Quantec Wiring Instructions

GENERAL

Quantec can be compared to a very sophisticated analogue addressable fire alarm system where the integrity of the wiring is of paramount importance.

As with any networked system, voltage drop can be a severe problem, especially if the power to operate the system's devices is taken from the network itself, as is the case with Quantec. Another problem is the potential failure of the entire network should the wiring fail, especially in the event of a short circuit.

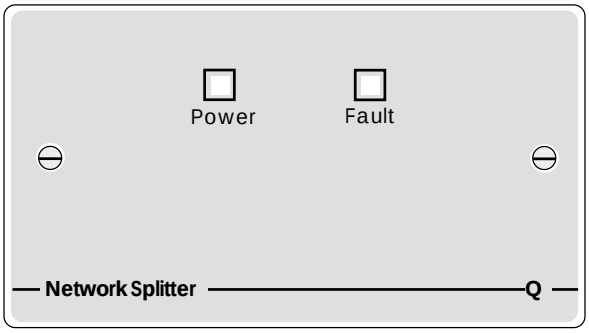
Because Quantec needs to provide considerably more power and data down the network than an addressable fire alarm system, it is impractical to wire Quantec in the same way (i.e. as a continuous ring with 'Loop Isolators').

It is common practice within the call industry to use low voltage signal cable. This cable is more prone to mechanical damage / poor installation than, say, MICC cable. Therefore some way of protecting the network against catastrophic failure must be implemented.

Consequently our **ONLY** recommended method of wiring Quantec involves the use of 'Network Splitters'. These devices have 6-fused 'limbs' for the wiring of individual sections of the system and they provide a convenient way of wiring, testing and protecting the system. In addition to simplifying the wiring, the Network Splitter 's fault and power LEDs also assist with the location of installation faults.

DETAIL

Each network splitter has one input and one output network connection (both UNFUSED) and six 'limb' outputs that are FUSED.



The unfused connections are for the connection of the network 'Spine' which should normally be wired in at least 1mm sq cable (e.g. T&E). It is important to maintain the integrity of this part of the network since any short circuit faults WILL cause a total collapse of the network until the fault is rectified.

DO NOT wire any networked devices to the spine other than Network Splitters.

The fused outputs i.e.'Limbs' are for the connection of individual circuits containing networked devices. These should be wired in four core security cable.

Each splitter has two indicators on the double gang facia plate - 'Power' and 'Fault'. '**Power'** indicates that power is being supplied to the network and **'Fault'** indicates that one of the circuits in use on that splitter has its fuse blown. (N.B. unused circuits may have their fuses removed without showing a fault).

60 addressable devices can be connected to each network splitter- 10 per way. Consequently four splitters are capable of accommodating an entire system. However, for larger systems and for convenience it is likely that more will be used.

There are many different cabling scenarios with varying lengths of cable and numbers of system devices attached to each spine/splitter combination(s), all capable of operating with different levels of simultaneous calls. For this reason only one general purpose scenario is explained in detail (Please refer to **'Application Note Q001-General Purpose Wiring Scenario'** on pages 3, 4 and 5).

PLANNING AN INSTALLATION

Quantec is wired as a network on two wires which distribute power and data to up to 255 network devices.

Network devices consist of call points, displays, monitor points, and addressable overdoor lights but do not include ancillary devices such as slave overdoor lights or ceiling pulls.

Although Quantec far exceeds the minimum requirements of all agencies, rules regarding installation vary depending on the location of the installation. If there is any doubt, please check with the relevant authorities.

The Network Controller

The Network Controller can be located anywhere on the network although it would be normal practice to install it centrally or in the manager or matron's office. There would usually be only one such device on the call system. The Network Controller, which includes a built-in 500 event datalogger, may also be used as a display.

Displays

Displays should be located strategically around the premises where they can be easily seen by staff, in areas such as nursing stations, junctions in corridors,staff rooms etc.

Call Points, Ceiling Pulls and Slave Overdoor Lights

Call points should be sited next to each bed, preferably above bedhead height to avoid damage to leads, and in lounges, dining rooms, etc. Ceiling pulls should be fitted in each bathroom and WC. Call points are not required in corridors or staff areas. Slave overdoor lights are normally installed outside rooms.

Addressable Overdoor Lights

If a 'Follow My Leader' system is required, addressable overdoor lights may be sited at the ends of corridors, above fire doors etc, depending on the layout of the premises. Their operation is set by programming the Network Controller. Addressable Overdoor Lights may also be used outside rooms with more than one call point (conservatories, lounges, etc). However, when used in this type of situation it should be noted that addressable overdoor lights go out when a call is 'accepted' at a display, whereas slave overdoor lights remain lit.

Fire Exit / Door Bell Monitoring

Monitoring points make a call if fire exits, drug cupboards etc. are opened. An override key is provided so doors can be left open during the day. Monitoring points also allow most kinds of door bell to trigger a call. In fact, any device with a normally open or normally closed switch output, such as passive infrared sensors, pressure mats, etc. can be connected to the monitoring point and then to the system. Power for these devices must be provided separately.

Back Boxes

Call points and overdoor lights fit on 25 mm deep single gang flush or square cornered surface back boxes (MK2160). Displays mount on 35 mm deep two gang flush or square cornered surface back boxes. Ceiling pulls mount on BESA centres.

Please note: Although Quantec's software can accommodate up to 255 addressable devices, when installing a system with over 140 devices you are advised to contact your approved supplier for important information regarding the possible requirement for increased power supplies, etc.

General Purpose Wiring Instructions

With Quantec the only real limiting factor is voltage drop which should be limited to approximately 5 volts in the worst case. Since call points and overdoor lights take differing amounts of current depending on whether they are in a calling or passive state, it is difficult to predict the exact consequences of voltage drop without knowing the exact configuration. Appendix 1 at the end of this document gives more technical information regarding the calculations for voltage drop.

These wiring instructions are general purpose and give plenty of margin for error. They are are based on the following assumptions:

(1) Network Splitters will be used throughout.

(2) All Spines will be wired in 1 sq mm copper cable (e.g. 1mm T&E)

(3) All Limbs will be wired in 2-cores of a 4-Core Security type cable.

(4) A maximum of 15 networked devices complete with slave overdoor lights will be connected to any limb with the most distant networked device no further than 40m from the network splitter.

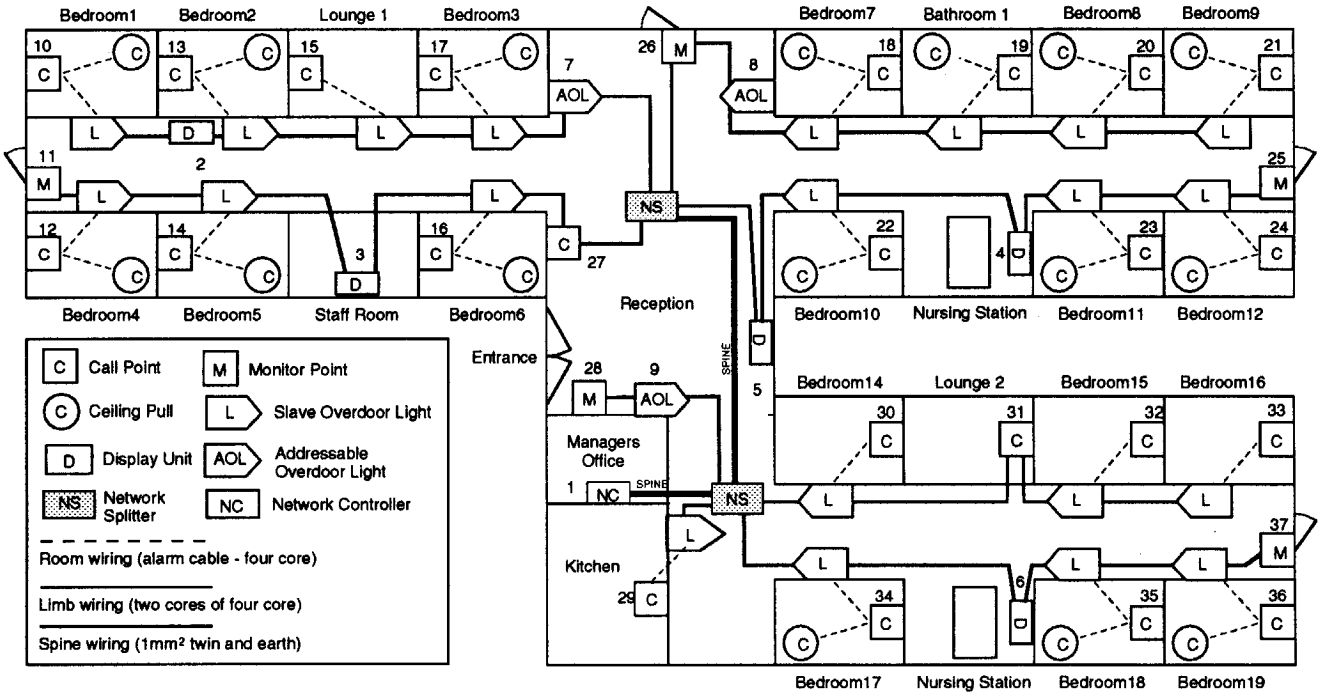
(5) Devices will be distributed at approximately equal distances along the length of the limb.

(6) The maximum resistance of the wiring system back to the main controller will be low enough to be capable of delivering a current which will blow the 'Limb' fuse. In this case a maximum resistance of 12Ω is assumed which is capable of blowing a 400mA fuse within approx 5secs under short circuit conditions. This is the equivalent of 150m of 1mm T&E (6Ω) and then 40m of security cable (6.4Ω).

(7) There will be a maximum of 20% of the devices connected to a spine in call at any one time. This may be higher in smaller systems but cable runs are likely to be shorter so volt drop ceases to be a problem.

FIRST FIX

(1) Plan cable routes and site the network splitters in strategic positions. **Please note:** as the system is addressable the programming of devices is not dependent on their location on the network. Therefore, devices that are difficult to access do not have to be connected to the same network splitter as other call points in the same area. For reference purposes, below is an example of the planned cable routes for an imaginary nursing home.



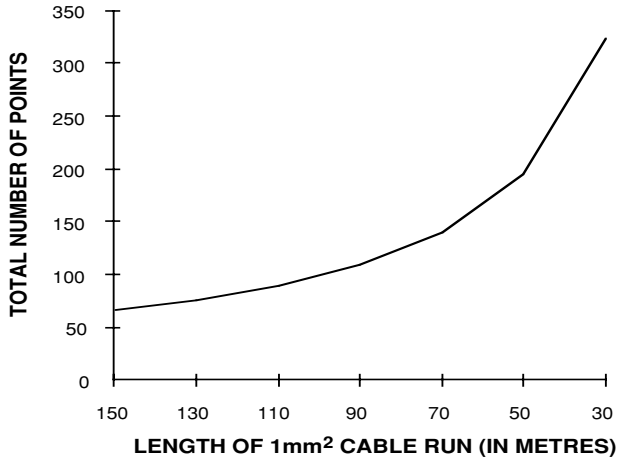
Care should be taken when planning cable routes not to exceed voltage drop limitations.

Use the Spine Length Calculator table (right) to work out the maximum spine cable lengths taking into account the number and type of devices connected to any network splitter(s) on that spine. If several splitters are connected to one 'Spine' then the calculation is for every device connected to that run of 1mm² cable on all splitters.

The calculations shown are for the worst possible case where every network splitter is placed at the farthest point of the run.

All spines wired from the network controller should be calculated separately, but there is usually one run that is worse than others and if that one works okay, it can be assumed that all other runs will also work okay. Where network splitters are wired adjacent to control equipment, providing they are wired in 1mm² cable, short runs of up to 5m from the network controller may be ignored for volt drop purposes.

Spine Length Calculator



DEVICE POINT VALUES

All of Quantec's devices have a 'points' rating which takes into account their current consumption and voltage drop risk:

Call Point = 1	Addressable ODL / Sounder = 2
Monitoring Point = 1	Display = 3
Slave ODL - 1	Ceiling Pull = 0

To determine the maximum length of a particular spine, calculate the total points value of all the devices that will be connected to any network splitter(s) on that spine, and read off the relevant figure on the graph above.

For the imaginary nursing home highlighted earlier, which has two splitters connected to one 'spine', the points calculation (with reference to the above spine length calculator) would be as follows:

Displays (5 x 3 points)	15 points
Addressable Overdoor Lights (3 x 2 points)	6 points
Call Points (23 x 1 point)	23 points
Monitoring Points (5 x 1 point)	5 points
Slave OD Lights (21 x 1 point)	21 points
Total	**70 points**

Thus, the maximum length of cable for this particular spine would be 150 metres. As the length of spine cable planned falls well short of 150m, if the basic assumptions for this general purpose application note are met, voltage drop at this site will not be a problem.

(2) Connect 'Spines' and Fix wiring to overdoor lights (call points if overdoor lights are not used) and mark up the Splitter Connection Record sheet at the back of this document. The schematic supplied should cover most applications and can be tailored to suit a particular site. An example of a Splitter Connection Record for the imaginary nursing home highlighted earlier is shown below:

Sample Splitter Connection Record

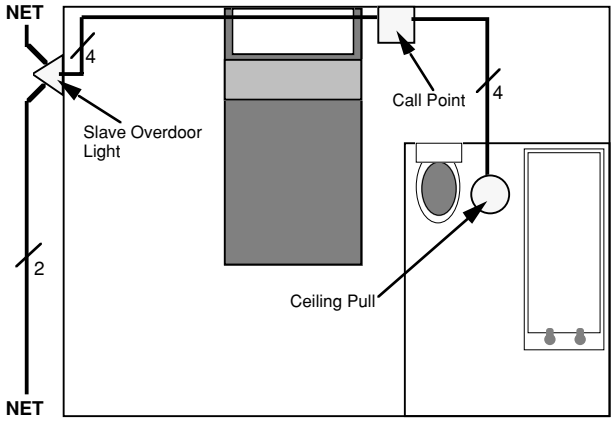
NETWORK CONTROLLER — *6m* —

NETWORK SPLITTER No: 1	Limb	Device ID Numbers	Length
Location: South wing, above suspended ceiling near corridor doors.	1	29	5
	2	6, 34–37	25
	3	30–33	25
	4	9, 28	15
	5	–	–
	6	–	–

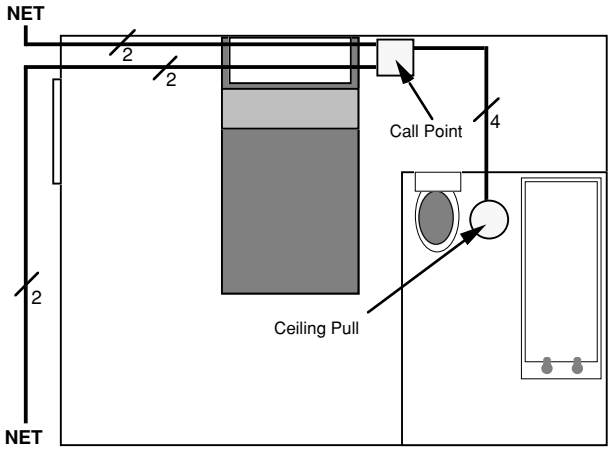
— *15m* —

NETWORK SPLITTER No: 2	Limb	Device ID Numbers	Length
Location: Middle of reception area above suspended ceiling.	1	11, 12, 14, 16, 27, 3	35
	2	7, 10, 13, 15, 17, 2	30
	3	26, 8, 18, 19–21	30
	4	4, 5, 22–25	35
	5	–	–
	6	–	–

(3) Wire each individual room in line with one of the typical room wiring diagrams shown below.



Device wiring when overdoor lights are used.



Device wiring when overdoor lights are not used.

SECOND FIX

1st Stage:

(1) Fit the network controller

(2) Connect the network splitters and spines of the network.

(3) Power up the system and check that all the 'power' lights are on at the network splitters. If they are all off there is probably a short. If only one is off there is an open circuit. Fix any faults. The integrity of the basic network is now proved.

(4) Connect the rest of the equipment (call points, ceiling pulls, overdoor lights, monitoring points, etc) as detailed in the wiring diagrams supplied with each device. (For reference purposes, these diagrams are reproduced in Appendix 2 at the back of this application note).

(5) Plug the limbs onto the network splitters one at a time. For each limb in turn check that the green power light on the network splitter is illuminated and that the furthest networked point on that limb goes into unassigned call when the device is operated. Repair any wiring faults as necessary.

2nd stage - Programming: Refer to the Programming Manual for details.

HINTS

■ Loop the network through the slave overdoor lights (if fitted) then wire spurs to the call points. This tends to reduce the cable run to the furthest point.

■ If slave overdoor lights are NOT used then the only effect on wiring considerations is that the wiring system's capacity for simultaneous calls is DOUBLED.

■ If four core security cable is used on a limb then 'Doubling up' the cores i.e. 2 pairs of 2 has the effect of doubling the capacity of the limb i.e.twice the length or twice the number of points to the limb in question. This increase in the number of points must be taken into consideration when calculating the capacity of that part of the network.

■ Don't try to economise on network splitters - the more you use the easier & quicker it is to programme/fault find.

■ In order to blow a fuse on the network splitter, a fault must be capable of sinking approx 3 times the rated fuse carrying capacity to guarantee to blow the fuse in a short time. Network splitters are provided with 400mA fuses as standard. Although 400mA is adequate for virtually all situations within this application note, smaller fuses can be sourced (e.g. 200 mA) to accommodate higher circuit resistances. It should be noted, however, that voltage drop problems and circuit limitations may then apply.

APPENDIX 1- VOLTAGE DROP CALCULATIONS

Actual volt drop down the network depends on several factors, namely:

(1) Number of devices connected.

(2) Are overdoor lights being used?

(3) Length and size of cable run.

(4) Total number of simultaneous calls that are to be accommodated.

All these parameters are variable. It is therefore virtually impossible to give an exact definition of what is right or wrong without working out the exact system parameters.

The wiring scenario in this application note is general purpose and, if adhered to, will always give a satisfactory system. If you wish to work out specific cases that are outside the norm you can do so by following the information below.

This data, coupled with the simple application of Ohms law and the amount of simultaneous calls you need to accommodate, is all that is required to yield the correct results. Exact equations are not given as they are extremely simple.

If you cannot work it out for yourself, **DO NOT** use this method as you are unlikely to understand the underlying principles and therefore make mistakes. Use the general purpose scenario instead, putting in larger cable/ doubling up etc.

METHOD

From your analysis of the system it is normally obvious that one particular section is going to suffer the worst volt drop problems. Choose the furthest networked device on this section of the system and work out the volt drop, by:

(1) Using the table below, work out the volt drop using Ohms Law, taking into consideration the required simultaneous call rate that will influence the average current required by the connected devices. Due consideration should be given to the different resistance of the different cables used. Providing the volt drop given by this method is less than 5 volts then it is OK. If necessary double up on the 1mm T&E and/or the security cable cores or increase the size of the cable. Common resistance information is contained within the IEE wiring regs which should be in the possession of all competent contractors.

All figures in mA	QUIESCENT	ACTIVE
CALL POINT CONSUMPTION	4.5	10
SLAVE OD LIGHT CONSUMPTION	0	25
ADDRESSABLE OD LIGHT CONSUMPTION	4.5	25
ADDRESSABLE SOUNDER CONSUMPTION	4.5	25
DISPLAY CONSUMPTION	12	35
RESISTANCE OF SECURITY CABLE PAIR	16 Ohms per 100m	
RESISTANCE OF 1mm^2 T&E PAIR	4 Ohms per 100m	

(2) If call points down a limb are spaced equally then assuming they are all sited halfway down the length will yield the volt drop to the end device on the full length. If you are unsure, assume they are all placed at the furthest point and this will yield the absolute worst case.

SPLITTER CONNECTION RECORD

NETWORK SPLITTER No:	Limb	Device ID Numbers	Length
	1		
	2		
Location	3		
	4		
	5		
	6		

NETWORK SPLITTER No:	Limb	Device ID Numbers	Length
	1		
	2		
Location	3		
	4		
	5		
	6		

NETWORK SPLITTER No:	Limb	Device ID Numbers	Length
	1		
	2		
Location	3		
	4		
	5		
	6		

NETWORK SPLITTER No:	Limb	Device ID Numbers	Length
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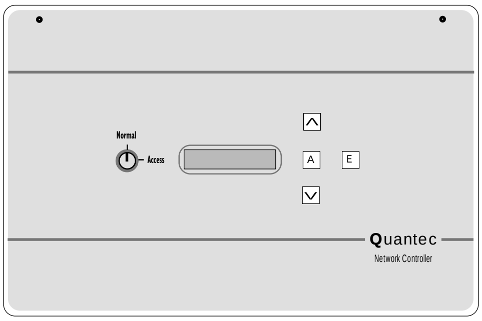
	2		
Location	3		
	4		
	5		
	6		



NETWORK SPLITTER No:	Limb	Device ID Numbers	Length
	1		
	2		
Location	3		
	4		
	5		
	6		

NETWORK SPLITTER No:	Limb	Device ID Numbers	Length
	1		
	2		
Location	3		
	4		
	5		
	6		

NETWORK SPLITTER No:	Limb	Device ID Numbers	Length
	1		
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NETWORK SPLITTER No:	Limb	Device ID Numbers	Length
	1		
	2		
Location	3		
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	5		
	6		