Comparison of Cabling Marking Techniques
Software-based versus dedicated printers

1.0 Introduction

There are essentially two different ways to properly mark cables and associated hardware. The first is to use a dedicated printer with durable tape-

cassette labels and an integral keyboard. The second is to use a software-based package that formats the labels on screen and then prints them

out on a standard laser printer on to specially made A4 or US letter pre-formatted label sheets.

It is a requirement from the Standards, e.g.

- **ANSI/TIA/EIA-606-A**
  Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

- **EN 50174-1**
  Information technology – cabling installation – Part 1:Specification and quality assurance

- **ISO/IEC 14763-1:**
  Information Technology – Implementation and operation of customer premises cabling – Part 1:Administration

- **TIA 942**
  Telecommunications Infrastructure Standard for Data Centers

and

- **BS 6701:2004**
  Telecommunications equipment and telecommunications cabling — Specification for installation, operation and maintenance

… that all cables and components be suitably marked to uniquely identify them. The durability of all labelling must also be suitable for the rigours of the environment in which they are placed and the expected timescale of the installation, usually in excess of ten years.

This project compares the time taken, the capabilities available and associated costs involved by using three leading hand-held dedicated printers

and a leading software package.

2.0 Market availability

Table 1 shows the market leading products from both the software-based and dedicated printer camps.

Table 1

Manufacturer	Hardware Printers	Software
Brother	P-Touch 65	
Brady	IDXpert	
Dymo	RhinoPro 5000	
Silver Fox		Labacus Innovator
Sharpmark		Sharpmark v 3.10

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3.0 Method

Three dedicated printers, the Brother P-Touch 65, the Brady IDXpert and the Dymo RhinoPro 5000 were trialled alongside the software-based Silver Fox Labacus system. In the latter method the labels are prepared on a PC running the Labacus software and then printed out on a standard laser printer. The labels are ordered in A4 sheets according to the requirements. Labels can be self-adhesive polyester for patch panels, wrap around self-laminating polyester for cables or cardboard for wall outlets and terminal blocks. For comparison the Sharpmark V3.10 software was also trialled.

The three dedicated printers vary in size and cost and of course capability. All work on the method of installing cassettes of continuous tape and thermally printing onto that tape. Small LCD screens and alphanumeric keypads allow the label text to be entered and then printed.

In each of the four cases the times taken to prepare 24 labels for a standard 1U, 24-port data patch panel were recorded for each of the four methods. Using the general distribution pricing for labels, and an allowance of £25 per hour for labour, a cost for labelling one 24-port panel was derived.

From this figure the cost of labelling for a 10,000-port project could be extrapolated. This model takes an extremely simplified view of numbering however. The Brady and Dymo labelling machines can only sequence one field at a time (the Brother P65 doesn't autosequence at all), whereas TIA 606 and TIA 942 require numerous fields which may be independently sequenced. This would be an absolutely laborious task to do on a labelling machine in a large project.

The Brady IDExpert and the Dymo RhinoPro 5000 can autosequence any number from 0 to 99 and any letter from A to Z. This in theory gives a huge range but it means that the numbering scheme would have to follow what the labelling machine can do, whereas a real 10,000 port installation would be unlikely to have everything numbered neatly from 1 to 10,000. In reality the numbering scheme identifies port locations and destinations which would usually change from one rack to another, meaning that the labelling machine would have to be set up again after every 24 ports and then again after every 24 patch panels or so, as few racks are loaded, in practice, beyond 24 patch panels.

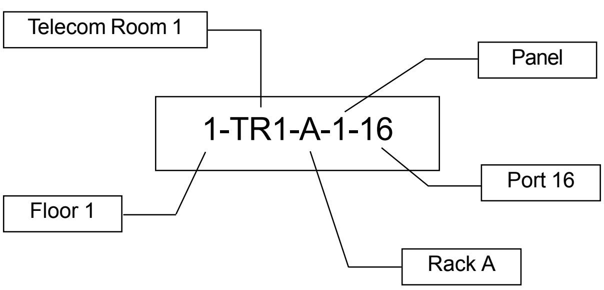
The biggest problem comes from multi-field labelling and sequencing, i.e. where there are two or more independent fields on the same label that require sequencing as would be seen in all classes of TIA 606 installations. The appendix to this report gives a synopsis of ANSI/TIA/EIA 606-A and TIA 942 labelling requirements.

For example, the designator for the simplest horizontal link is fs-an

Where,

- -f identifies the floor
- -s identifies the telecommunications room or space on that floor
- -a represents the location and number of the patch panel
- -n is the port number on that panel

So even a simple example needs five fields.



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So imagine if this 10,000 port job requires 2,000 outlets over five floors, with one telecom room on each floor with 4 racks in it, and associated backbone cabling. The set up on the PC based system, in the comfort of your office, would be;

- Set up the field as shown
- Select the patch panel manufacturer to get the right pitch on the printout
- Cycle the floor field from 1 to 5
- The TR1 field stays the same, as there is only one per floor
- Cycle the rack field from A to D
- Cycle the panel field from 1 to 22
- Cycle the port field from 1 to 24
- Load a pack of patch panel labels, appropriate to the manufacturer used, into your laser printer and print and save the file
- Format the same numbers into the wall outlet label design, load correct label sheets into printer and print.
- Format the same numbers into the cable label design, load correct laminated label sheets into printer and print two copies.
- Take all 40,000 labels to site and apply.

Now to do the same with a leading dedicated printer:

- First load a continuous label cassette. Then calculate the pitch required to get an eight-label block to match the patch panel being used.
- Check batteries are charged or plug in mains adaptor
- Enter the label length
- Enter the field as above
- Set the cycle on the ports field from 1 to 8
- Print out a block of 8
- Reset the port field from 9 to 16
- Repeat for all ports on that panel
- Repeat for all ports on the next 22 panels
- Repeat for all the panels and all the ports for the next rack
- Stop every 12 panels and put in a new tape cassette
- Repeat for every floor
- Change cassettes and repeat for all outlet labels
- Change cassettes and repeat for all cable labels, twice. Cable and outlet labels can be printed out 24 at a time before resetting the counter for the next patch panels.

This makes 2500 operations to reset the counters and print out blocks of labels.

So with 10,000 ports, that's 10,000 numbered patch panel ports, 10,000 wall/floor outlets and 20,000 cable labels, i.e. one at each end of the cable, 40,000 labels in all, plus there would also be a requirement for labelling the backbone cabling, earthing system, containment and even firestops.

4.0 Results

Table 2 shows the results of the trial. The Brother P-65 is an adequate and low cost machine but hampered by the lack of an auto number sequencing facility. This means that every single identification number must be individually entered. The Brady and Dymo machines, plus the software-only methods, all facilitate auto sequencing whereby the common part of an ident is entered and then the ranges of any variables can be entered e.g. 1 to 24 for a typical patch panel. The machine then automatically prints out the next sequential 24 labels. The software variant does the same thing but on a larger scale as the entire project is prepared on-screen before printing starts.

Table 2 tabulates the set up time for each method on our 10,000 port example project. The Brother P-65, with no autosequencing and a fairly slow printout, would take about five weeks of labour to fully label up this job. There are no self-laminating labels with the Brother printer and so would not be a serious contender anyway for a cable-labelling project.

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The Brady and Dymo are far more sophisticated and have a range of suitable labels and a limited autosequencing and multi-element or segment capability, although only one element can be changed at a time before printing, e.g. all the patch panel ports from 1 to 24 would have to be printed out before anything else could be changed on the autosequence segments. For these machines, the patch panel labels could be printed out in units of eight, for a typical 3 x 8 24-port patch panel, then in blocks of 24 for the outlet and cable markers. Between eight and ten days of labour would be required using this process.

A PC-based labelling system is by far the most efficient means of label production. It takes about a minute and a half to set up any numbering scheme as may be seen in all four levels of the TIA 606A, or beyond. Label registration is automatic by selecting from the menu which patch panel from which manufacturer is being used, and then the appropriate label sheets are loaded into a laser printer, where they can all be printed in one go.

The ten thousand-port project would require less than half a day of set-up and printing on a PC-based system but more than a week using dedicated printers. The standalone printers are dedicated to that task, and if it breaks, or the batteries run out, then there is no other alternative and this suggests that extra machines need to be bought purely for backup. A PC based system could be spread over a number of PCs and laser printers to reduce dependence upon any single machine and reduce the actual time taken even further.

Table 2

Manufacturer	Product	Set up time per operation (seconds)	Time per label (seconds)	Average price per label	Machine Cost	No. of setup operations in a 10,000 port job	Time spent on label preperation (hours)	Total cost over 40,000 label including machine
Brother	P-Touch 65	17	5	£0.031	£22.99	30,000	197	£6194
Brady	IDXpert	70	2.9	£0.058	£304	2500	81	£4645
Dymo	RhinoPro 5000	58	2.4	£0.05	£89	2500	67	£3763
Silver Fox	Labacus Innovator	100	0.13	£0.03	Free for basic Standard program	3	1.6	£1240

-Silver Fox: based on printing full pages with 320 labels per sheet plus ten seconds to change sheets
-Labour charged at £25/hour
-Brother and Dymo labels are not self-laminating cable labels

The results show that the Brother P-65 takes a long time due to the lack of auto sequencing whereas the more sophisticated Dymo and Brady products gave similar results on a reduced time scale. The Silver Fox Labacus was the fastest method of all and the overall cost for the 10,000-port project was less than one fifth that of the slowest hand-held printer and still less than an one third of the cost of the fastest hand held printer.

5.0 Capabilities

The two methods have many similar capabilities but also many differences. Table 3 and Table 5 give more detail. Table 3 gives more details of time taken and also comments on the label types available. The hand-held printers will always be limited to a cassette-style approach, and the Brother P-65 only has a modest number of tapes available.

Another issue is related to saving the work done. Any amount of label data can be stored in the PC-based systems. The best of the hand-held printers can store 10 formats, but each time an auto sequence segment changes this would be seen as new item to be stored, so only a representative number of label formats could be stored for the large 10,000 port project, not all of them.

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6.0 Labels

Only a software-based system can offer polyester labels for panels and components, wrap-around self-laminating labels for cables and paper and cardboard labels for wall and floor outlets and terminal blocks. Any kind of material that can be formed into an A4 or US letter sheet, and is laser printable, can be used in a software-based system.

The labels must also be of a suitable durability and must be smudge and smear proof as soon as they are made, will not fade over time or rub off, will not peel or loosen and will survive large temperature swings, moisture, common solvents and UV light. None of the labels tested appeared to have any problem adhering to metal or plastic surfaces but all labels used in the IT environment should have test data and approval associated with them to guarantee long term longevity.

Table 3

Manufacturer	Product	Sizes and types available	Wrap around laminating polyester cable labels available?	Paper labels for outlets and terminal blocks?	Auto-numbering option
Brother	P-Touch 65	12	None, but standard labels can be wrapped	No	No
Brady	IDXpert	83 (inc colour options)	Yes	No	Yes
Dymo	RhinoPro 5000	16	None, but standard labels can be wrapped	No	Yes
Silver Fox	Labacus Innovator	58+ colour options	Yes	Yes	Yes

7.0 Conclusions

All of the products tested can produce adequate labels for patch panels and associated IT equipment. However the simplest hand-held printers have a very limited range of labelling materials and would take an exceptionally long time to implement in a large project.

The more sophisticated printers offer a wider range of labels and general on-board facilities and can produce labels much quicker. However none of them come close to the speed and low costs of a good software-based labelling package, and the larger the project the more cost effective software-based packages become.

There will always be a place for the hand-held dedicated printers in cable installation projects but their use is best limited to smaller jobs and ad-hoc printing requirements. Larger jobs can be much better managed, and at a lower cost, using a PC/laptop and laser printer combination with labels dedicated to the environment.

Even better optimisation is possible with software-based systems that offer labels pre-cut and dedicated to a range of specific manufacturer's products. More time can be saved by this approach compared to generic labels as the exact pitch between label positions for different manufacturers panels is already loaded into the software and can be seen for example in products like the Silver Fox Labacus Advanced edition.

Sophisticated PC-based packages like Silver Fox Labacus Professional also offer spreadsheet manipulation that works with CAD output and can accept e-mailed jobs guaranteeing 100 % accuracy of the information – this is particularly useful for critical installations or even cross border contracts.

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Table 4

Function	Silver Fox Labacus Innovator	Brother P65	Dymo RhinoPro 5000	Brady IDXpert
Intuitively guides through label building process	✓	Must read manual but some intuitive guidance is on the keypad		
Intuitive Template Browser	✓	✗	✗	✗
Dedicated Official OEM Templates	✓	✗	✗	✗
User-Define Label Templates	✗	✗	✗	✗
Context-Sensitive Help System	✓	✗	✗	✗
Sequence Tool	✓	✗	✗	✗
Add Symbols	✓	✓	✓	✓
Adjust Font Size & Style	✓	✓	✓	✓
Automatic size-to-fit of Fonts	✓	✗	✗	✗
Build Editor	✓	✗	✗	✗
Change Test Alignment	✓	✓	✓	✓
Change Viewing Scale	✓	✗	✗	✗
Copy Job from one label type to another	✓	✗	✗	✗
Job Notes Facility	✓	✗	✗	✗
Field Splits (Horizontal)	✓	✗	✓	✓
Field Splits (Vertical)	✓	✗	✗	✗
Fine-Tune Printing	✓	✗	✗	✗
Import .csv Files	✓	✗	✗	✗

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Table 4 (continued)

Function	Silver Fox Labacus Innovator	Brother P65	Dymo RhinoPro 5000	Brady IDXpert
Integrated Tutorials	✓	✗	✗	✗
Save Job	✓	✗	✓	✓
Open Saved Jobs	✓	✗	✓	✓
Print Page Number & Date	✓	✗	✗	✗
Print Title of Job on Page	✓	✗	✗	✗
Set Measurement Units for fine-tune and calibration	✓	✗	✗	✗
Start-at-line Facility	✓	✗	✗	✗
Automatic Web Update Facility	✓	✗	✗	✗
Barcode Support	✗	✗	✓	✓
Multiple Open Files	✗	✗	✗	✗
Rotate Text	✗	✓	✓	✓
Import .bmp Graphics	✗	✗	✗	✗
Copy & Paste from any open Windows applica-tion	✓	✗	✗	✗
Printer Calibration	✓	✗	✗	✗
Sub-Templates	✓	✗	✗	✗
Links to website on software	✓	✗	✗	✗
Links to website in Help File	✓	✗	✗	✗
Download Software from Website 24/7	✓	✗	✗	✗
Buy Software from Website 24/7	✓	✗	✗	✗

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Appendix I

A summary of the TIA 606 and TIA 942 labelling and administration requirements

The ANSI/TIA/EIA 606-A Standard specifies administration for a generic telecommunications cabling system that will support a multi-product, multivendor environment. It provides a uniform administration approach that is independent of applications, which may change several times throughout the life of the telecommunications infrastructure. It establishes guidelines for owners, end users, manufacturers, consultants, contractors, designers, installers, and facilities administrators involved in the administration of the telecommunications infrastructure.Use of this Standard is intended to increase the value of the system owner's investment in the infrastructure by reducing the labor expense of maintaining the system, extending the useful economic life of the system, and providing effective service to users.

There are four classes of administration that all cabling systems fall within.

Class 1 is for systems within a single building having only one Telecommunications Room (TR) that all workstation cabling runs to. The TR, Horizontal Links (HLs) and Telecommunications Main Grounding Busbar (TMGB) are required to be labeled and administered. If the system owner wishes to document pathways or firestopping locations, Class 2 administration should be used.

Class 2 is for systems within a single building that are served by multiple TRs. Class 2 includes administration for backbone cabling, multi-element grounding & bonding, firestopping as well as all the items within Class 1.

Class 3 is for systems spanning multiple buildings, known as a campus environment. Class 3 includes administration for buildings and inter-building cabling as well as all elements of Class 2. Administration of Pathways, Spaces and Outside Plant elements is recommended.

Class 4 is for systems spanning multiple campuses, known as a multi-site system. Class 4 included administration for each site as well as all elements of Class 3. Administration of Pathways, Spaces and Wide area network connections is recommended.

IDENTIFIER	DESCRIPTION OF IDENTIFIER	CLASS OF ADMINISTRATION			
		1	2	3	4
fs	telecommunications space (TS)	R	R	R	R
fs-an	horizontal link	R	R	R	R
fs-TMGB	telecommunications main grounding busbar	R1	R1	R1	R1
fs-TGB	telecommunications grounding busbar	R1	R1	R1	R1
fs1/fs2-n	intrabuilding backbone cable		R	R	R
fs1/fs2-n.d	intrabuilding backbone pair or optical fiber		R	R	R
f-FSLn(h)	firestop location		R	R	R
[b1-fs1]/[b2-fs2]-n	interbuilding backbone cable			R	R
[b1-fs1]/[b2-fs2]-n.d	interbuilding backbone pair or optical fiber			R	R
b	building			R	R
c	campus or site				R
fs-UUU.n.d(q)	intrabuilding backbone pathway element		O	O	O
fs1/fs2-UUU.n.d(q)	intrabuilding backbone pathway between two TSs or areas		O	O	O
[b1-fs1]/[b2-fs2]-UUU.n.d(q)	interbuilding pathway or element			O	O

R = Required O = Optional

Identifiers Required Identifiers & Records

A unique identifier is associated with each element of the infrastructure to be identified and serves as the key to finding the recorded information within the administration system selected.

The following is a list of the required records for each of the four classes of administration. An administration system shall provide a method to find the record associated with any specific identifier. The administration system may be managed using a paper-based system, general-purpose

spreadsheet software, or special-

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purpose cable management software.
Class 1 systems require the identifiers and records for the following:

- TS identifier
- Horizontal Links
- Telecommunications Main Grounding Busbar (TMGB)
- Telecommunications Grounding Busbar (TGB)

Class 2 systems require the identifiers and records for the following:

- All class 1 elements
- ntra-building Backbone Cable
- Intra-building Backbone pair or strand
- Firestopping

Class 3 systems require the identifiers and records for the following:

- All class 2 elements
- Inter-building Backbone Cable
- Inter-building Backbone pair or strand
- Building

Class 4 systems require the identifiers and records for the following:

- All class 3 elements
- Site or Campus

Horizontal Link

A horizontal link is defined as the cabling between and including the telecommunications outlet/connector and the horizontal cross-connect termination hardware. It was often referred to as the workstation cabling, horizontal cabling or user drop.

The Horizontal Link Identifier shall be formatted as fs-an, where:

fs = TS Identifier
a = one or two alpha characters uniquely identifying a single patch panel, a group of patch panels with sequentially numbered ports, an IDC termination block, or a group of IDC termination blocks, serving as part of the horizontal cross-connect
n = two to four numeric characters designating the port on a patch panel, or the section of an IDC termination block on which a four-pair horizontal cable is terminated in the TS

Intrabuilding Backbone Cable

Cables that run within one TS or extend between two or more TS's within a building are called intrabuilding backbone cables. A unique backbone cable identifier shall be assigned to each backbone cable between two TS's in one building and it shall have a format of fs1/fs2-n,
where:

fs1 = TS identifier for the space containing the termination of one end of the backbone cable
fs2 = TS identifier for the space containing the termination of the other end of the backbone cable
n = one or two alpha-numeric characters identifying a single cable with one end terminated in the TS designated fs1 and the other end terminated in the TS designated fs2

In this format, the TS with the lesser alpha-numeric identifier shall be listed first. All intrabuilding backbone cable identifiers in a single infrastructure should have the same format where possible. The backbone cable identifier shall be marked on each end of the backbone cable within 300 mm (12 in) of the end of the cable jacket.

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Interbuilding Backbone Cable

Cables that run from a TS in one building and extend to two or more TSs in another building are called interbuilding backbone cables. A unique interbuilding backbone cable identifier shall be assigned to each backbone cable connecting TSs in different buildings, and it shall have the format [b1-fs1]/[b2-fs2]-n, where:

b1-fs1 = building identifier and TS identifier for the TS in which one end of the backbone cable is terminated
b2-fs2 = building identifier and TS identifier for the TS in which the other end of the backbone cable is terminated
n = one or two alpha-numeric characters identifying a single cable with one end terminated in the TS designated b1fs1 and the other end terminated in the TS designated b2fs2

From TIA 942

B.5 Cable and patch cord identifier

Cables and patch cords should be labeled on both ends with the name of the connection at both ends of the cable. Consider color-coding patch

cables by application and type. A sample cable and patch cord administration schema follows:

p1n / p2n
Where:

p1n = The near end rack or cabinet, patch panel sequence, and port designator assigned to that cable.
p2n = The far end rack or cabinet, patch panel sequence, and port designator assigned to that cable.

For example, the cable connected to first position of the patch panel may contain the following label:

AJ05-A01 / AQ03-B01

And the same cable at cabinet AQ03 would contain the following label:

AQ03-B01 / AJ05-A01

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