HellermannTyton
Network Sciences

Pre-Terminated Cabling

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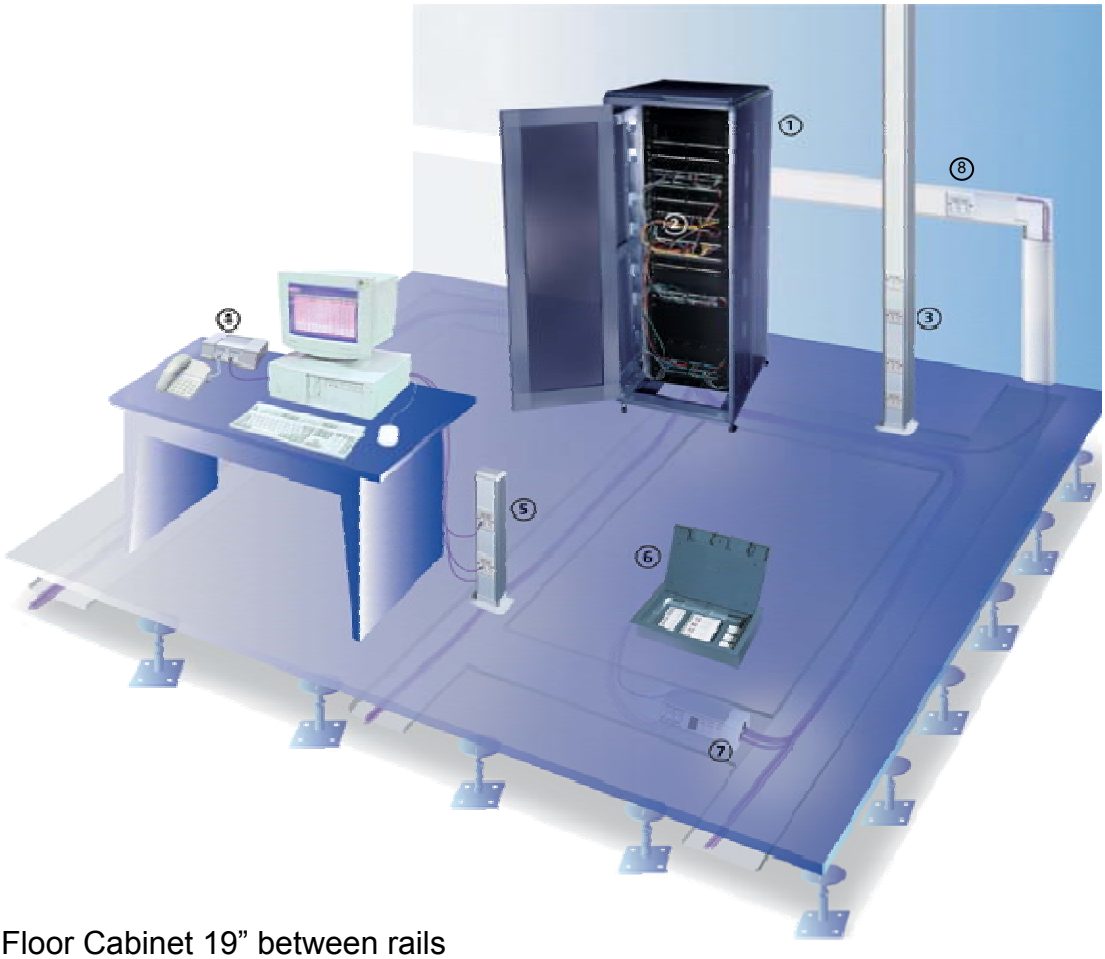
Cabling Overview

Modern office building techniques with raised floors and suspended ceilings have led the way to revised thinking when it comes to structured cabling. The modern office space is no longer a static environment with fixed walls and individual offices, but a dynamic space that can change and evolve with the needs of the company.

The structured cabling system has to be flexible enough to work with these changes with little or no additional costs. The concept of “flood wiring” an office space with a grid of outlets that saturate the office area is not new, but the change to raised floors and suspended ceilings is now making this a far more straightforward process. Most buildings are best supported with a grid of outlets based on $3M^2$ coverage.

To actually install this a substructure of cabling can be installed that allows the fixed cabling to consolidation points fitted under the floors or in the ceilings and adaptable or moveable cabling from these point to the outlets in floor boxes, on desks, or in partitions that can be moved in the future.



1. Floor Cabinet 19” between rails
2. 24 port Patch Panel
3. Service Pole
4. Desk Box
5. Remote Outlets
6. Floor Box
7. Consolidation Point
8. Wall Outlet
9. Flexible Patch Cords

In a conventional structured cabling installation, the cables are “star wired” from the distribution point out to the outlets or consolidation points. Each is installed into the building, followed by the individual outlets at one end and the distribution panels at the other. This process has hardly changed in the last 20 years, with critical termination of very high performance systems carried out in sometimes non ideal conditions.

Pre-terminated or what should be called factory terminated cabling has been around for many years. The copper cabling industry was first with the use of 25 pair cable terminated with “Telco” connectors allowing zone or area wiring in telephone systems. The fibre industry soon caught on to the idea of pre-terminated assemblies to de-skill the black art of optical fibre installation.

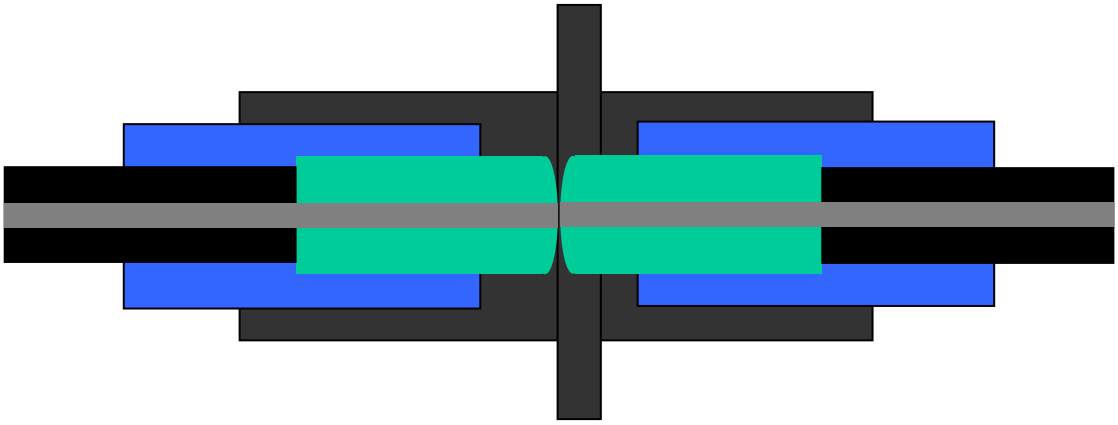
Today the copper cabling manufacturers are moving into pre-terminated cabling to support the ever increasing demand for high quality cabling systems that can support the need for shorter project lead times without any loss of quality in the installation.

Modern office building techniques are changing with many buildings using raised floors and suspended ceilings; this make the use of pre-terminated cabling even easier.

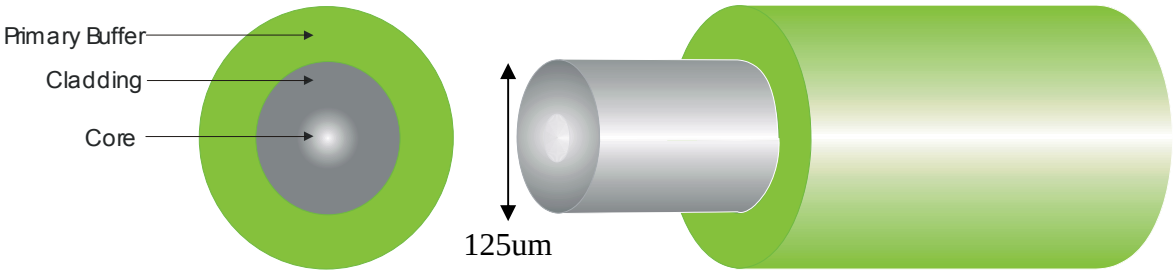
Optical Fibre

Optical fibre is an obvious area to use factory terminated cable assemblies as the termination process has been hidden behind an air of mystery that in reality can be likened to a magician's smoke and mirrors than a highly technical process.

To call an optical fibre connector a "connector" is a misnomer as the connector in traditional optical fibre does not actually connect anything; it is merely there to very accurately bring two optical fibres into alignment with each other and give the required support and latching to keep the two fibres in contact with each other.



The most common fibre today is 62.5/125, the second number 125 denoting the overall dimension of the glass, and the first number 62.5 denoting the diameter of the glass actually carrying the optical signal. To put this into a practical sense the thickness of a human hair is approximately 45µm and any miss-alignment will cause an insertion loss drastically reducing the optical signal. To take this to its extremes, the dimensions of single mode optical fibre is 9/125µm, the inner glass carrier being one fifth the thickness of a singe hair, yet users handle patch cords with gay abandon totally expecting these cables to work every time.



Fibre termination can be split into three categories; Polish, Splice or Jelly. Polishing has been the primary method of attaching connectors to fibre since it was originally developed. Terminating a fibre with a connector is a simple process where epoxy adhesive is injected into a hole in the centre of the ferrule, followed by the optical fibre. The adhesive in the connector is left to harden before the glass fibre protruding out of the end of the connector is cut short and polished to a near perfect finish.

The polishing process is basically a simple one, where the connector is held in a jig perpendicular to the surface of an abrasive paper. Starting with course abrasive paper that to the naked eye is like smooth paper, the majority of the work is completed. Once the basic profile is correct at the end of the connector the abrasive paper is changed to use finer and finer abrasive paper that eventually polish the connector to a perfect dome and mirror like finish with not even the slightest scratch. All this takes time, with the average multi-mode termination taking between 10 and 15 minuets to complete and the slightest partial of grit of dirt spoiling the termination process, requiring the person terminating the fibre to start from the beginning.

The set up cost involved with terminating optical fibres is very high, Polishing Jigs for each type of connector, Polishing tables made to give the perfect base to work on, Microscopes to inspect the connector during the process, Power loss test equipment and worst of all OTDR test equipment added together will be at least £20,000 for a basic kit.

The high costs and the inherent difficulty of producing the near perfect termination on fibre has lead to this process being carried out in virtual clean environments, and by skilled people who spend their time visiting installation sites terminating cable that was “pulled in” by the main contractor. Sub contracting the termination of optical fibre has been the norm for many years, but is expensive as these specialists demand high prices to cover their investment in equipment and their expertises.

On site termination of fibres will rarely give perfect results, and will have insertion losses considerably higher than factory terminated fibres. The high prices demanded by on-site termination and the lower performance obtained from the termination lead to an advancement in the way optical fibre was installed. A method of welding or more correctly fusing two pieces of optical fibre together was developed; called “Fusion Slicing” an electrical spark is used to heat the glass causing the two ends of the optical fibre to fuse together, giving incredibly low losses. This process is idea for linking together long runs of fibre reducing the number of connection points in a system, and is used extensively in the telecoms industry.

The off shoot of this process was to give the possibility to use pre-connectorised optical fibre cable assemblies called pig-tails that were manufactured in clean factory environments to give near perfect results. These are then fusion spliced within the distribution rack to the main optical fibre cable, and the combined losses of the fusion splice and the factory terminated connectors are still lower than a hand terminated connection, with lower costs, and faster installation.

Unfortunately the cost of fusion splicer is very high, initially the cost was well over £20,000 but with today improved production process the cost has fallen to around the £6000 mark, and with a low cost OTDR costing similar amounts a complete set up can be obtained for £13,000. This may be a big reduction in costs, but it is still far too much for the average communications installer.

Several years ago some telecommunications companies looked at simple mechanical splices, which used a very basic polishing process, and the used

of a jelly that matched the optical qualities of the glass. These allowed very fast repairs of damaged optical fibres, before a permanent repair was made. These mechanical splices have improved over the years to give a simple low cost alternative to fusion splicing, with minimal set up cost. The installers still require the used of OTDR and power loss test equipment, but the overall cost is dramatically reduced to around £7000.

The technology within the mechanical splice has given a spin off, the simple virtually tool less, pre-polished optical connectors have been designed, that allows for a fibre to be accurately cut, slid into the jelly filled connector and fastened with a simple compression joint to the cable. Again the installer requires the same test equipment to certify the performance of the system, but the speed of the process makes this very popular.

Although the latest generation of mechanical splice and clip on connectors, give quite low insertion losses, they are no where near the quality and performance of fusion splicing, and the longevity of the splice has been put under question as the jelly used has a finite life before its degradation reduces the performance of the splice.

Several companies have been looking at the fibre installation market, starting from the beginning. The obvious answer to keep termination quality high and install costs down is to use pre-terminated fibre cables. This does require the installer to do accurate site surveys to ensure they order the correct length of cable, but the finished assembly will give the installer and the end used an assurance that the performance of the system is perfect.

Produced in clean room environments, using specialised factory equipment; each connector is perfectly polished to give very low insertion losses. There is no need for fusion splicing, and although this gives very low losses there will always be some, and the removal of this slice improves the overall performance of the system.

Once completed the cable assemblies are factory tested with a report issued along with the cable. The installer has the relatively simple task of installing the assembly, fitting the pre-terminated connectors into the patch panel and carrying out a basic loss test to the fibres. The installers require a basic education of how to install fibre, and how the connectors are fitted to the distribution panel. Taking the skill out of the project allows the use semi-skilled trade’s people, keeping the installation costs to a minimum.

The distribution panel is the Achilles heal of this system; semi skilled personnel can be used for this whole process, but the inherent fragility of glass and optical fibre can cause problems. Rough manipulation the terminated fibres once the protective sleeve has been removed, will cause damage, and the cost of getting optical fibre specialists into repair the damages, will far outweigh the inherent savings. The simple answer to this is to produce a system where the delicate optical fibres are never exposed. Several systems are produced that enable this, some using a multi fibre connector, others using small patch panel modules that can slot directly into the distribution panel.

The multi fibre connector has been around for some time, this allows for small modules or patch panels to be pre-installed with connectors in a clean environment, and the main fibre is terminated with a small connector that can support up to 12 fibres. The installer pulls in the main fibre, removes the protective cover from the multi fibre connector, and makes the connection with the panel of module. This give what seems an ideal solution, but the losses across the special connector are very high, usually over 0.5dB each end, a considerable loss for high bandwidth protocols to handle.

The final option is where the cable assembly terminated with a small patch panel module that is sealed at the time of termination, protecting the delicate fibres from damage during installation. The installation is simple, and the chances of damage to the fibre during installation are very low, but the most important factor to the installer is the installation time. This kind of solution can reduce the installation time of a fibre link by over 50% from the conventional pigtail and splice method, and the performance of the system will benefit from the reduction of two splices. This solution has its merits where guaranteed performance, quality of termination, compliance to standards and low installation time are the critical factors. In a time when electrical installers are looking to offer the complete solution of cabling within a project this seems to offer them the best solution. Copper cabling may seem to be easy when compared to the intricacies of optical fibre; but the pitfalls of poor termination in copper systems can be a drain on the time and resources of the installer.

Copper Cabling Systems

Copper systems have become more and more performance dependant on the skills of the installer. Gone are the days when providing the wires were in the correct position the system would work flawlessly. When it comes to performance the current generation of cabling systems are totally installer dependant; too much untwist of the pairs can cause excessive cross Talk, where as too tight on the twists can cause problems on return loss. In the past an installation that had been tightly fixed into place with cable ties every few feet would have been held in high regard. Now too many or too tightly fixed cable ties will cause performance issues and the best system is one where the cables are laid loosely with minimal fastenings.

Testing has gone from the simple continuity test to use of devices that only 5 years ago were dreamed of even in the test laboratory. Only three years ago the Category 6 were considered fast when they tested 9 different complex tests in about 60 seconds; the current versions of Category 6 testers can test a multitude of complex tests in a matter of 12 seconds.

Where as optical fibre has the four basic fibre types (OM1, OM2, OM3 and OS1), copper has four performance levels of Voice, Category5E, Category 6 and Category 7 covering the technology requirements of simple analogue voice systems all the way up to 1.2Ghz High band width data and high definition video systems.

The technology for interconnecting thee cabling systems has not really changed in the last 20 years with the ubiquitous RJ45 being the mainstay of the interconnection market. In the telecoms industry British Telecom has been

using a six pin, side latched connector for many years but even this is being superseded by the RJ45.

Originally designed as an over sized version of an American telephone connector that had 4 or 6 connections, the RJ45 with its 8 pins started as a 4Mhz datacomm connector. With the various changes in networking protocols, this simple connector has be modified, adapted and tailored to the point it can now support 500Mhz 10Gb networking protocols; and in its customized Category 7 form can support 1.2Ghz systems.

Virtually all copper systems use insulation displacement connectors (IDC) to make the connection between the cable and the panel or outlet. This is a simple and fast way of terminating copper cables buy using two metal blades separated by a small gap. The insulated copper wire is pushed between the blades “displacing” the insulation allowing the blades to make contact with the inner copper conductor. There are several versions of IDC connector used within the Data and Telecommunications industries, but in the main two versions “Krone” and “110” cover 95% of the market. The tools required to work with these connections cost around £20 each, so kitting out a team of installers for a project is relatively inexpensive.

Testing of the connector has changed almost as much as the connector itself. In early standards the connector was tested in isolation to the cable it was required to terminate, causing many challenges when the system performance was discovered to be below the required levels. It became common place to have systems on the market that would only perform when installed with products from the same manufacture. Wow betide any installed that mixed panels from one supplier with cables or outlets from another. Finally 5 years ago with the advent of Category 5e and Category 6 standards did the testing specification fix the performance of the system components to ensure each manufacturer was inter-mateable with other manufacturers’ products.

The development on what was a 4Mhz connector into the Category 6 or even the 6a 500Mhz connector has made the termination process very critical. In early structured cabling systems an “installer” could have one or two hours of training and would happily be allowed to terminate the cables being pulled into the project. Today it is common to have the installation teams are split into two defined teams; cable pulling and laying and the termination, with the skilled termination engineers earning 1.5 to 2 times more than the cable fitters.

Whilst not as time consuming as traditional fibre termination the expertise required to ensure a perfect termination of a copper Category 6 connector far exceeds that of its optical equivalent.

Testing copper systems can range from a simple continuity tester that confirms correct pair alignment, through Class2/3 cabling analysers that give reasonably accurate compliance tests in sixty seconds; to the current highly accurate and high speed Class4 analysers that can test all of the parameters required to certify the cabling system to the relevant TIA or ISO standard in less than 10 seconds.

Testing is a slow process requiring at least two installers to work through the entire installation, testing each run of cable or port. The test analysers come in two parts, one master unit that displays and stores the results and the slave unit that completes the two way test procedure with the master. One installer needs to positioned at the distribution panel whilst the other walks around the building locating each outlet in turn. As each outlet usually has between 2 or 4 cables terminated, the walking installer needs to be in direct contact with his partner to ensure they are connected to the correct port of the outlet. Finding each outlet can take 2-3 minutes, and then adding the actual test time can be as long as an additional 2 - 4 minutes depending on how many ports each outlet has. With just 100 double outlets on a small installation the testing time can be as much as 17 hours of the two man team, but using the latest Class4 analysers this will be reduced to 12 hours. Now take these numbers onto to a large modern office complex and the testing can take well over a week of the two installer's time. Costs of these tester range from tens of pounds up to around £5000 for the latest high speed system Class4 analyser. Many smaller installers are still using the older and slower class2/3 analysers but with the testing times for each outlet in excess of 60 seconds it only requires one or two 2-3000 point installations to warrant the upgrade to the latest versions.

Working on site is never easy, and cold temperatures or just pure human nature soon shows its ugly head during an installation, where the dreaded Monday morning and Friday afternoon disease strikes leaving outlets incorrect terminated. It is common during the testing process to find up to 10% of the outlets incorrectly terminated forcing the installers to return to rectify the poor workmanship, and finally re-test to show full compliance. Even with the modern high speed testers, the compliance testing and error rectification part of a project can add 1-2 weeks to a 2000 port project.

Projects are always tough to keep on schedule, and with the IT infrastructure one of the last parts of a building project to be carried out; it is usually the item that gets the most pressure to finish on time even though it is common for the installation to start late. A 2000 point installation using today's category 6 cabling systems will take approximately 31 days for two men to install; 25% of this re-work and testing. Finding ways to reduce the installation time is often the main concern for the installers; and when the project is running late reducing installation time is essential to reduce the risks of finishing late and being hit with penalties.

The tables on the next two pages show the time and labour cost comparisons of traditional cabling against pre-terminated cabling. The times used are based on a UTP category 6 project of 1992 outlets installed in floor boxes. The labour rate for a fully trained and experienced cabling installer is approximately £24 per hour. The labour rate for a semi-skilled installer is approximately £12 per hour. The labour rate used in the traditional cabling is based on two fully skilled installers. On the pre-installed cabling the labour rate used is based on one fully skilled installer and one semi-skilled installer.

In reality on a project this size it would be common to see an installation team double this size to ensure the project finished in as short a time as possible due to overall project time constraints affecting the delta even further.

Labour Comparisons For a project With 83 x 24 Way Patch Panels (1992 Points)

	Time (Man Hrs)		Assumptions & Comments	
Cabinet	**Traditional**	**Pre-Terminated**	**Traditional**	**Pre-Terminated**
Load Patch Panels	4.15	0	Panels Use Cage Nuts & Screws 3min PP	
Load Panel Frames	0	4.15		Panels Use Cage Nuts & Screws 3min PP
Termination	103.75	0	1.25Hrs Per Patch Panel	Included In Product Cost
Fix Cartridges	0	2.8		30 Sec Per Cartridge
Dress Cables	16.6	5.5	30 sec per cable	1 Min Per Cartridge
Rear label	8.3	0	15 sec per cable	Labels fixed in production
Front Labels	5.5	0	10 sec per Port	Labels fixed in production
Cable Install				
Install Cables 50 mtrs in tray	83	55.3	10 mins per 4 cables	10 Mins per Loom
1992 Outlets (332 Floor Boxes)				
Termination	110.6	0	20 Minutes Per Box	Included In Product
Fix and Dress	16.6	5.5	3 Minutes Per Box	1 Minutes Per Box
Label	8.3	0	1.5 Minutes Per Box	Included In Product
Testing				
Continuity Tests	0	27.6	Not required	2 men 30 Sec per point 1660 (1992 - 332)
Rework	16.6	0	10% of all ports 200 ports 5 mins per port	Not Required
Certification Tests	66.4	5.5	2 Men For 11Hrs (1Min Per Point)	2 men 1 min per cassette = 332 ports
Rework	4	0	2 Men For 2 Hrs (No Guarantee)	Guaranteed Pass From Factory
Totals	**443.8**	**106.35**	**4.2**	**:1**

Other Issues

These are actual working Man Hours. They Do Not Include Travel Times and Non Productive Times

From The Example Above if 2 Engineers install and certify the site.

A site engineer will spend at least 10% of their time non-productively and at least 1Hrs of their day travelling

	Traditional	**Pre-Terminated**	
Installation Time	443.8	106.35	Man Hours
Non Productive Time	44.38	10.635	Man Hours
Total	**488.18**	**116.985**	**Man Hours**
Travel Time			
Days On Site (8 Hrs Per Man Per Day)	30.5	7.3	Days
Travel Time	61	14.6	Man Hours
Summary			
Total Man Hours	549.18	131.58	Man Hours
Installer Labour Cost Per Hour	£24.00	£18.00	/hr
Installer Labour Cost	**£13,180.32**	**£2368.44**	

Today many manufacturers are looking at ways to assist the installer, producing easier to terminate jacks that reduce the risk of termination errors. New methods of pre-loading the wires of the cable into a carrier before pushing all 8 wires into their corresponding IDC allow the installer the opportunity to double check the wires are in the correct position before termination. In reality the installer should be doing this with conventional IDC termination methods, but human nature dictates that at times when people are under pressure mistakes happen.

Like the optical fibre market some manufactures are looking are the copper cabling market in a totally new way. The first big change is the way the cables are manufactured and instead of shipping the cables in single elements, the cables are produced in multi elements. Dual element shotgun and quads have been around for many years, but now many companies are developing cables with 6 elements in a single cable. New constraints from the standards covering alien or what should be called exogenous cross talk (electrical noise from adjacent cables) are forcing the manufacturers to design these cables that reduce the cross talk form the other cables to a minimum.

These new multi-element cables reduce the amount of time it takes to install the cables, allowing six or more cables to be installed at the same time. They still require terminating in the same traditional way, but this considerably reduces the installation time.

By using these same multi element cables in factory pre-terminated units the installation time can be reduced even further. The challenge is to overcome the way the panels and outlets are presented in the installation. Like optical fibre copper manufacturers have been producing small patch panel modules for some time. These small modules are now being used in cassettes to produce protected pre-terminated copper cabling systems that are easy to install and protect the terminations during the installation process. The modules are ideal for use in the distribution panels, but the same techniques can be used in to outlets pre-terminated to multi-element cables to reduce installation time to a minimum.

These pre-terminated systems can reduce the time to install a cabling system by 75% by transferring the termination and testing labour time back to the factory. The factory terminated assemblies dramatically improve the quality of the termination process. Sitting in warm comfortable surroundings the people terminating the cables can reproduce the perfect termination time after time, but when errors do occur, the testing process will ensure that only perfect assemblies get to the installation.

There are constraints with pre-terminated systems; the Multi-element cables generally take up slightly more room that their single element cousins. The cassettes and terminated outlets dictated the size of any access hole the cables need to be passed through. The main concern with any pre-terminated system be it copper or optical fibre is the fact that the site needs to be accurately surveyed before the assemblies are ordered. Having an assembly

2 metre too long is easy to overcome, but the opposite could require a new cable being ordered.

Each of these problems is not insolvable, and with care and careful planning the change over to this new technique can be made in a painless manner.

Many new office building utilise raised floors and suspended ceilings along with partition walls over prefixed carpets. This modern way of laying out offices is ideal for the new pre-terminated solutions; raised floors, simple access make it the ideal home for the pre-terminated cabling systems. In these new complexes where walls or partitions can be moved to solved today's needs, but may need to change to meet tomorrows requirements; a new approach to cabling is required. Using simple under floor boxes, or boxes fixed in the ceiling space, a skeleton cabling can be installed using the pre-terminated cabling systems, with the last 3-5 metre of cables run from the under floor, or ceiling box into the partition wall or furniture.

Using the pre-terminated cabling system massive time savings can be made. Using the 2000 point project discussed earlier, the conventional system will take at least 31 days for two people to install. The same system using a pre-terminated cabling system would take only 8 days with the same two people.

Project realities

On an installation there are four groups of people; The End User/Client, The Consultant, The Prime Contractor and finally the Installer. Even though they are all working to the same goal their priorities and requirements differ from each other.

The End User/Client wants a system that meets their needs for today and for the foreseeable future. It has to be competitive and have the backing of a substantial guarantee supporting the manufactures claims; but most of all they expect the system they choose to perform as promised by the manufacturer.

The Prime contractor is more interested in the project schedules; ensuring that any changes to the program of works or conflicting priorities of the project can be met. To them the IT infrastructure is just a part of the whole project and getting the project finished on time and on budget is paramount. They have a multitude of services to bring into the project each with its own needs. One of the biggest challenges for the prime contractor is the competition for floor space from each of the disciplines, and any reduction in the time required or the amount of people on site is a great advantage.

The IT Consultant has a priority to meet the end users expectation; assisting with the choice of cabling system and even appointing an experienced installer. They need to be sure the installation when completed will meet the needs of the total IT network. Having a system that has the best quality with a comprehensive and professional hand over documentation makes their job considerably easier.

The installer has the toughest priorities; they need to meet every one else's requirements. Changes in program or schedule that require extra sub-contracted labour have their own challenges as differing skill levels lead to increased supervision and variations in the quality of the installation. They have to be sure their people can produce good work day after day with minimal errors.

Pre-terminated cabling solves a multitude of challenges to each of the four groups. By it nature of requiring accurate site survey, leads the installer to know the project site before the installation starts. Traditionally many installers have a walk through a project with the end user or consultant before the project starts, but rarely does the installer go into absolute detail with each of the four groups before a project starts. Traditionally may small issues will only raise their head during the cable laying process; insufficient tray work, small access points, drawing not up to date and even changes to the design of the building can go un-noticed before the project stats. The action of surveying the site or drawings of the site with the end user, consultant and the main contractor before the pre-terminated assemblies are ordered brings many issues to a head long before any cable is laid.

The End user can be sure with a pre-terminated cabling system that the performance will be exactly as promoted by the manufacturer. Being terminated in the factory and tested to ensure it meets their specifications, the manufacture will have no issues with offering a full system warranty.

The Main contractor will be aware that many of the challenges that can delay the IT infrastructure have been already removed during pre-project surveys. The reduced number of people over a shorter period of time allows the main contractor to stay on schedule. The reduced number of people on site has added benefits, reducing many health and safety risks on the project. The reduced installation process of the multi-element cable allows other services to get onto to site far earlier that traditional cables would allow. An additional benefit to pre-terminated cabling is the intrinsic tidiness; traditional cabling will involve many short lengths of cut cable and small pieces of wire scattered over the floor. This needs to be cleaned away at the end of each day but during the installation process can lead to health and safety issue, and has led to many impromptu site meetings to discuss the mess and waist made during an installation where other services have to work.

The IT consultant gain significantly from the use of Pre-terminated cabling; guaranteed performance and termination quality, with full testing documentation delivered directly from the manufacture at the end of the project. The consultant's reputation is at risk with each project and even the best system can be spoilt by delays or poor performance caused by poor termination.

The installer may see pre-terminated cabling as a threat to their business as it reduces the amount of work gained in each project; the ability to use the same installation team in up to four projects in the time one traditionally cabled project would take easily makes up for the changes in the way each project is

costed. Like the main contractor the lack of waste and mess saves a significant amount of time during a project. The virtually zero waste saves on costs is several ways; in traditional cabling many hundreds of metres of cable is wasted due to the process of termination and finding unusable short lengths of cable left on reels; all waste has to be disposed of and today's environment conscious times means all mixed waste has to be disposed of by using very expensive waste disposal services. The use of semi-skilled work force with skilled supervisors can save considerable amounts of money on a pre-terminated project; the removal of the need to terminate the cables leads to the majority of worker on site being cable pullers rather than skilled termination engineers. In many projects installers are held to penalties for running late; having a system that removes the need for time consuming error correction and reduced testing time can be the difference in finishing on time or being forced to pay out large late penalties.

Several new markets have developed over the last few years that make pre-terminated cabling the ideal choice. Although designed to be installed and left in place, the modular nature of these systems allows the cables to be removed and re-used in another location.

The data centre is a growing area where the need to make moves adds and changes on a regular basis makes pre-terminated optical fibre and copper the idea choice. Cables being used from cabinet to cabinet connecting servers to switches and routers can be removed and re-positioned as required; saving thousands in re-cabling or modifications.

Disaster recovery is an area that has used a form of pre-terminated cabling for some time. The new generation of cabling gives the disaster recovery companies access to pre-terminated looms loaded onto reels, for them to store and use when needed. Once the disaster is over the assemblies are simply wound back onto their reels ready for the next time.

In the same way as disaster recovery companies use pre-terminated cabling, special event companies use temporary cabling to support Media information and General IT infrastructure around the events. In a recent international tennis tournament pre-terminated cabling was used for the first time; in previous times the cabling was lead out, terminated and at the end of the event, scrapped. The pre-terminated cabling was used, re-packaged back onto their reels ready for the next event. It was calculated that the assemblies both copper and fibre will pay for them selves several times over. With many special events and especially the Olympics being held in the UK, pre-terminated cabling can be used to give a saving of cost and a reduction in waste.

It would not be fair to say that pre-terminated systems will replace traditional cabling systems. Small projects or even large projects where there is no time or working constraints will stay with traditional cabling systems. Many older buildings have to be installed in such a way that there is little advantage to using pre-terminated cabling, but there are few projects that this modern "next generation" of cabling systems will not have added benefits.