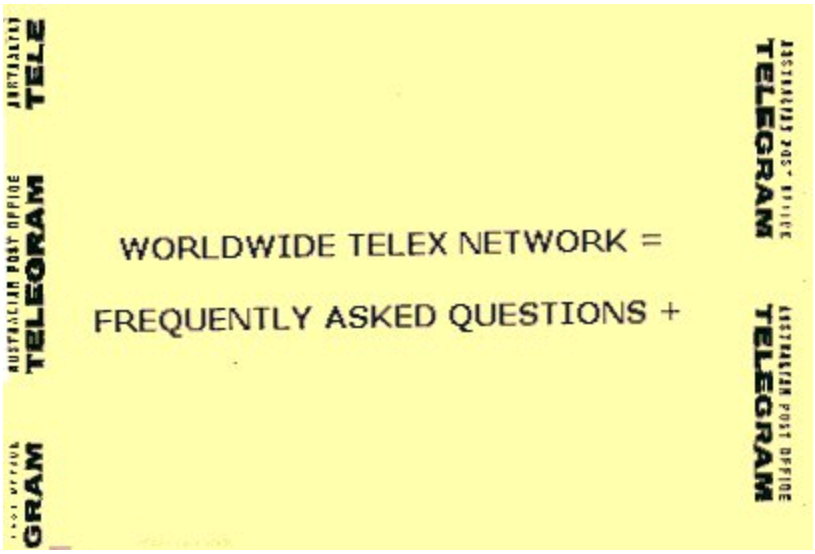
TELEX -
the key to instant communication.



by Larry Rice

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1. **What exactly is the telex network?**

   The TEL egraph EX change Service is a 24 hour a day world-wide communications network.

   Customers communicate with each other by exchanging the typed word using CCITT International Telegraph Alphabet No.2 protocol.
   The communications session can be either be a real-time two-way keyboard-based conversation between 2 Telex subscribers or a simple straight forward typed message that has been prepared earlier offline for later automatic transmission.

   Telex is still the only form of transmission system which is legally recognized as possessing full legal document status.
   Governments use this medium extensively so they make sure that it is a reliable, up-to-date and well-maintained network.
   Telex offers the safeguard of the typed word.

   It is a reliable dedicated network that has stood the test of time and developed technologically for over 50 years.

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2. **How big is the telex network and who uses it?**

   There are approximately 1.7 million customers in over 200 countries.
   (400 in Australia).

Users are from such fields as embassies and consulates, government departments, newspapers, airline offices, stock exchanges, business enterprises such as import/export agencies, hotels/motels, universities and many other diverse organisations.

In 1996, British Telecom won a contract worth up to half a million Pounds to provide a telex-based charge card authorization service to American Express. Because of erratic telephone communications in Africa, American Express cards could not be used. But now by using telex, American Express can now give immediate authorization on all its card transactions and it now has a system which can be used from telex machines anywhere in the world including East European countries.
(B.T. Today May 1996)

NEW Telex Network undergoing a revival. (B.T. Today April 2002)

British Telecom's declining telex network is enjoying a new lease of life by becoming a means of delivering a low-cost and highly effective security service in conjunction with a data 300baud circuit.

So successful is this usage of the telex network to provide the signalling medium that Lloyds Trustee Savings Bank has entrusted it for its property and panic alarm requirements across its sites and has increased its requirement to between 1,500 and 2,000 circuits.

The UK dedicated telex network has been modernised so that this revitalised network incurs virtually no capital cost, whilst continuing to attract revenue.

Allan Renton, head of telex support and engineering explains, "We supply the customer with an SS 300 circuit that is tied into the telex network and the customer purchases a modem and interface to hook up with the building monitoring panel. Once these are installed, the customer can use the network [with] whatever type of data they choose to send anywhere in the UK."

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3. **Compare the differences between telex messages and facsimile messages.**

- **TLX:** A secure, switched messaging service that conforms to international transmission standards. The telex network is used by government and business so the powers that be make sure this network works perfectly. Where the telephone systems do not perform well as in some countries in Africa, the telex network is maintained on a seperate telegraph network.
- **FAX:** Low line current on some telephone systems cause problems to facsimile transmission.

- **TLX:** A telex message consists of typed text using telex-compatible equipment either stand-alone or computer-based linked to a telex interface. The telex network is constantly being developed internationally using Intelligent Network technology.
- **FAX:** A facsimile message has to be prepared beforehand. It can be typed, hand-written or contain graphics.

- **TLX:** Telex transmissions confirm and authenticate delivery from sender to receiver, and vice versa, through the exchange of strictly controlled answerback codes by the controlling telex administration. Telex directory enquiries can unpack the senders name and address from answerbacks, this means telex is one of the safest and most reliable ways for use as primary communications.

- **FAX:** As it is the facsimile machine users responsibility to key in the Station ID, this can easily be changed or withheld, so the caller is never really sure that the message has reached the correct receiver. Horror stories are not unknown of 'secrets' being given away to foreign powers by careless or negligent checking of fax headers. Facsimile machines can easily be moved from one telephone line to another and not all users may be diligent to change the station ID accordingly.

- **TLX:** A telex message will often receive the same attention as a telegram/telemessage/lettergram, and will not usually remain unanswered for long.
- **FAX:** In a pile of incoming facsimile messages, personal chit-chat messages can easily hide an important message.

- **TLX:** The sender of a telex message can be confident that the message will arrive perfectly at the distant end. Exchange of answerbacks after transmitting a telex message ensures that connection is still established with the distant end before the sender terminates the call.
- **FAX:** Horizonal streaks with missing lines on received faxes are a result of a poor telephone connection or could be low line current from distant countries. Getting a repetition from far flung places could well be a chore. The writing implements some folk use to compile facsimile messages may make them hard to read at the distant end.

- **TLX:** Live keyboard two-way conversations can be had with the telex system.
- **FAX:** Once the document has gone past the scanner and the wait time for more sheets has finished, the facsimile machine automatically clears down.

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4. **Technically, what happens when a telex message is sent?**

Technology is changing the way the Telex system operates by taking the network off its own independent exchanges and 're-introducing' a similar VF system, that is, back to routing traffic via the phone network that was used on the Telex network way back in the 1930's. The only real difference is that different tones are used for send and receive instead of the simplex on/off tone 1500 cps method, and it's using modems with data compression protocol with additional equipment to interface the existing conventional telex network to co-exist upon the public switched telephone network. You can now send a telex message via the internet from a PC.

In Australia, telex signalling is either double-current 50-0-50 by reversing a current that is normally on the line or FSK via the PSTN using FSK.
Telex has two divisions of signalling, Type A and Type B.
It's internationally agreed that if two countries with different types of signalling systems are trying to make a connection, the originating country will convert its outgoing signals to that of the receiving country.
Type A signalling is where the keyboard is used to type in the called telex number.
Type B signalling is where the telex dial is used to send the wanted telex number.
Most countries have either changed or are in process of changing over to Type A keyboard selection as it's easier to incorporate into the intelligent systems used today.

The telex equipment started with mechanical teleprinters, now the latest teleprinters are built around a microprocessor, disc drive, keyboard, VDU, printer together with word processor software to enable the operator to prepare, edit and store messages for later onward transmission. Telex computer software, telex forwarding services using Email-to-Telex, Real-Time conversational and store-and-forward via the Internet, all enhance the Telex network with the secure knowledge that you cannot unsuspectingly download a virus from a telex call.

To initiate a telex call on a teleprinter using keyboard selection, the operator presses the call button and types in the wanted telex number finishing with a + (plus) sign. After a few secs either the wanted answerback code appears on the calling teleprinter/VDU screen or a service code is sent from the exchange. The operator checks that the answerback code is the desired one and signalling by ITA#2 5-unit code can commence in either direction alternatively.

Answerback codes consist of a pre-determined set of 20 characters signifying the telex number, customer name and the country of origin. International telex directories exist for unpacking answerback codes.
Telex operates in simplex mode so both parties have a local record of what's being sent/received.

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5. **What are the abbreviations/Service Codes used on telex?**

ABFF	Answerback Format faulty.
ABS	Absent. (Office closed).
ANUL	Delete.
BK	I cut off.
CFM	Confirm.
CLG	Calling.
COL	Collation please/I collate.
CRV	How do you receive?/I receive well.
DER	D rang . (Out of order)
DF	You are in communication with the called telex service.
GA	Go ahead/You may transmit.
INF	Customer temporarily unobtainable.
IFE	Office closed because of holiday.
MNS	Minutes.
MOM	Wait a moment please.
MUT	Mutilation.
N A	Correspondence to this international destination is not admitted.
NA	Not Admitted. (Correspondence to this service is not admitted).
NC	No circuits.
N C	No circuits (International).
NCH	Number has been changed.
NI	No line identification available.
NP	No Plant. (The called number is not, or is no longer a telex service).
N P	The called international number has been typed incorrectly.
NR	Indicate your number/My number is..
OCC	Occup . (Distant equipment occupied).
PPPP	Stop transmission.
PPR	Paper.
R	Received.
RAP	Rappel. (I shall call you back).
RPT	Repeat/I repeat.
SSSS	Here ready for data transmission.
SVP	Sivousplait - Please.
TAX	What is the charge/The charge is..
TESTMSG	Please send a test message.
THRU	You are now connected with a telex terminal.
TPR	Teleprinter.
W	Words.
WRU	Who are you?
XXXXX	Error.
+ +	End of transmission acknowledgement not required.
+?	End of transmission, you may transmit.

Service Codes, automatically generated by telex exchanges, are based upon a mixture of English and French expressions.

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6. How can one connect to the telex network and how much does it cost?

A prospective customer would contact the telex network administration in their country and ask their advice on how to proceed. New and pre-owned equipment are likely to be available as well as a choice of computer-based equipment suppliers on the Internet.

The costs of getting a dedicated telex line in Australia at time of writing are:
$AU260.00 per annum for installation of new line.
$AU37.00 per month plus call charges.
Calls dialled automatically are charged in 6 second increments. International call rates depend on destination country from $AU1.46 per minute to $AU3.12 per minute.

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7. Why should I use telex when I can use facsimile or electronic mail?

(Assuming both parties have those systems)

- Use Telex when you really need to make sure that important message has been well received by pressing the Bell key after transmission on a monitored call to get an on-line acknowledgement. The exchange of answerback codes anyway signify a good receipt. You may even get an immediate reply on the same connection. It is impossible to download a computer virus from the telex network.
  The shocking results of one study suggested that four out of every 10 e-mails sent to companies were being ignored.
- Use Telex when legality of that transmitted message is needed.
- Use Facsimile when images or handwriting need to be electronically transmitted.
- Use Electronic Mail when no acknowledgement is needed that the email has been received by the addressee, notwithstanding mail unsent notifications from your internet provider.
- When the addressee does not have any of the above services, and you do not wish to use the postal service, send a Telegram/Telemessage/Lettergram/Mailgram...etc.

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8. How did the Telex Network start?

In U.K. June 1932, the "Telex Service", a switching service for teleprinter subscribers, was introduced for British Post Office administrative use followed by the opening to the public in London on 15th August 1932.
Similar services were also commenced in several other European countries and in 1936 an international telex service, using 1500 cps signalling, was established between London and Amsterdam then onwards into the German telex network in 1937 and to a number of other countries.
Germany inaugurated the worlds first automatic teleprinter exchange system, developed by Siemens and Halske, based on telegraph circuits in October 1933. Special modem equipment was installed in Amsterdam to accomodate the telephone to telegraph line conversion.
The German automatic teleprinter exchange system was recognised world-wide as a most efficient system and received high acclaim. Over 90 percent of countries telex networks later adopted this model TW39 system. It was the CCITT Type B system with dial selection.
Countries who opted for keying selection CCITT Type A system were initially very few, ie Australia, France, Italy, Netherlands, Norway.
The first telex machines were connected to the telephone network alongside a telephone so by setting up a telephone call first, one then transferred that line to the teleprinter. It worked using a single-tone voice frequency carrier signal of 1500 cps which was keyed on and off by the teleprinter keyboard, a tone for a space element and no-tone for marking and idle periods.
Telex subscribers had a basic modulator-demodulator (**Modem)** that was connected between their teleprinter and telephone line.

Within a short space of time, the number of teleprinter subscribers increased to such an extent that it was more advantageous and economical to have an independent telegraph network both national and international. Conversion of the telex system to its own telegraph network in UK was completed in 1954. The bandwidth of a signal sent by telex is only about one twentieth the bandwidth of a telephone signal.
Initially the networks were switched by manual exchanges but due to the popularity of telex by the business community, these were eventually upgraded to automatic exchanges.
By 1956, telex service internationally was available to most of Europe, to Africa via radio links, to U.S.A. and Canada via voice frequency telegraph channels along the trans-atlantic telephone cable.
Now, intelligent network technology such as *InTelex* has reverted the network back to using telephone lines in majority of countries using keyboard selection incorporating modems between the telex line at the subscribers end and, either the teleprinter, or the telex interface and the PC.

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9. **What's the difference between a telex machine and a teleprinter machine?**

- A **Telex machine** is a teleprinter used on the telex network.
- A **Telex message** is the communication transmitted/received on the telex network.
- "A **Telex**" usually means a message sent on the telex network.
- A **Teleprinter** is a device for transmitting and receiving the typed word using International Telegraph Alphabet No.2 code designed for start-stop telegraph systems.
- A **Teletype** is a teleprinter manufactured by the Teletype Corporation.
- A **Creed** is a teleprinter manufactured by the ITT-Creed Company.

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10. **What about sending a telex message say from England to Japan - will it be received in the Japanese language?**

No. Japan's international telex carrier is KDD which uses normal 5-unit signalling, NTT is the domestic Telex carrier which uses 6-unit signalling for the Japanese script and is linked with KDD via signal converters for 6 to 5 unit and conversely 5 to 6 unit.
In the United Arab Emirates, ETISALAT is supplying dual language telex machines capable of sending and receiving messages in both Arabic and Latin script. Telex subscribers in the UAE using the dual language machines can switch between Latin to Arabic or vice versa any number of times and it's possible to send the Arabic and Latin translations of the same message in the same transmission, assuming both parties have dual language machines.
Telexing to the UAE from outside that country are assured that if a Latin answer-back is received back from the distant end, the called party can receive Latin script, and if the first symbol in that answer-back is an equals sign (=), it denotes that machine is a dual language machine.
Telex users who have accented letters in their language on their teleprinter keyboards are advised not to use those letters internationally.

Five-unit codes

By Alan G Hobbs, G8GOJ
President of British Amateur Radio Teledata Group, (c) 1999

In articles that mention RTTY codes there is usually reference to Baudot, Murray and ITA2 codes. These codes are often taken to be identical and interchangeable. Even "respectable" engineering journals do not seem to understand the fundamental differences between the different codes. For any two equipments to satisfactorily inter-operate, it is essential that the code in use is thoroughly specified and understood, and the same at each end. The purpose of this article is to explain the similarities, and the differences, between the codes, and to indicate their relationship to the Radio Amateur.

All codes have their strengths and their weaknesses. For instance, one of the strengths of Morse code is that commonly used letters have short codes, making them easier to send. Whereas one of its weaknesses is the difference in length between the code for the shortest character ‘E’, and the code for the longest character ‘0’, which takes 19 times as long to transmit. This vast difference in length made the Morse code difficult, but certainly not impossible, to mechanise. For example, the Creed Morse printer, developed in the early 1900s, read and printed in plain language, a perforated Morse tape at speeds of up to 100 words per minute.

It had long been realised by many telegraphic engineers, that the real answer to the mechanisation of telegraphy was to use a code in which every character took the same time to transmit. A so-called "constant length" code. With 26 letters in the alphabet, it was only natural that the most popular codes would all consist of five signalling elements, with each element taking one of two states, e.g. +ve/-ve, off/on, etc. Therefore the number of available combinations is two raised to the power five:

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ie 2 x 2 x 2 x 2 x 2 = 32
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By reserving two of the combinations for use as non-printing shift control characters, it is possible to associate a numeral or punctuation mark with every letter of the alphabet, effectively doubling the capacity of the code. Naturally, this will slightly reduce the rate at which the message is transmitted, but the machinery could be designed to insert these shift characters automatically, thereby reducing the effort on the part of the operator.

Baudot Multiplex System

The earliest, successful, printing telegraph system which used a five-unit code, was the Baudot Multiplex System, which was devised by Emile Baudot, of the French Telegraphic Service, in 1874. This is a time division multiplex system, and utilises (1) certain printing details of the Hughes printing telegraph instrument, (2) the distributor arrangements invented by Bernard Meyer in 1871 which were employed in a Morse multiplex system, and (3) a five-unit code devised by Johann Gauss and Wilhelm Weber. The system was adopted in France in 1877, and thereafter its use in France was extensive, and it was to some extent adopted in other countries. The British Post Office adopted the Baudot system for use on a simplex circuit between London and Paris in 1897, and subsequently made considerable use of duplex Baudot systems on their Inland Telegraph Services.

The Baudot distributor could be designed so that it could be used by from two to six operators, with the quadruple Baudot system, using four operators, adopted as the standard installation for use in the British Post Office. The distributor, consisting of copper segments and rotating brushes, successively connected each operator to the line, for a time long enough to transmit the five units corresponding to one character. Additional segments transmitted correcting currents, from one end to the other, to maintain synchronism between the sending and receiving stations. Hence the Baudot system was one of the earliest five-unit synchronous systems.

The standard speed of transmission, by each operator, was 180 characters per minute, each character being set-up manually on a small piano-like keyboard, which only had five keys. The keys were so arranged that once pressed down, they latched down, and were only released by the distributor when all the five elements of the character had been transmitted.

The operator was given an audible indication of the keyboard unlocking by means of what is known as the "cadence signal". This signal came from the operation of the electromagnet which released the keys. The manipulation of the Baudot keyboard called for a high degree of operating skill, since a definite, unvarying, rhythmic speed of signalling was necessary.

Figure 1 shows the allocation of the Baudot code which was employed in the British Post Office for continental and inland services. It will be observed that a number of characters in the continental code are replaced by fractionals in the inland code. Code elements 1, 2 and 3 are transmitted by keys 1, 2 and 3, and these are operated by the first three fingers of the right hand. Code elements 4 and 5 are transmitted by keys 4 and 5, and these are operated by the first two fingers of the left hand.

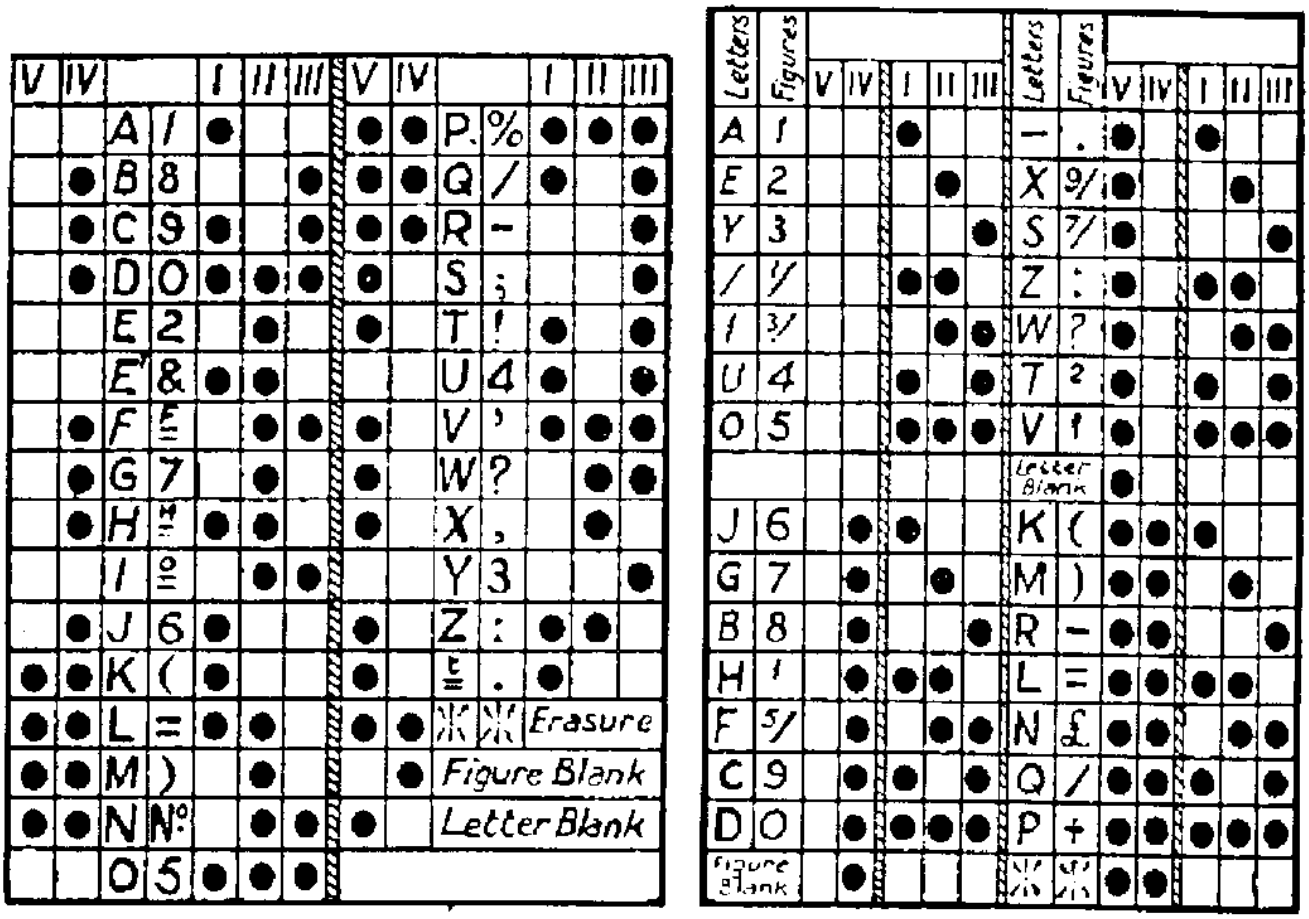


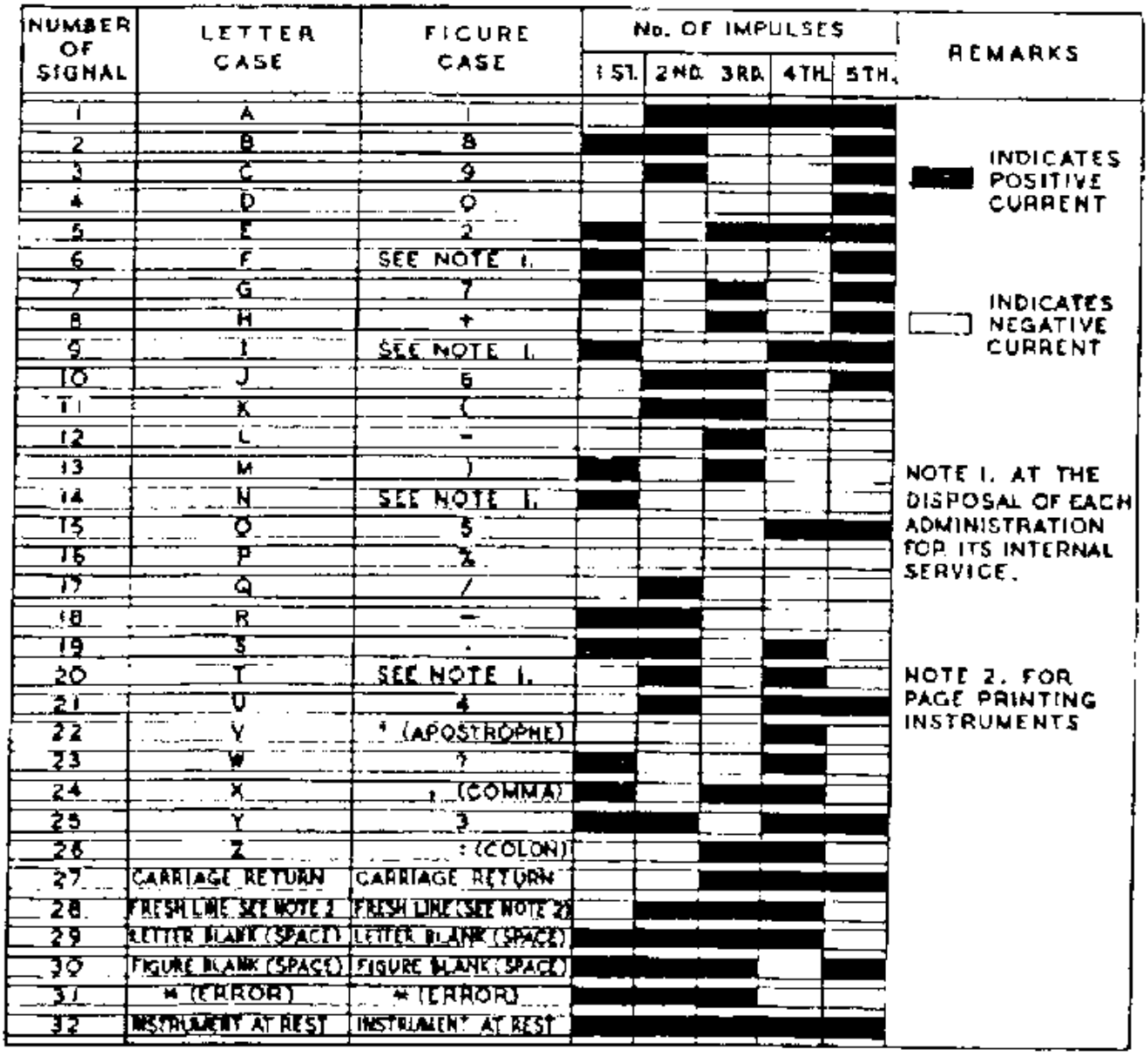
Fig 1. The Baudot code

Because the combinations were set-up manually, the code was so arranged that the finger movements to be performed by the operator were as evenly divided as possible between the right and left hands, and also as few as possible for those characters having the greatest frequency of occurrence. This ensured the minimum fatigue of the operator.

A fine example of Baudot equipment may be seen in the Science Museum in London. Until the autumn of 1997, another fine example was to be seen in the BT Museum in London. Unfortunately, this museum is now closed to the public.

The Baudot code was eventually standardised for multiplex systems as the International Telegraph Alphabet number 1 (ITA1), and is shown in figure 2.

Figure 2. International Telegraph Alphabet Number 1

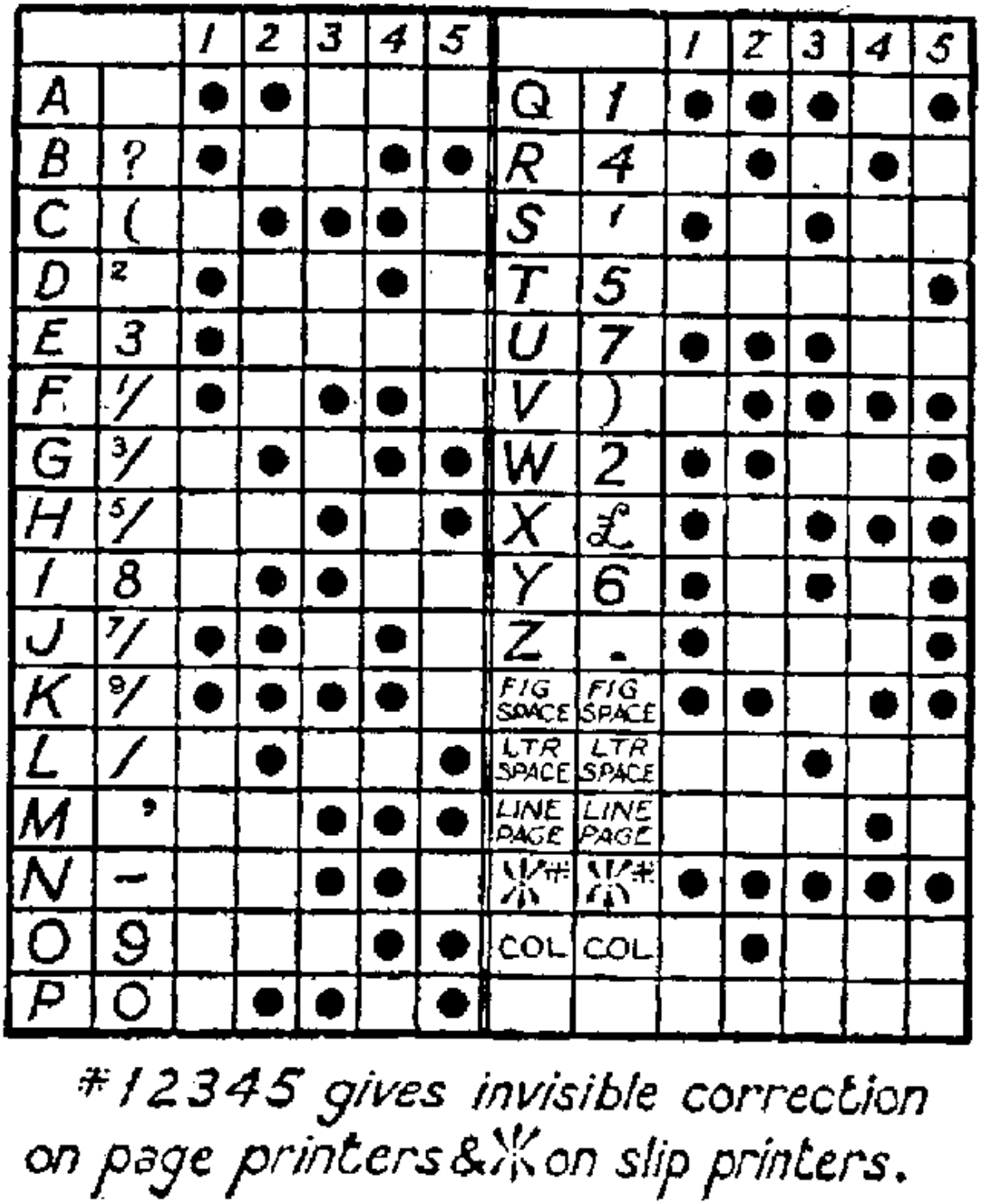


NUMBER OF SIGNAL	LETTER CASE	FIGURE CASE	No. OF IMPULSES 1ST.	2ND.	3RD.	4TH.	5TH.	REMARKS
1	A	-						
2	B	8						
3	C	9						
4	D	0						
5	E	2						
6	F	SEE NOTE 1.						
7	G	7						
8	H	+						
9	I	SEE NOTE 1.						
10	J	6						
11	K	(						
12	L	=						
13	M	)						
14	N	SEE NOTE 1.						
15	O	5						
16	P	%						
17	Q	/						
18	R	—						
19	S	.						
20	T	SEE NOTE 1.						
21	U	4						
22	V	' (APOSTROPHE)						
23	W	?						
24	X	, (COMMA)						
25	Y	3						
26	Z	: (COLON)						
27	CARRIAGE RETURN	CARRIAGE RETURN						
28	FRESH LINE SEE NOTE 2	FRESH LINE (SEE NOTE 2)						
29	LETTER BLANK (SPACE)	LETTER BLANK (SPACE)						
30	FIGURE BLANK (SPACE)	FIGURE BLANK (SPACE)						
31	* (ERROR)	* (ERROR)						
32	INSTRUMENT AT REST	INSTRUMENT AT REST						

Murray Type Printing Multiplex System

This system was designed in 1901 by Donald Murray, a New Zealand sheep farmer, as a combination of the best features of the Baudot multiplex system and the Murray automatic system. Murray also employed a five-unit code, but the allocations of the of the signal combinations differed very considerably from that used in the Baudot code, as is shown in figure 3.

Figure 3. The Murray Code



The main reason for this was that he choose to use a keyboard layout similar to that of a typewriter, which relieved the operator of the burden of setting up the individual code elements. This allowed Murray to allocate the codes so that those characters having the greatest frequency of occurrence were given a combination which involved the least number of mechanical operations, thereby reducing the wear in the equipment.

At the transmitting end, the Murray system comprised: (1) A keyboard perforator, which produced a tape in which the code was perforated transversely. The feed holes being in line with the front edges of the perforations, so that the direction in which the tape should be read was at once apparent, and; (2) A transmitter which could be mounted adjacent to the perforator in order to give the minimum possible distance between the perforating and transmitting mechanisms. With this arrangement the distance was reduced to only 16 character spaces.

In the transmitter, the five contact levers which sensed the perforations in the tape were connected to individual segments on a distributor, very similar in principle to the Baudot transmitter distributor. Additional segments on the distributor operated an electromagnet which stepped the tape forward after the line brush had passed the segments connected to the five contact levers. A novel feature on the transmitter was a start-stop device which sensed the size of the tape loop between the perforator and the transmitter, and held the five sensing levers in the space position, thereby sending spacing currents to line until the tape became slack. Mutilation of the tape, or disconnection of the transmitter, was thus avoided.

At the receiving end, the Murray system comprised: (1) A reperforator which produced perforated tape corresponding to the original sending tape, and which could then be used for onward transmission to further stations, and; (2) A printing receiver which interpreted the incoming line signals, and printed the characters on a paper tape. The Creed multiplex printer was commonly used for this purpose, which employed a series of bell-cranks and a rotating typehead, as used on the later models 3 and 7 series of teleprinters. Either the reperforator, the printing receiver, or both, could be connected to the receiving distributor as required by the local circumstances.

Start-stop systems

Synchronous printing telegraph systems employing constant length codes, such as the Baudot and Murray, were a great advance over the previous telegraph systems. However, they suffered from a lack of flexibility, and required very accurate means for maintaining accurate synchronism between the transmitting and receiving instruments. To overcome these disadvantages, a number of inventors experimented with the idea of starting and stopping the receiving mechanism for each character. For this purpose, a "start" signal was transmitted immediately preceding the code elements, and a "stop" signal was transmitted immediately the code elements had been transmitted.

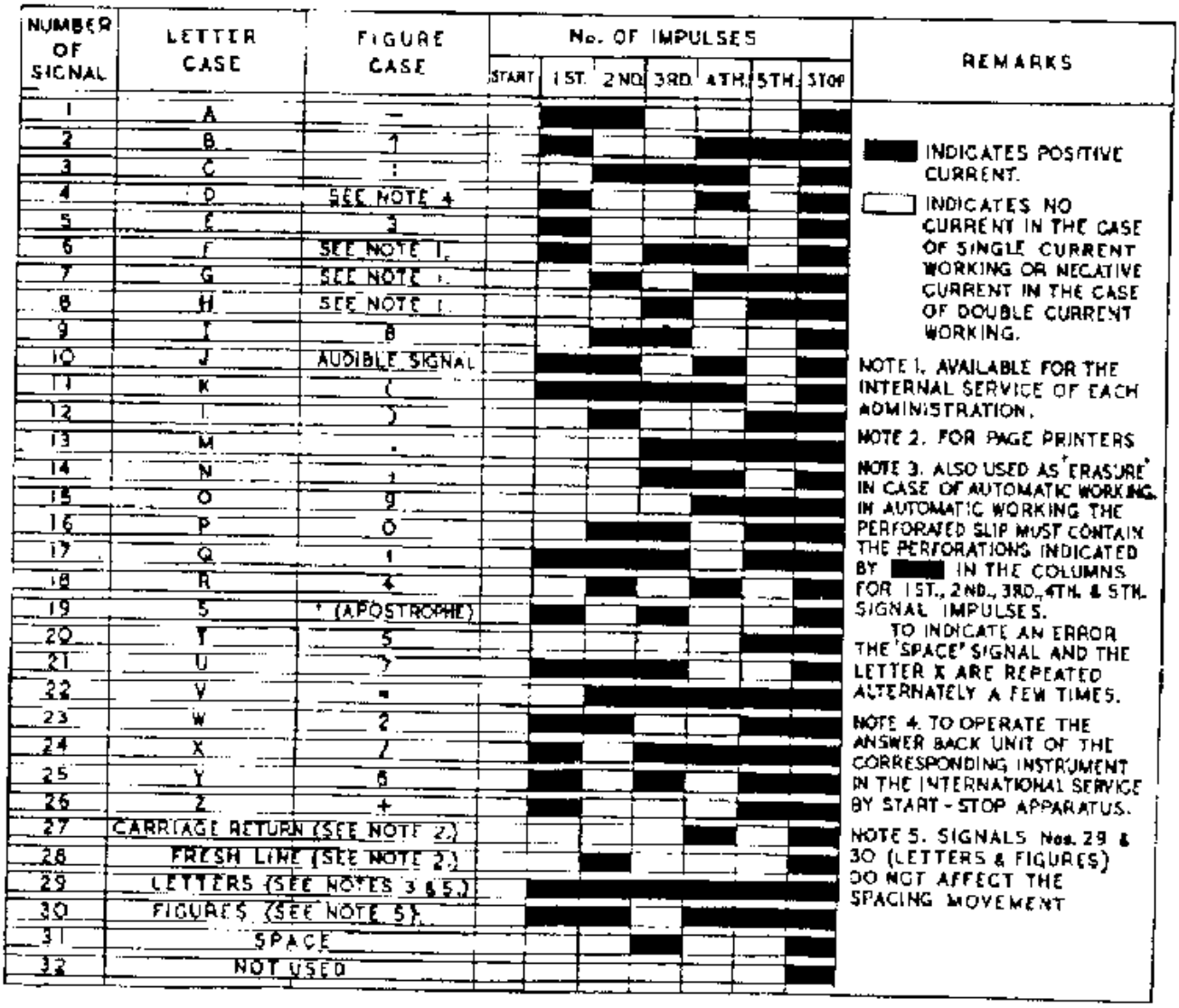
The code employed was still a five- unit code, with the start signal equal in duration to one code element, and the stop signal being in some cases equal in duration to one code element, and in other case more than one element – often 1.5 elements. For this reason the code is sometimes referred to as a 7½ unit code. The transmitting and receiving instruments were now arranged to have a definite rest position, at which point they were precisely in phase with each other in readiness for their respective timing cycles when released.

Because the transmitter and receiver effectively re-synchronised at the start of each character, it was no longer necessary for the speed of the instruments to be very accurately controlled, and simpler centrifugal governors which maintained the speed to within +/- 0.5% were now adequate. This implies the possibility of a noticeable speed difference between the two ends of a system, so the receiving mechanism is arranged to rotate for a shorter time period than the transmitter mechanism. The time difference usually being equal to one element period, but sometimes only equal to half of one element period. By this means the receiver was always at rest before the start of the next character, even with speed errors greater than 0.5%.

The earliest type of start-stop instrument was introduced in America in 1907 by Charles L Krumm and his son H Krumm. It was manufactured by the Morkrum company, which would later become the Teletype corporation, and began to find practical application about 1920. The instrument employed a typewriter style keyboard, and printed the received signals direct onto paper tape, without requiring the intermediate use of perforated tape at either end of the system. It was capable of working at a speed of 40 words per minute, in either simplex or duplex.

In 1922, Frederick George Creed in Croydon designed a start-stop receiver, and a few years later produced a combined transmitter and receiver having a typewriter-style keyboard. This machine, known as the Model 3 and operating at 65.3 words per minute, printed the messages directly onto a gummed paper tape and was widely adopted for the British Post Office Public Telegram service. The year 1931 saw the introduction of the first Creed Model 7 page printing teleprinter, operating at the now standard speed of 66.6 words per minute.

Figure 4. International Telegraph Alphabet number 2



NUMBER OF SIGNAL	LETTER CASE	FIGURE CASE	No. OF IMPULSES						REMARKS
			START	1ST	2ND	3RD	4TH	5TH	STOP	
1	A	—		■	■					■ INDICATES POSITIVE CURRENT.
2	B	?		■			■	■	■	□ INDICATES NO CURRENT IN THE CASE OF SINGLE CURRENT WORKING OR NEGATIVE CURRENT IN THE CASE OF DOUBLE CURRENT WORKING.
3	C	:			■	■	■			NOTE 1. AVAILABLE FOR THE INTERNAL SERVICE OF EACH ADMINISTRATION.
4	D	SEE NOTE 4		■			■			NOTE 2. FOR PAGE PRINTERS
5	E	3		■						NOTE 3. ALSO USED AS 'ERASURE' IN CASE OF AUTOMATIC WORKING. IN AUTOMATIC WORKING THE PERFORATED SLIP MUST CONTAIN THE PERFORATIONS INDICATED BY ■ IN THE COLUMNS FOR 1ST., 2ND., 3RD., 4TH. & 5TH. SIGNAL IMPULSES. TO INDICATE AN ERROR THE 'SPACE' SIGNAL AND THE LETTER X ARE REPEATED ALTERNATELY A FEW TIMES.
6	F	SEE NOTE 1.		■		■	■			
7	G	SEE NOTE 1.			■		■	■	■	
8	H	SEE NOTE 1.				■		■	■	
9	I	8			■	■			■	
10	J	AUDIBLE SIGNAL		■	■		■		■	
11	K	(		■	■	■	■		■	
12	L	)			■			■	■	
13	M	.				■	■	■	■	
14	N	,				■	■		■	
15	O	9				■		■	■	
16	P	0			■	■	■		■	
17	Q	1		■	■	■	■		■	
18	R	4			■		■		■	
19	S	' (APOSTROPHE)		■		■			■	
20	T	5						■	■	
21	U	7		■	■	■	■		■	
22	V	=			■	■	■	■	■	
23	W	2		■	■	■		■	■	
24	X	/		■		■	■	■	■	
25	Y	6		■		■		■	■	
26	Z	+		■				■	■	
27	CARRIAGE RETURN (SEE NOTE 2.)				■		■		■	
28	FRESH LINE (SEE NOTE 2.)			■					■	
29	LETTERS (SEE NOTES 3 & 5.)			■	■	■	■	■	■	
30	FIGURES (SEE NOTE 5).			■	■		■	■	■	
31	SPACE					■			■	
32	NOT USED								■	

NOTE 4. TO OPERATE THE ANSWER BACK UNIT OF THE CORRESPONDING INSTRUMENT IN THE INTERNATIONAL SERVICE BY START - STOP APPARATUS.

NOTE 5. SIGNALS Nos. 29 & 30 (LETTERS & FIGURES) DO NOT AFFECT THE SPACING MOVEMENT

Early start-stop machines tended to use versions of the Murray code but, in the 1930s, the CCITT standardised on the International Telegraph Alphabet number 2 (ITA2), shown in figure 4, for start-stop telegraph systems. The Americans chose to use a variation of ITA2 known as the Teletypewriter code, which is shown in figure 5.

Figure 5. Teletypewrite Code

NUMBER OF SIGNAL	START ELEMENT	CODE ELEMENTS 1	2	3	4	5	STOP ELEMENT	AMERICAN TELETYPE COMMERCIAL KEYBOARD	
1		●	●				●	A	—
2		●			●	●	●	B	?
3			●	●	●		●	C	:
4		●			●		●	D	$
5		●					●	E	3
6		●		●	●		●	F	!
7			●		●	●	●	G	&
8				●		●	●	H	£
9			●	●			●	I	8
10		●	●		●		●	J	'
11		●	●	●	●		●	K	(
12			●			●	●	L	)
13				●	●	●	●	M	.
14				●	●		●	N	,
15					●	●	●	O	9
16			●	●		●	●	P	0
17		●	●	●		●	●	Q	1
18			●		●		●	R	4
19		●		●			●	S	BELL
20						●	●	T	5
21		●	●	●			●	U	7
22			●	●	●	●	●	V	;
23		●	●			●	●	W	2
24		●		●	●	●	●	X	/
25		●		●		●	●	Y	6
26		●				●	●	Z	"
27					●		●	CARRIAGE RETURN	
28			●				●	LINE FEED	
29		●	●	●	●	●	●	LETTERS	
30		●	●		●	●	●	FIGURES	
31				●			●	SPACE	
32							●	BLANK	

1. ● = MARKING ELEMENT

2. AN AUTOMATIC MOTOR STOP FACILITY IS OPTIONAL IN PLACE OF THE SECONDARY OF LETTER 'H' ON THE TELETYPEWRITER

Summary

Virtually all mechanical teleprinter equipment which remains in Amateur hands dates from after the early 1930s and was, therefore, designed in accordance with CCITT standards, and uses either ITA2 or its American equivalent.

The only teleprinters which used the Murray code, and may still exist in ever deceasing numbers, are the very early Creed models 3A, 3W, 3X, 3Y and 3Z tape printing machines. The later Creed models 3B, 3C, 3D and 3E used the standard ITA2 code.

No teleprinters were ever produced which used the Baudot code, but that is hardly surprising when one considers that the Baudot code was used in a very early synchronous system, and all teleprinters, as we now know them, operate on the start-stop (asynchronous) principle. Also, as far as this writer is aware no computer programmer has yet implemented the Baudot code or the Murray code for the Amateur home computer market, no matter what may be found in advertisements in the Amateur press. For those readers who wish to learn more about the history of telegraphic communications, and the ingenuity of the engineers and inventors, this writer would recommend a trip to a library, where you should ask for: Telegraphy by J W Freebody, published by Sir Isaac Pitman in 1958.

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