**Basic components**

A Dupline® network consists of 4 basic elements: A Central unit, input modules, output modules and a 2-wire cable. The Central Unit controls the communication in all Dupline® installations. It sends out the Dupline® carrier signal and coordinates all transmission between input and output modules. Input modules connect to contacts, voltages and analog signal sources etc. and transmit this information via the 2-wire cable. Some input modules are sensors with integrated transducer hence no external signal source is required. Output modules connect to lamps, contactors, LEDs, instruments etc. and control these devices according to the information received via the Dupline® network.

**The cable**

All the Dupline® modules connect to the same 2-wire cable to form a communication network where signals can be transmitted between the modules. Ideally, the 2 wires are twisted, but in practice basically any cable can be used, as long as the 2 wires follow each other in the same conduit or cable. In many cases this means that existing cables can be used.
**Bus-powered components**

Some Dupline® I/O modules are powered directly from the bus hence no external power source is required. This makes installation flexible and easy and is a particular advantage when no local power supply is available. Most of these devices are input modules such as light switches, small contact input modules and sensors for temperature, light intensity or movement detection, but a bus-powered relay output for de-central installation is also available.
**Topology**

The topology of a bus system is the definition of which type of cable routing is allowed. Dupline® features a completely free topology allowing the network to be established as a line, ring, star or a combination of these. This makes planning easy and provides a high degree of flexibility for last-minute changes and future expansions.
**Communication principle**

Dupline® signal transmission is based on a timedivision multiplexing principle that provide a more efficient transmission of simple signals than the traditional message-oriented method. This has made it possible to run Dupline® on a low carrier frequency of 1 kHz, which is the key for Dupline® features like long-distance transmission, high noise immunity and robustness. The Controller generates a square-wave signal consisting of an 8 ms synchronization period followed by 128 pulses each with a length of 1 ms. This 136 ms pulse train is repeated continuously. Each pulse defines a time slot where those modules assigned to that specific pulse number are allowed to transmit and receive information. So, in fact the I/O modules are sharing the same two wires by using them in turn. The response time in a Dupline® system is always below 272 ms, regardless of the number of nodes and active signals in the network.

![Communication principle diagram](image)

**Addressing**

Each input or output needs to have one of the 128 addresses assigned. The address defines which pulse number in the Dupline® pulse train the I/O point shall use for transmitting or receiving its signal. The 128 addresses are divided into 16 groups (A-P) each with 8 addresses (1-8), so an address reference is a combination of a letter and a number, e.g. B3. The addresses are assigned to the nodes by means of a simple handheld coding device.

![Addressing chart](image)
**Dupline Asic**
The key electronic component in each I/O module is the Dupline ASIC chip. A Carlo Gavazzi development using the latest technology to compress years of industrial communication experience into a single chip. The small size and low current consumption of the ASIC chip makes it possible to design very compact bus-powered components, like sensors or light switches.

**Coding and testing**
Addresses are assigned to the Dupline® modules by means of the handheld GAP1605 coding tool. The modules do not need to be powered or connected to the Dupline® bus to be coded. The current address can be read back into the GAP1605 for verification. Coding an address is as easy as dialling a telephone number. The GTU8 is a test tool, which makes it possible to read the actual status and control all 128 addresses in a running system. This is a useful tool during commissioning of a system and for isolating a problem with a wrongly wired input or output module. The GTU8 can be connected to the Dupline® two-wire at any point in the installation.
**Dupline operation mode**

In the figure below, two inputs and two outputs are assigned the same address B3. Every time an input module detects the time slot corresponding to address B3, it checks the status of the input coded for B3 and if it is activated it sends a signal to the central unit. The central unit will register address B3 as having an active input no matter which one of the two inputs are active. All inputs coded for the same address are OR-ed together, and there is no limit to the number of inputs that can have the same address. This is useful for example when a light is to be controlled from light switches mounted at different positions. If the central unit is a standard type or an interface without intelligent functions, it will simply transfer the input status detected on B3, to the B3 outputs. This function, that outputs coded for B3 follow the input status of B3, makes it easy to perform a simple peer-to-peer transfer of a signal without involving an intelligent unit. If the configurable Master Generator is used, then it is possible to assign an intelligent function to an address. If a toggle function is assigned to address B3, then the output coded for B3 will toggle whenever an input coded for B3 is activated. Or if an OFF-delay timer is assigned, the B3 outputs will remain ON for the specified time after the B3 input has been deactivated. There is no limit to the number of inputs that can be coded for the same address and thereby output the same signal. This is useful, when the status of lights and alarm signals need to be displayed at multiple locations, or when more loads need to be switched with the same signal. The fact that several Dupline I/O modules can input and output information on the same address without knowing the existence of each other, is a key characteristic that demonstrates the open and flexible architecture of Dupline®.