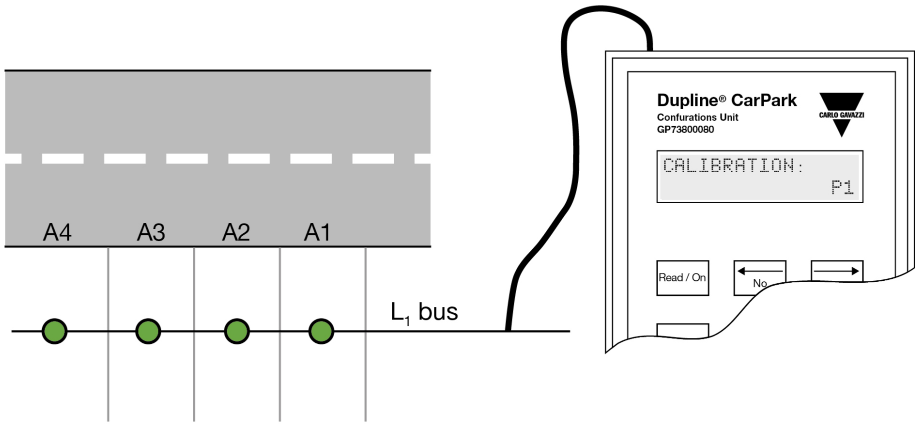
There are two ways of calibrating the sensor: Local or global calibration

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.

Press the button smoothly for 3 seconds and remove from the sensing area while the sensor is calibrating

- Push the button on the outside of the sensor. The LED flashes green for 30 seconds with 1 Hz. (The technician has time to get clear of the sensor before the calibration starts).
- The calibration starts when the LED flashes green for 6 seconds with 4 Hz.
- If the calibration is OK, the LED will respond with a constant green light.

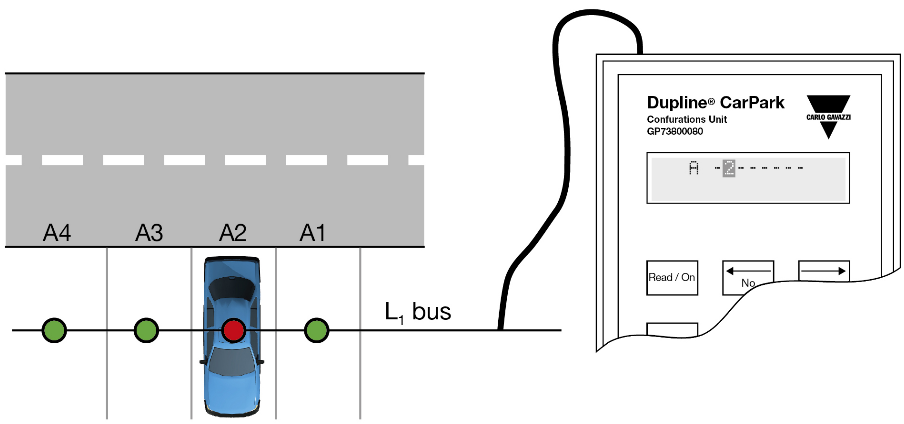
Global calibration can be performed by means of the configurator GP73800080 global. The GS7380 0080 is connected to the segment (L1 bus) in GTU8 mode. Selecting “global calibration" enables simultaneous calibration of all the sensors connected to the segment.
The parking space must be empty during the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



Sensor Modes

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

In ***Normal mode***, the sensor detects the presence of a car in the parking space and turns on the red LED. See drawing below.
At the same time the sensor sends out a signal on the Dupline® 3-wire L1 bus.



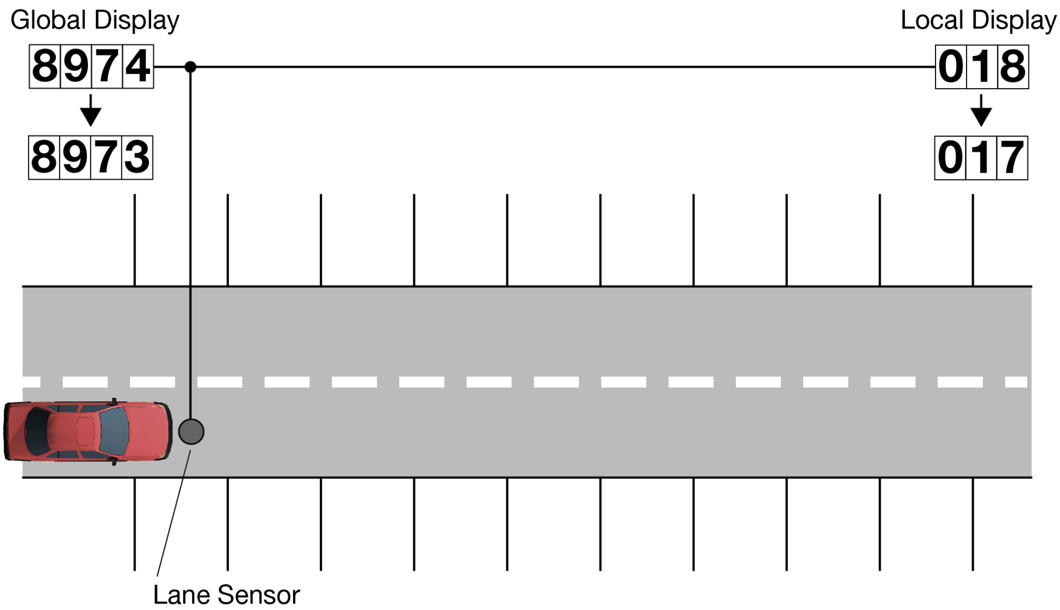
When the parking space is empty the LED will change to green and also send out a signal on the Dupline® 3-wire L1 bus.

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, as for instance concrete. A soft or uneven surface will reduce the signal.

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. See fig. next page.

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 that 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, startup and show the error status.

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



Car Park Monitor Modes

The unit has four different configurable modes:

Slave Mode

In slave mode the unit can collect data from maximum 120 sensors connected on the L1 bus (segment).
Addressing of the sensors is performed with the parking guidance system configurator, 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.

Roof Mode

Roof mode is designed for the top floor where it is impossible to mount sensors on across the cars. One sensor detects when a car enters the roof. Another sensor detects when a car is leaving the roof. The number of available parking spaces is transmitted to the Dupline® L2 bus in order to allow parking guidance system CPMs in master mode or master indicator modes to read the information. Roof mode allows max. 128 addresses.

Master Mode

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

Master Indicator Mode

In master Indicator mode the unit is only connected to the Dupline® net L2. The master Indicator read and summarize on L2 the total of open parking spaces transmitted from selected slaves and the roof module (if used).
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 specified ID area 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 indicator on the L2 bus.

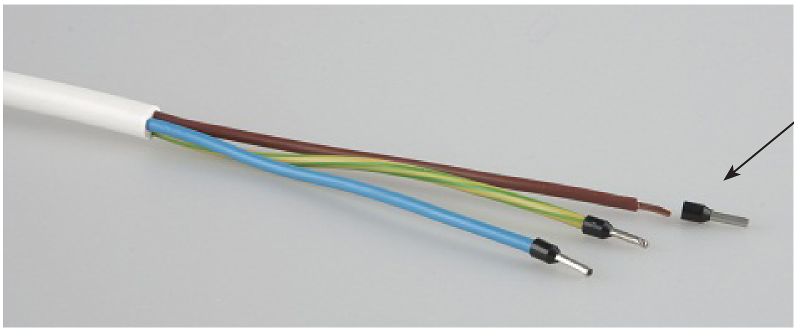
General Installation

Cable

The Parking Guidance System uses a 3-wire cable where the Dupline® bus and the supply are transported 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 customer must connect a ferrule on each wire end, because the connections on the sensors are all “push connectors”.



Mount ferrule on the multi core wire

*Fig. 1: 3 * 1,5 mm² multi core wire with ferrule*

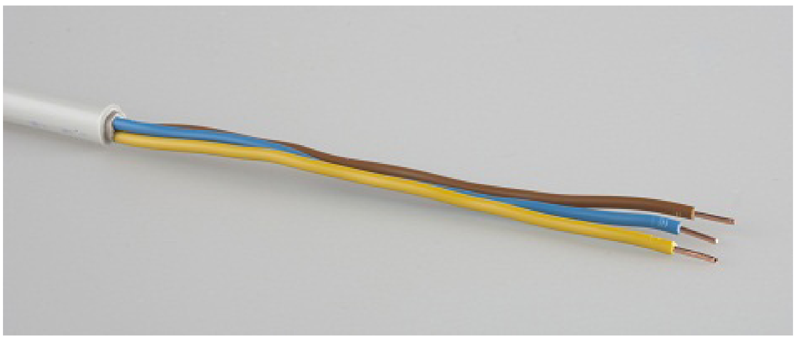


*Fig. 2: 3 * 1,5 mm² (14-16AWG) single core wire*

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

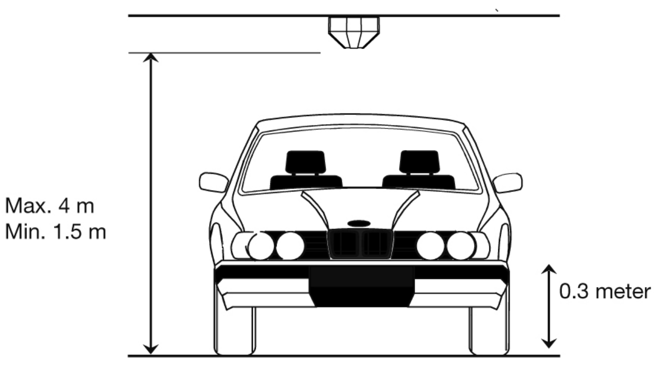
- Be sure that water cannot penetrate the Dupline® bus cable or junction boxes. Water can cause poor connection and random activations of the sensors.
- If the cable is installed close to high voltage cables or equipment, use shielded cable.

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 on where and how to mount the sensors. The decisions based upon physical conditions will include:

- On the ceiling
- On a cable tray
- Or as a lowered sensor



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

Fig. 3

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

It is our experience that cable tray installation is a very fast installation. In addition it is cheap (in Europe because of the labour) and it looks good (is aesthetic). In Asia experience has shown that customers prefer the lowered sensor installation.

Fig. 4: Sensors mounted on cable tray

Fig. 5: Sensors mounted on ceiling

Fig. 6: Lowered sensor installation

Positioning the Sensor

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

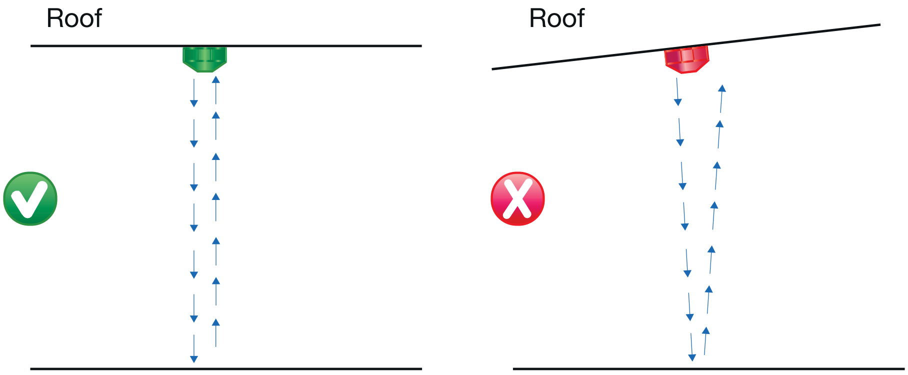


Fig. 7

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 problematic 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.

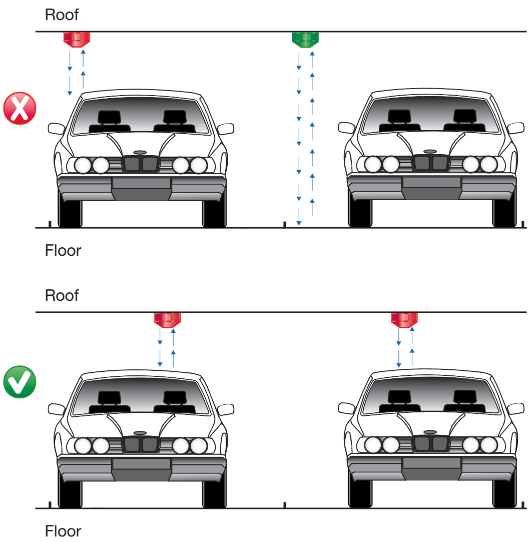


Fig. 8

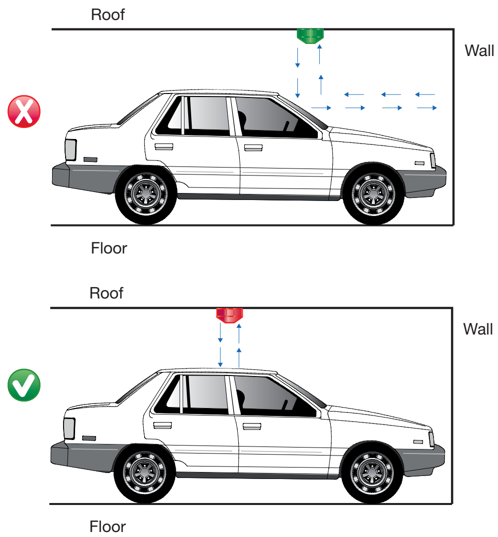


Fig. 9

The sensor can be programmed as “Normal sensor” or “Lane sensor”. “Lane sensor” is used to monitor cars that enter the 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.

Programming the Sensor

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

Fig. 10 : 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 installer can pre-program sensors before installation and write the address on the back of the sensor with a permanent pen. This may turn out to be an advantage during the installation and may be time saving.

When the programmer is connected to the sensor, press the “Read /on” button.

Fig. 11

Normal mode: Standard sensor 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.

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 open 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.
It is possible to see or change the status and calibration address for the connected sensor.

Fig. 12

Select the address by pressing the numeric key on the programming unit GP7380 0080.

Program the Parking Guidance System space sensors starting from A1 and forward.

Lane sensors should be programmed last using the last addresses. E.g. Parking Guidance System space sensors are programmed from A1 to E8 (40 Parking Guidance System spaces) and the lane sensors should start from e.g. the H group and forward.

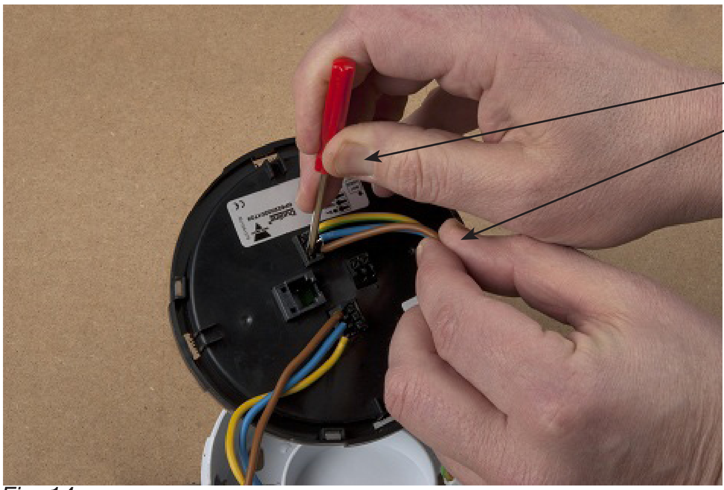
We suggest that the calibration channel is programmed to P1 on ALL the sensors. When using global calibration (see section programmer test unit), all sensors on a segment will calibrate simultaneously. Remember to remove cars and other obstacles when calibrating.

Wiring the Sensor

Mounting the wires to the connectors on the sensor is possible without using tools. The sensors use the push connector technically. Just press the stripped single core wire into the connector and it will be fixed inside with an excellent connection.

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

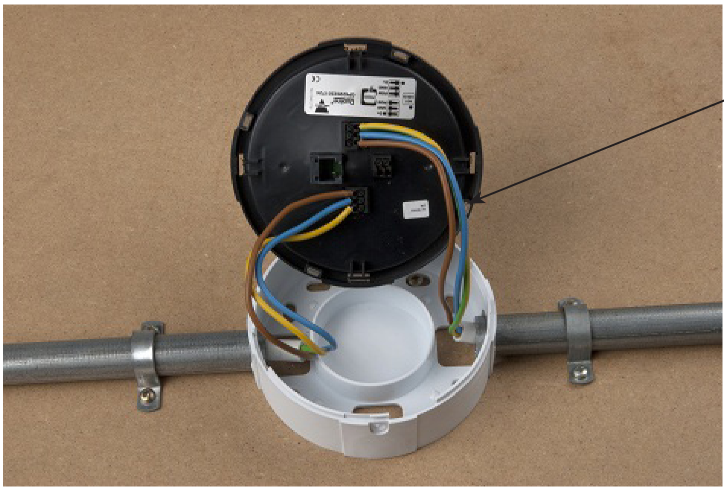
Fig. 13



Dismount the wire by pulling it while at the same time push the release button.

Fig. 14

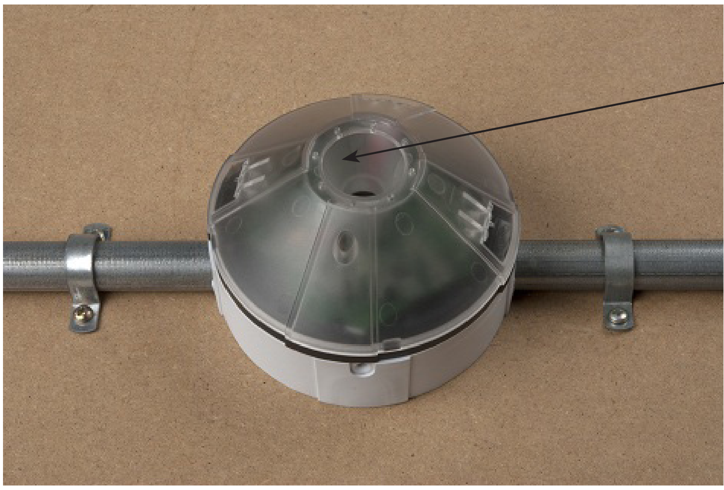
Allow 20 cm or 8 inches of extra wire for making the connections to the sensor. This not only makes it easier to connect but keeps stress off of the connections due to extreme radii.



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

Fig. 15

To mount the sensor to the back housing, press the two parts together and turn the sensor counter-clockwise just a couple of centim (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.



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

Fig. 16

Use the plastic barbed push fastener to join the two parts.

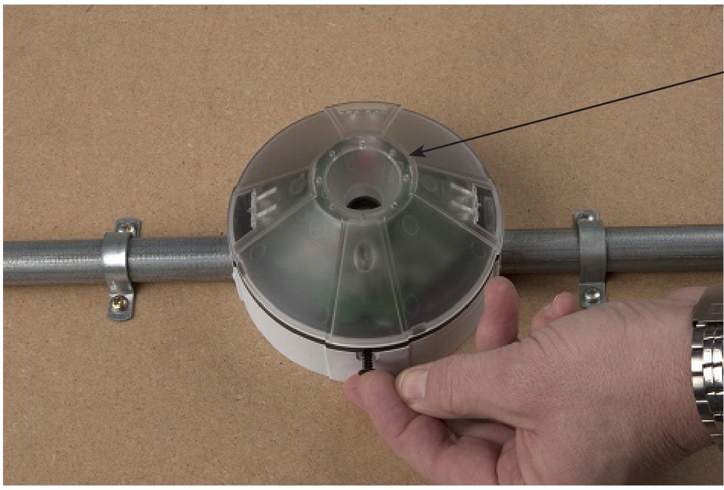


Fig. 17

Programming the CPM Module

By using the programming tool GP7380 0080 the installer can program the CPM module GP3482 9091 724.

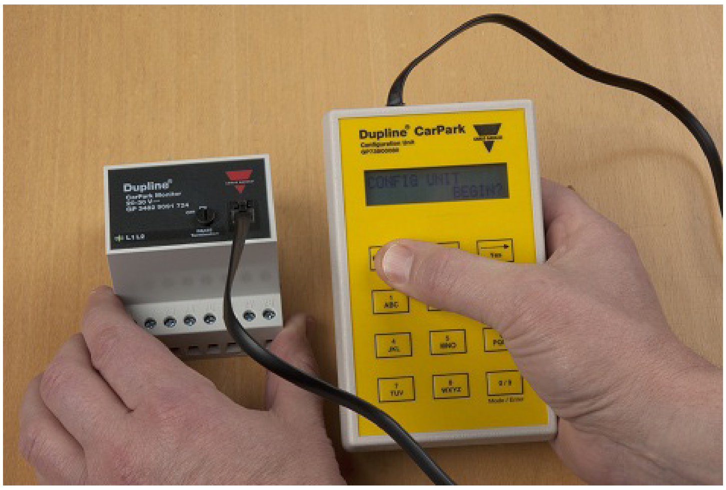


Fig. 18

The CPM modules do not require power during programming. The power is supplied from the programmer GP7380 0080 in program mode.

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 sync. signal to the entire Parking Guidance System network)

Configuration of master/slave

Fig. 19

Slave Mode

A slave CPM is connected directly to the sensors. Each slave CPM can handle up to 120 sensors. The segment to which the sensors are connected is named the L1 bus. The communication between the slave CPMs to the master CPM is named the L2 bus.

The maximum ID number is 480. See Fig. 20. It means that it is possible to install 480 L1 segments in a system.

In "Slave mode" the CPM can operate in either "Normal mode" or "Roof" mode (see Fig. 21).
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 (see fig. 22).

Device ID for slave mode

Fig. 20

Mode selection for slave mode

Fig. 21

Calibration in slave mode

Fig. 22

In “Normal operation Mode” the user must know if a lane detector sensor is used on the L1 segment. If the user does not use a lane detector sensor, the address with two crosses “XX” has to be disabled by pressing the tactile key “8”.

If the lane detector sensor is selected, it is possible to implement an “off delay” of maximum 120 sec. (see Fig. 24). When a car moves under the lane detector sensor, the Parking Guidance System reduces the open number of 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 detector sensor is activated.

Lane detection in slave mode

Fig. 23

Off Delay Lane in slave mode

Fig.24

The slave CPMs are monitoring the L1 segment with the maximum of 120 Sensors. In “Units on Grp” (Fig. 25) the user 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 detector sensor or for “Calibration”. The user can implement an “Offset Space” (Fig.26) 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 open spaces.

Select/See channel for each connected sensor in slave mode

Fig.25

Offset spaces in slave mode

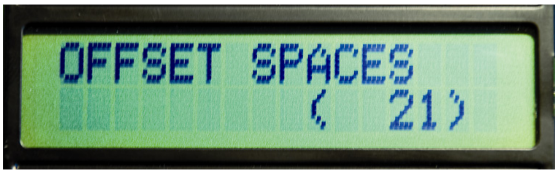


Fig. 26

In “Roof mode”, the slave CPM is able to monitor up to 127 Sensors. At the entrance of the roof, a sensor is mounted to detect each car passing and reduce the total numbers of open spaces. The same thing happens at the exit, but here it increases the total numbers of open spaces. The input and the output sensor are specified for each unique Dupline® channel. If, for some reason, there is a mis-match between the sensor's counting and the correct number of open parking spaces, it is possible to reset the counter when the roof is empty (Fig. 28).

Roof Spaces in slave mode

Fig. 27

In/Out channels and Reset channels in slave mode

Fig. 28

Master Mode

The GP3482 9091 724 can also be used in “master mode”.

Select master by pressing 1 for YES (Fig.29). The response is shown in Fig. 30.

Selection between master and slave mode

Fig.29

If the user selects” NO” in the indicator mode (press 2 and then Enter), the master will produce the sync. 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 works the same way as the master except that the master indicator cannot generate a sync. signal.

Indicator in master mode

Fig.30

In both modes 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.

System size in master mode

Fig. 31

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 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 see 100 * 120 = 12000 parking spaces.

ID number in master mode

Fig. 32

An “Offset space” for the master (or master CPM) can be selected. The maximum number of “Offset” is 9999.

The “Offset” is used to prevent car jam and to make a smooth parking experience for the driver.

Offset spaces in master mode

Fig. 33

When settings are finished and ready to transfer to the unit, the configurator will respond with “Send data to unit”.

Send data to unit (both sensor and master/slave unit)

Fig. 34

If, for some reason, the transmission fails, the configurator will respond with “Send failed Try again”. The user then has to find out what has caused the failed transmission before trying again. Please check cable or battery in the configurator for possible problems.

Message from the Configurator

Fig. 35

Cabinet Wiring

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. This is also a cost benefit (only few cabinets are used) and will reduce the length of cable to the sensors. This has already been discussed earlier in the section “Phase two” on page 6.

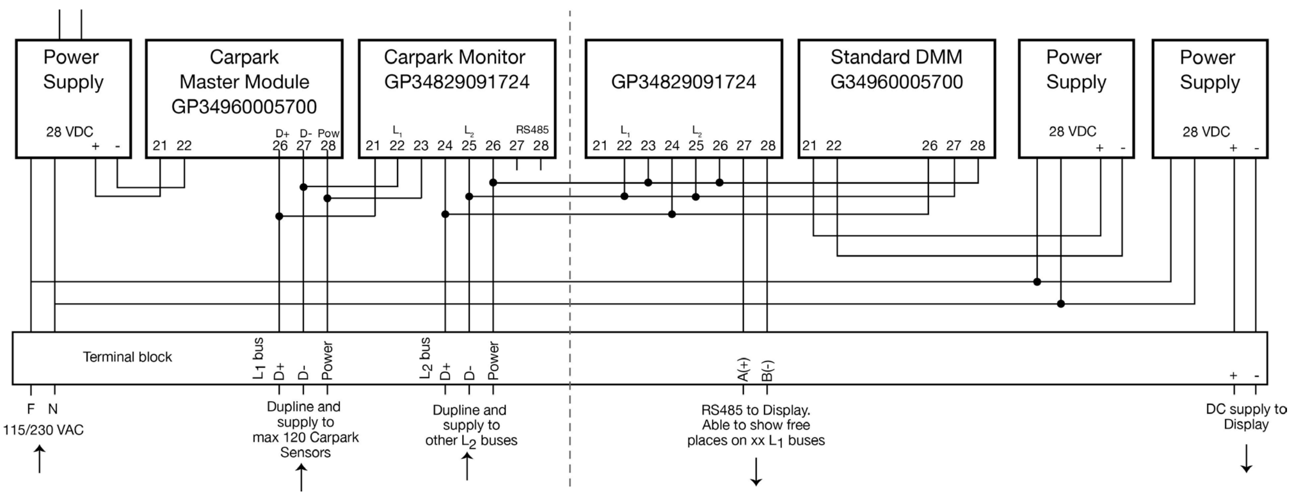
Reducing the length of cable to the sensors means that it is possible to mount more sensors on the same L1 bus. This can reduce the number of CPM modules etc.

However, if requested, the cabinet(s) can be installed away from the system or just at the end of the system. If the rules mentioned in “Phase two” are not obeyed, it is important to perform a load and voltage drop calculation. See section “System Calculation” below.

Simple Stand-alone Wiring

The below diagram example shows how to configure a simple stand-alone wiring.

Carpark Wiring with Cabinet



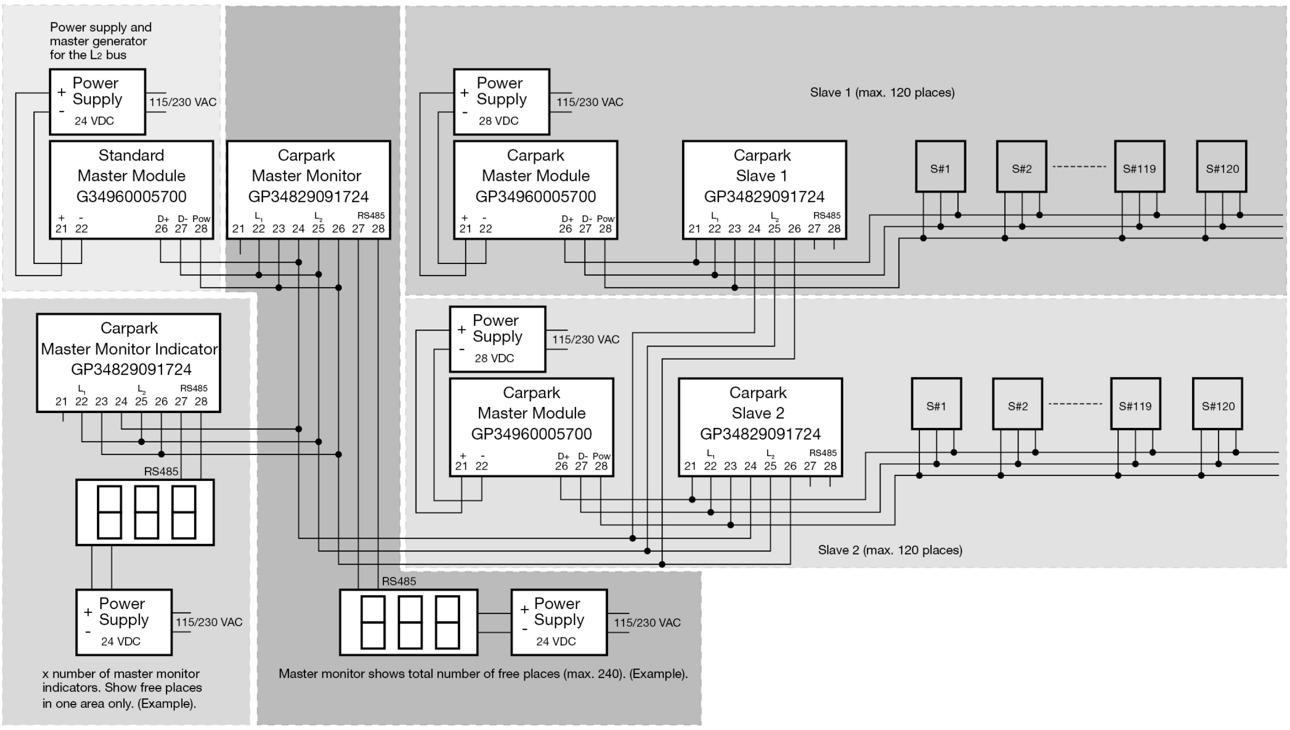
The simple stand-alone system consists of two CPMs programmed as slave and master respectively. The Parking Guidance System DMM provides power and Dupline® signal on the L1 bus. The standard DMM provides power and Dupline® signal for the L2 bus.

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

This simple stand-alone system can handle up to 120 sensors and send information on available spaces as either RS485 Modbus information on the Parking Guidance System DMM, RS485 on the slave CPM to a local display or as 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.

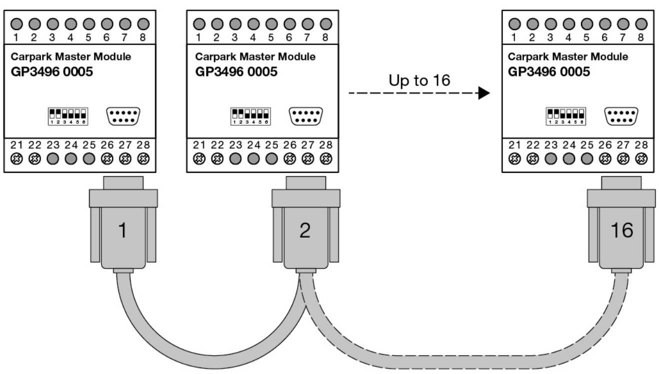
It is possible to install an unlimited number of the CPM modules named “master monitor indicator”. The function of the master monitor indicator is to show available spaces on the displays and nothing else. The “master monitor” function does the same as the “master monitor indicator”, except that it supplies also the entire L2 bus system with the sync. signal. The sync. 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.

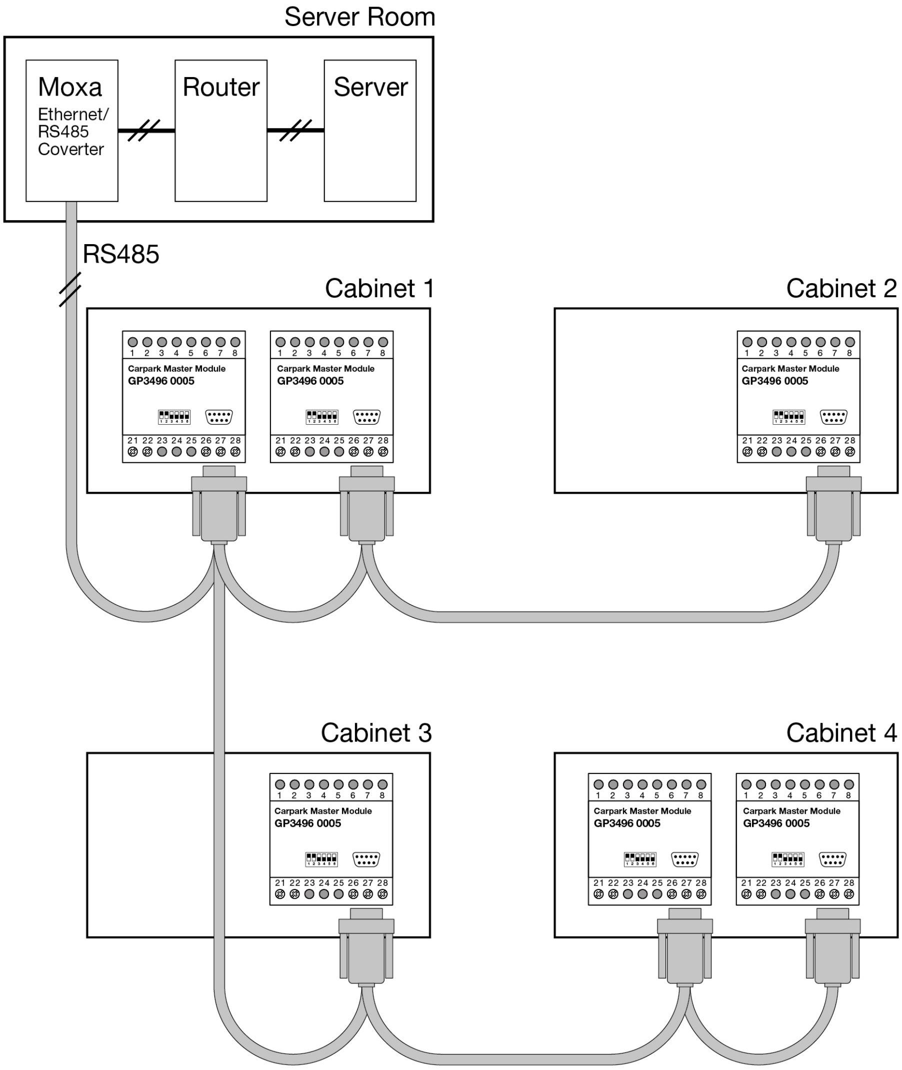


Extended Wiring for Parking Guidance System Software Solution

When pairing the simple stand-alone Parking Guidance System with a software solution, just require a daisy changed RS485 connection between all Parking Guidance System DMM modules in the entire system. On the front of the GP34960005700 modules a DP9 connector can be found for that purpose.



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 (ETHCONV3 or 4) that must be loca–ted less than 100 m away from the ethernet router or the server for Parking Guidance System software. If this is not possible, an optical solution can be used.



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 max 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)

Max 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 max number of sensors with a known cable length

Example of a slave monitor 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/km with the use of 1.5 mm2, (14-16AWG)
- Wire length is 200 m with 1.5 mm2, (14-16AWG)

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

Max current consumption is 4.0 / 2.6 = 1.54 A

Maximum number of sensors is 1.54 / 0.020 = 77 sensors

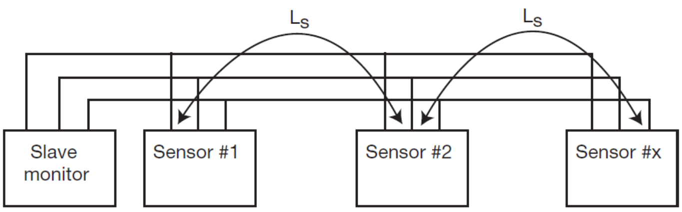
It is possible to calculate in an easy way for instance the “total number of sensors” by using the below equations:

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

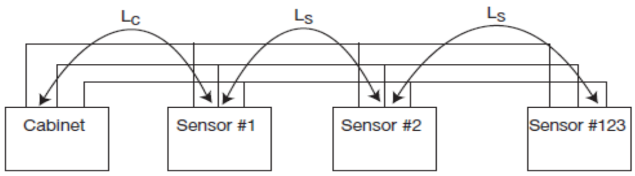
x= 45 sensors

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

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



Test and troubleshooting of the system

Example 1

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

x= 55
Lc= 35

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

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.

No Yellow 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

Sensor LED flashes red:

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

Led indicates incorrect color or does not work

- 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 interchanged

Configurator not working or no connection to Parking Guidance System modules

- Battery defect
- Cable defect

Display is blank

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

Display shows incorrect number and arrow

- Settings for dipswitch D2 and D3 on the display is not correct
- 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 dipswitch 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 tool on www.car-park.dk
- Check power on the moxa, CPM module, master generator and the sensors

Tips

- Use 1.5 mm^2 (14-16AWG) single core wires in a system for the sensors and passive LED indicators. If 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 min 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 has the same ID number, the sensors will not be shown correctly. The sensors will have the same addresses which will cause a conflict.
- Use the Parking Guidance System configurator 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 light with the wrong color. Red for available and green for occupied.

6. Software

7. Accessories

8. References

9. Practical examples