Home Office

Radio Frequency & Communications Planning Unit

Strategic Planning Group 1

Technical Standard

At-Incident Telemetry
Common Air Interface Document
MG 41A Issue 1.4

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Contents

At-Incident Telemetry Common Air Interface Specification MG41A Issue 1.4

Introduction

This document has been developed and agreed between manufacturers and the Home Office. It details the Common Air Interface for a Radio Distress Signalling and Telemetry System for use by fire-fighters.

Version 1.3. was produced as a result of comments from industry after the release of version 1 of this specification in July 1996. The main additions are to show the serial data protocol between base stations and host units and between portable units and telemetry data units (TDU's).

Version 1.4 changes some of the air interface message protocols and includes message sets to be used by suppliers for their own implementations of equipment produced to this specification.

The major points addressed in this document are signalling protocols for radio communications between base and portable units and also inter-unit serial data communications between radio units and any supplementary units used for measuring environmental and physiological parameters.

It is envisaged that this document along with the other two, provides sufficient information to enable suppliers to design inter-operable equipment to meet the specification; however it should be noted that before operational trials take place, system validation testing will be undertaken and that experience gained may lead to changes in the specification.

1. Related Documents

This document is to be read in conjunction with the documents below which describe the agreed User Requirement and the Home Office radio type approval specification. It should be noted that equipment must satisfy the requirements of these documents in addition to complying with the common air interface specification.

1.1. Fire Service User Requirement, JCDD 40 issue 2.

1.2. Home Office radio type approval specification MG-41 Issue 1.5 (amended June 1999).

At-Incident Telemetry Common Air Interface Specification

2. TRANSMISSION STANDARDS

Modulation:	Gaussian Minimum Shift Keying (GMSK 2 state).
Frequency deviation	1.2 kHz peak.
	Sense of modulation Logical "1" sent as decrease in frequency.
Bit Rate	4800 BPS.
Channel coding:	Bi-phase (Manchester encoding) is to be employed i.e. A non return to zero (NRZ) binary 0 is represented by a 1 to 0 transition and an NRZ binary 1 is represented by a 0 to 1 transition.
Symbol rate	½ x bit rate (i.e. before coding 2400 bps; after coding 4800 bps.)

3. PACKET STRUCTURE

Packet Length:	All transmission packets are 28 bytes in length
Transmission order:	Least Significant Bit (LSB) of Least Significant Byte is transmitted first.

4. PACKET CONTENTS

The packet consists of 8 bytes of preamble (bit synchronisation) followed by 2 synchronisation word bytes (frame synchronisation) and 18 message bytes. As shown in table 1. below: -

Table 1.

Byte No.	0	1	2	3	4	5	6	7	8	9	10	11	.....	<26	27
Content	TR	TR	TR	TR	TR	TR	R B1	R B2	SW	SW	MB	MB	.....	MB	MB

Table 1 key

TR	timing recovery byte (reversals, AA hex. = 1010 1010 binary) transmitted LSB (rightmost bit) first.
SW	synch. word byte (synch. word is 678A hex =0110 0111 1000 1010 binary transmitted LSB (rightmost bit) first).
RB1	represents a byte dedicated to repeater flags in which each bit is dedicated to a specific repeater. This will limit the number of repeaters to 7. The most significant bit of the byte shall be fixed as '0' to enable discrimination with TR and SW (byte 08). The most significant bit will be transmitted last.
RB2	represents a byte used to verify RB1. Its value will be the same as that placed in RB1. The most significant bit will be transmitted last.
MB	message byte (message structure is shown below)

5. MESSAGE STRUCTURE

The message bytes (MB) of the transmission packet are structured as shown in table 2: -

Table 2.

Byte No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Content	BI_s	HN_s	LN_s	BI_d	HN_d	LN_d	ID	D0	D1	D2	D3	D4	D5	D6	D7	D8	LC	HC

Table 2 key

BI_s and BI_d represent the source and destination brigade ID No. (annex refers)

HN_s and HN_d are MS byte of source and destination unit number.

LN_s and LN_d are LS byte of the source and destination unit number.

ID message type identifier.(see 6.)

D_n nth data byte (contents vary according to message type).

HC MS byte of CRC -CCITT where CRC input =(BI_s..D8)

LC LS byte of CRC-CCITT$_{(2)}$

Note 2: generating polynomial $x^{16} + x^{12} + x^5 + 1$. (Ref. 1).

6. MESSAGE TYPES

Note: PU = portable unit, BU = base unit

Name	Id	Direction	Expected response	Data($_7$),
ACK	1	PU to BU,BU to PU	None	D_0 = Message ID
LOGON	2	PU/TDU to BU($_2$)	Logon_Ack	D_0-D_1 = Elapsed time($_5$), D_2-D_6 = TDU Status($_3$);
LOGOFF	3	PU to BU	Ack	None
LOGON_ACK	4	BU to PU/TDU	Ack	D_0-D_5 = Time/Date($_4$)
EVACUATE	5	BU to PU($_2$)	None	None
ALARM	6	PU to BU($_1$)	Ack and Alarm_Ack($_8$)	D_0-D_1 = Elapsed time($_5$), D_2- = Alarm type(see 7);
ALARM_ACK	7	BU to PU	Ack	None
TDU_DATA	8	PU/TDU to BU	None	D_0 = Temperature, D_1 = Alerts(see 8); D_2-D8 = TDU Data ($_{11}$);
WITHDRAW	9	PU to BU($_1$)	Ack and Withdraw_Ack($_8$)	D_0-D_1 =Elapsed time($_5$);
CONTACT_REQUEST	10	BU to PU	TDU_Data	None
RECALL	11	BU to PU	Ack	None
WITHDRAW_ACK	12	BU to PU	Ack	None
ENG_DATA	13	PU to BU	None	D_0 = Temperature, D_1 = Alerts(see 8); D_2 = Voltage($_{11}$)
REMOTE_LOGON _REQUEST	14	BU to PU($_2$)	Logon	None
SELECTIVE_LOG_ON _REQUEST	15	BU to PU	Logon	D_0-D_5 = Time/Date($_4$)
TDU_STATUS	16	PU to TDU	TDU_Status_Ack	D_0-D_1 = Elapsed time($_5$), D_2-D_6 = TDU Status($_3$);
TDU_STATUS_ACK	17	TDU to PU	Ack	D_0-D_5 = Time/Date($_4$)
DISCONNECT	18	BU to PU	Ack($_8$)	None
SUPPLIER SPECIFIC MESSAGES	128/255	PU to BU,BU to PU	As required	Closed message types, No payload structure defined($_{10}$)

Notes

1. Portable Units (PU's) can only address specific Base Units(BU's) after the PU has been logged on. The destination address fields (i.e. BU brigade number and unit number) of all messages sent by the PU before the PU has been logged on should be set to normally unrecognised values, such as zero. In general, the BU only recognises messages from its own logged on PU's or from PU's which are not logged on to any BU. The exceptions are **Alarm** and **Withdraw** messages which are displayed on all BU's. **Logon, Alarm** and **Withdraw** messages from PU's which are not logged on to any BU are displayed on all BU's so that they may be accepted or rejected manually at the discretion of the Breathing Apparatus Entry Control Officer (BAECO). If the PU is logged on, it will only accept acknowledgement from the BU to which it is logged on.

2. Evacuate and **Remote_Logon_Request** messages can be considered to be "broadcast" messages to all PU's. The destination address fields (i.e. PU brigade number and unit number) of these messages should be set to normally unrecognised values, such as zero.

3. Initial TDU status comprises TDU active/failed status (1 byte) and, if TDU active, BA cylinder capacity in litres (1 byte), maximum BA cylinder pressure in bar (2 bytes)

4. Time /Date contains **HH MM SS DD MM YY** (6 bytes BCD, units in lower 4 bits and tens in higher 4 bits). This is to be updated on every retry.

5. Elapsed time in seconds since Portable activation expressed as a long integer

6. The Evacuate signal will contain the identity of the Base station, which initiated it. This is to ensure that units logged on to a particular Base station are not falsely evacuated by another.

7. TDU data contains up to 8 bytes (6 bytes of 8-bit analogues, 1 byte 8 digital outputs, 1 byte of alert types.(para. 7)). Unused data bytes set to zero (don't care)

8. An Ack response is only expected from logged on PU's.

9. Unused data bytes may take any value.

10. Supplier specific messages are not to be used to replace the functions listed above but are incorporated in order to allow supplier specific messages to be passed that include additional functions to those described.

11. There are two types of telemetry data message, TDU_Data and Eng_Data. Both message types contain temperature obtained form the PU's internal temperature sensor and a set of PU alert indications (See 8). TDU Data contains an additional 7 bytes of data obtained from the TDU. Eng_Data contains an optional external analogue voltage.

7. ALARM TYPES

Name	Bit	Mask(Hex)	description
AUTO	0	01H	No Movement
MANUAL	1	02H	Button Pressed
SPARE	2-7	04H - 80H	Not Allocated

8. ALERT TYPES

Name	Bit	Mask(Hex)	description
PU_BATT_1_LO	0	01H	PU battery 1 low
PU_BATT_2_LO	1	02H	PU battery 2 low
TDU_LINK_FAILED	2	04H	Pressure Low
SPARE	3 - 7	08H – 80H	Not Allocated

9. SYSTEM MESSAGE SEQUENCES

9.1 LOG ON

Log on between portable units and base units may be achieved in one of three ways: -

9. 1.1 LOGON initiated by the portable unit.

Upon activation, the portable unit transmits up to 10 LOGON messages(message **id 2**) randomised in time about a 2 second transmission interval until it receives a LOGON_ACK message **(message id 4)** from any base unit. The LOGON message includes TDU status information.

The LOGON_ACK message identifies the base unit so that the portable unit can ignore acknowledgements and other messages from base units to which it is not logged on.

If LOGON_ACK is not received after 10 attempts the portable unit reverts to an automatic distress signalling unit (ADSU) but which can accept a LOGON_ACK message at any time. It should still attempt to log on but at a much slower rate (determined by supplier).

9. 1.2. Late entry LOGON.

Late entry LOGON is likely to be required in practice as often the portable units will be deployed before there is a chance to set up the base station at the incident.

9. 1.3. Manually activated broadcast Base Station LOG_ON

Once the base station is set up, the operator activates manually (e.g. by button press) a request message **(message id 14)** inviting all units in range not already logged on to a base station to log on. The operator, on seeing these units reply **(message id 2)** may elect to log them on if their identification is recognised as being associated with teams under his control. Once logged on a LOGON_ACK **(message id 4)** is sent from the base station to the portable unit.

9. 1.4. Manually activated selective base station LOG_ON

This method of late entry log on would require some automatic identification number to be related to portable unit tags. (By bar code or other method). The operator enters the tag identification numbers into his enhanced Base station (by swiping bar code into reader) which then sends a message **(message id 15)** inviting the portable unit with the corresponding identification number to log on. The portable unit replies with a LOG_ON message **(message id 2)** and this is confirmed with LOGON_ACK **(message id 4)** from the base station.

9.2 Evacuate

9.2.1. Upon initiation of the evacuate (i.e. global recall) sequence at the BU, the BU shall broadcast 3 Evacuate messages, randomised in time about a 2 second transmission interval (see 10).

9.2.2. Only those PU's which are either

- logged on to the source BU or
- not logged on to any BU,

shall react to the Evacuate message. No PU shall reply to the Evacuate message.

9.2.3. After the transmission of Evacuate messages, the BU shall automatically recall all of its logged on PU's individually (see 9.3).

9.2 Recall

9.2.4. Upon initiation of the recall (i.e. selective evacuate) sequence at the BU, the BU shall send up to 3 recall messages, to the selected PU, randomised in time about a 2 second transmission interval until an ACK message is received from the selected PU.

9.3. Alarm

9.3.1. Upon initiation of the Alarm sequence at the PU, the PU shall send an unlimited number of Alarm messages, randomised in time about a 4 second transmission interval (see 10).

9.3.2. If the PU is logged on, it shall only terminate the transmission of Alarm messages when the Ack or Alarm_Ack message is received from the BU to which it is logged on. If the PU is not logged on, it shall terminate the transmission of Alarm messages when an Alarm_Ack is received from any BU.

9.3.3. The same message sequence shall be used for manual (i.e. button pushed) alarms and automatic (i.e. no movement) alarms.

9.4. Withdraw

9.4.1. Upon initiation of the withdraw sequence at the PU, The PU shall send an unlimited number of Withdraw messages, randomised in time about a 4 second transmission interval (see 10),

9.4.2. If the PU is logged on, it shall only terminate the transmission of Withdraw messages when an Ack or Withdraw_Ack message is received from the BU to which it is logged on. If the PU is not logged on, it shall terminate the transmission of Withdraw messages when a Withdraw _Ack is received from any BU.

9.5. Logoff

9.5.1. Upon initiation of the logoff sequence, the PU shall send up to 5 Logoff messages, randomised in time about a 2-second transmission interval (see 10). The PU shall shut down on receipt of an ACK message or after the transmission of 5 Logoff messages.

9.5.2. Logoff messages shall not be sent by PU's which are not logged on.

9.6. Telemetry

9.6.1. The PU (whether it is logged on or not) shall send telemetry data at regular intervals according to the PU's telemetry message transmission schedule. It shall also send telemetry data when it is informed by the TDU that immediate transmission is required.

9.6.2. The shortest time interval between telemetry message transmissions must be compatible with air interface traffic predictions based on the maximum number of operational PU's.

9.6.3. The type of telemetry message sent by the PU, either TDU_Data or Eng_Data, shall depend on the PU's operating mode.

9.6.4. The BU shall not reply to either type of telemetry message.

9.7. Contact Request

9.7.1. Upon initiation of the contact request sequence by the BAECO, the BU shall send a Contact_Request message to the selected PU. On receipt of a Contact_Request from the BU to which it is logged on, a PU shall send a telemetry message (see 9.6).

9.7.2. Contact_Request messages shall be ignored by PU's which are not logged on.

9.8. Disconnect

9.8.1. The Disconnect sequence is initiated by the BAECO at a BU when a Logon message from a PU has been acknowledged by mistake. The Disconnect message instructs the PU to change its state from "Logged on" to "Not logged on" and to restart its Logon phase.

9.8.2. The PU shall respond to a Disconnect message from BU "A" according to its state as follows:

- If the PU is logged on to BU "A", it shall send an Ack message to BU "A", change its state to "not logged on" and restart its logon phase.
- If the PU is logged on to BU "B", it shall send an Ack message to BU "A", but shall remain logged on to BU "B".
- If the PU is not logged on to any BU, it shall send an Ack message to BU "A", and restart its logon phase.

10. ACCESS METHOD

10.1.1 The system may be accessed by either a random access protocol or polling method.

10.1.2 In order that different systems do not interfere with each other when using different access methods then polling systems must leave sufficient time for random access systems to be able to successfully send messages.

10.1.3. Polling systems will have a repeat cycle of 20 seconds length and will space out polls to mobile terminals equally. I.e. if three terminals are logged on then these will be called at intervals of 6.7 seconds. If there are 12 terminals the polling rate will be 1.7 seconds.

10.1.4. Random access methods are used as an alternative to polling. It is rewired that the time interval between transmission of one message and transmission of the next shall be uniformly distributed over a range in steps of 100 milliseconds.

10.1.5. The randomisation range of the BU shall be +/- 350 milliseconds.

10.1.6. The randomisation range of the PU for Logon messages shall be +/- 1400 milliseconds.

10.1.7. The randomisation range of the PU for all other messages shall be +/- 700 milliseconds.

11. SERIAL INTERFACE PROTOCOL PHYSICAL

Both the portable unit and base station are to have serial ports in order to communicate with telemetry data units (TDUs) and enhanced control units respectively unless these functions are integrated as a single unit. The physical and electrical interface standards are detailed below. Both portable and base units are to be treated as DTE devices.

11. 1. Physical interface

The portable unit and base units will use a 4-way socket or equivalent connector.

Hirschmann ELST 4408RV FM805 933 147-001

The equivalent connector with free plug will connect the TDU and enhanced Base station to these units as appropriate. Corresponding plugs for attachment to portable unit are: -

11. 1.1. Straight entry

Hirschmann ELKA 4008 933 367-100

11. 1.2. Angled

Hirschmann ELWIKA 4008 933 369-100

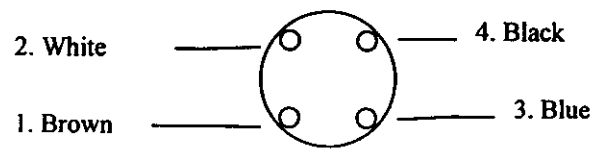
11. 1.3. Base Station Log Transfer

For transfer of the log from the base station, it shall employ a standard 9 way serial connector configured as DTE.

11. 2. Pinout (portable unit and base station)

Pin no.	Designation
1.	Common
2.	Transmit
3.	Receive
4.	Data enable

Fig. 1 Pinout of Hirschmann connectors and cable colour coding viewed from the pin side



11. 3. Electrical interface

type: V24 (RS232c)
TTL voltage levels are to be used i.e. 5v and 0v
Data rate 2400 bps
Data word: - 8 bits, 1 stop bit, no parity

11. 4. Message Protocol (Physical)

The serial data protocol between portable units and TDUs, Base station's and enhanced Base station's is as follows: -The portable unit will allow data from the TDU to be sent only if pin 4 (**data enable**) is high. There is no additional software or hardware handshaking on this link. The TDU must be available to receive data from the portable unit at any time.

The same principle outlined above for the TDU/portable link applies to the Base station/enhanced Base station link. The Base station will only accept data once the data enable pin is high. The enhanced Base station should be available to receive data at any time.

12. SERIAL MESSAGE STRUCTURE

The message interface will be packet based, assuming a master/slave relationship, between the portable unit and TDU and the base unit and host with the portable unit and base units acting as hosts.

12.1. Packet structure.

STX	Type	length	Msg_0	" "	Msg_{n-1}	Check

12.2. Explanation of data types

STX indicates start of packet.

Type indicates the packet type; ENQ for packets transmitted by the master and ACK or NAK for packets transmitted by the slave.

Length indicates n, the number of message bytes; range for 0 to 16 inclusive. Note that packet length = n+4 bytes. Length =0 when type = NAK.

Msg_i indicates message byte i.

Check is the message checksum of calculated by the sender of the packet. The checksum is calculated as the summation of the n message bytes modulo 2(XOR). On reception of the packet the message bytes and the check byte are summed modulo 2 so that an error free result is zero.

The NAK packet has no message bytes. The check byte would therefore have an indeterminate value. To overcome this the NAK packet will be sent as: -

STX	NAK	0	0

12.3. Message Structure

All messages shall have the following structure:

Msg_0	Msg_1	Msg_2	Msg_3	;	;	Msg_{n-1}
Identity	$Data_0$	$data_1$	$data_2$		$data_{n-3}$	$Data_{n-2}$

Identity indicates the message type (see below)

$Data_i$ indicates the data byte i.

12.4 Message type

Identity	Name	Purpose	Length	Data content
1	Get-status	Sent by the portable to request the TDU's status. Sent at portable power-on and at 5-second intervals thereafter until a valid response received. Also sent by portable during late logon.	ENQ 1 ACK 5	None TDU status(1)
2	Put_status	Sent by the portable to inform the TDU of the portables status when a change in status occurs	ENQ 3 ACK 1	portable status(2 None
3	Set_time	Sent base station to set the hosts time/date and sent by the portable to set the TDU's time/date	ENQ 7 ACK 1	Time/date(3) None
4	Spare	Not Allocated		
5	Get_data	Sent by the portable to request telemetry data. Sent at 5-second intervals after a valid response to Get_Status has been received.	ENQ 3 ACK 9	Portable status(2 TDU Data(4)
6	Radio_to_ portable	Sent by base station to inform the host of a radio message just transmitted.	ENQ16 ACK 1	Radio message(None(6)
7	Radio_from _host	Sent by the base station to inform the host of a radio message just received.	ENQ 16 ACK 1	Radio message(None(6)

Notes

1. TDU Status comprises TDU status flags (1 byte, as defined in 12.5); BA cylinder capacity in litres (1 byte), BA cylinder pressure in bar (2 bytes) and current pressure (1 byte). The portable's radio logon sequence is not affected by the readiness of the TDU. If the portable logs on to a base station successfully before the TDU is ready, it sends a TDU_status radio message to the base station as soon as the TDU is ready.

2. Portable status comprises portable status flags (2 bytes, as defined in 12.6). This information is repeated in the periodically transmitted Get_Data message in case the Put_Status message fails.

3. Time/Date contains 6 bytes binary, one byte each for hour, minute, second, day, month and year in Binary coded decimal (BCD) format, one digit per nibble (tens in upper 4 bits, units in lower 4 bits).

4. TDU data comprises TDU status flags (1 byte, as defined in 12.5) and 7 bytes max. of telemetry data (1 x 8 alarm flags, 5 x 8-bit analogues, 1 x 8 digital). The portable unit sends telemetry data to the base station at regular intervals according to the portable's contact message schedule. It also sends telemetry data to the base station on and event driven basis when the TDU_alarm flag changes from 0 to 1.

5. Radio messages as defined in air interface specification

6. The base station will normally disable the host's acknowledgement of relayed radio messages via the data enable control line.

12.5 TDU Status flags

Name	Bit	Mask(hex)	description
Data_Valid	0	01	TDU data is valid
TDU_Alarm	1	02	TDU alarm has occurred
spare	2	04	not allocated
spare	3	08	not allocated
spare	4	10	not allocated
spare	5	20	not allocated
spare	6	40	not allocated
spare	7	80	not allocated

12.6 Portable status flags

name	Bit	Mask(hex)	Description
Logon_Tx	0	0001	LOGON message transmitted
Logon_Ack	1	0002	logon message acked
Alarm_Tx	2	0004	Alarm message transmitted
Alarm_Ack_1	3	0008	Alarm acked automatically
Alarm_Ack_2	4	0010	Alarm acked manually
Withdraw_Tx	5	0020	Withdraw message transmitted
Withdraw_Ack_1	6	0040	Withdraw acked automatically
Withdraw_Ack_2	7	0080	Withdraw acked manually
Evac_Rx	8	0100	Evacuate message received
Recall_Rx	9	0200	Recall message received
Recall_Ack	10	0400	Recall message acknowledged
Pre_Alarm	11	0800	Pre_Alarm warning active
Logoff_Tx	12	1000	Logoff message transmitted
Logoff_Ack	13	2000	Logoff message acknowledged
Disconnect_Rx	14	4000	Disconnect message received
Disconnect_Ack	15	8000	Disconnect message acknowledged

12.7 Message handling at portable/base station

For ENQ messages, which require a response, the portable/base station shall expect the response within 250 ms of transmission. If an invalid response is received (i.e. a message containing an incorrect checksum), the portable/base station shall re-transmit the ENQ message.

The portable shall deem a response to be invalid if any of the following are true:

- The Type byte does not contain *ACK*.

- The length byte is out of range.
- The check byte is incorrect.
- The message ID byte does not match that contained in the ENQ message.

The portable/base station shall deem the link to have failed it does not receive a response to an ENQ message within the defined time window.

None of the above checks are applicable to ENQ messages, which do not require a response. The portable/ base station is not required to respond to either an ACK or a NAK packet. The portable/ base station shall ignore all unsolicited packets.

12.8. Message handling at TDU/Host

While no packet is being received the TDU/Host shall poll its receive data stream for STX. On receipt of STX, the TDU/Host shall commence packet reception.

The TDU/Host shall terminate packet reception and wait for the next STX if any of the following are true.

- The Type byte does not contain ENQ.
- The length byte is out of range.
- The time interval is between adjacent bytes exceeds 100 ms.

The TDU/host shall terminate packet reception and attempt to process the message when all bytes (as indicated by the length byte) have been received.

The TDU/Host shall not respond to the message in any way if the data enable line controlled by the portable/base station is not in the data enabled state.

The portable/ base station shall respond to the ENQ message with an NAK packet if the data enable line is in its enabled state and either the Check byte is incorrect or the message identity is not recognised.

The portable/ base station shall respond to the ENQ message with an ACK packet if the data enable line is in its enabled state and the Check and Identity bytes are valid. The ACK packet shall contain the same Identity as that contained in the ENQ message and, if applicable, all data requested by the ENQ message.

13. REFERENCES

1. CRC-CCITT: The CCITT Red Book Vol. V111, International Telecommunications Union, Geneva 1986, Recommendation V41, "Code Independent Error Control System".

Annexe A. County Fire Service Code Address list

1. It should be noted that each brigade has a unique number (between 001 and 255). Each portable unit also has a unique address number (between 00001 and 65535). Requests of additional brigade addresses should be made to Home Office RFCPU.

Fire Brigade		Code Block	Fire Brigade		Code Block
ENGLAND & WALES					
AVON	Avon	001	LEICS	Leicestershire	026
BEDS	Bedfordshire	002	LINCS	Lincolnshire	027
BERKS	Berkshire	003	LONDN	London	028
BUCKS	Buckinghamshire	004	MERSY	Merseyside	029
CAMBS	Cambridgeshire	005	MWAL	Mid & West Wales	030
CHESH	Cheshire	006	NORFK	Norfolk	031
CLEVE	Cleveland	007	NHANT	Northamptonshire	032
CORNW	Cornwall	008	NHUM	Northumberland	033
CUMBR	Cumbria	009	NWALE	North Wales	034
DERBY	Derbyshire	010	N.YKS	North Yorkshire	035
DEVON	Devon	011	NOTTS	Nottinghamshire	036
DORST	Dorset	012	OXFRD	Oxfordshire	037
DURHM	Durham	013	SHROP	Shropshire	038
E.SX	East Sussex	014	SOMER	Somerset	039
ESSEX	Essex	015	S WAL	South Wales	040
F.COL	Fire Service College	016	STAFF	Staffordshire	041
GLOCS	Gloucestershire	017	SYKS	South Yorkshire	042
MANCH	Greater Manchester	018	SUFFK	Suffolk	043
HANTS	Hampshire	019	SURRY	Surrey	044
H & W	Hereford & Worcester	020	T & W	Tyne and Wear	045
HERTS	Hertfordshire	021	WARKS	Warwickshire	046
HUMBS	Humberside	022	W.MID	West Midlands	047
IOW	Isle of Wight	023	W.SX	West Sussex	048
KENT	Kent	024	W.YKS	West Yorkshire	049
LANCS	Lancashire	025	WILTS	Wiltshire	050
SCOTLAND					
CENTR	Central Region	101	H IGHL	Highland & Islands	105
D & G	Dumfries & Galloway	102	LOTHN	Lothian & Borders	106
FIFE	Fife	103	STRCL	Strathclyde	107
GRAMP	Grampian	104	TAYS	Tayside	108
OTHER REGIONS					
NIREL	Northern Ireland	200	IOM	Isle of Man	207
JERSY	Jersey	205	IOSC	Isles of Scilly	208
GUERN	Guernsey	206	TEST	TEST	250 to 255