STATION GROUPS AND COMMUNICATION CENTRES

STATION GROUPS

1. A Station Group consists of a Communications Centre (COMMCEN), Transmitter and Receiver Sites, linked by Communication Systems (usually BT landline).

2. There are two such groups in the UK, the Northern Group comprising WHITEHALL COMMCEN, HMS INSKIP (Tx) and HMS FOREST MOOR (Rx), and the Southern Group of LINDHOLME, BAMPTON CASTLE (Rx), and EDLESBOROUGH (Tx) controlled by the RAF. There are however additional sites employed for specific services. The two groups share the load of most of the DCN fixed Overseas Services in addition to their Single Service functions.

3. The Naval Northern Group fulfils several functions:

(1) Services

a. Fixed Services (DCN).

b. Contingency Services (CRL, MRL).

c. Ship/Shore and its associated FAB.

d. Ship Broadcasts.

(2) Message Relay

a. Automatic utilising Telegraph Automatic Routeing Equipment (TARE).

b. Manual as an emergency TARE replacement.

c. Interface with other systems, ie TELEX, DTN.

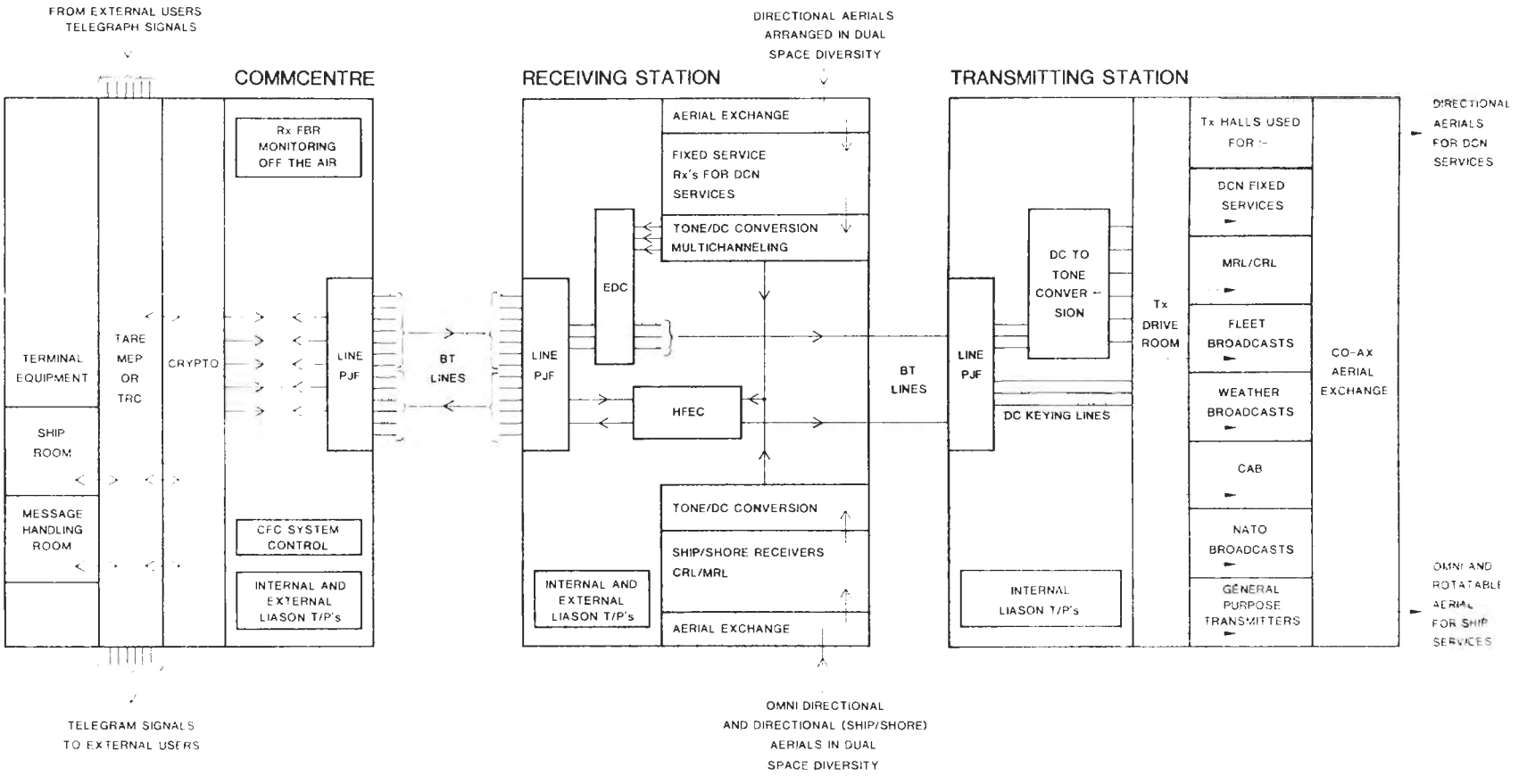

Figure 4.1 - Typical Station Group

4. The group Commcen is part of the Intra-UK DCN Common User Sub-system, and as such may be one of two types:

(1) Major Relay Station - when two or more trunk circuits connected thereto provide an alternate route or to meet command requirements.

(2) Minor Relay Station - when it has Tape Relay responsibility but does not provide an alternative route.

NB: Increased connectivity is converting Minor Relay Stations to Major to enhance survivability.

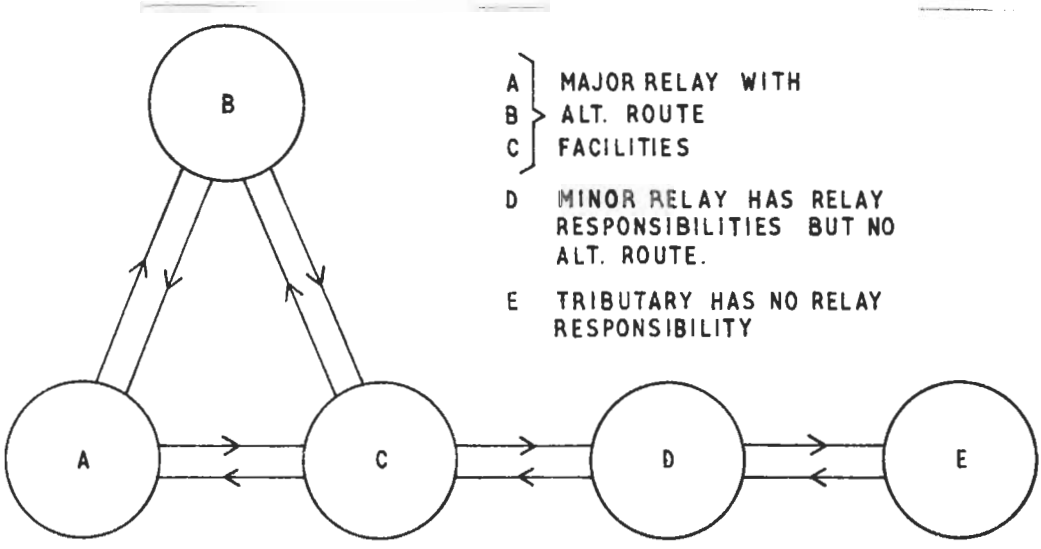

Figure 4.2 - Classification of Relay Stations

5. The System Engineering and Quality Control of the services provided are carried out by Engineering Staff at all sites, but the responsibilities differ between the RN and the RAF, and are discussed in Chapter 6.

6. This chapter is concerned with the Communication Centre, its equipment and its connectivity with other sites in the group to provide the services required.

COMMCEN MANUAL TELEGRAPH EQUIPMENT

7. A Commcen contains several pieces of equipment for routeing signal traffic around the Commcen, preserving Electronic Security, and acting as terminal equipment. Although nearly all signal handling is automatic now, it is valuable to first consider a manual system, analyse its deficiencies, and then consider automatic systems.

Line Terminal Arrangements

8. As seen in Chapter 2, BT landlines are connected to the IDF via the MDF.

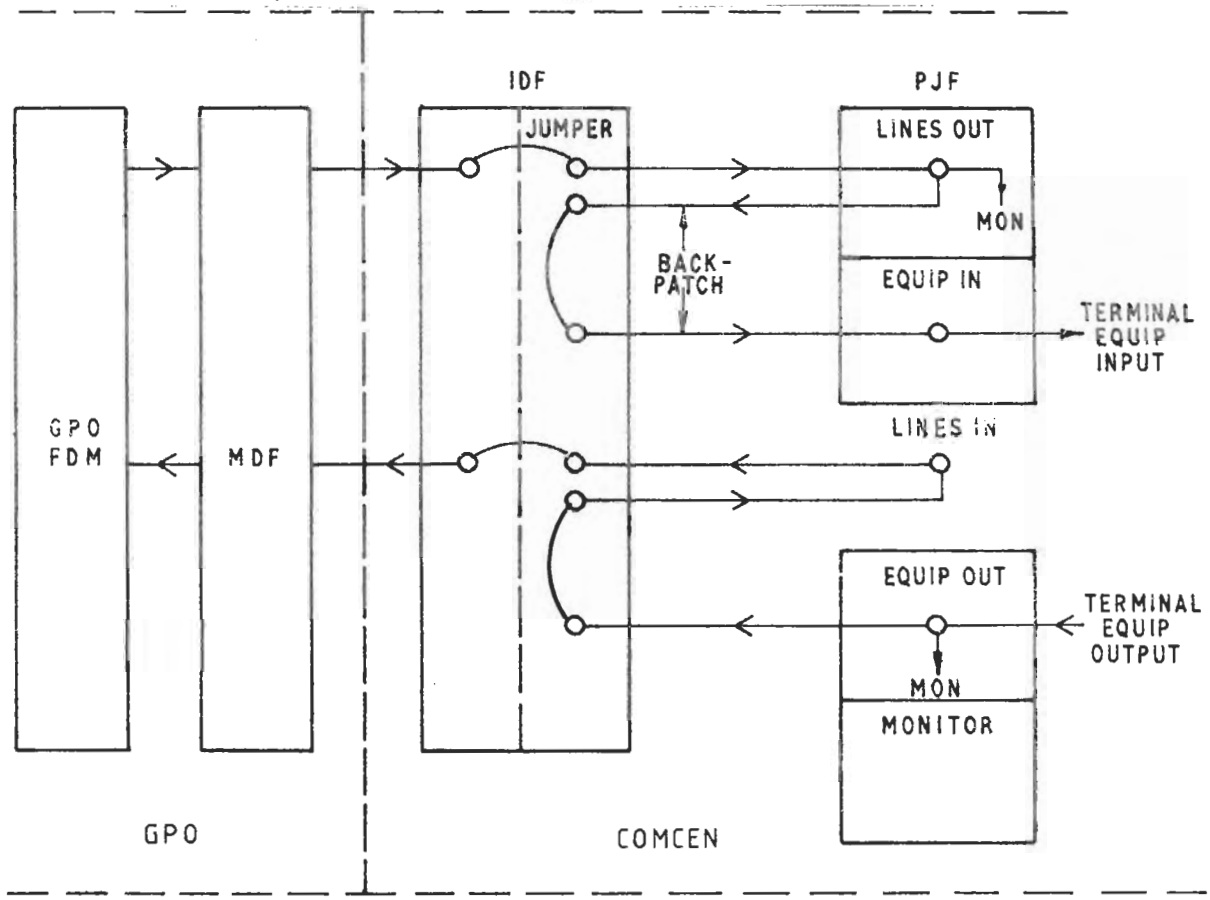

Figure 4.3 - Line Terminal Arrangements

MDF - Main Distribution Frame
IDF - Intermediate Distribution Frame
PJF - Patching Jack Field

9. The arrangements for connection within the Commcen are shown in Fig 4.3. The MDF acts as an interface between the inland communications system and the station. In Fig 4.3 it enables the BT to match RN d:c lines with their channeliing equipment. The IDF is constructed in two sections, one to which the MDF is connected and the other to which the jack sockets on the Unclassified Patching Jack Field (UPJF) are connected. The two sections are connected as required by short soldered jumper wires. This allows line/PJF connection to be altered easily, without disturbing the PJF permanent wiring.

The Unclassified Patching Jack Field (UPJF) (BR 2422(3))

10. The UPJF connects lines to equipment (usually Crypto) in the Commcen. Each line input terminates in a jack socket, with an additional monitor socket in parallel to enable incoming traffic to be monitored. Each piece of equipment has an input jack socket. In order to keep the PJF clear of patching leads the line and equipment sockets are backpatched to the IDF and connected there by jumper wires. Thus input lines are connected to dedicated equipment in the Commcen.

11. Construction and layout of UPJFs vary as new systems are introduced, but there are two main layouts. These are considered in Paragraph 12. However all UPJFs are supplied with certain monitoring and test facilities.

(1) Test voltage ± 80 V ± 6 V.

(2) Voltmeter.

(3) Ammeter.

(4) Test Message Generator.

(5) Audio Monitor.

(6) TDMG, TDSA.

(7) Tape Reader (TAA6).

(8) Teleprinter.

(9) Test Trunks connecting sections of the PJF together.

(10) Grouping relays, where six outputs are provided for a single input. This is an operational facility found on all UPJFs. Usually used to provide multiple outputs for distributions on primary and secondary routes to multiple transmit sites, eg for a primary broadcast.

12. Two common forms of PJF layouts are found:

(1) The older system where monitor and equipment sockets are separated.

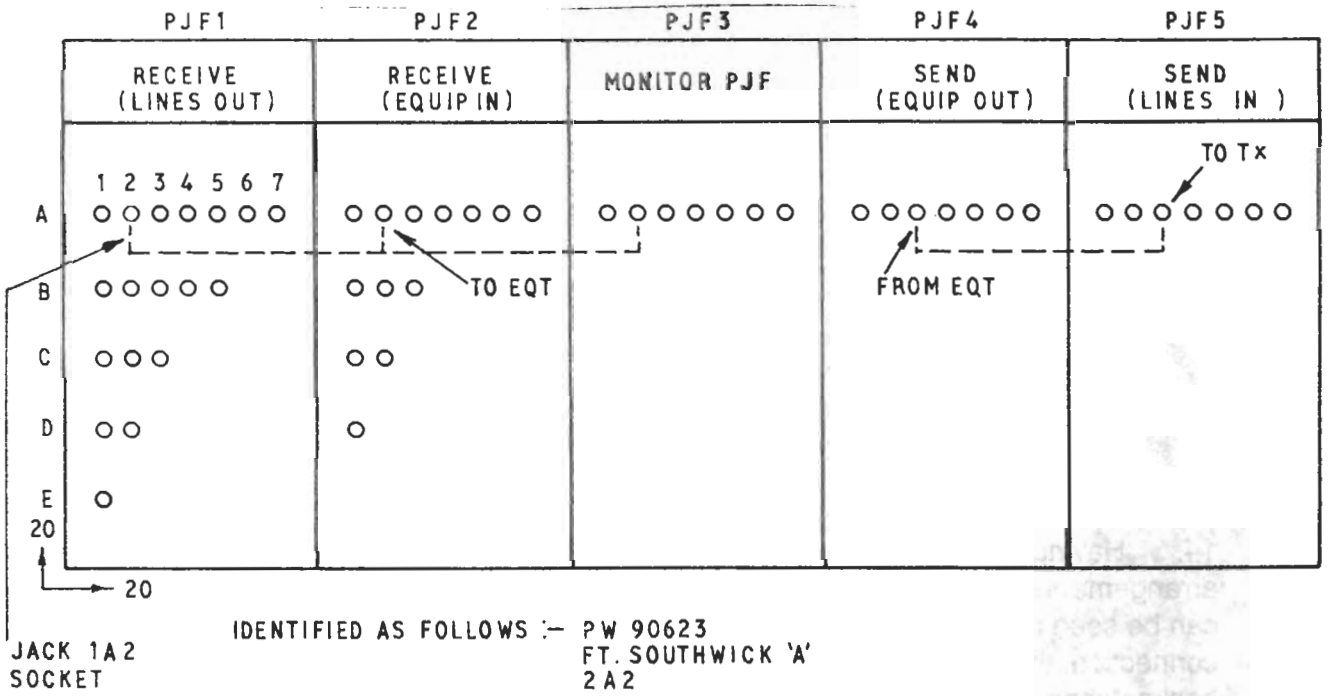

Figure 4.4 - PJF Layout 1

(2) The more recent system whereby Line, Equipment and Monitor Socket are grouped together using Patch Panels with built in parallel monitor sockets.

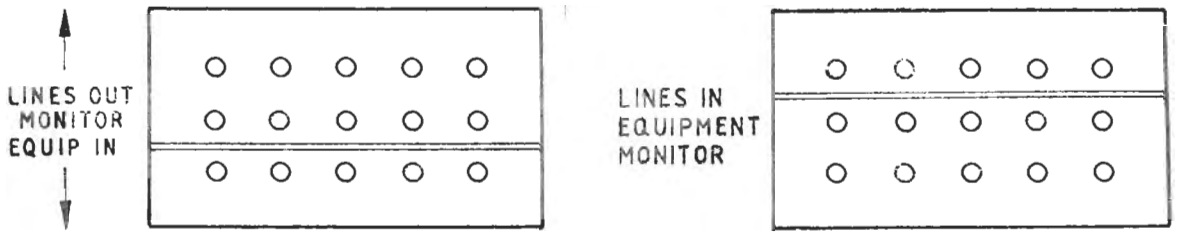

Figure 4.5 - PJF Layout 2

Wiring of Jack Sockets and Leads

13. Front patching is carried out using YELLOW REVERSING CORDS (connected tip to ring, ring to tip) so that the signal appears at the ring of the jack, thus preventing shorting to earth during insertion:

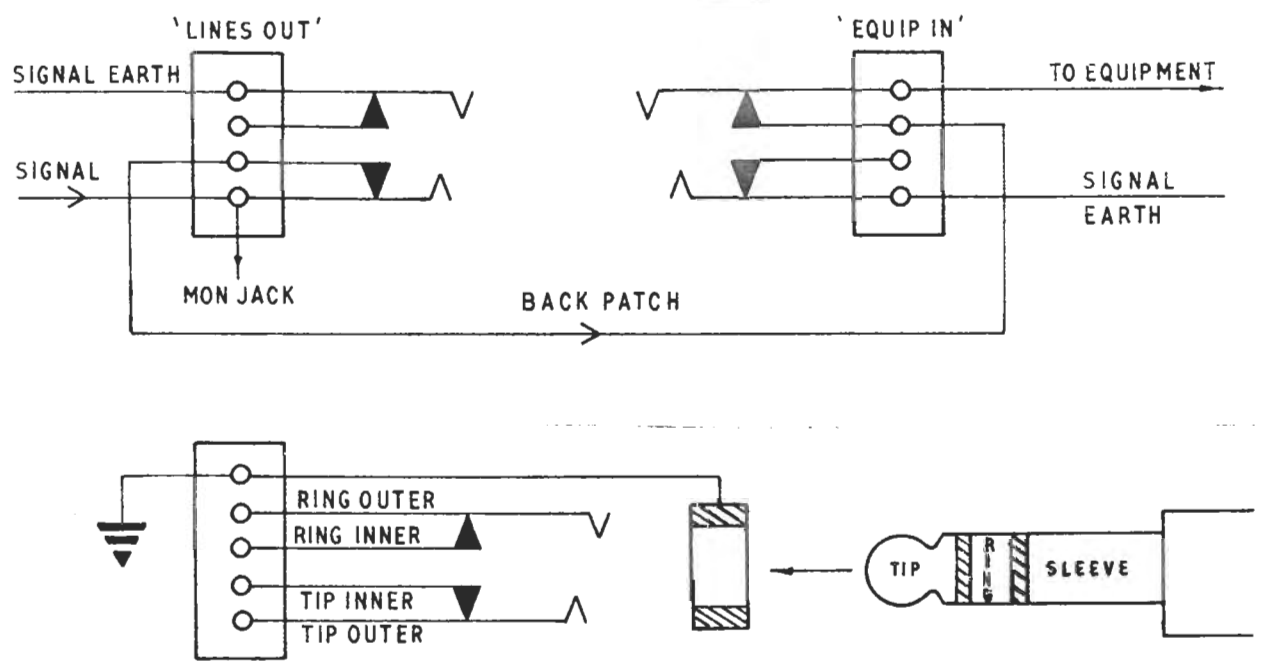

Figure 4.6 - Wiring of Jack Plugs

14. Having backpatched equipment to lines it becomes necessary to make arrangements to cross-connect equipment in the event of equipment or line failure. It can be seen from Fig 4.6 that inserting a patch lead breaks the backpatch connection, thus allowing cross-connection of equipment/lines which have been backpatched. Note that monitoring facilities remain unchanged. Fig 4.7 shows typical cross-connections.

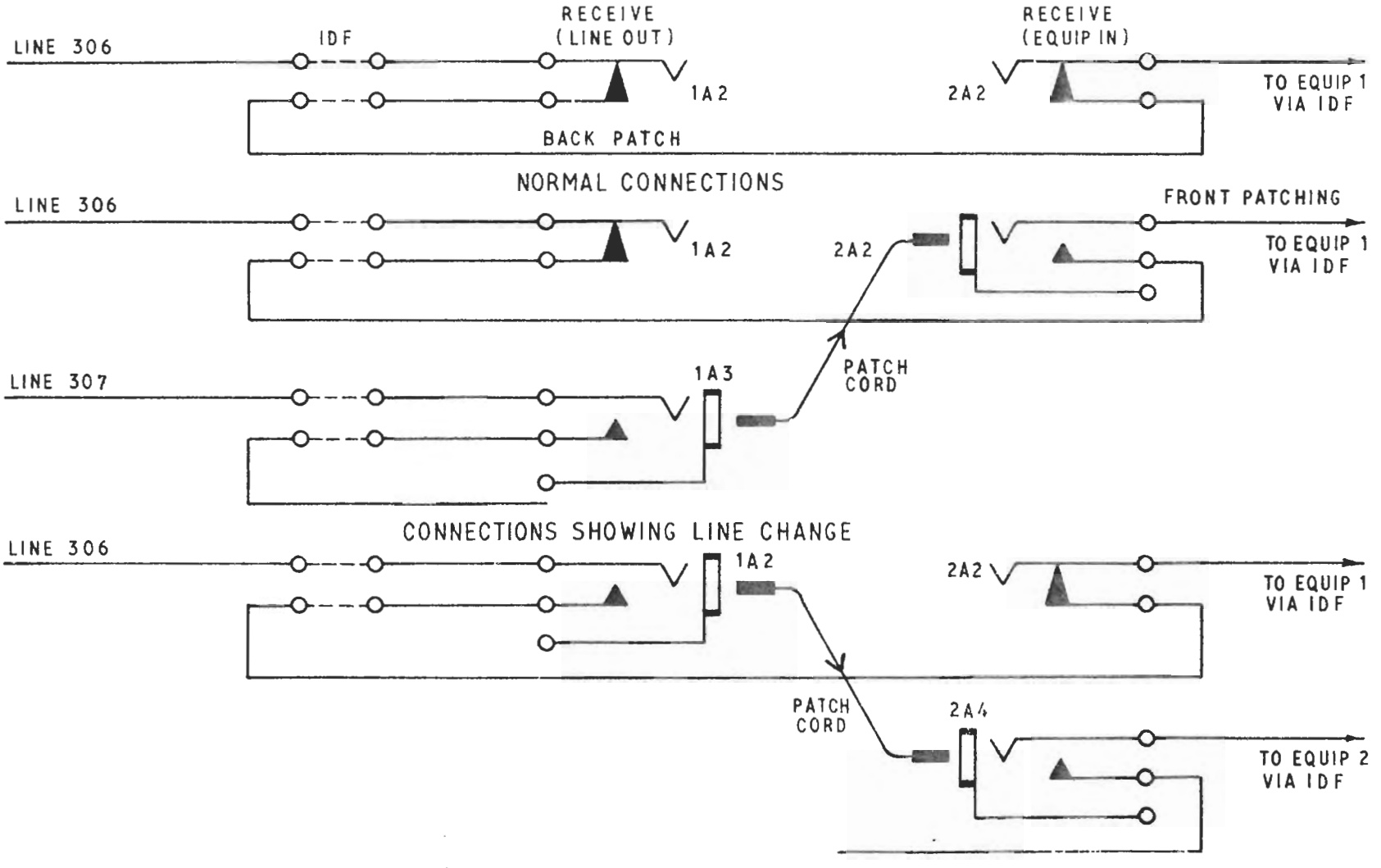

Figure 4.7 - Connections Showing Equipment Change

The Classified Socket Field (CSF) (BR 2422(3))

15. Fitted mostly in Commcens, known as the CLASSIFIED Socket Field as it carries Plain Language (PL), which may be monitored, as the CSF incorporates the same monitoring and testing facilities as the UPJF. The CSF and its attendent IDF interfaces the PL side of the crypto equipment with the terminal equipment allowing flexibility in choice of crypto and termination. The CSF is located in the secure area of the Commcen, and signals are at low level. (± 6 V or 1 kHz TONE ON/OFF). Connection between crypto and terminal equipment is by multi-point 'U' links which give a high protection against spurious radiations to preserve crypto security. Special cables are available for cross-connection in the event of equipment failure (see TARE failure Chapter 6).

RADIATION SECURITY WITHIN A COMMCEN

16. All signal traffic passing through a Commcen will at some stage be converted to Plain Language (PL). Precautions are taken therefore to prevent a compromise and these are tested regularly by the DNST electrical security team operating from Fort Southwick.

17. The Commcen is divided into three security graded areas, and signal security and levels are controlled in each (Fig 4.8).

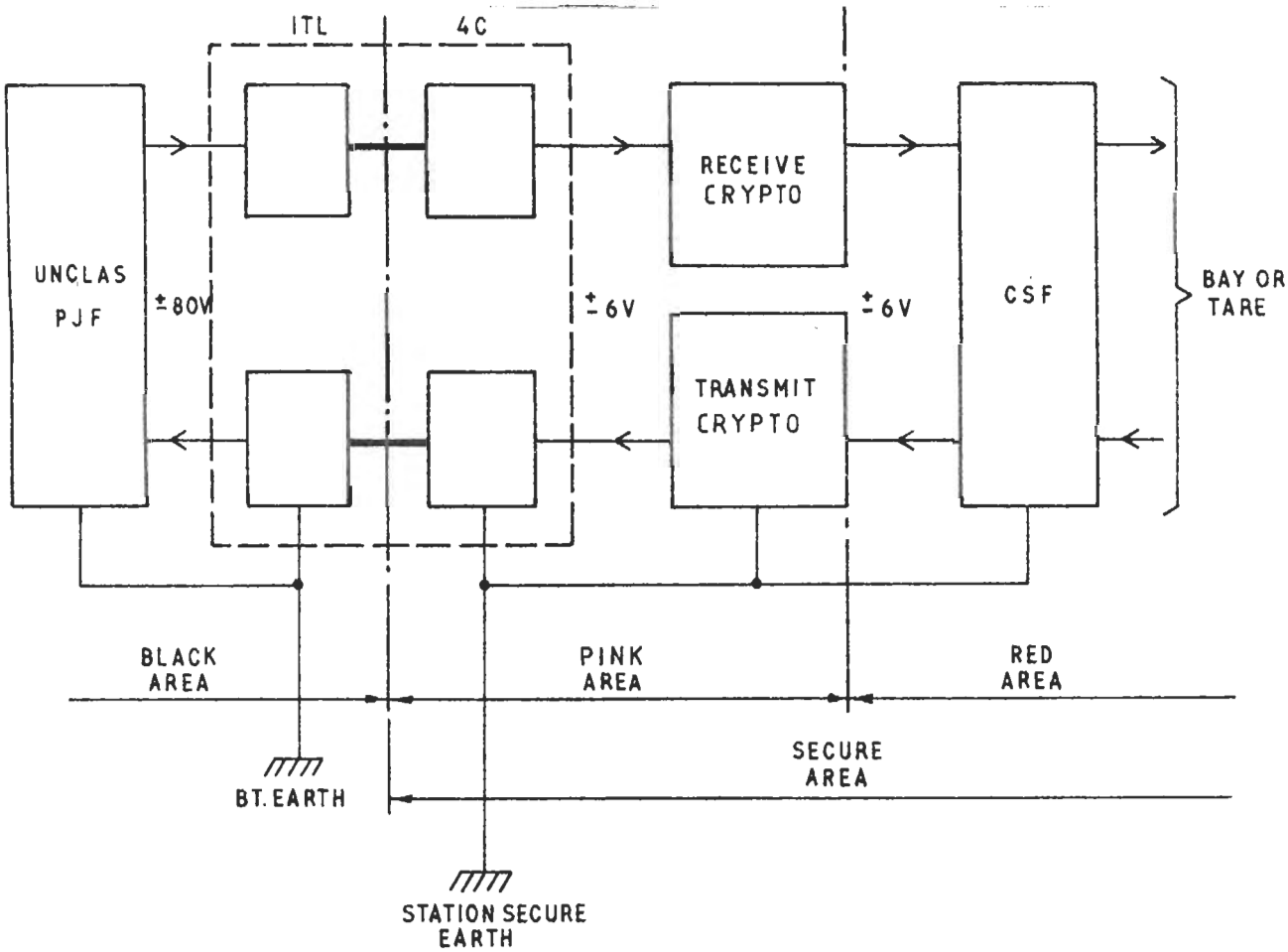

Figure 4.8 - Commcen Secure Areas & Earths

18. The incoming signal is converted to ± 6 V at the Isolator Telegraph Line (ITL). The line current is not keyed by a relay, but by an infra-red optically coupled isolator through a non-conducting tube. The two sides of the ITL are earthed to separate systems, hence the Commcen line is completely electrically isolated from the BT line circuits.

19. Mains supplies for the secure and black areas are isolated by means of filters. Audio circuits passing from Black to Secure areas are isolated by a Filter Radio Frequency. Care must be taken to preserve security by such precautions as not allowing tape recorders into the red area and strictly controlling the route of wandering leads.

20. Should the crypto operate on 1 kHz TONE ON/OFF, then the ± 6 V dc is converted immediately on the PINK side of the crypto, and the TONE ON/OFF immediately on the RED side.

MANUAL TERMINATION FACILITIES

21. Virtually all signal traffic handled by major Commcens is processed automatically. However in most minor Commcens, tributaries and as emergency fallback in major Commcens, there is fitted pieces of manual termination equipment, usually grouped into bays. There are many types of bay, depending on its role and equipment fitted, so these notes will only briefly consider the equipment.

Telegraph Equipment

22. The standard tape reader is the double tape headed TAA70 which may be used on direct fixed services as a start-stop automatic transmitter of 5 unit code, or with error detection equipment employing character release pulses. The unit comprises two electro-mechanical tape readers and an electronic character generator operating to either the free-run or pulse release mode. The tapes are transmitted sequentially from the two tape heads and are preceded automatically by the Transmission Identity updated for each signal, and terminated with an End of Message Function. In the absence of traffic a test message may be transmitted every 2 minutes.

23. The standard printing, reperferator is the Type PR76R. An electro-mechanical device closely related to the old Type 12 teleprinters. The reperferator uses 17.5 mm paper tape to produce standard ITA No. 2 punched characters, accompanied by a printed character (eight places displaced). This device has a limited fit being replaced by TGN.

24. The third device is the Teleprinter Type TGN, with its interface unit, as fitted throughout the Fleet. This device may also operate in the Free-Run or CRP modes. It is not modified for use ashore and is a familiar and very reliable piece of equipment.

25. Bays are usually provided in a Commcen for emergency fallback for control of broadcasts, manual termination of MRLs and CRLs and anchoring of special communication, or satellite communication in the event of MEP failure. Should a major TARE failure occur (see Chapter 6) then special bay facilities are provided for manual termination of selected TARE services. This collection of bays is known as the Manual Tape Relay Centre (MTRC).

MTRC

26. Before the introduction of TAREs, all Commcens operated manually through Manual Tape Relay Centres. These have now been considerably reduced in size, but are retained for emergencies. The arrangement is shown in Fig 4.9.

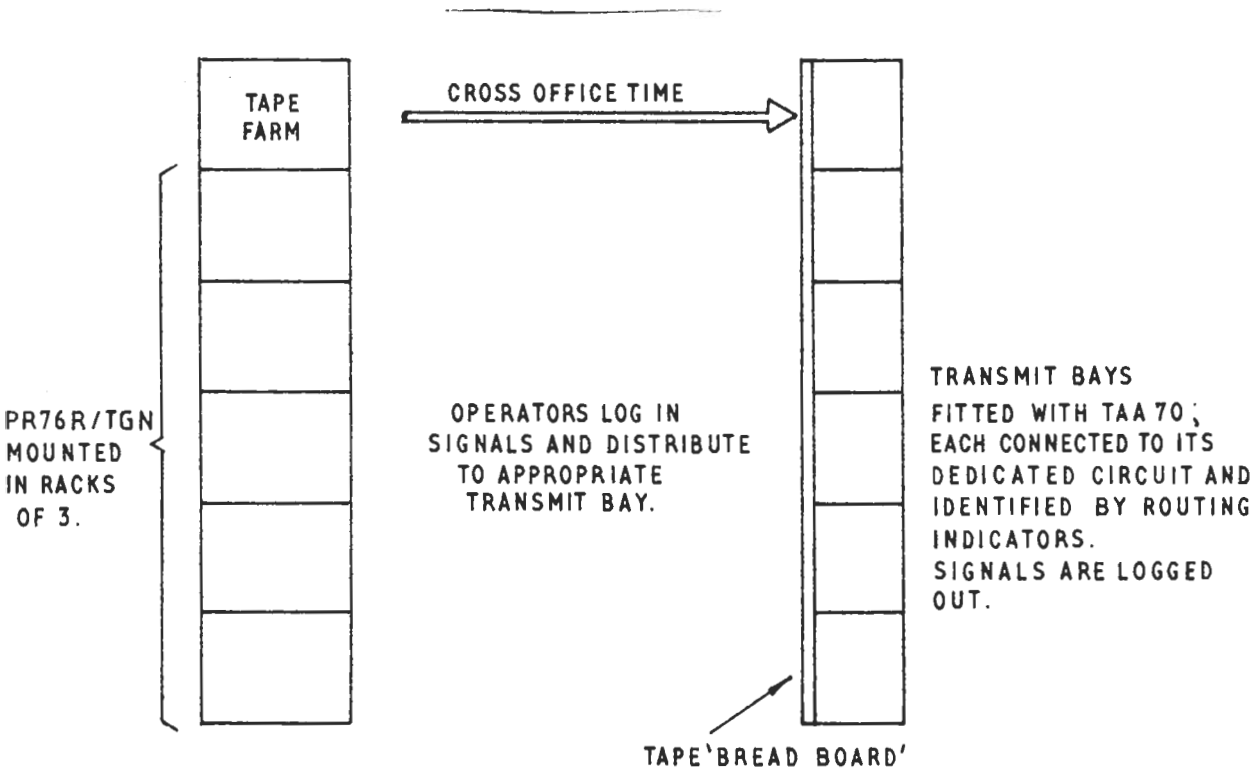

Figure 4.9 - Manual Tape Relay Centre

27. The PR76R/TGNs are connected to dedicated receive circuits. Signals received are checked by an operator, who logs it in. He then reads the address and 'posts' it in the appropriate slot of the "breadboard" adjacent to the transmit bay for that address. The breadboards are arranged to provide precedence segregation. Should the signal have a multiple address, then multiple tapes are produced by the TAPE FARM (usually three copies per tape) for distribution. This process is known as "Routeing Line Segregation" and the copies are distributed to the particular outgoing bays. At the outgoing bay another operator transmits the tapes from his breadboard in order of precedence, logging each signal as it is sent on the dedicated TAA70.

28. Manual TRC require a lot of operators and involve a long "cross-office time". This has led to the development of automatic routeing equipments.

AUTOMATIC MESSAGE HANDLING

29. For the reason stated above, allied to the tremendous increase in the volume of traffic, most message handling is now conducted automatically by message switches known as Telegraph Automatic Routeing Equipments (TARE). Several different types of TARE exist (ARGUS, NICS, TANDEM etc) but all operate on the same principles:

(1) Logging messages 'IN'.

(2) Reading the address.

(3) Storing

(4) Routeing Line Segregation.

(5) Transmission - Precedence Segregation.

(6) Logging 'OUT'.

All major Commcens in the DCN Intra-UK Common User Sub-systems are fitted with TAREs.

30. In order to allow messages to be processed in any sort of automatic data processing system, they must be arranged in a very strict format. This is laid down in ACP 127 and is the agreed format for message preparation. Any mistakes occurring in the first few lines, or the last line of a signal can cause delay as it is corrected manually, or at the worst a compromise of security as it passes through the system.

MESSAGE FORM

Serial No. F. Sigs. 266 (Revised AUG 81) (Pads of 100)

CHECK BOX

Routed by .....

Time .....

Perforated by.....

Time .....

For SINGLE TRANSMISSION

Transmitted to.....

Channel No/System .....

Time .....

Operator.....

LINE 1 12↓VZCEC HMA↑ ØØ7↓ S→HH CC≡

LINE 2 PP→RBDFOGU→RBDNGZ→RAYWYY CC≡

LINE 3 DE→RBDNGX↑ ØØ5 Ø9122Ø↓CC≡

LINE 4 ZNY RRRRR. CC≡

ROUTING INDICATORS	Precedence-Action	Precedence-Info	DTG, Month, Year
(5)	PRIORITY.	Routine	Ø912ØØZ APR 84

(6) RBDNGX — FROM COLLINGWOOD

(7) RBDFOGU — TO HMS INVINCIBLE

(8) RBDNGZ — INFO CENTURION'

RAYWYY — BDLS CANBERRA.

(9) — XMT.

(10) GR

(11) BT CC≡

MESSAGE INSTRUCTIONS

SECURITY CLASSIFICATION (Messages referring to a classified message must be classified RESTRICTED or above.)

(12A) RESTRICTED.

SIC

(12B) SAH/SWB.

(12C) FREE TEXT

(13) BT CC ≡

(14) COLLATION (if required)

(15) CORRECTIONS (if necessary) CC BK≡

(16) NNNN 12↓

INTERNAL DISTRIBUTION

FILE NUMBER / OR REFERENCE

DRAFTER'S NAME IN BLOCK LETTERS

Page ..1.. of ..1.. Pages

This message (tick appropriate box)

refers to a classified message ☐

does not refer to a classified message ☑

TELEPHONE NUMBER

BRANCH

RELEASING OFFICER'S SIGNATURE

RANK

FOR OPR'S USE	R	FILING TIME / TOR	SYSTEM	OPERATOR	FINAL CHECK OPERATOR	NAME IN BLOCK LETTERS

MESSAGE PREPARATION

31. The standard message form (F Sigs 266) is divided up into a number of lines (1-16). Some of these are completed by the drafter, the remainder by the operator prior to transmission. Fig 4.8 shows a standard message form with a fictitious signal drafted, together with the operators preparation. The message will be explained line by line.

Drafters Section

32. Certain lines are completed by the originator when drafting the signal:

(1) LINE 5:

a.

Precedence			Action Addressee
ROUTINE	-	R	- 3 hr to start of next working day
PRIORITY	-	P	- 1 hr to 6 hr
IMMEDIATE	-	O	- 30 min to 1 hr
FLASH	-	Z	- <10 min per leg of route
ENGINEERING	-	B	- ON RECEIPT

b. Precedence - Information Addressee (usually ROUTINE). As for Action Addressee.

c. Data Time Group (DTG). Always in ZULU time, includes month and year.

(2) LINE 6: Originator's Address (as found in JSP 203).

(3) LINE 7: Addresses of authorities who will take action on receipt of the message.

(4) LINE 8: Addresses of authorities to whom the signal is passed for information.

(5) LINE 9: If required "XMT" excludes addresses from an AIG.

(6) LINE 12A: Security Classification:

UNCLASSIFIED			- U
CLASSIFIED	)	RESTRICTED	- R
	)	CONFIDENTIAL	- C
	)	SECRET	- S
	)	TOP SECRET	- T

Note: When replying to a classified signal, the reply must be classified.

(7) LINE 12B: Subject Indicator Code - describes Subject in text three letter codes are found in NASIS. More than one code may be used, but description should be as accurate as possible as some systems distribute the message automatically by SIC. (ICS3, OPCON, AMRAD)

(8) LINE 12C: Free test, noting that some messages are formatted in RNCP 9, which also gives advice on how to write a signal.

(9) The draft is then completed at the bottom of the form, message instructions completed if required (ie NOTWITHSTANDING MINIMISE) and the message released.

Operators Section

33. On delivery to the MCO the message is then prepared by the operators for transmission. It is this part where a mistake would cause the signal to be rejected.

(1) LINES 6-8 - Routeing Indication are added. Routeing Indication consist of a minimum of four letters and a maximum of seven, and are a coded form of the address, which indicates to the TARE's the route by which a message must pass on its way through the system to its destination. RNCP 6 contains the RIs of all static addressees. Mobile addressees are addressed via the MEP which has an automatic Routemaster in its memory. RBDFO routes a signal to the MEP. It is followed by a two letter suffix (also RNCP 6) which denotes the mobile address,ie RBDFOGU. The MEP can read this, look up the ship's route in its routemaster and distribute the signal accordingly.

Position	Indication	Allocation	Example
First	Network	R - WORLD-WIDE RI Q - World-Wide, not yet allocated U - Theatre/ Local RI	R
Second	Nation or Alliance	A - Australia B - BRITISH COMMONWEALTH C - Canada U - USA S - South Africa X - NATO	B
Third	Geographical Area	D - GREAT BRITAIN M - Far East Q - Middle East T - MED V - South Africa/MAURITIUS Y - Australia, New Zealand	D
Fourth	Primary/Major Relay Station and Service	A Army Primary B - H Army Major I NAVAL PRIMARY J - O NAVAL MAJOR P RAF Primary Q - V RAF Major W Ministry of Defence X Joint	I
Fifth	Minor Relay Station	Any letter except "C" X - Tributary station directly connected to Primary/Major relay station	P
Sixth and Seventh	Tributary Station	Any letters except "C" C - Followed by any other letter in a special suffix X - Ship connected to DTN when in SIXTH position	L

Suffixes: Used to facilitate internal message handling within a Commcen, ie CZ - TARE SUPERVISOR.

(2) LINE 1:

a. 12 Letter Shifts, followed by the letter V (Start of transmission indicator). The 12 letter shifts are required by some encryption devices to commence their function. The 'V' is recognised by the TARE as the commencement of a valid transmission.

b. 'ZCZC' - known as Start of Message Indicator, this allows the signal entry to TARE (manually terminated messages commence 'VVVV').

c. The Start of Message Indicator (SOM) is followed immediately (ie no space) by the Transmission Identity (TI). The TI is a three letter identifier of the traffic channel over which the message is to pass followed by the serial number indicating that the signal is the seventh (for example) since crypto zero - (Example COLLINGWOOD to Fort Southwick HMA and vice versa. MHA - 'A' denotes the first channel, if there were two the second would be HMB and MHB). Every traffic channel has its own TI, and TIs are automatically put on by TARE or TAA70.

d. The TI is followed by letter shift, five spaces and then the Security Warning Prosign (SWP). This is UU for an UNCLAS signal and HH for a CLASSIFIED signal. This ensures that CLASSIFIED signals are only passed over CLASSIFIED circuits.

e. LINE 1: is completed by two carriage returns, line feed.

(3) LINE 2:

a. Repeated Precedence Prosign, ie

BB - Engineering Message
ZZ - Flash
OO - Immediate
PP - Priority
RR - Routine

'BB' and 'ZZ' are automatically routed to the TARE SUPERVISORS position for immediate attention. Prosign is followed by a space.

b. The RIs of the action and info addressees, in order with one space between each. RIs commencing with RU/RH to come first. The last indicator to be followed by 2CR 1LF. The end of the ROUTEING LINE is recognised when '1LF DE Space' or '1LF Z' followed by a letter other than 'Z', eg 1LF is detected.

(4) LINE 3: The Prosign 'DE' (from) followed by a space and a valid RI, the stations signal serial number and a seven character group consisting of the Julian date and time of filing, followed by 2CR 1LF.

(5) LINE 4: Security Warning Operating Signal which consists of ZNR (UNCLAS) or ZNY (CLAS signal), one space and then five characters representing the security grade, ie:

ZNR UUUUU - UNCLASSIFIED
ZNY RRRRR - RESTRICTED
ZNY CCCCC - CONFIDENTIAL
ZNY SSSSS - SECRET
ZNY TTTTT - TOP SECRET

followed by 2CR 1LF.

(6) LINE 10: Number of Groups in an off-line encoded signal.

(7) LINE 11: 'BT' 2CR 1LF - indicates that all following is free text.

(8) LINE 13: 'BT' 2CR 1LF - indicates end of free text.

(9) LINE 14: Not now used.

(10) LINE 15: Correction to text (if necessary) followed by 2CR 8LF - this helps to clear the paper away from the print mechanism at the distant terminal.

(11) LINE 16: 'NNNN' 12 letter shifts (clears tape from Reperf) - Note the END OF MESSAGE (EOM) FUNCTION is denoted by the 2CR 8LF NNNN 12 Letter Shifts contained in LINES 15 and 16 and indicate the end of the message.

TARE

34. TARE is an electronic switching system with the ability to verify essential format lines, receive, segregate; store and relay messages from numerous line inputs. All messages are afforded automatic precedence selection segregation and routeing in strict accordance with format Line 2 content and time of receipt in TARE. Internal Transfer (cross-office time) of messages within TARE is very rapid. The principle tasks carried out by TARE are listed in Paragraph 29. These principles are common to all TAREs. Individual characteristics of certain TAREs will be discussed later.

AMRAD

35. The Automatic Message Routine and Distribution System (AMRAD) is a fully computerised electronic message switching system providing the following facilities for the MOD London Complex:

(1) Collection, electronically of messages from departments and outstations of the MOD.

(2) Conversion of the simplified format of the above messages to standard ACP 127 format for transmission over the Military Networks, and vice versa for messages received for distribution within the MOD.

(3) Provision of confirmatory copy to the originator once the message has been sent.

(4) Multiple access to TARE and TASS facilities within the UK.

(5) Transmission of messages to connected stations in ACP 127 or Format D as appropriate.

(6) Storage and Retrieval of all messages for a period of 30 days.

36. AMRAD operates under two main constraints compared to TARE:

(1) Unlike TARE which ceases signal analysis after the 'DE' in Line 3, AMRAD performs in addition, a detailed analysis of all lines up to LINE 12. The SWP is analysed and compared with the Security Warning Operating Signal in Line 4 and the Classification in Line 12 and as a result of this analysis will forward or reject the signal.

(2) AMRAD distributes its messages within the MOD, purely in accordance with the SIC of the signal.

ADX 6400 and ARGUS 500 TAREs

37. ADX 6400 are fitted at RUDLOE MANOR and BODDINGTON, whilst ARGUS 500 TAREs are fitted at BODDINGTON and LINDHOLME. Although much more modern than ATS 102 and with a much higher capacity CMS (DISC), all TAREs are expected to be replaced within the next 4 years.

TANDEM Computers

38. TAREs incorporating TANDEM non-stop computers are installed at Northwood, Plymouth, Pitreavie, Fort Southwick, EDCC, Gibraltar, Faslane and Whitehall. This equipment, used as part of a complete communication network, facilitates the replacement of torn tape as a communications medium and enables the use of modern data transfer technology. This will be expanded in Chapter 5.