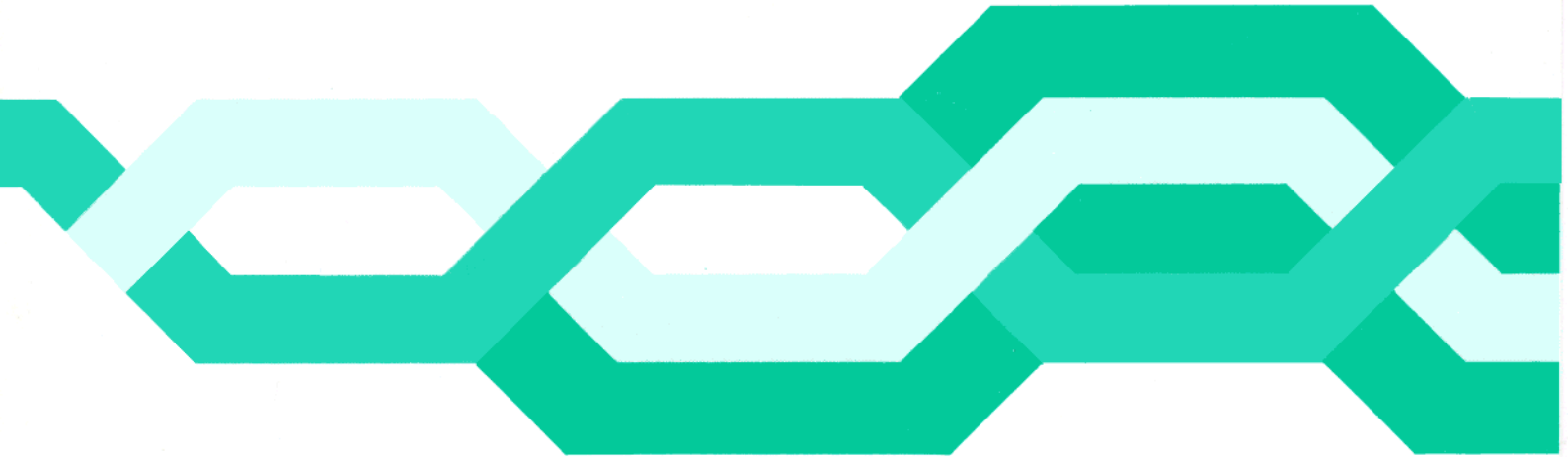
Maintenance News

26
Spring/Summer
1985



For British Telecom Staff only

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203 High Holborn
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01-432 2490
Maintenance News

In Maintenance News No. 25 there was an article entitled 'National Network co-ordination centre review 1968-1984'. The paragraph on FDM Performance should state '4 faults per 100km per annum' **not** '4 faults per 1000 km per annum'. I am sorry if anyone found this misleading.

Editor

Contents

Editorial

This issue, the largest ever, covers a wide range of topics. In particular may I call your attention to the articles by George Clark and Trevor Morton-Holmes on 'Static', a phenomenon of which we are all aware but which has assumed vastly increased importance in our modern micro-electronic age. If your job involves handling static sensitive devices make sure that you know and apply the proper precautions.

Today the emphasis is on Quality and the need to 'get it right first time'. Quality Manuals and checklists are now widely available. Their aim is to enable us to provide our services economically and efficiently as our standing with our customers is determined by how we serve their needs and not by reports of our business successes as reported in the financial press.

Ken Jones
Editor

Fourth generation modems

by **Dennis Anastasiades** BTE Business Systems Division PGT6

'Fourth Generation' is literally the fourth generation of modems to be supplied by British Telecom, but there is more to it than that. Fourth Generation is also a family of modems with commonality of design and construction covering the whole speed range from 300 to 9600 bit/s. It includes all the V series recommendations, plus some extras, and is the most comprehensive range of British made modems available anywhere.

All modems in the range use the most up-to-date technology, incorporating LSI devices and micro-processor control. They are designed on a modular basis with common ancillary equipment so that a mixture of types of modem can be housed together on the same shelf. When a user has a new requirement, for example upgrading the speed of operation, a new card is simply inserted in the case or shelf in place of the old. Every member of the family has comprehensive diagnostic capabilities and nearly all are suitable for operation on both private circuits and the PSTN.

Space forbids a catalogue of model types and numbers but one or two are worthy of mention. Datel modem 4124 is unique in the marketplace combining as it does the V21 and V22 standards. A valuable feature is its auto-switch capability from 1200 to 300 bit/s. A recent addition to the range is the Datel modem 4961 which is a non-CCITT 9600 bit/s modem designed specifically for use on the UK network where it achieves optimum performance by matching to the network characteristics.

Other special features in a feature-rich range are that PSTN modems offer auto-answer, auto-disconnect and adaptive equalisation as standard, whilst private circuit modems boast such options as down-line loading, remote unattended diagnostics and auto switching to standby lines. Fourth Generation modems were designed to have a beneficial impact on maintenance activities.

For example, occasions when a maintenance engineer goes out to find a faulty terminal should be significantly reduced. And that's because user friendly tests which include local and remote digital loop, analogue loop and self test enable the communications manager to locate exactly where his system is at fault, often without assistance from the remote end. And when a visit is necessary, that soldering iron can be left behind. Simple plug and socket connections for line, power and terminal equipment ease the task of dismantling a unit to replace a faulty module.

Racked installations are supplied complete with a telephone module, so that any line in the cabinet can be patched through and tested.

Standardisation of design means greater use of common components thus reducing the variety of spare parts to be stocked and carried about.

Second level maintenance is provided by→

MerlinCare, a service operated by British Telecom Factories on behalf of Merlin. MerlinCare provides a repair and return service on faulty equipment out of warranty, a clearing house service for items in warranty and – rapid replacement for any item.

The impact on the marketplace of Fourth Generation modems has been significant. Major data users have already placed large orders for the products – £3M from Midland Bank, £200K from Tarmac Roadstone Limited and £1.5M from Royal Bank of Scotland are just a few examples. These orders for nationwide data communications networks, won in the face of fierce competition, amply demonstrate that we have a product line which is second to none.

They also express strong customer confidence in our technical expertise and product support activities. Merlin Fourth Generation modems are capturing an increasing share of the market by their customer appeal, and the old criticisms of expensive, bulky, power-hungry products have at last been silenced.

What of the future for modems? In this digital age will we see the demise of these devices? It seems improbable in the shorter term, although there will come a day when they are no longer required. Meanwhile it is clear that modems will be with us for the foreseeable future – they are currently living in harmony with digital networks by providing end links for access to Packet Switching and X-Stream services – and the high-speed duplex modem is likely to be a cost effective data transmission system for some time. The recent publication of the CCITT recommendation for 9600 bit/s 2-wire modems will see this situation being maintained as products are developed in this field. Fourth Generation is a success for British Telecom data communications and a success for British design.
(01-631 2100)

The Edgeley electronic queueing equipment

by **Ken Lowe** Liverpool District (EM51)
BACKGROUND – The rising cost of maintaining the ageing electromechanical Directory Enquiries queuing system at Edgeley in Manchester South Telephone Area highlighted the need for a cost effective replacement which would fulfil requirements from operators, management and maintenance engineers. The design and build brief was given to a small but enthusiastic team of engineers led by Jim Hirst and Dave Donnelly, who completed the prototype, including software within 10 months. The team effort was suitably acknowledged by an award from the National Awards Committee. Production of the system was undertaken by BM FACD for national provision and work is now under way to develop the system for use with the 151 Repair Service Control.

OUTLINE – The system assembles calls from 48 incoming circuits into a queue on a first come first served basis under the control of a single 8085 microprocessor. Passing through a single full availability matrix, made up of TXE4 Incoming Junction A Switches, the calls are offered to a maximum of 32 operator positions including 4 monitorial positions and 4 outgoing transfer circuits.

Control of the queue is provided automatically by the microprocessor on the basis of 1·3 calls to every staffed position in strict rotation with equipment engaged tone being returned to any caller after this figure has been reached, thus with 3 operator positions staffed 4 calls are allowed into the queue the 5th call receives EET. This method of queue management has met with customer approval as it eliminates an extremely long wait which previously was a common cause for complaint. Further to this aspect, the supervisor's desk top console has a display which indicates the length of the queue and, depending on the position of a control key, either the number of positions staffed or the number of engaged tones returned to callers. And an Audio Visual Alarm is activated should the number of engaged tones exceed a preset value thereby alerting the supervisor to the possible need for an adjustment in staffing levels. The training supervisor, from a 'listen only' console can monitor calls without any noticeable degrading of transmission.

The system provides a repeat attempt to a different operator should the first routing attempt fail. Failures like this and the status of all parts of the system are stored to provide statistical and faulting information for operator management and engineering maintenance use. Information retrieval is carried out using a Commodore Personal Computer (PET) with VDU and printer. Programs written in basic and stored on pre-recorded cassettes are issued to the relevant staff as the unit is commissioned. Indeed commissioning itself is carried out with the help of a program written in basic. Hard copy of bar charts, operators per shift and call failures can be obtained using the PET VDU and printer.

The system is entirely self contained with incoming and outgoing circuits, call switching and monitoring equipment, microprocessor with interface and power pack all accommodated within a cabinet which is no larger than two four drawer filing cabinets stood side by side. The equipment is virtually silent and with the PET, VDU and printer atop the cabinet, it can be sited within the switchroom.

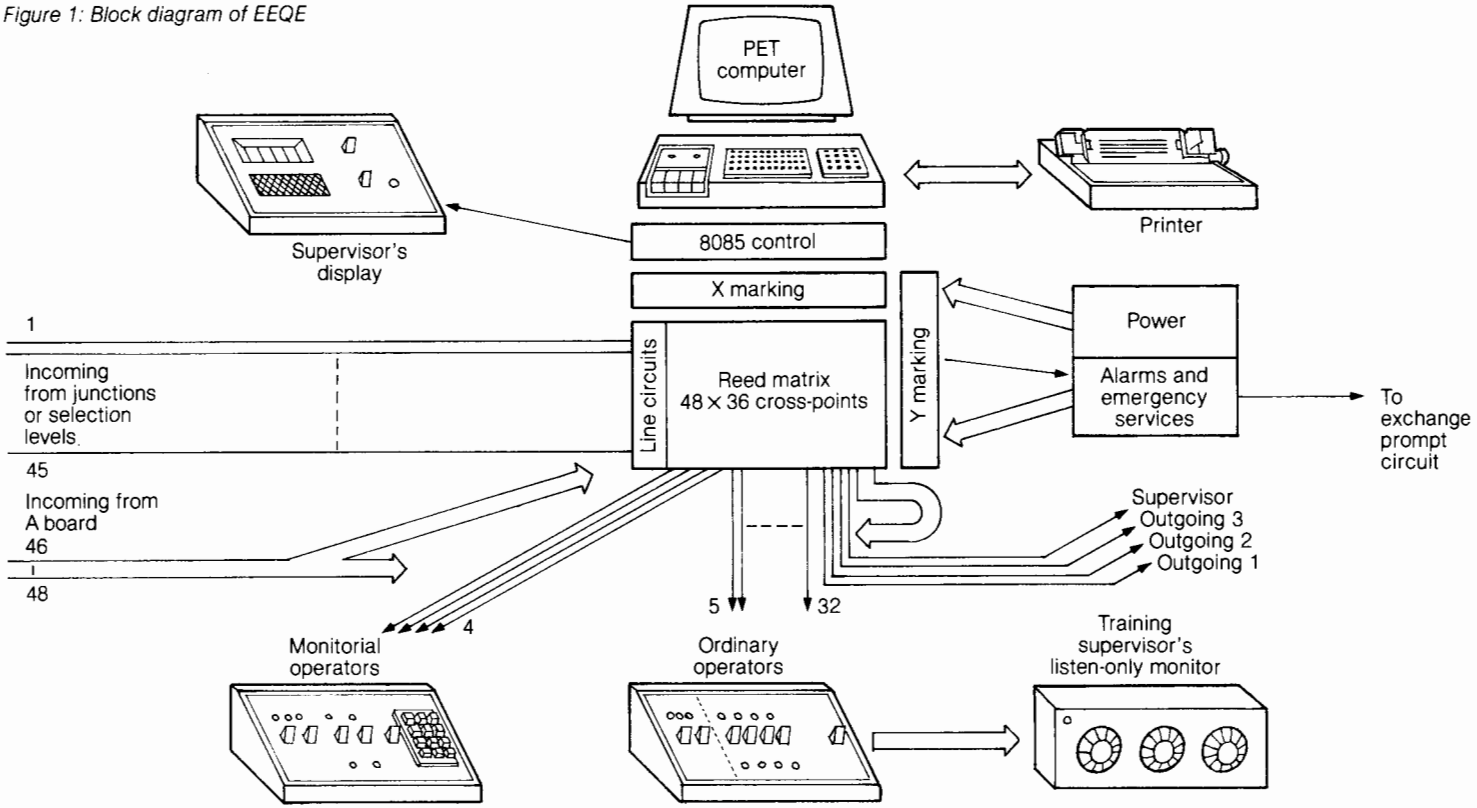
Operating procedure is similar to existing systems with night service concentration giving two appearances on the manual board. Any call can be force released from the operator's console back to the incoming relay set by using the FR key. During night service if force release is needed, the key on the operator's console has to be used as this facility is not cabled to the night service appearances.

Under total failure conditions, direct connection of incoming circuits to operators on a one-to-one basis is made using a manually operated key.

OPERATION – Referring to fig 2; at any time, the processor will calculate from the number of operators in service how many calls it will ►

allow to join the queue and set either the ring tone or busy tone toggle in the i/c relay set as appropriate. If the queue is closed, the toggles in all the free relay sets will be set to busy tone so that a calling loop will result in busy tone being returned to the caller. If however the queue is open the appropriate number of i/c relay sets will have toggles set for ring tone so that a calling loop applied to the i/c relay set will result in ring tone being returned to the caller. In the former case, the processor takes no further part in the proceedings but in the latter, as ring tone is returned to the caller, a contact of the line relay now operated calls the processor which allocates a queue number to this call. The processor takes the lowest queue number and routes it to an operator as and when one becomes free. Having decided which cross point to operate, the processor then marks the X and Y coordinates of the reed relay

Figure 1: Block diagram of EEQE



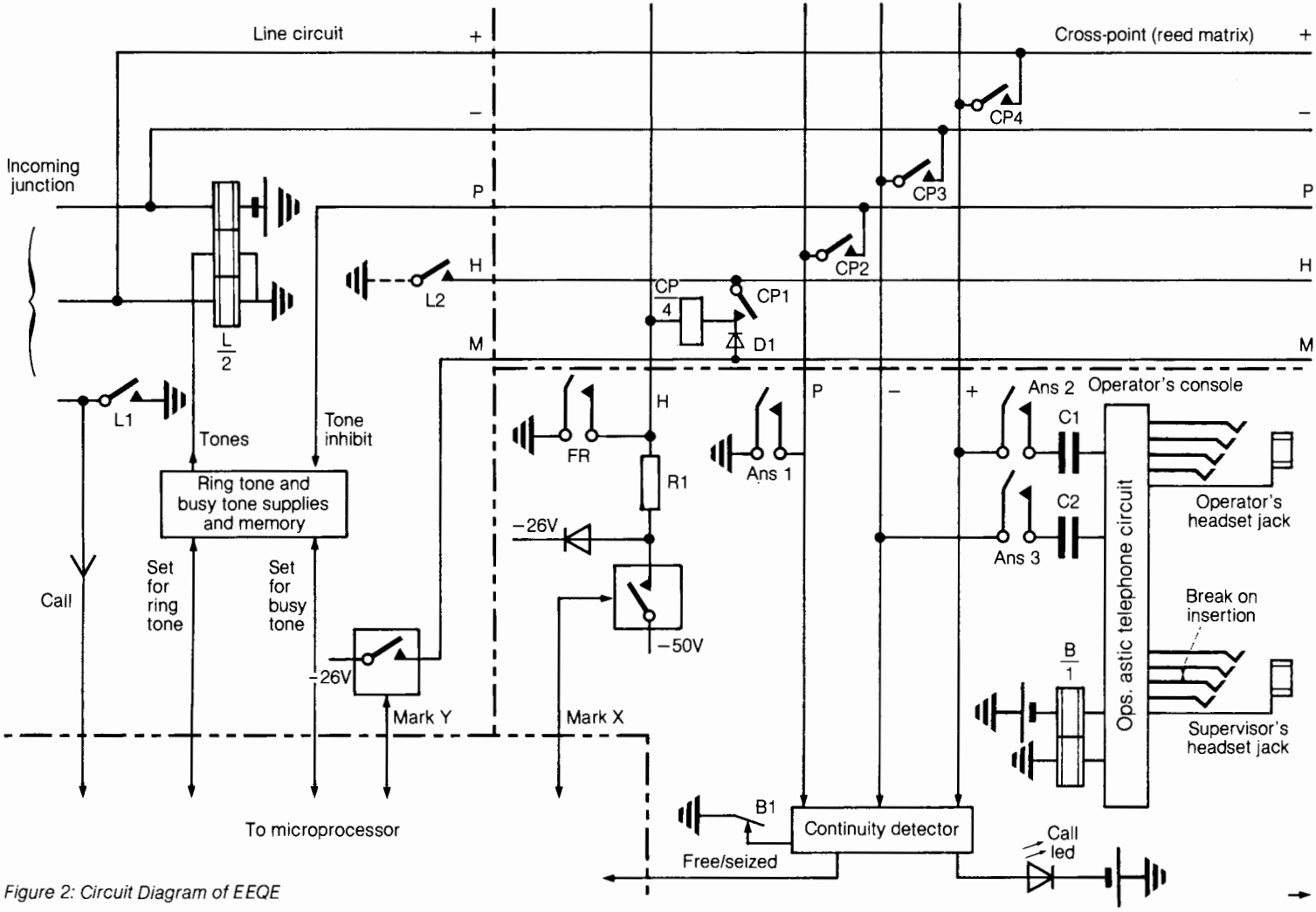


Figure 2: Circuit Diagram of EEQE

matrix by applying −26V to the i/c relay set M lead (Mark Y) and a −50V to the operators H lead (Mark X), this results in one CP relay being operated as only one diode D1 is forward biased. Contact CP1 operating provides a hold path from L2 contact earth via CP relay coil to −26V, as diode D1 is now reverse biased the original mark X and mark Y conditions are no longer needed. The contacts CP2, CP3, and CP4 extend a metallic path to the operators circuit and a continuity detector checks the path. If this check fails, another attempt is signalled by the processor. If however the check is valid, then the call LED is lighted on the operator console.

The call is answered by the operation of the answer key. Contacts on the answer key connect the speech path as well as earthing the P wire which suppresses the ring tone supply. The transmission bridge is the familiar stone type with half in the line circuit relay set and the other half in the respective operator's console. In order to preserve the transmission level when the supervisor inserts a handset plug, the receivers are connected in parallel but the transmitters are in series via a break contact in the supervisor's jack.

In the event of an ordinary operator being unable to deal with the call due to a need for further enquiries such as to a distant DQ then the call is transferred to a monitorial position using a sub routine which releases the original cross point and operates another one which connects the call to a monitorial operator. The monitorial console is fitted with a push button keypad to enable outgoing calls. On completion of transfer, the original operator is free to accept another call after a built in delay of at least two seconds.

The PET computer software written in basic comprises management and statistical information retrieval whilst engineering maintenance needs are catered for by 5 programs.

- To identify the sources of alarms and to reset same.
- To give the states of lines and operator positions.
- Call trace within the switchblock either forward or backward.
- Enables the user to temporarily change the line and operator state of call as well as manually steering a call from any line to any operator.
- Gives access to the System Technical Officer Fault Log.
- Setting of system calendar clock.

The system has proved itself satisfactory to customers and BT staff and with several million calls handled successfully has justified the faith of the design and build team.
(051-229 5585)

Materials advice for P.W.B's

by **John Mottram** MC1.6 Birmingham

Printed Wiring Board (pwb) assemblies were once considered a throw-away item. Today, the assembly may comprise expensive semiconductor components on a multilayer pwb with delicate gold plated edge contacts or two-part connectors.

Procedures for the repair and modification of pwb assemblies need to be tightly controlled in deference to the replacement cost of the item. Last year saw the issue of BS6221; Part 21 'Guide for the repair of PWBs'. BT Materials and Components Centre (MCC) were represented on the committee which compiled this document and have now produced a list of suitable materials which may be used for this purpose.

The MCC memorandum MC5/222/01/84(0) 'List of acceptable materials for the repair and modification of pwb's' details information on suitable adhesives, fluxes, solvents and wire insulants. Whilst the listings are not exclusive, the materials given are of known quality and will introduce no hazards to the assembly if correctly used.

Copies of the MCC Memorandum may be obtained from L.A. Pillinger, MC5.2.2.2. Telephone No. 021 772 2361 Extn. 2058.
(021-708 1111 x 260)

BTI 4MHz Hypergroup Switching equipment

by **P D Taylor** BTI/IL3.3.3.1

Equipment is currently being installed to enable the semi-automatic changeover of failed international hypergroups (HGs) to International Protection Network (IPN) HGs at frontier stations. This facility will permit a fast restoration of service with minimal traffic loss. It will be particularly beneficial on instances of out-of-hours failures involving non 24-hour staffed frontier stations where service will be restored pending the arrival of 'call out' staff to localise and repair the fault.

The remotely controlled wideband switch matrices and asociated monitoring and activating circuitry necessary to provide this capability have become known, collectively, as 4MHz HG Switching Equipment. It is being installed in Scarborough, Lowestoft, Winterton, Aldeburgh, Tolsford Hill, St Margarets Bay, Broadstairs, Widemouth Bay, Eastbourne and Land's End repeater stations and in the Goonhilly and Madley Earth Stations.

The equipment will operate in conjunction with existing station Access and Switching Equipment (ASE or ES No 1005A). It provides an alternative to the patch panel of the existing Broadband Switching Equipment (BSE or ES No 1007A). The system will be supervised and controlled via a BT Factories small business computer (SBC) situated in the International Network Maintenance Centre/Network Co-ordination Centre (INMC/NC), in Caroone House, London.

The frontier stations will be linked to the SBC via a private wire network and communication will be an X25 protocol, 1200 baud data stream, providing high security and low susceptibility to interference. Figure 1 shows the equipment involved.

The remote facilities

The SBC has menu driven software which will enable INMC/NC staff

- to record the current status of a frontier station's HG to IPN HG connections.
- to effect connections or disconnection at a frontier station between any HG and any IPN HG in the station, in either direction of transmission.
- to connect at a frontier station, using appropriate attenuation (usually 25dB), a received IPN HG to a transmit IPN HG, thereby looping a HG through the station.

The SBC will also alarm upon the loss of the 1552kHz pilot on any receive hypergroup in the frontier stations, alerting the INMC/NC staff to the hypergroup failure.

Frontier station equipment

At each station transmit and receive hypergroup switch matrices must be installed, together with control equipment which

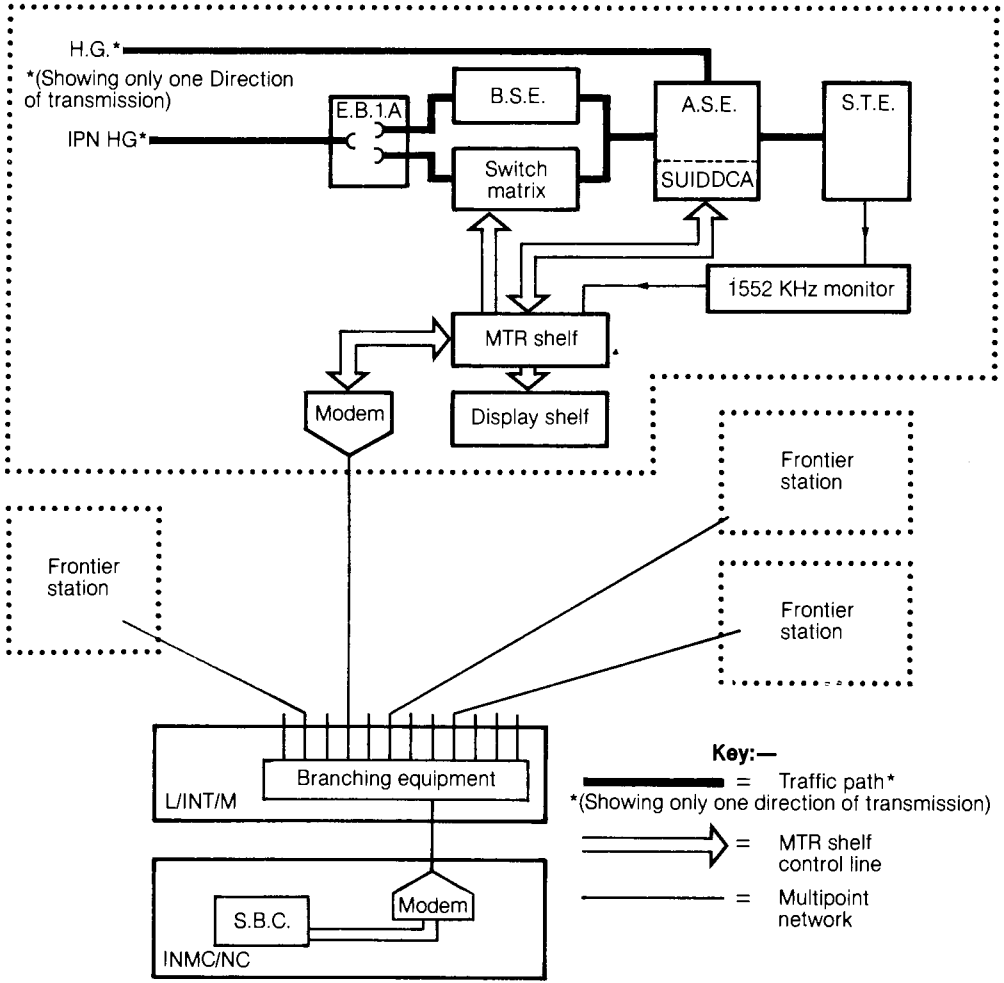
- communicates with the INMC/NC SBC
- monitors the status of the switch matrices and changes the state of the switches.
- operates the ASE Switch Unit No 1000A when a receive HG is switched to an IPN route.
- raises alarms when receive hypergroup pilots fail.

These functions are performed by a shelf of 62-Type equipment designed within BT and named Equipment Message Transmit Receive No 1A (MTR Shelf). The MTR shelf is a general purpose, microprocessor based equipment configured to suit a particular application by utilising specifically designed interface cards and appropriately programmed PROM software.

Also provided within the station are a display shelf, named Equipment Switch Monitor No 1A and an Equipment Bypass No 1A panel. The former gives the local maintenance staff a visual indication of the current status of the transmit and receive switch matrices in their station. The equipment bypass panel enables the local maintenance staff to remove the 4mHz Switching Equipment from service and revert to BSE manual patching.

Finally, the 4 mHz Switching Equipment relies upon Hypergroup Monitoring Units 1552kHz to detect pilot failures on receive traffic hypergroups and to pass a fail condition to the MTR Shelf. →

Figure 1: 4mHz Hypergroup Switching Equipment
(Block schematic only, actual interconnections may not be as shown.)



These equipments are described briefly in the following paragraphs.

The switch matrices

These are constructed from strips of coaxial reed relays, to a size permitting any of the station traffic hypergroups to be connected to any of its IPN hypergroups. Additional capacity is provided to facilitate IPN through patching and the matrices also incorporate 75 ohm termination strips to terminate IPN HGs or standby HG paths currently not in use. A maximum of 19 HGs and 7 IPN HGs can be accommodated.

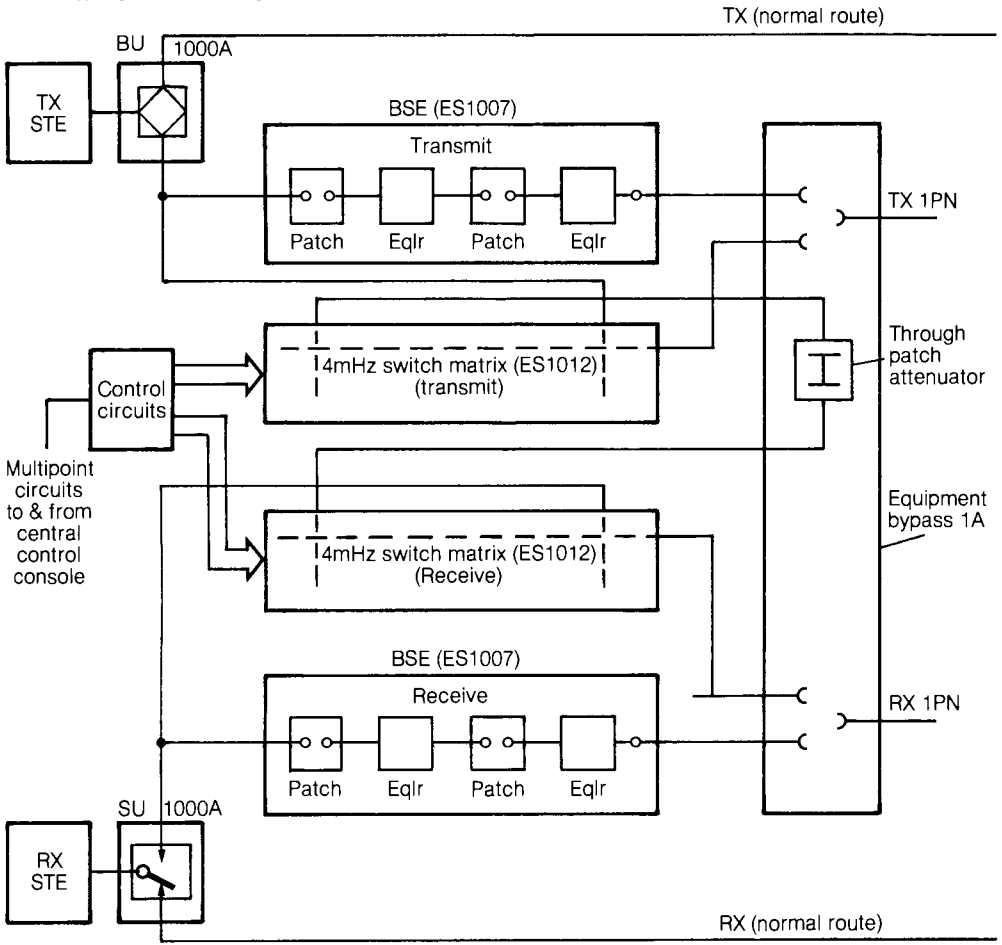
Each matrix assembly is mounted in a Type 62 shelf frame and one matrix is required for each direction of transmission. The matrices are cabled in parallel with the station BSE, between the station ASE and the newly fitted Equipment Bypass 1A. See figure 2.

Message transmit and receive equipment

The basic general purpose shelf comprises a backplane, two power converter units (PCUs), a central processor unit (CPU) and an Alarm and Services card. The PCUs are paired for security, provide +5V, +12V and −12V supplies and in this application they detect power failures to the ES1012A.

The CPU is based upon the Intel 8085 microprocessor. It incorporates up to 40Kbytes of PROM and two HDLC data link controllers either of which may communicate with the INMC/CC SBC through the back-plane and modem link. The Alarm and Services card can raise station alarms. It incorporates a 4 segment, alpha-numeric

Figure 2: General arrangement for IPN at frontier stations using 4mHz hypergroup switching equipment



LED display which provides information about any operational faults on the 4mHz Hypergroup Switching Equipment. A push button edge switch on the card enables MTR shelf testing routines to be called up. Routines can be developed for the interface cards as well as the essential shelf cards. The tests are executed and progressed using four push button switches on the Alarm and Services card.

The backplane permits up to 13 interface cards to be connected to the shelf. It interfaces the shelf to other equipment and incorporates two V24 compatible sockets for connection to modems. Additionally, it accepts a hardwired 'key' which enables each MTR shelf to be given a unique identity.

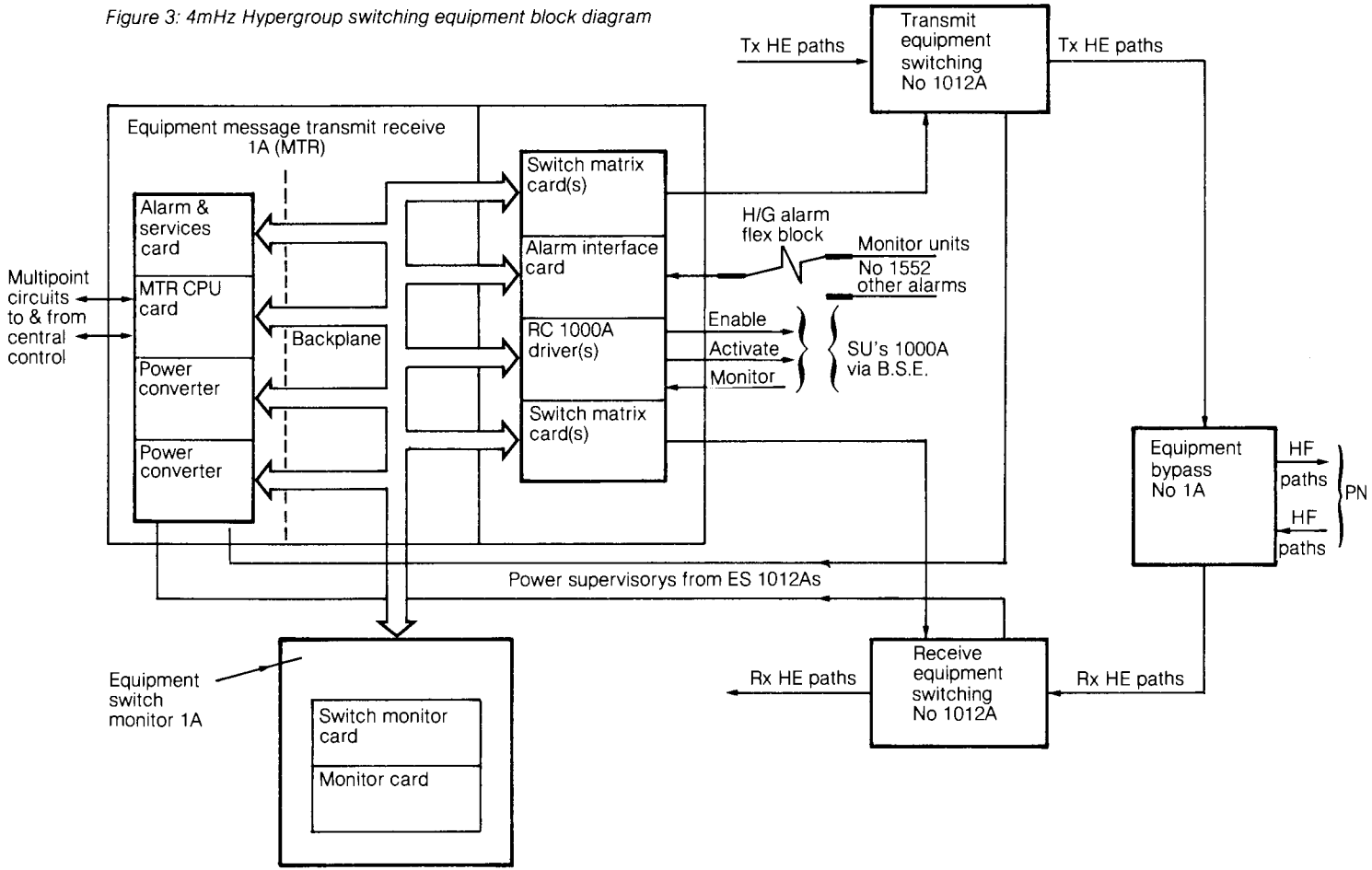
Figure 3 shows how the MTR shelf and its interface cards connect with the other equipment.

Interface cards

For the 4mHz Hypergroup Switching Equipment purposes, three types of interface card are employed in the MTR Shelf.

- Alarm interface card. This card can accept up to 48 alarm conditions. It is the means by which receive hypergroup pilot failures in the station are brought to the attention of the MTR shelf. A change of state in any alarm status is communicated to the SBC when it polls the station MTR shelf.
- Switch matrix cards. Each card serves up to 4 columns by 8 rows of a switch matrix. The card basically consists of 32 latching relays which operate 32 of the reed switches in the switch matrix.
- RC 1000A Driver card. This card provides enable and activate pulses to the Switching

Figure 3: 4mHz Hypergroup switching equipment block diagram



Units No 1000A in the station ASE. These switches have to be operated when receive hypergroups are switched to IPN HGs. The card also monitors whether the SW1000As are in the main or standby positions. It serves up to 16 SU1000As.

Monitor shelf
This 62-type shelf is installed adjacent to the MTR shelf. The front panel incorporates an LED array which represents the cross points of the switch matrices. A lit LED represents a made HG to IPN HG connection. More LEDs indicate the failure of pilot tones on the working hypergroups.

Bypass equipment
Also built to 62-type practice, one shelf suffices for 6 IPN HGs. By moving 'U' links each IPN may be connected to the ES1012A or to the BSE. The shelf also incorporates the attenuators necessary for the IPN HG through patching.

1552kHz hypergroup monitoring unit
Based on the Level Measuring Set No 18A, the unit extends alarm conditions to station alarms, and to the MTR shelf, when the receive hypergroup it is monitoring fails. A fail is considered to have occurred if the 1552kHz pilot level falls below a pre-set threshold. The hypergroup is considered to be restored to normal when the pilot level is raised above a different pre-set threshold level, typically, 'fail' on pilot 6dB low, 'restore' on pilot 3dB low. A non latching receive attention key is provided: Operating the key will silence the station alarm and it will not reappear when the hypergroup is restored.

Equipment maintenance
The shelf diagnostic facilities in the MTR shelf should greatly aid identification of a faulty unit. Discussions are in-hand to arrange for faulty MTR cards to be repaired in an International Repair Centre (INTARC) in London.

The reed relays in the switch matrices have a proven high reliability. Should one fail the strip can be removed from the matrix and replaced by a new one. Again, an INTARC is being considered to undertake the repair of faulty strips.

Spare MTR cards and matrix strips may be held at district centres or centrally, in London.

The Equipment Bypass 1A is made to standard BT specifications and will be repaired on site. The HG monitoring units 1552kHz are being provided as standard items of repeater station equipment and the maintenance procedure will be similar to that used for LMSs No 18A.

The SBC equipment in the INMC/NC (duplicated to provide worker and spare units) will be maintained by BT Factories, under contract.
(01-936 3365)

'Scrambled megs'

by **Ray Carter** NN/SSP1.3.1
The routings of many MegaStream circuits are now likely to include one or more Digital Line Sections (DLS) provided with Regenerators 15B.

The Regenerator 15B, which replaces the Regenerator 15A, is a terminal regenerator fitted in the Line Terminating Equipment (LTE) rack at each end of a DLS.

The Regenerator 15B differs from the Regenerator 15A in that the power is parallel fed rather than series fed and it has two modes of operation namely,

- Scrambler out – in this mode the regenerator is transparent and operates in the same way as a 15A.
- Scrambler in – in this mode the transmit signal to line is scrambled and the receive signal from line is descrambled.

Note: – all signals are in correct HDB3 format, only the information content is scrambled.

The Regenerator 15B was designed and introduced to overcome the high level of crosstalk caused by frame synchronism of the 2.048 Mbit/s outputs from System X exchanges by scrambling the signal transmitted to line. The scrambling facility has also been used to good effect on MegaStreams carrying frame synchronous signals from digital PABXs.

Experience of late has shown that certain tests applied to DLSs in the past do not show

up problems when Regenerators 15B are involved.

Further work is necessary to fully detail all appropriate tests but to date the following guidelines have proved successful.

- End to end tests using a pseudo-random bit sequence with error detection in the **Binary** mode **will** highlight problems. This can be done using testers 232 for error detection and testers 169 or 254 for pattern generation.
- Loop tests **are not** valid as problems can be masked.
- HDB3 tests on DLSs containing Regenerators 15B **are not** valid when performed on the LTE test points.
- HDB3 tests **are** valid on DLSs containing Regenerators 15B if performed on the HDB3 monitor point on the front of the regenerator. It must be noted however that this test will only show errors arising in that particular DLS. HDB3 errors in preceding DLS sections will not be seen.

It is hoped that further information can be given later. Enquiries to Ray Carter NN/SSP1.3.1. on 01-432 1309/1310.
(01-432 1309/1310)

Customer service systems the way ahead

by **E A Magee**

Many of us in BT have long recognized that there are shortcomings in the service we provide to our customers. Until quite recently our customers had little choice but to use our services. Not unnaturally in such a safe environment, the need for change and the provision of better service to customers did not feature high on our list of priorities.

Liberalisation changed all that. Suddenly we found ourselves in the real world, with real live competitors, fighting for our market share.

The Management Consultants, McKinseys, worked together with LCS senior managers to draw up a plan which would put LCS in the best possible position to compete effectively. Essentially the plan was to change the business to one in which the satisfaction of customer needs was the major concern of every one of us working within LCS. Bringing about such a major change in emphasis demands organisational and cultural change. It also demands that we have top quality systems to help us run the business. The existing computer systems were never designed to support this type of operation – they use incompatible hardware and software. And, even more important, they were not designed with the customer in mind.

Really top class customer service should start at the moment a customer first makes contact with us – either by telephone or in person. First impressions are crucial! Currently, there are a multitude of interfaces between our customers and ourselves and, needless to say, this causes confusion. Customers find themselves passed from person to person, from department to department. What we really need to do is to make it easier for the customer by reducing the number of possible contact points. We need a Front Office. Ideally, this will be a single point of contact at which we will be able to handle the majority of customer enquiries. The tasks that may be handled by Front Office Staff include simple orders, billing enquiries, fault reports and general enquiries.

A successful Front Office operation will depend upon our having up-to-date information about our customers immediately available.

CSS (Customer Service Systems) will replace nearly all of the existing computer systems used by LCS. All the information relating to one customer will be held within a District database. Unlike many of the systems with which we are familiar, the requirements of the end-users (all of us!) were the foundation upon which the CSS was built.

The Customer Service Systems Directorate was established in late 1983 to

develop CSS and to assist in its implementation. Because of limitations of space it is impossible to describe the roles of the individual groups shown in Figure 1. I intend therefore to concentrate on the role of the National User Group (NUG) and its relationship with the System Design Group (SDG).

Unlike any other major projects the Business has undertaken it was decided from a very early stage that the 'end user' would be directly responsible for defining the facilities and information systems that would satisfy District operational requirements. The National User Group was formed to ensure 'end user' involvement in the design of the systems. Its structure reflects the uniqueness of its role and position within the organisation.

The NUG has two distinct parts

- Consultative Panels comprising District Managers, Area General Managers, Deputy General Managers, Heads of Division, Heads of Group, Regional Controllers and Heads of Section who come together on a part-time basis to verify, confirm and endorse the individual application system requirements.
- The Information System Manager (ISM) teams made up of seconded Area, Regional and Headquarters staff. The teams include COs, STs, TOs, Band A (Inspector), Band B (TS), Band C (AEEs) and through to level 2 and 3 (EES and HD's). Between them the ten teams will look at 35 individual applications. Figure 2 shows the responsibilities of the individual ISM teams.

Figure 1: CSS Directorate

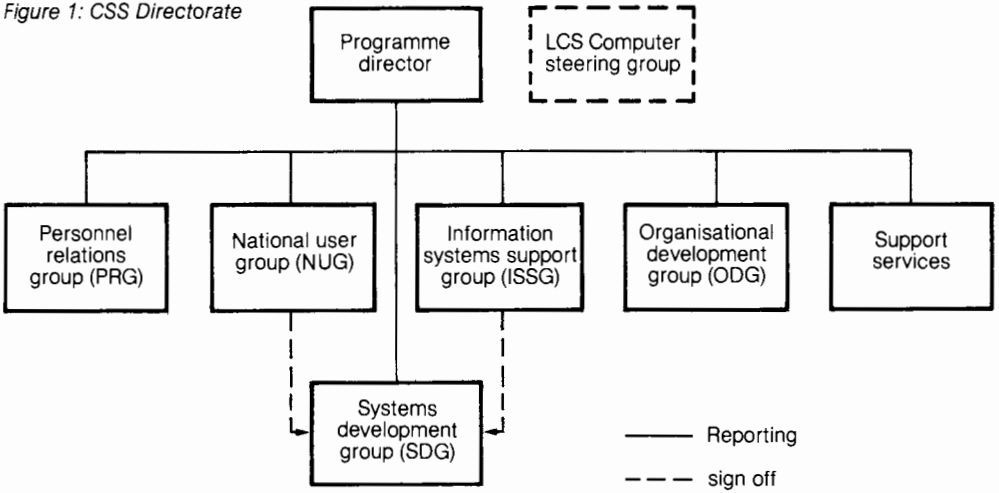


Figure 2

1. Manpower Resources
2. Materials and Transport
3. Billing
4. Network Management
5. Order entry and processing
6. RSC entry and processing
7. Market intelligence
8. Revenue Forecasting and analysis
9. Financial and Management accounting
10. Operator and Directory services

The Network Management Team is one of the larger ones with a responsibility for 7 applications: Internal Data, Internal Planning and Projects, Internal Maintenance, External Data, External Planning and Projects, External Maintenance and Resource Estimation.

Both internal and external maintenance applications can be further broken down into corrective, preventative and routine maintenance. External preventative maintenance revolves around the 'Blackspot Analysis point'. Figure 3 shows the main inputs for Blackspot analysis. Historical fault information is currently gathered by LOCAMS, A51 and 'Sort' type programs. This type of information will continue to be input to CSS although as fault rates reduce, its importance will diminish. The current state of plant information on the other hand will play an increasingly important role. With the development of Line Test Systems (LTS) it will soon be possible to test each customer's line every night and have the results analysed and available to engineering staff first thing in the morning. The facilities that CSS is specifying for line surveillance test systems →

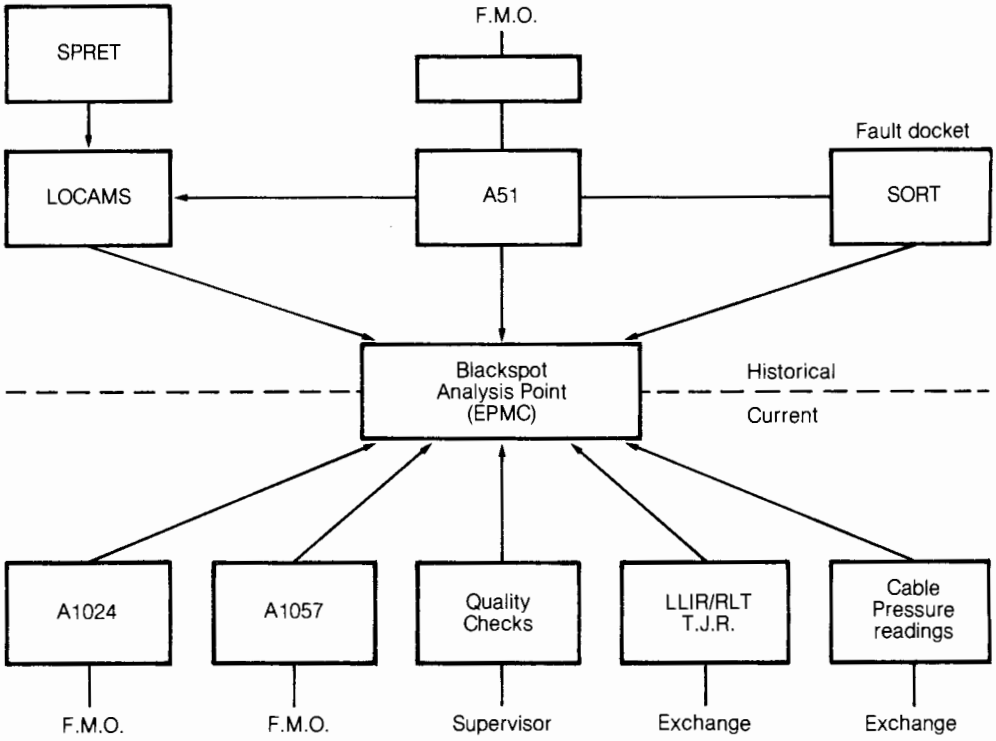
can be summarised as follows

- Test each customers line every night
- Perform the following tests:
  - disconnection
  - insulation
  - Battery B leg (BB)
  - Battery A leg (BA)
  - Earth B leg (EB)
  - Earth A leg (EA)
  - Partial Short Circuit (PSC)
  - Reverse Partial Short (RPS)
- Classify defective lines
  - service affecting
    - class (1) disconnexion
    - class (1) = than 20K contact
  - non servicing affecting
    - class (2) between 20K and 52K contact
    - class (3) between 52K and 110K and previously (1) or (2)
    - class (4) not above 1M for 7 consecutive days since line classified as (1) (2) or (3)
- Automatic output for
  - all new service affecting faults
  - other associated class 2 and 3 faults
- On demand printout for
  - all faults
  - faults by exchange area
  - faults by PCP/SCP
  - faults by DP
- Detailed Customer Report
  - including customer number, routing details, fault details, fault history termination details and special conditions (SVI & CNI)
- Input information
  - New customer records
  - On site amendment or addition of routing information
  - fault records from
    - overnight tests
    - RCS reported faults
    - fault clears
    - reported faults
    - night routining faults

Cable pressurisation and the automatic monitoring of both flow and pressure readings will form the second major input to current state of plant information. summarised as follows: –

- record flow readings
- maintain flow readings history
- record pressure readings
- maintain pressure reading history
- show flow and pressure thresholds
- record and flag flow and pressure threshold

Figure 3



breakers
- provide status reports for cabinet areas or individual cables
- provide exception reports for all transducers in an alarm condition
- alarm summary – an extension of the exceptions report which shows all alarms for a given period and includes clear dates and times for those alarms cleared during the period
- update trend report – records current readings and allows comparison with previous reset values.

The three remaining inputs, A1024 (plant requiring attention), A1057 (pair diversion advice) and Quality checks will be used in the CSS environment in essentially the same manner as they are used today in (EPMC) Blackspot analysis.

Figure 4 shows the stages through which each of the application areas progresses. The preparation and presentation of system applications requirements has of necessity been formalised to ensure that all relevant areas have been investigated and all interested parties consulted. A Product Review and Approval procedure lays down strict rules to be followed through each stage of development.

The Operational Requirements Specification (ORS) is the first formal stage at which all facilities are defined, agreed and confirmed by the NUG and 'signed off' by the Consultative Panels.

On completion of the ORS the NUG teams begin to work very closely with the System Design Group (SDG). The SDG is responsible for the production of the next stage of the development – the System Design

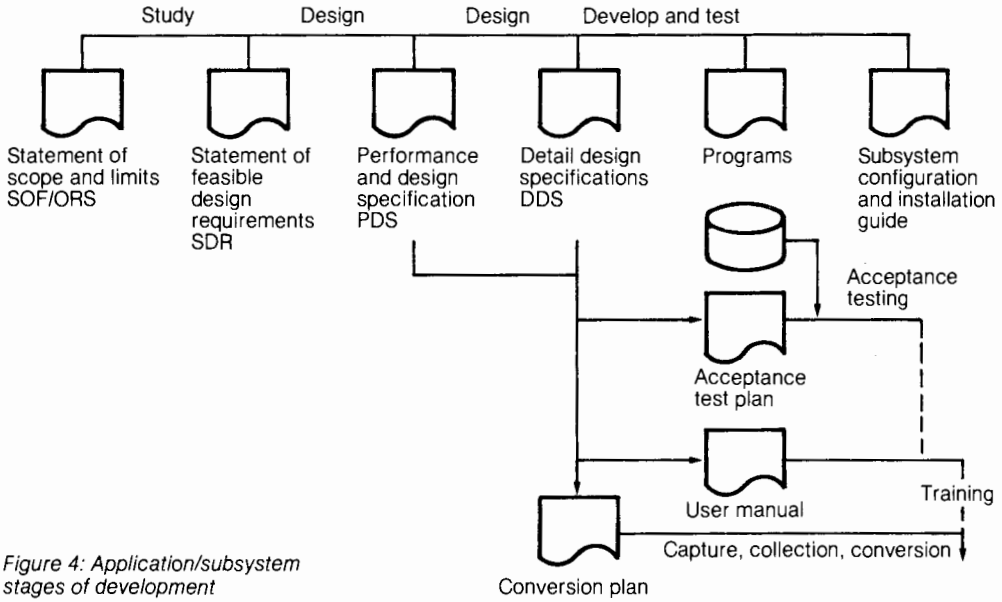


Figure 4: Application/subsystem stages of development

Requirement (SDR). SDRs translate the ORS into a more detailed design requirements document. The CSS development is currently at the SDR and Performance and Designs Specifications (PDS) stages. The NUG will continue to work closely with the SDG through all stages of development including preparation of user manuals, initial training and the formulation of the Conversion Plan.

Because the project is so huge implementation will take place in four phases. The pilot District Thameswey, (Reading/Guildford Areas) is due to start phase A implementation in July 1985 with phases B, C & D following at six monthly intervals. Two trial Districts follow shortly after Thameswey. The Project will be completed in all Districts in 1988.

CSS is far and away the biggest project ever undertaken by the business. We will all be involved with it in the near future. Providing the best possible service to our customers is vital. CSS is the way ahead. *(01-242 9893 x 221)*

Public Utilities Streetworks Act of 1950 – Why it's being reviewed

by **David Trimmings** LLS2.1.7

In 1938 a joint Committee of the Houses of Lords and Commons – the Carnock Committee – was established to consider the original statutes of the utilities in relation to the procedures for breaking open streets and to make recommendations, taking account of modern conditions. The Carnock Committee reported to Parliament in June 1939 and their recommendations provided the framework for the Public Utilities Streetworks Act of 1950. The Act is in four parts

- The Street Works Code which regulates the exercise of the utilities statutory powers to work in streets
- A code to govern the relations between utilities and highway authorities where roadworks affect utilities' apparatus
- A minimum code regulating the relations between the utilities themselves
- deals with enforcement, interpretation, financial and general provisions and application in London and Scotland.

There is no doubt that the Act is complex and often difficult to interpret other than by lawyers. It was therefore important to produce a 'layman's guide'. This was published in 1972 by the Department of the Environment entitled – 'Guide to the Public Utilities Street Works Act 1950'.

In the 34 years since PUSWA was enacted the street works environment has changed dramatically. The number of vehicles on the road has increased from 4.5 million to 20 million. Similarly the utilities systems have grown into a complex infra-structure of some 1,650,000 kms underground mains, with a replacement cost of £117,000m. It is an infra-structure upon which much of the nation's standard of life and commercial success depends but the system has to be continually maintained, refurbished, extended and repaired. This amounts annually to some 2 million small openings and the installation of over 18,000 kms of new mains.

A major difficulty was that although the Act obliges utilities to carry out reinstatement to the reasonable satisfaction of highway authorities, the Act itself did not provide an agreed standard of reinstatement. In 1974 the PUSWA Conference, which is a representative body of the utilities, highway authorities and the Department of Transport, produced a 'Model Agreement and Specifications' for reinstatements under PUSWA. One of the main aims of the document is to enable the utility or its contractor to carry out the permanent reinstatement themselves; thereby avoiding the often lengthy delays which occur before authorities who have elected to do so carry out permanent reinstatement. Unfortunately, only half of the highway authorities in the country have so far entered the Model Agreement.

The House of Commons Select Committee on Transport during the 1982/83 Parliamentary session undertook an examination of road maintenance. This included public utilities works. Various bodies gave both written and oral evidence, much of which was critical about the number of utility openings and the standards of reinstatement. In this evidence the National Joint Utilities Group (NJUG) suggested that many of the problems put to the Select Committee would be overcome if all highway authorities were to enter the model agreement with the utilities.

In their Report, the Select Committee concluded 'There is clearly considerable room for improving the standards of trench reinstatements. We hope that through the PUSWA Conference the highway authorities and public utilities will be able to reach an agreement on procedures and standards which is fair to both sides. If provisions within the 1950 Act prevent such an agreement from being reached, the Act should be amended.' In her evidence to the Select Committee, Mrs Chalker indicated that although she did not rule out the possibility of legislation resulting from the review of PUSWA 1950, she would prefer, if possible, to obtain voluntary agreement between the parties.

Early in 1984, Mrs Lynda Chalker, M.P., Minister of Transport announced in

Parliament that she had decided that a review would be carried out of the Public Utilities Street Works Act 1950 and the Model Agreement and Specifications 1974.

The Review is currently being undertaken by a three man team. Its Chairman is Professor Home OBE, FRS, P.Eng, formerly Professor of Civil Engineering, Manchester University. Mr N G Ellis, OBE, P.Eng, FICE, FIHT, formerly County Surveyor, South Yorkshire and Mr D V Ford, C.Eng, FIEE, formerly Head of Distribution Engineering, The Electricity Council.

It is inevitable that with such a large work load disagreement between utilities and highway authorities is likely to occur. Professor Horne and his team have therefore been asked to carry out their review in the light of present day circumstances. Their terms of reference also include examination of the safety of workmen and other road users, liaison arrangements, the impact of cable television and utility mapping.

The investigation commenced in February 1984 and interested parties were invited to submit written evidence by April of that year. It was decided by the member utilities of NJUG not to make individual submissions but to be party to one composite NJUG submission. This was prepared by a joint utility team who had been seconded away from their normal duties to deal with the PUSWA review.

The NJUG submission is in three parts. Part 1 deals with evidence and covers 104 pages. It sets out the NJUG views and makes recommendations to the Review Committee. Part 2 contains complementary evidence in the form of appendices and covers a further 152 pages. Lastly Part 3 deals with 17 exhibits submitted to the Review. Details of the NJUG evidence will not be available until Professor Horne's report is published by the Department of Transport later this year.

In addition to taking written evidence, Professor Horne and his colleagues have taken oral evidence and have also had detailed discussions with the utilities and the highway authorities. During the early part of the Review the team also made a number of technical visits to obtain first hand experience of street works. These visits were rated by the utilities and the highway authorities.

They included particular visits to the Dudley Digital Records Trial, the Lothian One-Call Trial and to the British Gas, Engineering Research Station in Newcastle, where a vast amount of research and development work is being undertaken on road excavation and reinstatement.

It is in the context of this background that, a 34 year old Act of Parliament, is under review. However, it is often forgotten that the utilities rights to break open streets goes back to the mid-19th century. Unlike other industries, the utilities have no freedom in deciding whether or not to provide and maintain a supply or service to the public; they are statutorily obliged to do so.

It would be presumptive to speculate what the outcome of the Review is likely to be. What one can say is that the theme of the NJUG submission is the efficient and responsible use of public money, for whether it is utility or highway authority expenditure it must be used to the optimum benefit of all.

Acknowledgements to Secretary, 'National Joint Utilities Group'

Comfort (E) TXE4 computer aids to maintenance

by **Graham Mitchell** LES1.5.3

COMFORT(E), COmputerised Maintenance FOR Telephone Exchanges, is a collection of computer programs to assist in the maintenance and management of TXE4(RD) and TXE4A exchanges. The programs are being developed to operate on the DPE standard range of single-user Small Business Computers (SBC's) and the BT Factories Multi-User Multi-Processor (MUMPS) machine.

It is intended that program development and implementation follow a series of logical steps with the objective of providing maximum support to TXE4 exchange maintenance.

The programs currently available or planned are listed and described below.

Work scheduling

This program provides a method of estimating, planning and controlling work carried out by exchange maintenance staff based on the use of Standard Times. The facilities enable manpower resources to be matched with the work required in an exchange as determined by local management. Programs and documentation have been completed for TXE4(RD), TXE2, TXK1, TXK3 and some Strowger exchanges. The scheme was field trialled in the Aberdeen Area and is now available for national use. Note that its implementation is subject to agreement between the POEU and local management. The program will not be available for use on TXE4A until the Standard Times for routines, faulting and miscellaneous tasks have been specified.

Pate 4

This program enables fault printout from TXE4(RD) and TXE4A exchanges to be analysed locally. The program is widely used throughout the country with a considerable degree of success. The lack of easy access to SBC's prevent some sites from obtaining the full benefits of the program. Data transfer from the exchange to the SBC currently may be direct (online), by means of paper tape which is cumbersome and error prone, or by magnetic tape. The use of magnetic tapes for data transfer requires a small modification to the exchange interface. This small modification provides the facilities for high speed fault printout and is essential to obtain the full benefits from other programs. The development of the program is complete except for the investigation of any apparent sofware bugs discovered in the field.

Local docket analysis

Brief Description. This program enables TXE4(RD) or TXE4A fault docket information to be keyed in via the VDU terminal and contains facilities for retrieval and analysis into a wide range of categories. These facilities could eventually eliminate the need for a paper fault docket. A basic docket analysis program should be available soon.

Exchange records

This program provides a very rapid access to the subscriber records database for TXE4(RD) exchanges using a variety of enquiry entry points eg Directory Number, Equipment Number, Rack & Line Cct and MDF bar & pair. The database used is that developed by traffic and construction programs during the design and installation phases. The subscribers data on the 156mS scan can be examined and updated. The contents of the Cyclic Store may be compared with the records database base using the WAM (Tester 229) output which may be transferred to the computer online or via paper or magnetic tape. A utility program is available to enable the exchange database to be generated using the WAM tester output. This utility can be used for exchanges which were brought into service before the traffic and construction programs were available.

- Programs that provide enquiry and updating facilities for the TXE4A's subscribers database are being developed now and should be available soon.
- No database enquiry program exists for equipment which appears on the 36mS and 12mS scans of the Cyclic Store, eg

equipment such as O/G junctions etc. An enquiry program for these scans in addition to the enquiry program for subscribers scans would go further towards eliminating the needs for paper records. A feasibility study has been carried out to see what other information could be recorded and the structure of the appropriate database but this has not been finalised to date.

Service and performance

This program processes several cost and service indicators and compares them with locally set targets. The idea is to combine certain indicators and produce exception reports as required. A demonstration program has been written but future development is not anticipated.

If you require any further information regarding any of the programs above or the hardware required to run any of the programs contact your District (or Regional) TXE4 Maintenance Support Group.
(01-432 2388)

Materials and components centre makes its move on static

by **Trevor Morton-Holmes** MC1.5

Modern electronic components and systems are susceptible to electrostatic discharge (ESD) or 'zap' problems. Previously it had been thought only Metal Oxide Semiconductor (MOS) technology devices were at risk, but from work performed within BT it is now proven that the majority of semiconductor devices, and indeed some modern technology passive components, can be degraded, even if not instantly destroyed. The trend towards smaller device geometries, to achieve a lower (speed × power) product, will lead to increased vulnerability, as the on-chip protection circuits have very limited capacity to prevent damage from ESD type events. Components mounted on PCB's are just as vulnerable as the unmounted device, and in some cases the risk of damage is increased.

One of the more significant sources of static fields is the human body, where under certain conditions, static voltages exceeding 30,000 volts can be developed.

The human body threshold of feeling on discharge is around 5000 volts, yet **semiconductor components can be degraded by zaps of less than 100 volts.** The photograph shows the catastrophic damage caused by two 500 Volt electrostatic discharges applied to an input pin of a microprocessor. **You could do the same by touching that same pin** and would not know it!

Detailed studies have shown that the only effective way to control the static discharge from the human body is by equipotential bonding using a wrist strap and cord to the equipment receiving attention. It is not necessary, in this context, for the cord to be earthed, but only for man and machine to be at the same ambient electrostatic potential.

In common with the computing, electronics and the telecommunications industry generally, BT has recognised the cost benefits afforded by an ESD awareness campaign and the Materials and Components Centre in conjunction with Tools Group LLS2.3.4 has developed a range of electrostatic protection (ESP) items which are now available through the Vocabulary of Engineering Stores, (section 5T-B for all items except Bags Static Shield which are in Section 8M-B). Details of ESP items and their use in typical situations are available in a booklet entitled 'British Telecom Electrostatic Protection' available from LLS2.3.4, Room 1432, 207 Old Street, London EC1V 9PS.

Many commercially available products are on the market but their use by BT staff is not recommended. The BT range has been →

designed to provide highly controlled static bleed off times.

The range is manufactured to a standard of quality and reliability which we are confident will encourage a high level of user acceptability. Large contracts have been placed with reputable UK manufacturers leading to considerable cost advantages to BT. It is intended that quantities will be sufficient for individual tool kit issue for all BT staff involved with 'handling' electronic equipment.

ESP bonding points are also gradually being introduced on BT systems for the direct connection of ESP cords during installation or service activities.

It is vital that contract deliveries of electronic equipment and components are free from electrical overstress by static discharge and BT is ensuring that correct procedures are carried out by contractors and that the finished product is correctly packaged in static shielded or safe materials. A range of static shielding bags has been introduced for use within the business and it is equally important that all personnel involved with the 'handling' of electronic items are aware of the correct precautions so that systems realise their designed 'in service' lifetimes.

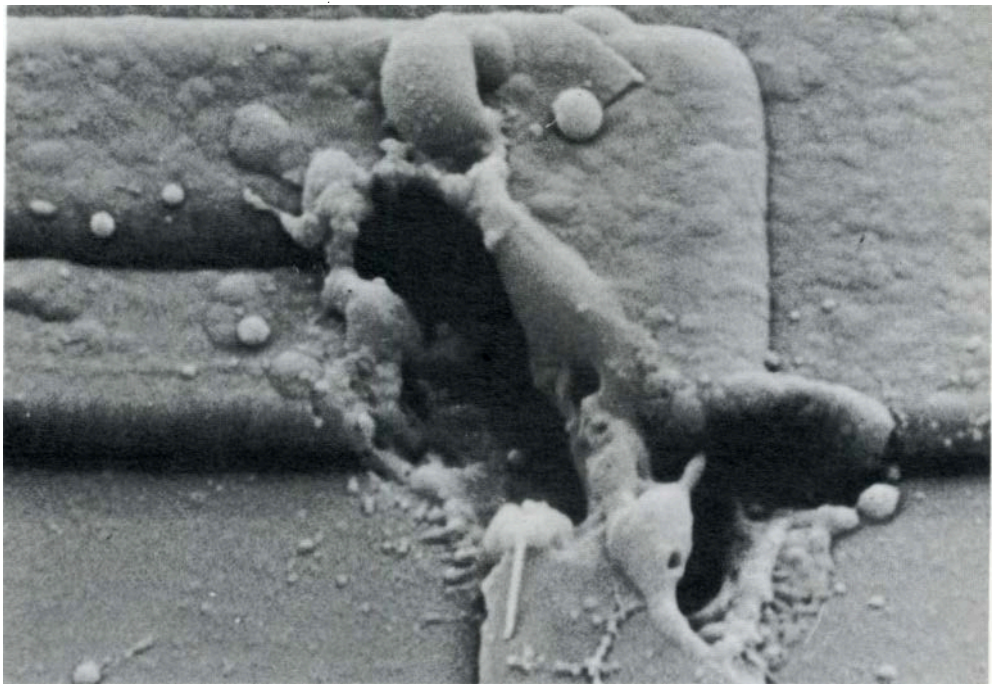
To help promote the principles of good ESP precautions and practices and to explain fundamental concepts involved, MCC has produced a short 'ESD Awareness' video film which is available for purchase in either VHS or U-matic format. ESD awareness seminars can also be arranged, tailored to be suitable, and entertaining, for staff at all levels in every part of the business.

An ESD module is included on BT electronic equipment training courses and an ESP 'user guide' will be available to managers in September for use as local instructions or procedures. Clearly situations will arise which will not be covered by the currently available information, but MCC will be pleased to help with any technical or procedural advice.

The Materials and Components Centre has a full range of laboratory facilities and services available to support staff involved with ESD, Electromagnetic Compatability (EMC) and related problems. On site investigations of problem situations or installations can be undertaken if required.

For further information please contact John Lee on 021-708 1111 Ext 267 or Chris Wynne-Davies on 266.
(021-708 1111 Ext 266)

Catastrophic damage on a microprocessor input pin which has received two separate 500V ESD zaps. Magnification 3000X.



Static electricity and digital equipment

by **George Clark** TSO2.1.3

The previous article has dealt with the work that the Materials and Components Centre has carried out in identifying the need to protect electronic components from the effects of electrostatic discharges. This article looks at the problems caused by electrostatic discharges in digital repeater and switching units and the precautions required to prevent discharges affecting equipments.

The problem

Electrostatic discharges are responsible for two serious problems in digital units.

- The first, and probably the best known, is component damage (see previous article). It should be noted that most current electronic components can suffer damage from electrostatic discharges even when mounted on printed circuit boards.
- Of equal importance, in an operational station, is the problem of electrostatically induced interference. Interference results in corruption of data and will thus affect the service seen by our customers. The following test results illustrate the interference effects for digital transmission equipment.

Equipment	Discharge volts applied to rack		
	2kV	4kV	6kV
EDL 140	Errors	Loss of synch	
EDM 6000 2/8 Mbit/s	—	Errors	Loss of synch
EDM 6001 8/34 Mbit/s	Errors	Loss of synch	
EDM 6002 34/140 Mbit/s	Loss of synch		

This is by no means a comprehensive list of affected equipments. It would be reasonable to assume ALL digital equipment is susceptible to interference.

Note that a discharge of approximately 4kV is just perceptible to a person as a slight shock and a discharge of approximately 7kV is required to produce a spark.

Typically voltages in the range 2kV to more than 10kV can be generated by a person walking. The actual voltage depends upon a number of factors such as floor material, clothes worn, humidity etc.

The solution

At present we can do little to prevent the generation of static charge and although it is possible to design equipment that is unaffected by static discharge it would be an expensive operation. Fortunately the preventive measures already devised for protection at component level are equally effective in preventing static discharges from reaching equipment.

These preventive measures are the use of a conductive wrist strap and high resistance connecting cord to connect a person to an identified point on equipments.

On connection any charge on the person will dissipate slowly to bring equipment and body to the same potential. This protection will continue as long as the connection is maintained.

This method of protection is known as equipotential bonding.

On BT equipment the position of the discharge points will be prominently identified. The position of the point may vary from equipment to equipment to minimise interference effects.

It is essential that only the identified bonding point is used.

Similar application of the principle of equipotential bonding, together with the use of anti-static bags and packing material will be used to protect spare units in storage and faulty units during transit between site and repair centres.

These preventive measures are being introduced as quickly as possible into units →

controlled by LCS and NN. The necessary instruction to implement these measures is currently with Unit Managers and District Specialists.

It is contained in Operations and Maintenance Guides, DMSU Maintenance Note No 38, and the booklet 'Take precautions. Electrostatic Interference Costs Us Money'

The latter booklet is currently being issued to all LCS and TS staff working on digital equipment. For further information on ESD problems and on the proposed methods of reducing the effects of discharge contact:

- Your Unit Managers
- Your District Specialist.
- DMSU Maintenance. Steve Barber TSO2.3.5 01-432 9168.
- NN Switching Maintenance. (except DMSU) Brian Harris TSO2.2.1 01-432 9178.
- NN Transmission Maintenance. George Clark TSO2.1.3 01-432 1328.
- LCS Digital Switching Maintenance. George Huggins LES4.2.2 01-432 9412.
- LCS Transmission Maintenance. Mike Howard LLS2.6.5 01-250 6036.

(01-432 1328)

Call sending capability for the O/G Junction Routiner

by **George Gaffney** ES37
Stoke on Trent Area

If you are responsible for the maintenance of a TXS exchange that already has an O/G junction routiner, then this is for you, read on.

In the unmodified state the routiner (diagrams AT 5255 and AT 5131 refer) was designed to test two wire loop-disconnect junctions for continuity, polarity, and balance as far as the incoming selector or relay set at the distant exchange. It took no account of any outgoing relay set or the ability to dial over the junction. When it was designed tin 1957 two wire loop-disconnect junctions predominated in the local network and there was a need for a routiner of this type. During the last twenty-five years a number of different signalling systems have been introduced to the local network which cannot be tested by this routiner.

A modification seeks to overcome the shortcomings of the routiner by allowing it to make tests through an outgoing relay set, irrespective of the signalling system used, and after proving continuity and polarity, to send up to sixteen digits to a test number and interpret the results of the call. This is achieved by inhibiting the test finish signal after completion of the normal tests, which are still applied, and diverting into an auxiliary test unit the P, positive and negative wires. After completion of the tests applied by the auxiliary test unit, control is returned to the routiner.

The auxiliary test unit uses the BT Sceptre 100 telephone as its memory store and pulsing element. The test sequencing and routiner stepping is undertaken by a solid state logic control board.

The facilities are:

- on completion of the normal test sequence the routiner hands control to the auxiliary test unit if the auxiliary test key is operated. If the key is normal testing proceeds as if the auxiliary test unit were not fitted.
- seizure of the O/G relay set, if one is provided, or the distant selector or relay set, and testing for continuity and polarity up to the first transmission bridge.
- sending a number of up to 16 digits to an ordinary test number at or through the distant exchange.
- monitoring for receipt of any meter pulses, line reversals or tones received.
- if the pre-programmed combination of meter pulses, reversals, and three bursts of 400Hz test tone are received a test finish signal hands control of the routiner back to the normal test unit.
- to generate an alarm and if on automatic control, initiate docket print, under any of the following conditions
  - failure of line continuity.
  - polarity reversal on seizure.
  - receipt of NU tone after sending.
  - non-receipt of a meter pulse if pro-

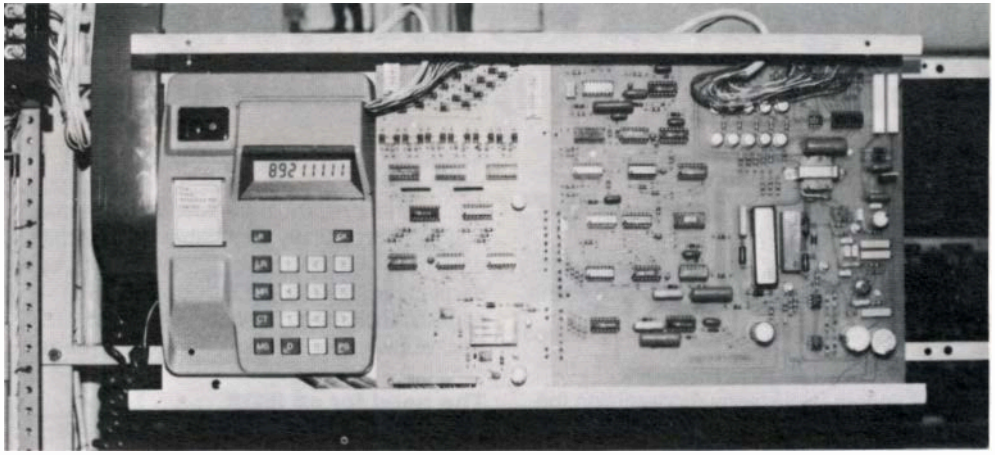
grammed to expect one.
– non-receipt of a reversal if programmed to expect one.
– non-receipt of test tone.

- if the routiner is under automatic control abandonment of the routine cycle if three to five (pre-programmed) fault dockets are initiated during any routine cycle. This prevents continuously ringing a customer under faulty routing conditions and the printing of useless dockets in the event of a junction cable fault.
- rejection of meter pulses of less than 110mS duration.
- on manual control only, the ability to check for subsequent meter pulses on MOJ routes, with the display on the Sceptre telephone displaying the time in seconds since receipt of the initial meter pulse.

Results

The modification was first applied at a 7000 line, RND exchange. There are 260 junctions, including level one, all connected to the routiner. From the date of implementation there has been a steady improvement in PD, PE and WC on MAC measurement sequences 2, 3 and 4.

One unexpected bonus has been the number of barretters found to be out of balance. Listening tests showed that relay sets failing the balance test were subject to line noise caused by mains hum. The level of noise dependant on the calling customers line conditions. It is also possible that those barretters that are high resistance on one element, may be the ones that will go open circuit in the near future.



Cost

The two PCB's and associated components cost around £70. Mounting the components and routiner modification is approximately sixty hours work. The greater cost is incurred in re-routing the routiner access from the TJF to the IDF and in providing the IDF jumpers. The amount of work depending on the size of the access and the number of junctions, this will obviously vary considerably from one exchange to another.

Circuit design

The circuit was designed by Roger White, TO at Rugeley exchange. He also constructed the prototype and produced the artwork for the PCB's used in the area standard modification. The photograph shows the Sceptre telephone and PCB's mounted at the top of the routiner rack. The perspex front cover has been removed for clarity.

Conclusion

MAC sequence results are being subjected to even more stringent targets. If further improvements are to be obtained it is necessary to identify faulty circuits and equipment at an early stage, preferably before becoming service affecting. This modification allows for all O/G junctions, from a medium sized exchange, to be tested every twenty-four hours and problems quickly identified. It is also possible to use the routiner during the day to send test calls over each junction in turn on any selected route. A very useful facility when customers report difficulty in dialling a specific destination. Regular use of the modified routiner can only result in an improvement to the service given to our customers.

(0785 57340)

Integrated services digital network (ISDN) – the network of the future

by **Colin Haworth and Alan Cook**
LCS/NSD 3.1.5

This article presents an introduction to a major development in telecommunications which will profoundly affect communications in the UK over the next decade.

The integrated digital network

British Telecom is currently modernising the Public Switched Telephone Network (PSTN) with the provision of the Integrated Digital Network (IDN). The IDN is based upon processor controlled digital System X exchanges interconnected with digital transmission and supported by fast interprocessor common channel signalling. The IDN wil provide a wholly digital connection (circuit switched at 64 kbit/s) between all digital local exchanges.

The conventional telephone network found in most countries, including the UK, is based primarily upon analogue transmission and switching with restricted signalling capability. This results in a network in which a national call takes between 5-25 seconds to set up, and establishes a transmission path of 3kHz bandwidth with an ill defined delay and attenuation characteristic. The latter places severe restrictions on the speed at which data can be transmitted.

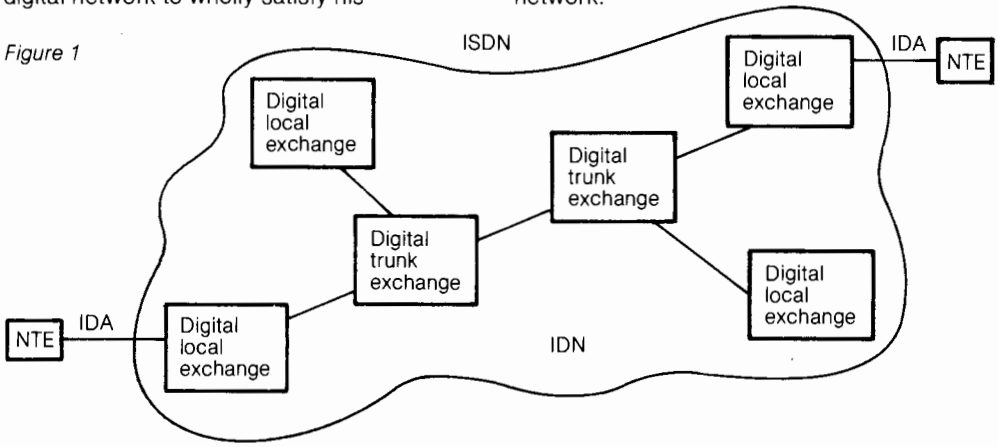
Despite these limitations the PSTN has been used to support both telephony and a limited set of non-voice services such as Datel and Prestel. However the inherent constraints present in the analogue network make it increasingly unsuitable for emerging data transmission applications. This has been partly overcome by the introduction of service dedicated networks such as the Packet Switched Network and Kilo Stream.

The need for an ISDN

Although the IDN will greatly improve the quality of service which the PSTN provides, the real benefits of a digital network will only be realised when digital working is extended to the customers premises and when the customer is given the capability to utilize the digital network to wholly satisfy his communication needs, whether for voice or data services. This is achieved by extending the IDN to the customer, by means of Integrated Digital Access (IDA), thus creating the ISDN (figure 1).

Telephony accounts for most of BT's current income but the rapidly expanding demand for data services will drastically change this position, and BT must be able to respond to market requirements. The creation of dedicated networks to carry these services is an expensive proposition. What is needed is a general purpose network to which comparatively small enhancements may be made in order to support new services as they arise. The ISDN is such a network.

Figure 1



The ISDN is aimed initially at business customers using modern office communications equipment but the continued market growth of such devices as home computers and videotext will make the ISDN attractive to the residential market too.

Integrated digital access

The creation of the ISDN hinges on the provision of a digital link between the customer's premises and the digital local exchange, known as IDA. Two forms of IDA have been developed; single-line IDA and multi-line IDA (figure 2).

- Single-Line IDA provides the customer with two traffic channels (exchange connections), each with a different directory number. One traffic channel can carry voice or data at rates up to 64 kbit/s whilst the other traffic channel can carry data at rates up to 8 kbit/s. Both traffic channels can be used independently and at the same time. (At the exchange, the 8 kbit/s traffic channel is rate adapted by reiteration to 64 kbit/s for transmission through the IDN.) In the customer's premises a Network Terminating Equipment (NTE) provides the customer with standard interfaces for the terminal equipment. Among the many functions that the NTE performs is the multiplexing of the two traffic channels (64 kbit/s and 8 kbit/s) along with an 8 kbit/s signalling channel (total 80 kbit/s). This signalling channel contains the signalling information of both traffic channels. The signalling system employed is specific to IDA and is known as the Digital Access Signalling System (DASS). The NTE also provides the interface to the full duplex digital transmission system which operates over the customer's normal 2 wire local line to the exchange. The three channels making up the 80 kbit/s IDA connection are shown in Table 1.

Table 1

Channel Designation	Channel Rate	Usage
B	64 kbit/s	Voice or data
B'	8 kbit/s	Data
D	8 kbit/s	Signalling

Note that the D channel provides the signalling for both the B and B' channels and carries call progress information by means of DASS.

- Multi-line IDA provides up to thirty 64 kbit/s traffic channels (exchange connections) carried on a 2 Mbit/s digital path. Separate 64 kbit/s channels are allocated within the 2 Mbit/s for signalling and parity/synchronisation. The principal initial use of this type of access is expected to be the connection of digital PBXs to the ISDN, thus

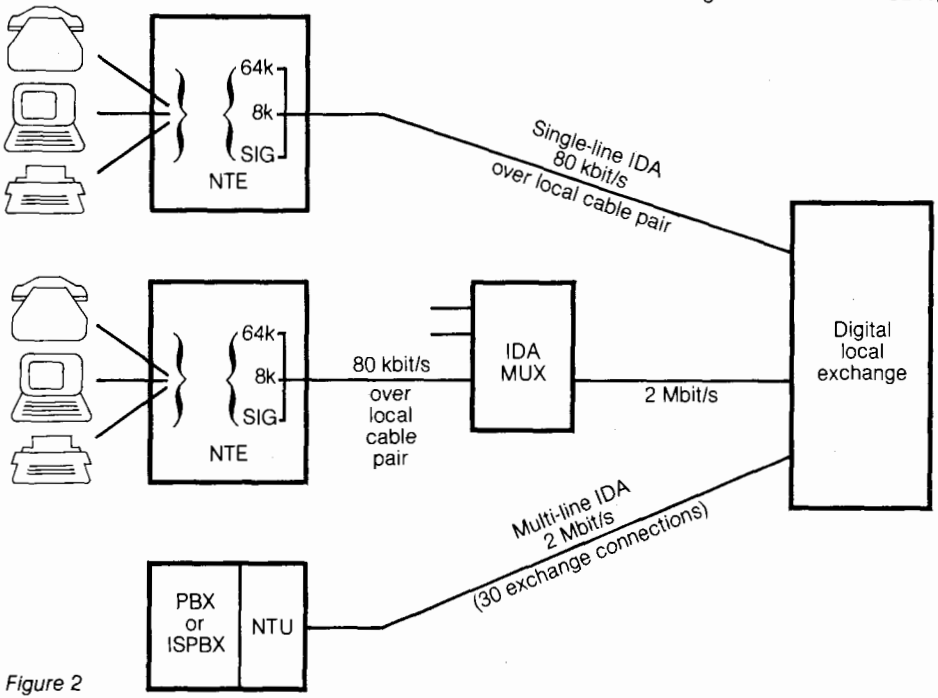


Figure 2

→

permitting the provision of the ISDN capability to the extensions of that PBX. Such a PBX is known as an Integrated Services PBX (ISPBX). The multi-line IDA connection is terminated at the customers premises on a Network Terminating Unit (NTU).

IDA multiplexor (IDAMUX)
In exceptional circumstances single line IDA can be provided to customers in exchange areas still served by analogue exchange equipment by means of an IDA multiplexor. This multiplexor extends single line IDA connections for up to 15 customers to the nearest most appropriate digital local exchange over a 2 Mbit/s digital path (figure 2).

Network terminating equipment (NTE)
Two types of NTE have been developed for the Pilot ISDN service. The NTE1 is a desk top instrument which includes a digital telephone, keypad, display and a single data port. This data port can be configured to operate over the 8 kbit/s or 64 kbit/s traffic channel to the exchange. The other type of NTE, the NTE3, is a wall or shelf mounted device designed for applications where there are a number of different terminal equipments requiring access to the network and which are all capable of controlling call set up procedures. This NTE has no built in telephone, keypad or display, but has six terminal ports each of which may be configured to support various types of terminal equipment. Because no more than two of the six data ports may be connected to the exchange at one time (64 kbit/s and 8 kbit/s traffic channels), the NTE resolves contention between them, acting as a traffic concentrator.

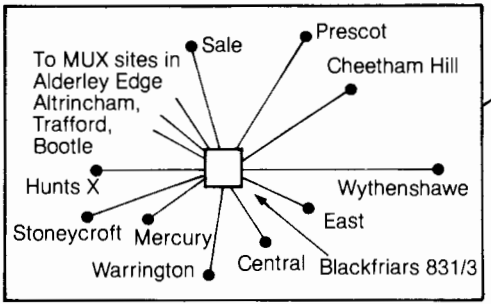
For the next phase of ISDN a new cost reduced NTE (NTE 4) is being developed which will incorporate new internationally agreed rate adaption techniques and will be a data only NTE offering two X21 ports. To facilitate interworking to V-series terminals and to provide a telephony capability, a range of terminal adaptors is being developed to connect onto the X21 port of the NTE4.

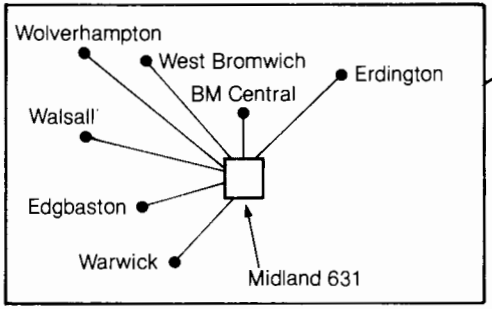
The pilot ISDN service
In order to gain experience on the technological development and operational aspects of providing a National ISDN, and to stimulate interest in ISDN amongst customers and terminal equipment suppliers BT is implementing a pilot ISDN service based on four System X digital local exchanges (two in London, one each in Birmingham and Manchester). The pilot ISDN service is not a field trial but the first step towards providing a National ISDN service.

The pilot ISDN service includes provision of 1000 single-line IDA connections and 40 multi-line IDA connections spread equally over the four System X digital local exchanges. The majority of the single-line IDA connections will be to out-of-area locations, served by IDAMUX's parented on these System X exchanges. By the use of these multiplexors a reasonably large geographical area of the UK, covering the major business centres, will be included within the pilot service (figure 3).

National ISDN
The pilot ISDN service is the nucleus on which the National ISDN will grow. All the digital local exchanges being purchased by BT have the inherent capability to terminate both single-line IDA and multi-line IDA.

A decision to include IDA line equipment in the normal planning, dimensioning and ordering procedures for digital exchanges will come after gaining marketing and operational experience from the pilot service. In the mean time, IDA line equipment, IDA multiplexors and NTE's will be purchased and controlled by LCS/HQ. Each Area or District will provide IDA service based on their





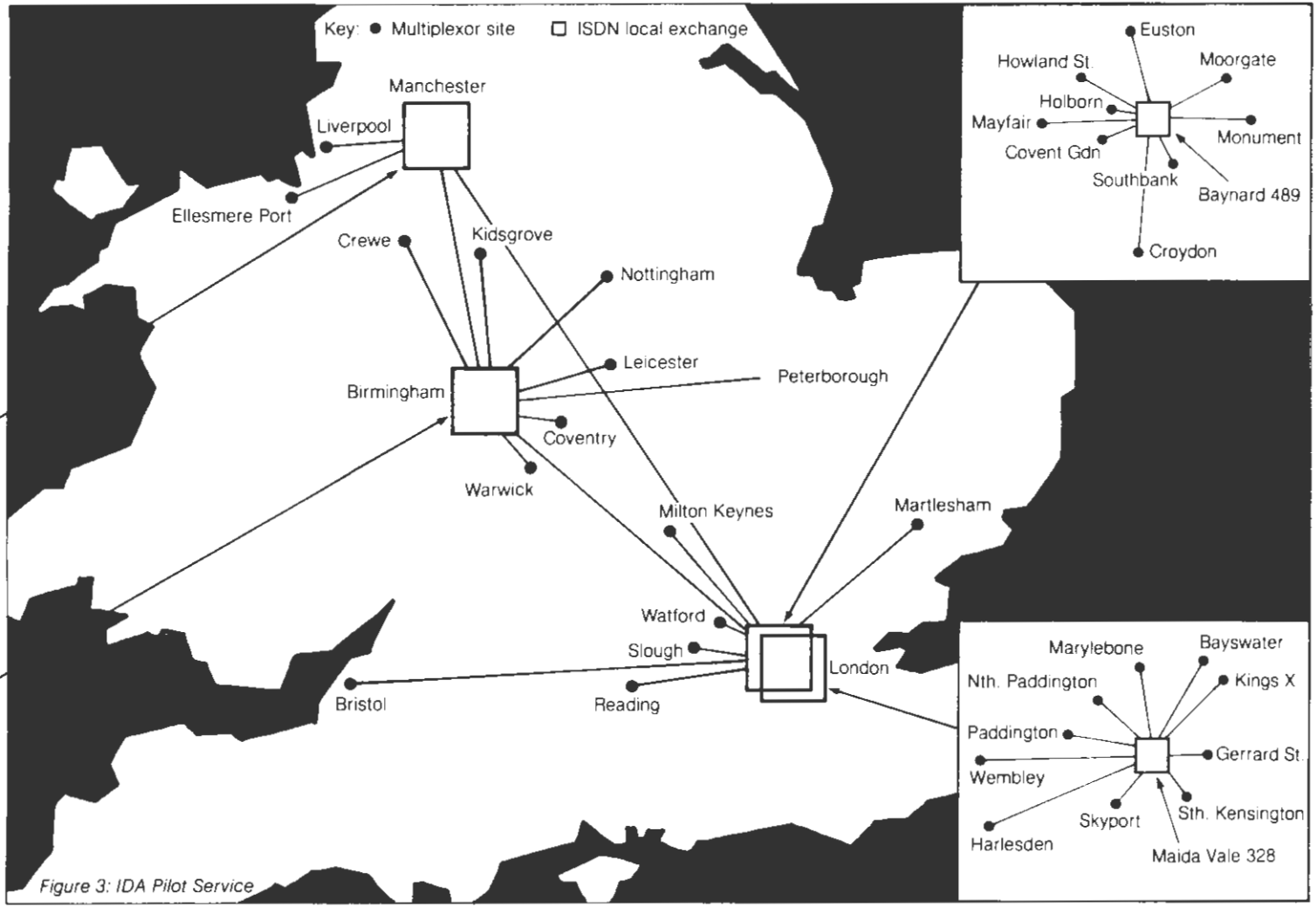


Figure 3: IDA Pilot Service

market forecasts by making use of these central stocks of equipment and installing the equipment by Direct Labour. During this time and beyond, there will be a program of enhancements to provide

- new ranges of NTE
- links between the ISDN and dedicated data networks
- new supplementary services
- enhanced network facility

BT will also implement international standards appropriate to ISDN as and when these are agreed. An example being the introduction of 144 kbit/s single line IDA (as compared with 80 kbit/s single line IDA) which will provide for two 64 kbit/s traffic channels.

ISDN/IDA Maintenance

ISDN equipment such as the multiplexors and the 2 Mbit/s digital path are continuously monitored allowing BT to identify and rectify faults rapidly, in many cases before the customer is even aware of the fault. With the introduction of IDA the local line from the NTE to the local digital exchange (or multiplexor) can now undergo automatic testing from the exchange at regular intervals, possibly at night. Faults causing loss of transmission and/or signalling are automatically identified and reported to the appropriate BT maintenance centre.

The NTE can support exchange based testing even if the customer has switched off the NTE mains power, minor faults not detected by automatic means will rely on the customer fault reporting in the normal way.
(01-432 2291)

The derived services network

by **Dave Baker** NN/TSO 2.2.1

Introduction

In June 1982 a Task Group was set up within Head Office to investigate what action should be taken to overcome the shortage of National Numbering Group (NNG) codes to provide for Derived Services. The recommendations were published in August 1982 which while acknowledging that the more elegant solution would be to add a Derived Services Switching function to selected Digital Main Switching Units the relatively long lead time precluded the use of this method.

The method recommended, and finally adopted, was to provide an overlay network using existing Type 14 Register Translators as the controlling equipment and recovered Strowger switching equipment. It was envisaged at that time that the function of handling Derived Services traffic would eventually be taken over by System X as the digital network evolved. However, because of the forecast in the growth of traffic it has now been decided to retain the overlay network and replace the analogue Derived Services Switching Centres (DSSC's) with digital centres in 1987.

Services

The services that will initially be provided by the Derived Services Network (DSN) are Linkline 0800 and Linkline 0345. Other services may be offered in the future and to cater for these additional NNG codes have been reserved.

- **Linkline 0800**

This facility is very similar to the existing Freefone facility with the exception that it is fully automatic and operator assistance is not required. The caller dials a six digit number preceded by access code 0800 and is automatically routed to the appropriate answering point. As with the current Freefone service the renter, called the Service Provider, pays for the call charge and not the caller.

- **Linkline 0345**

Again the caller dials a six digit number but this time preceded by access code 0345 and is automatically routed to the appropriate answering point. In this case however the caller only pays a local charge (at Peak, Standard or Cheap rate) and the Service Provider pays the difference between the local call charge and the total cost of the call.

- **Universal Access Number**

A facility that may be attractive to some organisations is Universal Access. This enables Service Providers to advertise one number nationally and have up to eight local answering points, that is one in each DSSC catchment area. This is achieved by

arranging for controlling equipment at each DSSC to give a local routing translation to the national number dialled. The facility can be offered on Linkline 0345.

The Derived Services Network

The analogue DSN will consist of eight fully inter-connected DSSC's each with their own catchment area. The location of the eight DSSC's will be

–London covering London area
–Guildford covering S.E. except London
–Bristol covering S.W. and S. Wales
–Cambridge covering East Anglia
–Birmingham covering Midlands
–Manchester covering N.W., N. Wales and N. Ireland
–Leeds covering N.E.
–Glasgow covering Scotland

Access to each DSSC will be via Main Switching Units (MSU's) within each catchment area. Smaller MSU's which cannot justify a direct route will gain access via larger MSU's.

Routing of calls

The Derived Services Network is only designed to handle incoming calls and cannot be used to make outgoing calls.

A Derived Services call is handled in the normal way by way of the local exchange to the MSU, where the charge rate is determined, and the call is extended to the local DSSC. The whole number minus the initial "O" is passed to the DSSC where it is examined by the Type 14 Register Translator to determine firstly, whether it is a chargeable or non-chargeable call (for example 0345 or 0800) and secondly, to determine the location

Figure 1: DSSC Catchment areas

of the Service Provider. The Type 14 Register Translator gives an appropriate routing translation and the call is switched to the Service Provider through the switchblock or if the Service Provider is in a distant catchment area the call will be routed to the appropriate DSSC. Trunks from distant DSSC's terminate on incoming 1st Selectors and the routing digits received from the distant DSSC switch the call to the required Service Provider.

Ringing current is sent to the Service Provider in the normal way from a Final Selector. When the called Service Provider answers, ringing is tripped, and the Service Provider answer signal is extended back to the contolling Type 14 Register Translator equipment. If the call is a Freefone call the Service Provider answer is suppressed at the originating DSSC. If it is a chargeable call the Service Provider answer signal is extended back to the MSU to initiate local call charging.

Derived Services Switching Centres

Each DSSC will use three main types of hardware

–Strowger switching equipment.
–Type 14 Register Translator Access equipment.
–Call logging equipment.

• Strowger switching equipment

The switchblock will, in the main, consist of recovered Strowger equipment refurbished to an acceptable standard. Where the demands for Strowger equipment cannot be met by re-use, then new equipment has been ordered from the manufacturers.

The switchblock comprises three Group Selector stages (D1st's, D2nd's and D3rd's) and a Final Selector stage. Each unit is fully self contained incorporating its own common equipment, Ringing Apparatus, Alarm Control racks, and so on. All standard Strowger exchange support equipment such as Trunk and Junction Routiners, Traffic Recorders, Special Faults telephone and Test numbers, are provided to ensure all maintenance procedures can be carried out to maintain the efficiency of the unit. →

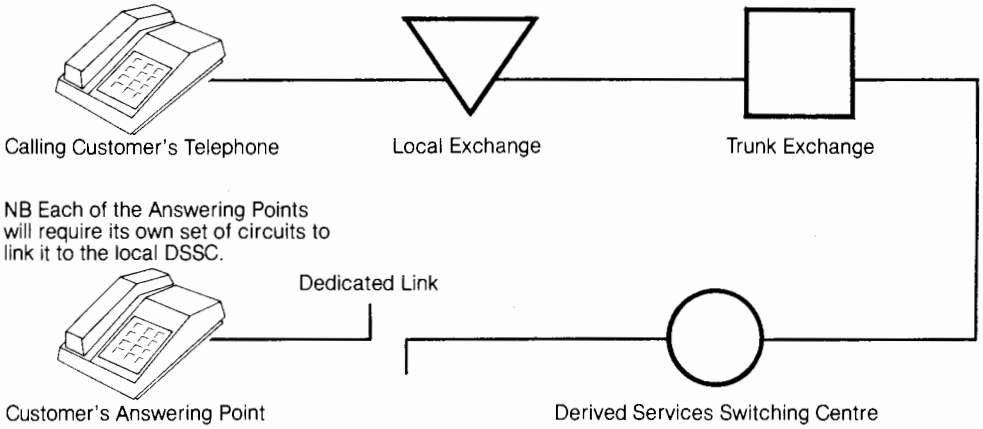


Figure 2: Call routing

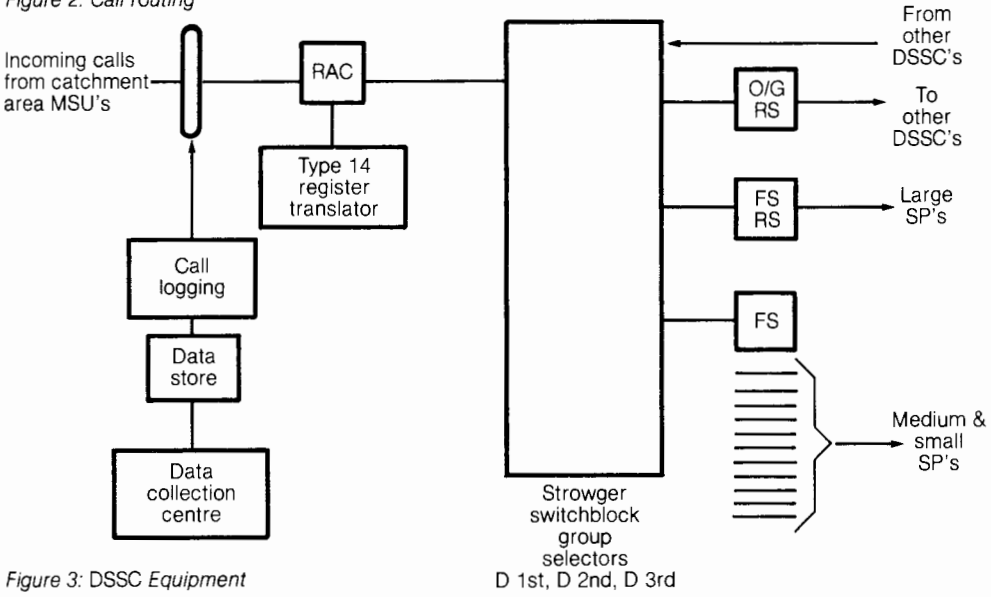


Figure 3: DSSC *Equipment*

• Type 14 Register Translator equipment

The Type 14 Register Translator installation at each DSSC will consist of a minimum of two processor racks and a number of Register Access Circuit (RAC) racks. Processors are connected in a ring with left and right highways connected to adjacent processors so that data is constantly being compared by adjacent processors and any discrepancies are output to a teletypewriter. Two teletypewriters are provided on each processor ring; the remote fault teletypewriter receives all print output from the system whilst the service teletypewriter is used for general man-machine communications, including RAC routiner control and system faulting.

Type 14 Register Translators are already in use at Central Switching Units in the Public Switched Telephone Network (PSTN) and have proved to be very reliable in service. The main differences of the DSN version to the PSTN version are

–Store capacity of DSN version has been increased from 64K to 128K words so to increase the code expansion and routing store capacity of the processor.
–RAC Routiner added.
–No MF capabilities.
–Different applications software.

A more detailed description of the Type 14 Register Translator is given in Maintenance News No. 20.

Register Access Circuits, although developed a number of years ago for use in the PSTN, were never utilised and are being used for the first time in the DSN.

Each RAC rack houses 128 RAC's and

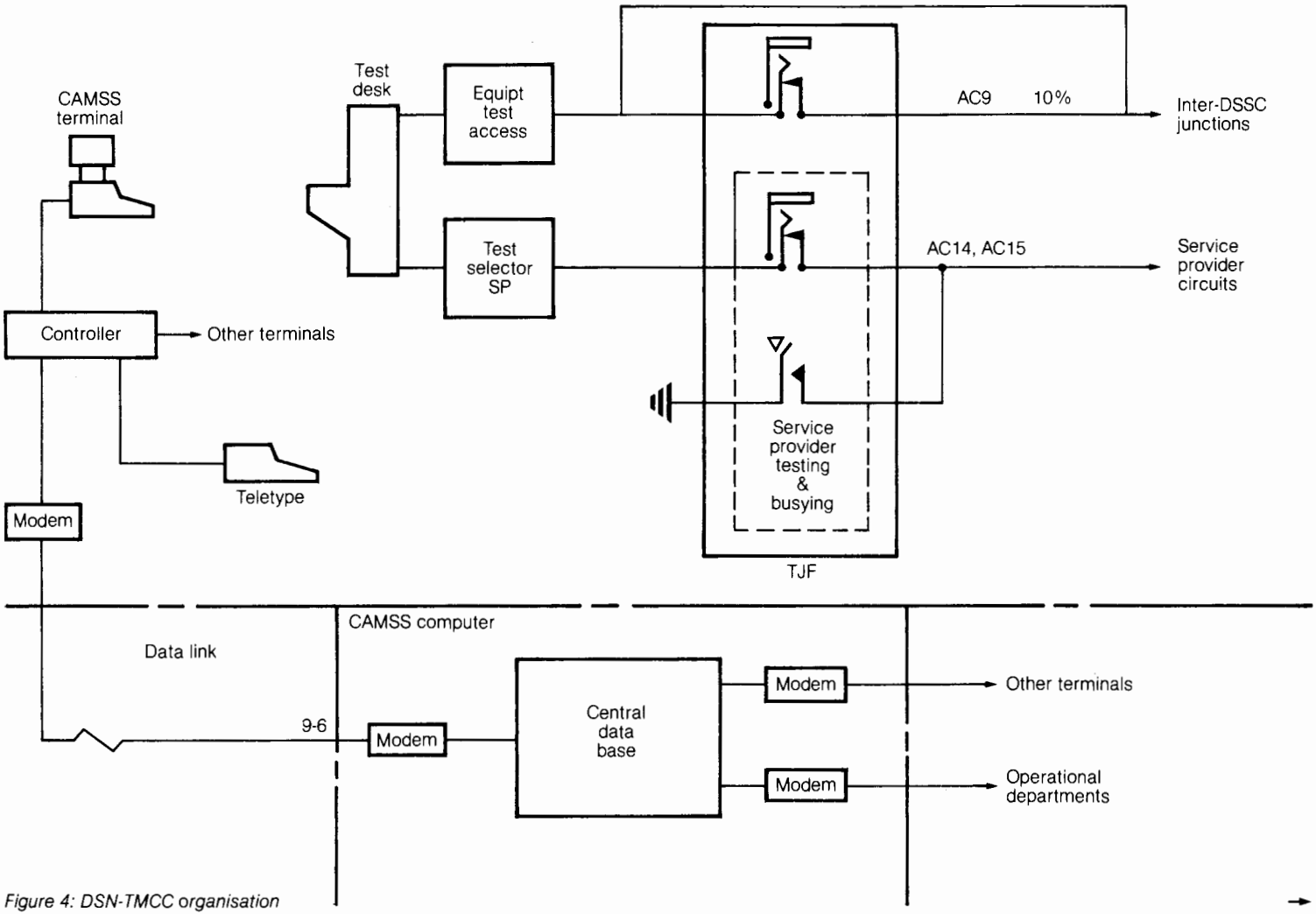


Figure 4: DSN-TMCC organisation

associated equipment including Access Switches. The two-stage Access Switches, maximum of 16 per rack, are graded crosspoints connecting RAC's to Signal Conversion Circuits (SCC's) on the processor rack. The RAC itself is a microprocessor controlled circuit which can be strapped on each circuit edge connector to give the required supervisory conditions, that is partial or full supervisory, 2 or 3 wire access. It acts as an interface between the line and the Type 14 Register Translator equipment and provides a transmission bridge and 'clean' pulsing-out circuit. On the outgoing side each RAC is associated with its own D1st Selector in the Strowger switchblock.

• Call logging equipment

The Call Logging Equipment (CLE) is a proprietary system which has been enhanced to meet the requirements of BT for a billing and network management system in the DSN.

The DSSC equipment consists of call logging equipment (SRS 2020A) which is connected to the −ve, +ve and TCS leads of all RAC's and records all details of the call, number dialled, time of call, duration of call, and so on. Each SRS 2020A can monitor 400 circuits. The Service Provider answer signal is monitored on the TCS lead to determine when call charging should start and finish. When the call has finished the SRS 2020A transfers all the information to a data store (PDU 20) where it is stored on disc.

At pre-determined intervals during the day the data stored on the disc is transferred over a data link to the Data Collection Centre (DCC) at Oswestry, Shropshire. Here the data is collated by the Host computer, transferred to magnetic tape and sent to the National Billing Centres for preparation of Service Provider bills. As all information of all calls is contained on the data records, use can be made of this to provide Management and Traffic statistics and also call statistics.

Service Providers

Service Providers are divided into three categories: High user, Medium user and Low user and these categories are related to the type of access provided

- High user Group Selector level (DDI or non-DDI)
- Medium user 11/- Final Selector level
- Low user 2/10 Final Selector level

Each non-DDI Service Provider will terminate on a subscribers uniselector circuit within the DSSC. Outlets of the uniselector are connected to a Service Provider Line Test Circuit (SPLTC) which when seized by the Service Provider will return continuous ringing tone. This facility enables Service Providers to check that communication with the DSSC is possible.

Service Providers using Director Exchange Line (DEL) accessing principles may be accessed from the DSSC by means of a direct 2 wire circuit to their premises provided they are situated within the unamplified signalling system limits. However, as DSSC catchment areas are large many Service Providers will require the use of amplified signalling systems. Initially this will be catered for by the use of SSAC14 or SSAC15C and eventually SSAC15E.

Fault Reporting and Testing arrangements

Each DSSC will have associated with it a Derived Services Network Fault Reporting Point (DSNFRP). All amplified Service Provider circuits will be routed through Test Jack Frames to enable faulty circuits to be tested quickly and busied if necessary. All other circuits will be accessed using either a Trunk Test Final Selector or Ordinary Test Final Selector for 2/10 and 11/- circuits.

The Test Desk connected to the DSNFRP will be used for Service Provider fault reporting, administration and control. A Freefone Universal Access Number 0800 1100 has been provided for this purpose and also a number of additional freefone lines have been provided for engineering use.

Service Provider details, fault history and so on will be entered onto a centralised database and for this the Computer Aided Maintenance for Special Services (CAMSS) will be used. Access to CAMSS will be provided by means of a terminal. This will enable Service Provider faults to be progressed quickly and efficiently, enable the status of any Service Provider in the country to be ascertained immediately and enable Service Provider fault statistics to be produced.,

(01-432 9037)

Optical connectors used on proprietary and standard optical line systems

by **B. Plummer** NN/TS02.1.1

Optical connectors provide a flexible method of interconnecting optical fibre ends to one another, enabling internal and external maintenance activities such as replacing an optical equipment card, or cable fault location, to be performed with greater ease. They are analogous to their coaxial counterparts in so far as the application is much the same but, whilst they may look like a coaxial connector, the physical differences are in fact profound. Optical connectors need to align glass-fibre cores of between 7 and 50 micrometres (one-thousandth of a millimetre) and are thus very high precision devices which have to be handled with great care. Optical connectors could be described as a necessary evil as they are easily damaged and have proved on many occasions to be a maintenance hazard. The problems have been caused by incorrect handling during maintenance and, with some connectors, weaknesses in their design.

The first three orders placed by BT were for Proprietary Optical Line Systems (POLS) utilising equipment made to the manufacture specifications. This has resulted in a variety of optical connectors being used, each employing different techniques to perform the same task and therefore requiring different terminating procedures. Further orders for Standard Optical Systems (SOS) made to BT specifications have been made, mainly of the single-mode 140 Mbit/s variety for the trunk network, and for these a standard connector (Connector Optical Fibre no. 4A) will eventually be used.

Table 1 **Types of connector in use**

Manufacturer		Proprietary Specification	BT Specification
STC	Single-mode	Cannon LLE	Cannon LLE or COF 4A
GEC		Diamond	Diamond or COF 4A
PTL		Seiko SAP-1	Seiko SAP-1 or COF 4A
STC	Multi-mode	ITT OFP101 or Stratos SS430 or SSR430	
GEC		Hellerman-Deutch "Kliklok"	
PTL		PTL FC704 "Taplow" or PTL FC703	

Connectors adopted as BT standard are:

Multi-mode: Connector Optical Fibre no. 2A (COF2A). See figure 1 ("Stratos" Ruggedised 430 series)

Single-mode: Connector Optical Fibre no. 4A (COF4A). See figure 2 ("Leetec" FL4000 series)

Connector care

It is most important that optical connectors are handled as little as possible and with extreme care, and should be kept clinically clean. Before de-coupling an optical connector, the LED or LASER transmitter on the fibre must be de-activated, by removing the appropriate card or its power supply or power feed unit for dependant regenerators. When the connector is decoupled it should immediately be checked with an Optical Power Meter to ensure no light is being transmitted.

Unless they are to be used immediately, the connectors and open ends of couplers should be protected with clean dust-caps. If dust-caps are unavailable the connector should be enclosed in a small clean polythene bag sealed with an elastic band or adhesive tape. Never touch the end face of the connector.

Do not let optical connectors lie on the floor. If they are to be left disconnected, then wind the cable into a loose coil, greater than 100 mm diameter, avoiding any sharp bends and tie the coil together.

Before re-coupling optical connectors, the end faces of the connectors and the coupler apertures must be cleaned with an air duster.

Cleaning aids

The following will be available from the Vocabulary of Engineering Stores as general-

sector items in due course. However an initial issue of kits is to be made by TSO2.1.1 in April of 1985, for use on POLS and SOS.

- KIT 721A (Optical connector cleaning kit)
- KIT 722A (Replenishment kit for KIT 721A)

KIT 721A comprises a plastic carrying case containing an aerosol air duster, cotton buds, cleaning solvent and a selection of optical connector dust-caps.

Also available as a special sector item are Microscopes No. 1A which are specially designed for the inspection of optical connectors. When using a Microscope it is important to follow the instructions given in TSO2.1.1 Group Memo no. 27 (OFDLS15), and never use a Microscope on a connector carrying Laser or LED light. **Note that the light is not in the visible spectrum, and therefore cannot be seen.**

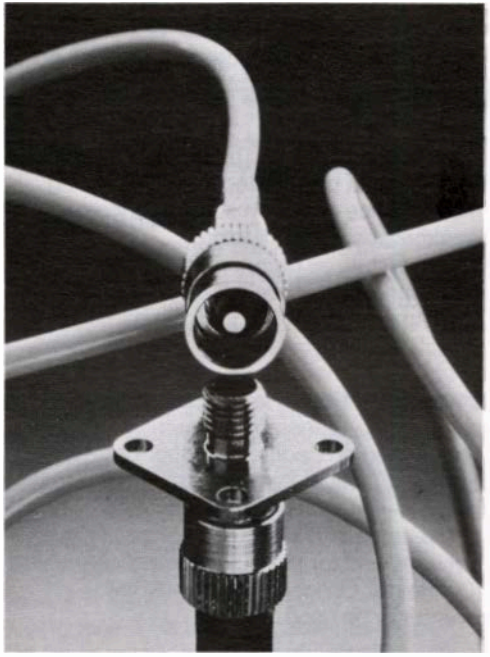


*Figure 1: Connector Optical Fibre no. 2A comprising 2 * POF 2A plus a Coupler*

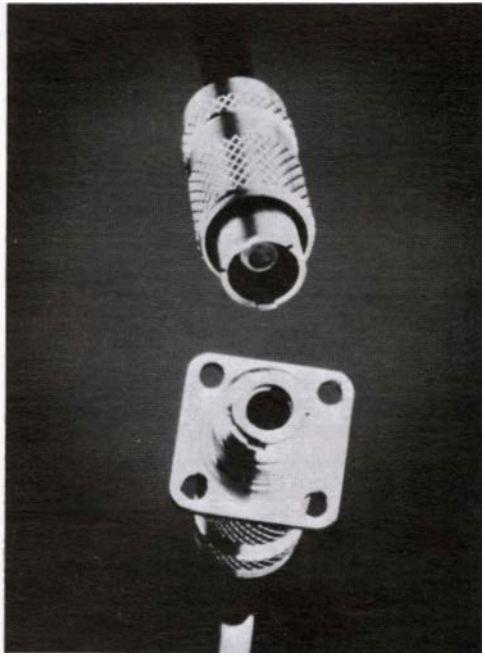


*Figure 2: Connector Optical Fibre no. 4A comprising 2 * POF 4A plus a Coupler*

Cleaning a connector

If the connector end face is accidentally touched or otherwise contaminated, the following cleaning process should be performed. View the connector with a Microscope, and if dirty, clean the end face with the aerosol duster. If this is unsuccessful further cleaning can be performed using a clean cotton-bud dipped in the solvent and gently wiped across the end face of the connector. Wipe dry with the other end of the cotton bud, then use the aerosol duster again. View under the Microscope and if necessary repeat the cleaning procedure until thoroughly clean.

Faulty connectors

Faulty connectors are found on test-cords, they can be repaired at Guildford ARC; TSO2.1.1 group memo 18/83 (OFDLS 09) refers. In addition a central stock of spare connectors and piece-parts are held at Guildford ARC together with terminating kits which can be dispatched to meet field maintenance and repair needs. Requests for assistance when faulty connectors are discovered should be sought via your supervising officer from NN/TSO2.1.1 head office.
(01-432 9142)

Electronic Component Supply

by **Trevor Morton-Holmes** MC1.5
Yes, I'm afraid it's another abbreviation to remember, but 'Co-ordinated Operations for the Supply of Telecoms Electronic Components' (COSTEC) is rather long winded to say.

Component availability problems
In these days of ever changing products and systems, field staff must be able to obtain replacement components at the right standard and quality as soon as they need them. This principle applies to all electronic components, even those 'difficult' obsolescent components, customised chips and low volume items.

The solution
COSTEC has been established to overcome your electronic component supply problems. All you have to do is tell the COSTEC divisional representatives the problem and we will help.

We use the information from the ORCHID (Off-site Repair Committee – Inland Division) on new products or systems to be repaired to anticipate your spares requirements. However if you still have difficulty obtaining replacement components please contact us.

What is COSTEC
It is a group of people who meet regularly to discuss the purchase and supply of electronic components for products or systems used within BT. Representatives from LCS, NNS and BTI provide the component user's requirements. The three primary in-house BT stockists, namely Materials Fast Response Service (FRS), British Telecom Research Laboratories Electronic Component Distribution (BTRL ECD) and BMF Electrospeed Components, decide how best to meet those requirements. COSTEC is co-ordinated by Materials and Components Centre (MCC) which is looking after the corporate interest and is concerned with the quality, reliability and sourcing of components. As you can see in figure 1, COSTEC enables direct communication between component users, buyers, stockists and suppliers of electronic components.

Market intelligence
MCC is the interface between BT and the electronics industry on component matters. It has frequent meetings with component manufacturers in order to gather market intelligence and predict future technological developments and industrial trends. It attends BSI committees in order to influence specifications and standards both at national and international levels. It also represents BT at major 'component user' organisations such as, STACK, EXACT and DATAQUEST.

Costec objectives
COSTEC aim to provide British Telecom with an economical, rapid and assured supply of suitable components using modern buying and distribution techniques.

How costec meets its objectives
Costec intends to produce a comprehensive list of all electronic components used within BT, detailing suitable sources of supply. In the meantime each in-house stockist has produced their own catalogue listing the components available.

In-house stockists
Materials FRS at Bridgwater is the major in-house BT electronic components supplier. They stock a wide range of high quality components for numerous systems which can be ordered over the telephone and despatched the same day. This ensures that users know immediately which items are in stock and the quantity available. Paper requisitions (A1063/A6310), facsimile and telex messages are other acceptable methods of ordering but obviously they do not give instant information of the stock positions.

BTRL ECD at Martlesham handles components for the newly developed products and systems. They accept telephone enquiries and orders by A1063 requisitions. The service offers fast turn-around and delivery to all parts of BT.

BMF Electrospeed Components at Birmingham will supply components for equipment that BT Factories handle. This is an extension of their well established Strowger Piece Parts service. Urgent orders are accepted over the telephone without the need for covering requisitions.

Corporate concern
Our in-house suppliers should be used first and foremost in preference to all external →

suppliers. Equipment 'whole life' costs will be dramatically increased if you buy components that are not of the right standard. BT has no quality control over components supplied from external electronic component distributors. Their components are expensive, generally more than twice the cost of those supplied by COSTEC stockists. And they give no guarantee for the continued supply of their items.

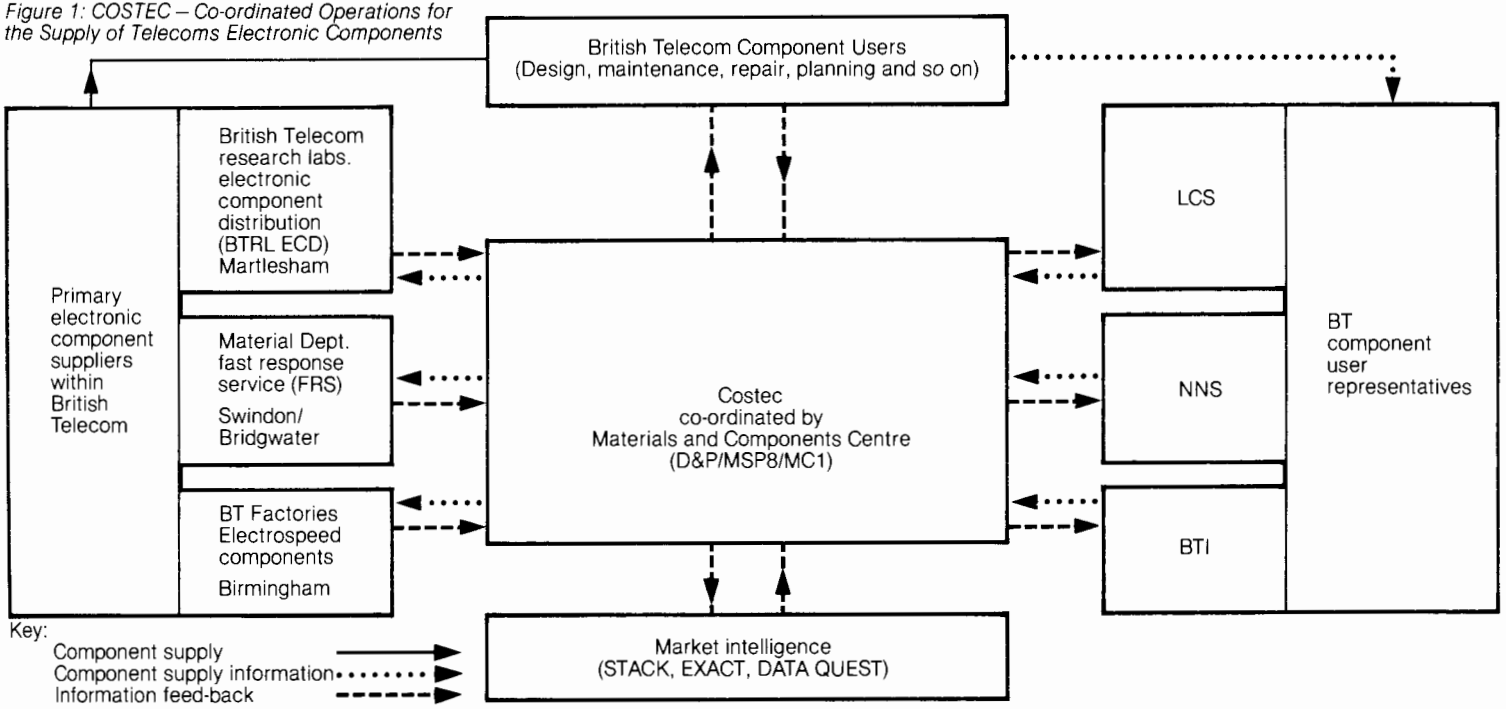
Costec representatives

If you have any component supply problems please inform either you local representative or the in-house stockist:

LCS – Mr K Jeffrey AES2.3.2 01-432 2870.
NNS – Mr S Wood TSO2.2.3 0532 433265.
BTI – Mr D Hensen CE2.1.3 936 2431.
Materials FRS – Mr A Pagan M6.3.2.3C 0793 484572.
BTRL ECD – Mr J Hill R1.4.2 0473 643173.
Electrospeed Components – Mr R Harper BMF/AS1.4 021-772 2361 Ext: 2141.

COSTEC has developed this supply operation to meet your needs and it is flexible enough to allow for changing requirements. If you have any comment on the current operations or suggestions for future improvements please contact Trevor Morton-Holmes. *(01-250 6556)*

Figure 1: COSTEC – Co-ordinated Operations for the Supply of Telecoms Electronic Components



International videoconferencing

by **Dave Hudson and Rod Hart** IB2.4.1

Background

Until recently international videoconferencing from the United Kingdom was transmitted over analogue broadcast TV circuits. This was an expensive means of communication and resulted in low usage of the service.

In 1983 the situation changed with the successful completion of a BT video development. The bandwidth used for transmission was cut considerably by using a new piece of equipment, called a conditional replenishment codec, which converted the analogue sound and vision signals produced from videoconferencing room equipment into a digital data stream. The Codec could send and receive data at 2 Mbit/s, working over European networks, or at 1.5 Mbit/s to North American networks. The picture quality was high and perfectly acceptable to users when using the new techniques.

The codec used in the UK is based on a specification originated from a project called COST 211 under the auspices of the EEC. Several European countries took part in the Project, the UK being represented by BTRL. The Codec is manufactured by GEC in the UK. Other EEC countries have their own manufacturers.

Codecs have also been produced in other parts of the world, notably in the USA and Japan but none of those produced in non-European countries conform to the COST 211 standard.

Services

At the present time there are three international public videoconferencing services from the UK. These go to the USA via transatlantic cable TAT7 (AT&T) and via satellite (SBS) and to Canada via satellite (Teleglobe). All three are working on a 3 year commercial trial basis and their financial viability is constantly being monitored with a full review at the end of that period.

Similar trial services will open to European countries this year starting with West Germany.

The main demand at the moment is for the use of public videoconferencing rooms which are supplied by BT and booked by customers on an hourly basis. There are also a few private customers who own their own videoconference rooms and lease a line to the international gateway exchange. They then book time over the international link when needed.

It is expected that, as the benefits of videoconferencing become more widely appreciated, the main demand in the future will be for private facilities.

Videoconferencing room

Videoconferencing rooms can range from being a normal office, with minor modifications to improve the lighting and sound properties, to a fully equipped specially built studio.

Figure 1 shows a physical arrangement of equipment for a typical room in the middle of the range. Figure 2 shows the equipment configuration.

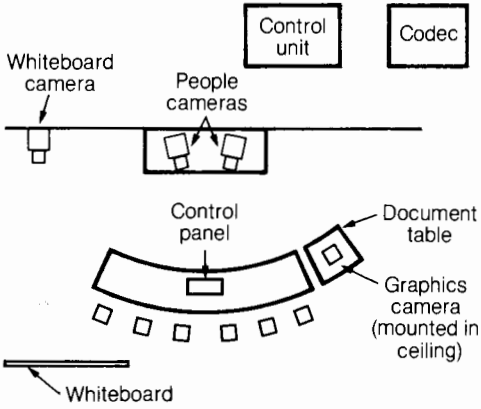


Figure 1: Video conferencing room

Normally up to 6 people are able to participate in a conference from each room and they are viewed from 2 cameras. To show diagrams or documents a high resolution camera is mounted vertically in the ceiling, or on a stand, pointing to a document table.

Often a wall flip chart or a whiteboard is provided and this is viewed from a camera mounted on the opposite wall.

A video recorder is sometimes used, to either record the meeting or to play back previously recorded tapes. When used in the transmission direction, a time base corrector is used to improve the quality of sync pulses coming from the tape. →

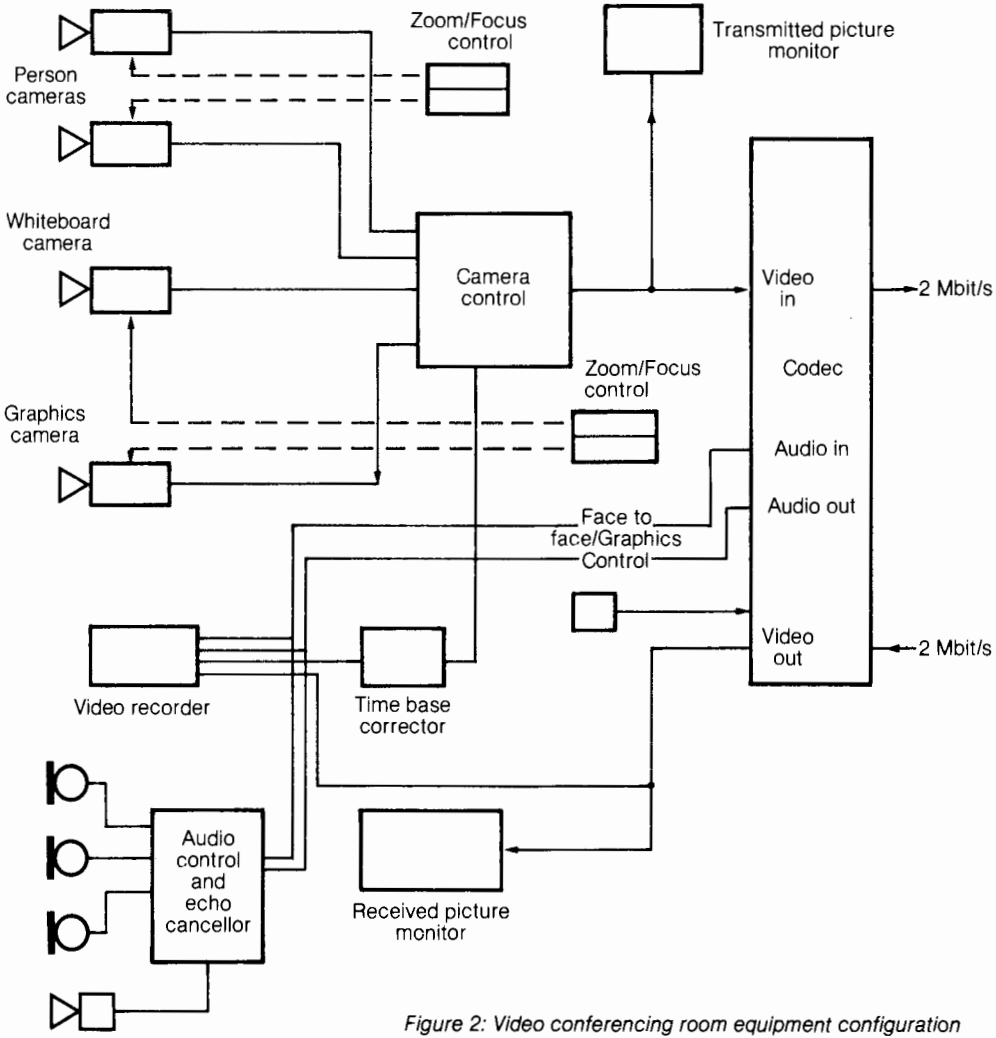


Figure 2: Video conferencing room equipment configuration

Sound and vision signals input to the codec are digitised and coded into a 2 Mbit/s data stream. The reverse function is performed in the receive direction.

• Codec

The Codec has two modes of operation, face to face and graphics, which are selected by a control button.

When the whiteboard or person cameras are used then the face to face mode is selected.

In this mode the codec makes use of the fact that in a conference there is not normally a lot of movement. An adequate picture can therefore be reproduced at the distant studio by only transmitting information about those parts of the TV frame that changed since the last frame.

If movement is greater than that normally expected then element sub sampling and field sub sampling occur to ensure that the data output rate is constant. The missing information is made up by the receiving codec after addressing its likely content following examination of the received data.

When the graphics camera is used to view documents then the graphics mode of the codec would be selected. A high resolution image is then transmitted by dot interlace sampling, that is, scanning the picture repeatedly and sending every 19th element to a frame store at the receiving codec. The effect is to build up the picture on the screen at the distant studio over several frames by slowly filling in the picture elements. This produces twice the resolution of full bandwidth TV.

The codec has 1.5 Mbit/s and 2 Mbit/s interfaces and can accept 625 line PAL or

525 line NTSC standards.

• Echo

Normally studios used fo international videoconferencing have some form of echo cancelling. Without this a speaker will find that his voice will come back to him in the form of an echo because of the transmission delay and the acoustic coupling between the loudspeaker and microphones in the studio at the distant end.

Transmission

A typical transmission path is shown in figure 3. The UK videoconference room is connected by means of a megastream link, to the international gateway at Mondial House where the circuit appears at a patching point. At this point the circuit can be patched to any international videoconferencing circuit.

The international circuits used are routed over cable and satellite, including small dish. All the circuits used contain a mixture of digital and analogue sections.

The links in the UK to the satellite earth stations are all digital and then analogue over the satellite. Modems are used at the earth stations to convert from digital to analogue, and these are mainly QPSK (Quadrature Phase Shift Key) modems developed by BTRL (R6). They connect to the satellite sub-system at an intermediate frequency of 70 MHz.

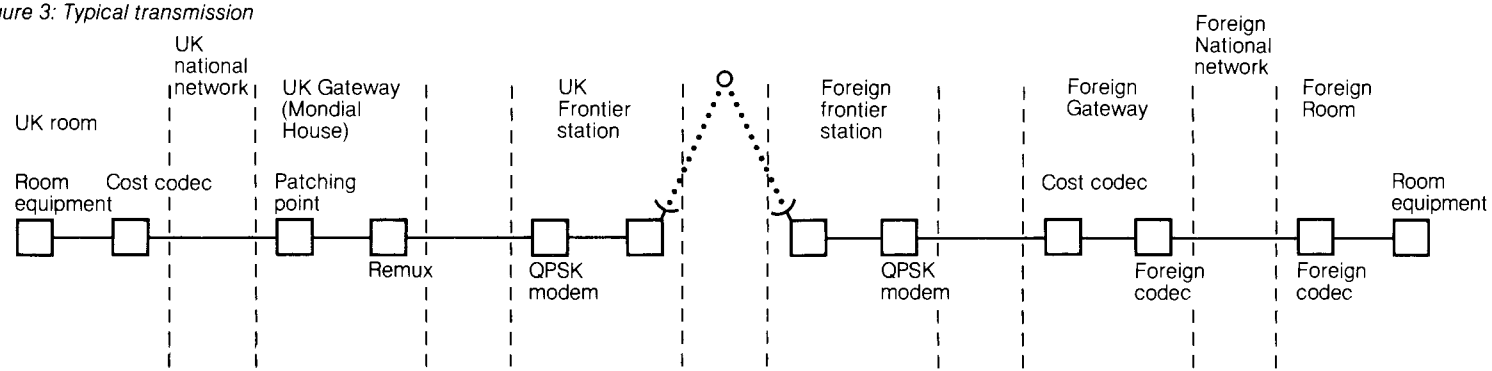
On the AT&T circuit the link is digital from the UK room to Mondial House but then is analogue from Mondial to the USA.

The modem used for the analogue section is a DIV (Data In Voice) modem made by NEC of Japan. It employs VSB modulation and produces a signal over the band 1188 kHz to 1532 kHz which occupies supergroups 5 and 6.

In the USA and Canada the bit rate is 1.5 Mbit/s and signals are required to be presented to their networks in accordance with T1 coding rules. To accommodate these requirements the codecs at each end are set up to transmit and receive only 1.4 Mbit/s of useful data. In addition to this the codec in the UK studio is also set to add padding bits to bring the data rate up to 2 Mbit/s in order to go over the megastream link. These padding bits are then removed normally at the international gateway, by a remultiplexer. The Remultiplexer changes the bit rate from 2 Mbit/s to 1.5 Mbit/s and the corresponding coding from HDB3 to T1. It was developed by BTRL (R16) specifically for the international videoconferencing service (IVCS) although it can be used with any data stream at these rates that conforms to CCITT Rec G732/G733 structures.

When connexions are made to foreign videoconferencing rooms that use codecs that are not compatible with our own a system of double encoding is adopted. This occurs at the foreign countries gateway exchange where a COST 211 codec converts the signals coming from the UK back to analogue sound and vision. These are then →

Figure 3: Typical transmission



redigitised and coded into a new form by the other codec for transmission over that countries network to the studio.

Maintenance

The ISPC (International Sound Program Centre) has been designated the Fault Report Point (FRP) and circuit control for the IVCS. The ISPC is the initial customer contact point for service problems and will co-ordinate initial fault localisation on the UK part of the circuit from the studio frontier stations.

Equipped with a monitor, camera and codec the ISPC can monitor circuits and actively test circuit sections on an end to end or loop-back basis.

If the fault is proved to be in the UK then responsibility for restoration or repair is delegated to the relevant sub-control or control stations.

If the fault lies overseas it is referred to the distant administration.

• Diagnostics

The codec, remultiplexer, DIV and QPSK modems all have built-in alarms.

The codec has alarms which respond to digital and video line conditions to give a visual warning (LEDs) and an electrical alarm output. It continually performs an internal self check which gives an alarm condition when a fault is detected and an LED lights on the printed circuit board that has failed.

The remultiplexer has a self test key which, when thrown, causes a comprehensive test cycle and indicates any internal failures that have occurred.

The DIV modem has a limited but adequate alarm array and the QPSK modem indicates failures of the 1.5 Mbit/s, 2 Mbit/s and carrier (70 MHz) inputs.

The future

European commercial services to four contries are now being established and following this it is intended to start engineering trials to Japan and Australia; tests have already been performed over analogue circuits to these countries. During the late 1980's an integrated international service is expected to evolve. Further developments are continuing. These include additional facilities, new network functions and a reduction in the transmission bit rate used to carry good quality video.

The future videoconferencing service will continue to build on the foundations of British Telecom developments by exploiting existing technology and network facilities. The videoconferencing service could become one of the most important BT services of the 1990's.

(01-936 2998)

Fast response service for components – FRS

by **Andrew Pagan**
Materials Department M6324

The third issue of the FRS Catalogue was published in February and contained approximately 2,000 items for general maintenance, repair and planning, as well as supporting over 20 specific products.

Orders are taken by telephone and goods despatched on the same day by first class post. Paper requisitions (A1063/A6310), facsimile and telex messages are also acceptable methods of ordering but do not give instant access to stock positions and prices.

Quantity delivery and price maintenance of components is becoming more important in BT's repair and maintenance activities – see the Editorial and Les Waller's article 'Quality in the Field' in MN25. Obviously, the need for quality components will increase during the coming months as new standards of quality are implemented.

The FRS is already providing the quality of components required by its customers. Each product stocked is BT approved, BS9000 (CECC) or a commercial item specified by a manufacturers data sheet. In the case of semiconductor devices only manufacturers recommended in BT Spec D5002 are used.

The handling and storage of components at our depot in Bridgwater are to the standards set by the BT Materials and Component Centre (MCC), in particular the handling of static sensitive devices.

We are continually introducing new items and products to our range. If you are buying large numbers of components outside BT or are having problems obtaining components, we may be able to stock the items in FRS.

If you would like to discuss new items or get a catalogue and further details of the service, please ring Andrew Pagan on (0793) 484572.

Ken Hooper and Mike Phipps of the Fast Response Service seen issuing components from the depot at Bridgwater

PCA25 Measurements at RSC's

by **Tony Richardson** LNS3.1.4

The quality of service at direct reporting repair service controls (RSCs) for '151' calls, and fault report calls from auto-manual centres (AMCs) is expressed in terms of 'percentage of calls answered in 25 seconds or less' – and is commonly referred to as 'PCA25'.

The Monitoring Unit 33A which replaced the mechanical type PCA Equipment MSW 23099 and described in Maintenance News 23 (Autumn 1983) has proved very successful in the field, and has been installed in over 180 RSCs.

The development of this unit however, was an interim step towards a more comprehensive measuring equipment, and the next stage in development will be the introduction of the **Monitoring Unit 33B** with increased facilities.

This new unit is now on test and, subject to satisfactory results, it is hoped to place a production order within the next few weeks.

The basic parameters for measuring PCA are of course similar to those on the Monitoring Unit 33A. Extra facilities available on the MU33B are

- Monitoring up to 30 incoming 151 or AMC circuits to detect calling and answering conditions (10 only on the 33A)
- Registering conversation time in six second units.
- Operation in two independent cyclic modes (one only on 33A) and one manual mode, with independent storage facilities.
- Storing and presenting results of both cyclic modes corresponding to user defined four or five week month with automatic print-out at the end of the period to an optional printer.
- Displaying results on a 16 character alpha-numeric LCD compared to six numeric characters on MU33A.
- Display of average time to answer a fixed number of calls.
- By means of a remote display in the RSC, connected to the main unit, display a single character derived from the PCA calculation for the last twenty calls.
- Print out of stored information by means of a V24 interface, with automatic print out on request at five minute intervals.
- Results saved under power fail conditions.
- Indication of the average time to answer the last twenty calls.
- An improved user defined security code to prevent unauthorised use.

Cost

It is anticipated that the price of the MU33B will be less than £900. The cost of a remote display unit, VDU and printer will be extra.

Installation

Installation and dimensions will be similar to ►

the MU33A, and the plug-in test unit for the MU33A which is available on a per Region/District basis (and is already held by some Regions) will be compatible with the new unit.

The unit is designed to be desk mounted and produced in a colour scheme which blends with the 'Crown Supplies' range of furniture. The unit is angled at 30 degrees for acceptable viewing and ease of operation, and in addition the alpha-numeric display has a separate adjustment to improve readability.

Ordering procedure

The Specification and Diagram Notes AT/ATW.626700 will be available shortly for the MU.33B and the Item Code number will be 39-1236. The Specification for the Display Unit 12A will be AT/ATW626710, and the Item Code number will be 37-5037.

Requisitions should be forwarded to this Group for the initial supply of this item.

In addition to new RSC installations, it is suggested that the MU33B could be substituted at RSCs where more than one 33A is being used to monitor over ten incoming circuits, or where 24 hour service is in operation.

(01-432 2876)

Letters

Prompted by Roger Sutton's article on 'Noise' **Don Wiltshire** of Merlin Operations writes—

In the investigations into noise problems and the plan of action described in the article, it is surprising to find no reference to any investigation into the integrity of wire termination systems, particularly those used in the external network, the performance of which is crucial to the overall performance and reliability of the network.

Studies prior to the introduction of insulation displacement connections (IDC) for use in customers' premises[1] showed that existing systems were deficient from a performance and useage point of view. Our studies revealed that due to lack of proper quality controls the use of wire wrapping was ill advised. The worst example of a termination technique that came to light was the CWI 1A, a crimp termination used extensively in the network for jointing cables. Usage of this device at that time being in excess of 100 million per annum.

When subjected to initial termination resistance and accelerated aging tests[1] the performance of these devices falls woefully short of any acceptable standard.

An article by H E Hines in British Telecoms Eng Vol 1, part 2 July 1982, shows clearly that the measured performances of all the

[1] (See Dons article in British Telecommunication Engineering, Vol 1, part 1, April 1982)

IDC's he tested were within the required test parameters and that none of the CWI 1A's could meet these standards of performance.

A description of the tests used to evaluate termination is contained in an article by Dr B Wiltshire in British Telecoms Engineering, Vol 1, part 3, Oct 1982. The evidence relating to the poor performance of the CWI 1A has been available for many years. It is not used on plastic insulated cables by other telephone administrations. They also, wisely, do not use aluminium conductor cable which is notoriously difficult to terminate reliably.

An article written by Mr D V Thorpe (British Telecom Eng, Vol 2, part 4, Jan 1984) describing the testing of customer lines suggests that faults due to additional series resistance in the line may be due to corroded joints.

Increased resistance at joints, often an indication of corrosion, will almost certainly make the termination act as an effective noise generator. It is also likely to be intermittent and subject to traffic vibration.

The use of CWI 1A's in street cabinets with the likelihood of their being disturbed by field staff also seems to be bad practice. It is inevitable that any poor termination will be disturbed, creating noise.

I am aware that Series 8 connectors, which do meet an acceptable termination standard, are now being introduced, although the rumour that it is to be cost reduced is worrying. Some Areas are still using the CWI 1A and without a positive replacement policy it will be with us for a very long time.

In the context of replacement it is disappointing that a version of the 'trimlock' type of connector which is suitable for a no break changeover is not used in preference to the series 8 connector. No doubt the cries of 'it's too expensive' have won the day again.

A vital clause in Specification D 2920, calls for production tests to be carried out on completed terminations in order to monitor the performance of the termination device, tools and operators. Without this control, a wireman with a batch of faulty devices, using a worn or damaged tool, who had been inadequately trained or had a weak wrist could make thousands of unreliable terminations without detection.

The failure of BT to use the more expensive full cycle tools, which make it impossible to release a crimp until the correct pressure has been applied is also a false economy.

Investigations into BT's external plant have revealed that a significant proportion of external staff are creating work for another significant proportion. If you use a CWI 1A this is very probably true. We are paying a heavy price in BT for some of the decisions taken in the past with cost being the dominating factor, a spell of reliability being top of the list would not go amiss.

Few of my colleagues working in telephone areas on external activities appear to have a good knowledge of fundamental termination technology. They usually do not have access to performance specifications and have failed to identify and resolve the problems with cable terminations that undoubtedly exist. Like many of BTs problems, this stems from a failure to manage the technical aspects of our work.

There would also appear to be serious deficiencies in our training schemes. How often are visiting speakers, from research and development divisions, expert in a particular field, asked to give a talk on technical matters to students on engineering courses? Our experts are frequently invited to address international conferences, why so seldom within BT?

Failure to address these problems in the past is currently costing the business very large sums of money, much of this expenditure could have been avoided.

The November issue of Management News shows a picture of Mr John Tippler, Head of Engineering, LCS, having a close look at the external network. There is to be a major effort to reduce the fault rates. I would venture to suggest that the causes of many of the problems are known, the solutions are available, their implementation is long overdue.

Ian Dufour LCS Network Quality Manager comments—

Mr Wiltshire's very interesting letter has identified a number of problems that have →

been experienced with termination systems – particularly those of the Connector Wire Insulated No. 1A (CWI 1A), it has been recognised for some time that it does not perform well in accelerated aging tests and there is some evidence of failures in the field.

The major factors affecting the long term stability of the CWI 1A are contact degradation, caused by expansion of insulation trapped within the crimped connector, and the need for the crimping tool to remain in calibration to give the correct degree of closure.

In view of the problems with the CWI 1A, it was obvious that a connector with an improved performance was required.

It was considered that an insulation displacement connector (IDC) would meet this need because

- It is less sensitive to the thickness and type of insulation.
- It can be more readily sealed to prevent corrosion.
- A simple crimping tool can be used.

Laboratory testing and evaluation confirmed that, compared with the CWI 1A, an IDC gave a more reliable electrical performance, was more resistant to corrosion, covered a wider variety of wire insulation and was easier to use.

The result of this work was the development, in co-operation with several manufacturers, of a new IDC, designated the CWI 8, the implementation of which commenced in 1983. To date something like 150 millions of the standard connector (CWI 8A) have been used in the field. In addition a 3 wire connector (CWI 8B) and a connector with a teeing facility, CWI 8C, which can be used for no break changeovers, are also available.

The implementation of the CWI 8A has not, however, been without problems. Jointers have experienced difficulties with wire insertion and with the initial 8A crimping tool. A new crimping tool has been provided and the evidence is now that these problems are being overcome as training and experience take effect. The right training is of course vital and Mr Wiltshire's point on more experts giving talks on training courses is being pursued with training branch.

It is undoubtedly true that a number of faults are self inflicted, particularly those in cabinets. The problem can be reduced by restricting access to cabinets: however, indications are that a cabinet terminated with CWI 8As will have a very low fault rate. Modular IDC's in cabinets are also under evaluation.

There is no substance in the rumours that the CWI 8A will be cost reduced. Indeed, manufacturers have been made aware of the desirability of a future connector with easier wire entry, and increased depth of wire insertion and a test facility.

Similarly the new crimping tool was not chosen on the basis of cost but primarily because it is simple to use and requires no adjustment. However, a cartridge tool, which may be more efficient in some jointing situations, is under field evaluation.

As regards quality control, checklist quality procedures have been successfully used for external jointing work since 1983. Checklists to cover other external activities are also being developed, including a computerised information system to replace the existing paper orientated system. In addition a THQ Network Quality Team has been set up to oversea quality matters and liaise with Area Quality Managers.

I would like to thank Mr Wiltshire for the interest he has shown and for highlighting some of the areas which affect quality in the Network. It is vital that we create a natural acceptance of quality so that it is taken for granted by staff at all levels. A 'hearts and minds' exercise was started at a conference of GMs and Senior Managers in November 1983 but a great deal more remains to be done to achieve an automatic acceptance of the need for quality.

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