

SECTION H — ELECTRICITY

H04 ELECTRIC COMMUNICATION TECHNIQUE

H04L TRANSMISSION OF DIGITAL INFORMATION, e.g. TELEGRAPHIC COMMUNICATION (arrangements common to telegraphic and telephonic communication H04M) [4]

Note(s)

This subclass covers transmission of signals having been supplied in digital form and includes data transmission, telegraphic communication, or methods or arrangements for monitoring.

Subclass index

SYSTEMS CHARACTERISED BY:

The code used: Morse; Baudot; details.....	15/00, 17/00, 13/00
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BASEBAND SYSTEMS.....	25/00
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ARRANGEMENTS OF GENERAL APPLICATION	
Security: errors; secret.....	1/00, 9/00
Multiple communications; synchronising.....	5/00, 7/00
OTHER ARRANGEMENTS, APPARATUS OR SYSTEMS.....	29/00

1/00 Arrangements for detecting or preventing errors in the information received

- 1/02 • by diversity reception
- 1/04 • • using frequency diversity
- 1/06 • • using space diversity
- 1/08 • by repeating transmission, e.g. Verdan system
- 1/12 • by using return channel
- 1/14 • • in which the signals are sent back to the transmitter to be checked
- 1/16 • • in which the return channel carries supervisory signals, e.g. repetition request signals
- 1/18 • • • Automatic repetition systems, e.g. van Duuren system
- 1/20 • using signal-quality detector [3]
- 1/22 • using redundant apparatus to increase reliability [3]
- 1/24 • Testing correct operation [3]

5/00 Arrangements affording multiple use of the transmission path

- 5/02 • Channels characterised by the type of signal
- 5/04 • • the signals being represented by different amplitudes or polarities, e.g. quadriplex
- 5/06 • • the signals being represented by different frequencies (combined with time-division multiplexing H04L 5/26)
- 5/08 • • • each combination of signals in different channels being represented by a fixed frequency
- 5/10 • • • with dynamo-electric generation of carriers; with mechanical filters or demodulators
- 5/12 • • the signals being represented by different phase modulations of a single carrier

- 5/14 • Two-way operation using the same type of signal, i.e. duplex
- 5/16 • • Half-duplex systems; Simplex/duplex switching; Transmission of break signals
- 5/18 • • Automatic changing of the traffic direction
- 5/20 • using different combinations of lines, e.g. phantom working
- 5/22 • using time-division multiplexing
- 5/24 • • with start-stop synchronous converters
- 5/26 • • combined with the use of different frequencies

7/00 Arrangements for synchronising receiver with transmitter

- 7/02 • Speed or phase control by the received code signals, the signals containing no special synchronisation information
- 7/027 • • extracting the synchronising or clock signal from the received signal spectrum, e.g. by using a resonant or bandpass circuit [5]
- 7/033 • • using the transitions of the received signal to control the phase of the synchronising-signal-generating means, e.g. using a phase-locked loop [5]
- 7/04 • Speed or phase control by synchronisation signals
- 7/06 • • the synchronisation signals differing from the information signals in amplitude, polarity, or frequency
- 7/08 • • the synchronisation signals recurring cyclically
- 7/10 • • Arrangements for initial synchronisation

9/00 Arrangements for secret or secure communication

Note(s)

In group H04L 9/06-H04L 9/32, in the absence of an indication to the contrary, classification is made in the last appropriate place.

- 9/06 • the encryption apparatus using shift registers or memories for blockwise coding, e.g. D.E.S. systems [5]
- 9/08 • Key distribution [5]
- 9/10 • with particular housing, physical features or manual controls [5]
- 9/12 • Transmitting and receiving encryption devices synchronised or initially set up in a particular manner [5]
- 9/14 • using a plurality of keys or algorithms [5]
- 9/16 • • the keys or algorithms being changed during operation [5]
- 9/18 • Encryption by serially and continuously modifying data stream elements, e.g. stream cipher systems [5]
- 9/20 • • Pseudorandom key sequence combined element-for-element with data sequence [5]
- 9/22 • • • with particular pseudorandom sequence generator [5]
- 9/24 • • • • sequence produced by more than one generator [5]
- 9/26 • • • • producing a nonlinear pseudorandom sequence [5]
- 9/28 • using particular encryption algorithm [5]
- 9/30 • • Public key, i.e. encryption algorithm being computationally infeasible to invert and users' encryption keys not requiring secrecy [5]
- 9/32 • including means for verifying the identity or authority of a user of the system [5]
- 9/34 • Bits, or blocks of bits, of the telegraphic message being interchanged in time [5]
- 9/36 • with means for detecting characters not meant for transmission [5]
- 9/38 • Encryption being effected by mechanical apparatus, e.g. rotating cams, switches, keytape punchers [5]
- 12/00 Data switching networks** (interconnection of, or transfer of information or other signals between, memories, input/output devices or central processing units G06F 13/00) [5]
- 12/02 • Details [5]
- 12/04 • • Switchboards [5]
- 12/06 • • Answer-back mechanisms or circuits [5]
- 12/08 • • Allotting numbers to messages; Counting characters, words or messages [5]
- 12/10 • • Current supply arrangements [5]
- 12/12 • • Arrangements for remote connection or disconnection of substations or of equipment thereof [5]
- 12/14 • • Charging arrangements [5]
- 12/16 • • Arrangements for providing special services to substations [5]
- 12/18 • • • for broadcast or conference [5]
- 12/20 • • • for converting transmission speed from the inherent speed of a substation to the inherent speed of other substations [5]
- 12/22 • • Arrangements for preventing the taking of data from a data transmission channel without authorisation (means for verifying the identity or the authority of a user of a secure or secret communication system H04L 9/32) [5]
- 12/24 • • Arrangements for maintenance or administration [5]

- 12/26 • • Monitoring arrangements; Testing arrangements [5]
- 12/28 • characterised by path configuration, e.g. LAN [Local Area Networks] or WAN [Wide Area Networks] (wireless communication networks H04W) [5, 6]
- 12/40 • • Bus networks [5, 6]
- 12/403 • • • with centralised control, e.g. polling [6]
- 12/407 • • • with decentralised control [6]
- 12/413 • • • • with random access, e.g. carrier-sense multiple-access with collision detection (CSMA-CD) [6]
- 12/417 • • • • with deterministic access, e.g. token passing [6]
- 12/42 • • Loop networks [5, 6]
- 12/423 • • • with centralised control, e.g. polling [6]
- 12/427 • • • with decentralised control [6]
- 12/43 • • • • with synchronous transmission, e.g. time division multiplex (TDM), slotted rings [6]
- 12/433 • • • • with asynchronous transmission, e.g. token ring, register insertion [6]
- 12/437 • • • Ring fault isolation or reconfiguration [6]
- 12/44 • • Star or tree networks [5, 6]
- 12/46 • • Interconnection of networks [5, 6]
- 12/50 • Circuit switching systems, i.e. systems in which the path is physically permanent during the communication [5, 6]
- 12/52 • • using time division techniques (in digital transmission systems H04L 5/22) [5, 6]
- 12/54 • Store-and-forward switching systems (packet switching systems H04L 12/70) [5, 6, 2013.01]
- 12/58 • • Message switching systems [5, 6]
- 12/60 • • • Manual relay systems, e.g. push-button switching [5, 6]
- 12/62 • • • • with perforated tape storage [5, 6]
- 12/64 • Hybrid switching systems [5, 6]
- 12/66 • Arrangements for connecting between networks having differing types of switching systems, e.g. gateways [5, 6]
- 12/70 • Packet switching systems [2013.01]
- 12/701 • • Routing or path finding [2013.01]
- 12/703 • • • Route fault prevention or recovery, e.g. rerouting, route redundancy, virtual router redundancy protocol [VRRP] or hot standby router protocol [HSRP] [2013.01]
- 12/705 • • • • Loop or livelock prevention, e.g. time to live [TTL] or spanning tree [2013.01]
- 12/707 • • • • using path redundancy [2013.01]
- 12/709 • • • • • using M+N parallel active paths [2013.01]
- 12/711 • • • • • using M:N active or standby paths [2013.01]
- 12/713 • • • • using node redundancy, e.g. VRRP [2013.01]
- 12/715 • • • Hierarchical routing, e.g. clustered networks or inter-domain routing [2013.01]
- 12/717 • • • Centralised routing [2013.01]
- 12/721 • • • Routing procedures, e.g. shortest path routing, source routing, link state routing or distance vector routing [2013.01]
- 12/723 • • • • Label or tag based routing, e.g. multi-protocol label switching [MPLS] or generalised multi-protocol label switching [GMPLS] [2013.01]
- 12/725 • • • • Selecting a path with suitable quality of service [QoS] [2013.01]

- 12/727 • • • • • Selecting a path with minimum delay **[2013.01]**
- 12/729 • • • • • Selecting a path with suitable bandwidth or throughput **[2013.01]**
- 12/733 • • • • • Selecting a path with minimum length or minimum hop count **[2013.01]**
- 12/735 • • • • • Disjoint routing, e.g. path disjoint or node disjoint **[2013.01]**
- 12/741 • • • • • Header address processing for routing, e.g. table lookup **[2013.01]**
- 12/743 • • • • • using hashing techniques **[2013.01]**
- 12/745 • • • • • using longest matching prefix **[2013.01]**
- 12/747 • • • • • Address caching **[2013.01]**
- 12/749 • • • • • Address processing over inter-domain or inter-network, e.g. mapping different addresses between IPv6 and IPv4 networks for routing **[2013.01]**
- 12/751 • • • • • Topology update or discovery **[2013.01]**
- 12/753 • • • • • Routing tree discovery, e.g. converting from mesh topology to tree topology **[2013.01]**
- 12/755 • • • • • Topology update consistency, e.g. link state advertisement [LSA], time stamping or sequence numbers in the updates **[2013.01]**
- 12/757 • • • • • Synchronised activation of routing updates, e.g. delaying or holding routing table updates **[2013.01]**
- 12/759 • • • • • Dynamic adaptation of update interval, e.g. event-driven updates **[2013.01]**
- 12/761 • • • • • Broadcast or multicast routing **[2013.01]**
- 12/763 • • • • • Shortcut routing, e.g. next hop resolution protocol [NHRP] **[2013.01]**
- 12/771 • • • • • Router architecture **[2013.01]**
- 12/773 • • • • • for supporting layer 3 switching, e.g. IP switching, cell switch relay [CSR] or tag switching **[2013.01]**
- 12/775 • • • • • multiple routing entities, e.g. multiple software or hardware instances **[2013.01]**
- 12/781 • • • • • Multiprotocol routing, e.g. for protocol adaptation between IPv4 and IPv6 or dual stack **[2013.01]**
- 12/801 • • • • • Flow control or congestion control **[2013.01]**
- 12/803 • • • • • Load balancing, e.g. traffic distribution over multiple links **[2013.01]**
- 12/805 • • • • • Determination of the optimum packet size, e.g. maximum transmission unit [MTU] **[2013.01]**
- 12/807 • • • • • Calculation or update of the congestion window **[2013.01]**
- 12/811 • • • • • Bitrate adaptation in active flows **[2013.01]**
- 12/813 • • • • • Policy-based control, e.g. policing **[2013.01]**
- 12/815 • • • • • Shaping **[2013.01]**
- 12/819 • • • • • Leaky bucket **[2013.01]**
- 12/823 • • • • • Packet dropping **[2013.01]**
- 12/825 • • • • • Adaptive control, at the source or intermediate nodes, upon congestion feedback, e.g. X-on X-off **[2013.01]**
- 12/827 • • • • • sent by intermediate network nodes **[2013.01]**
- 12/829 • • • • • sent by the destination endpoint **[2013.01]**
- 12/833 • • • • • Marking packets or altering packet priority upon congestion or for congestion prevention **[2013.01]**
- 12/835 • • • • • using buffer capacity information at the endpoints or transit nodes **[2013.01]**
- 12/841 • • • • • Flow control actions using time consideration, e.g. round trip time [RTT] **[2013.01]**
- 12/851 • • • • • Traffic type related actions, e.g. QoS or priority **[2013.01]**
- 12/853 • • • • • for real time traffic **[2013.01]**
- 12/855 • • • • • for signalling traffic, e.g. operations, administration and maintenance [OAM] or acknowledge [ACK] packets **[2013.01]**
- 12/857 • • • • • Mapping QoS constraints between layers or between different networks **[2013.01]**
- 12/859 • • • • • Flow control actions based on the nature of the application, e.g. controlling web browsing or e-mail traffic **[2013.01]**
- 12/861 • • • • • Packet buffering or queuing arrangements; Queue scheduling **[2013.01]**
- 12/863 • • • • • Queue scheduling, e.g. Round Robin **[2013.01]**
- 12/865 • • • • • Priority-based scheduling **[2013.01]**
- 12/867 • • • • • Fair share scheduling **[2013.01]**
- 12/869 • • • • • Multilevel scheduling; Hierarchical scheduling **[2013.01]**
- 12/873 • • • • • Bandwidth-aware scheduling **[2013.01]**
- 12/875 • • • • • Delay-aware scheduling **[2013.01]**
- 12/877 • • • • • Distribution of residual bandwidth, e.g. distribution of unused bandwidth to best effort traffic [BET] **[2013.01]**
- 12/879 • • • • • Single buffer operations, e.g. buffer pointers or buffer descriptors **[2013.01]**
- 12/883 • • • • • Packet storage using a linked list of buffers **[2013.01]**
- 12/885 • • • • • Jitter compensation buffering **[2013.01]**
- 12/891 • • • • • Flow control of aggregated links or flows **[2013.01]**
- 12/893 • • • • • Connection splitting, e.g. IP splitting **[2013.01]**
- 12/901 • • • • • Ingress point selection by the source endpoint, e.g. Internet service provider [ISP] or point of presence [POP] selection **[2013.01]**
- 12/903 • • • • • Selection among a plurality of different networks **[2013.01]**
- 12/905 • • • • • Dynamic network selection or re-selection, e.g. after degradation of quality **[2013.01]**
- 12/911 • • • • • Network admission control and resource allocation, e.g. bandwidth allocation or in-call renegotiation **[2013.01]**
- 12/913 • • • • • Reservation actions involving intermediate nodes, e.g. resource reservation protocol [RSVP] **[2013.01]**
- 12/915 • • • • • Reservation actions involving several network domains, e.g. multilateral agreements or mapping of resources **[2013.01]**
- 12/917 • • • • • Dynamic resource allocation, e.g. in-call renegotiation requested by the user or upon changing network conditions requested by the network **[2013.01]**
- 12/919 • • • • • initiated by the source endpoint **[2013.01]**
- 12/923 • • • • • initiated by the network **[2013.01]**
- 12/925 • • • • • Reservation of resources at the destination endpoint **[2013.01]**
- 12/927 • • • • • Allocation of resources based on type of traffic, QoS or priority **[2013.01]**
- 12/931 • • • • • Switch fabric architecture **[2013.01]**
- 12/933 • • • • • Switch core, e.g. crossbar, shared memory or shared medium **[2013.01]**
- 12/935 • • • • • Switch interfaces, e.g. port details **[2013.01]**
- 12/937 • • • • • Switch control, e.g. arbitration **[2013.01]**
- 12/939 • • • • • Provisions for redundant switching, e.g. using parallel switching planes **[2013.01]**

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- 12/943 • • • Transferring a complete packet or cell from each plane **[2013.01]**
- 12/945 • • • Transferring a part of the packet or cell from each plane, e.g. bit slice **[2013.01]**
- 12/947 • • • Address processing within a device, e.g. using internal ID or tags for routing within a switch **[2013.01]**
- 12/951 • • Assembling and disassembling of packets, e.g. segmentation and reassembly [SAR] in asynchronous transfer mode [ATM] **[2013.01]**
- 12/953 • • • Packet sequencing arrangements for supporting message reassembly, e.g. packet sequence number **[2013.01]**
- 12/955 • • • Padding or de-padding, e.g. inserting or removing dummy data in or from unused packet segments **[2013.01]**

13/00 Details of the apparatus or circuits covered by groups H04L 15/00 or H04L 17/00

- 13/02 • Details not particular to receiver or transmitter
- 13/04 • • Driving mechanisms; Clutches
- 13/06 • • Tape or page guiding or feeding devices
- 13/08 • • Intermediate storage means
- 13/10 • • Distributors
- 13/12 • • • Non-mechanical distributors, e.g. relay distributors
- 13/14 • • • • Electronic distributors
- 13/16 • of transmitters, e.g. code-bars, code-discs
- 13/18 • of receivers

15/00 Apparatus or local circuits for transmitting or receiving dot-and-dash codes, e.g. Morse code (teaching apparatus therefor G09B; telegraph tapping keys H01H 21/86)

- 15/03 • Keys structurally combined with sound generators **[2]**
- 15/04 • Apparatus or circuits at the transmitting end
- 15/06 • • with a restricted number of keys, e.g. separate key for each type of code element
- 15/08 • • • with a single key which transmits dots in one position and dashes in a second position
- 15/10 • • • combined with perforating apparatus
- 15/12 • • with keyboard co-operating with code-bars
- 15/14 • • • combined with perforating apparatus
- 15/16 • • with keyboard co-operating with code discs
- 15/18 • • Automatic transmitters, e.g. controlled by perforated tape
- 15/20 • • • with optical sensing means
- 15/22 • • Apparatus or circuits for sending one or a restricted number of signals, e.g. distress signals
- 15/24 • Apparatus or circuits at the receiving end
- 15/26 • • operating only on reception of predetermined code signals, e.g. distress signals, party-line call signals
- 15/28 • • Code reproducing apparatus
- 15/30 • • • Writing recorders
- 15/32 • • • Perforating recorders
- 15/34 • • Apparatus for recording received coded signals after translation, e.g. as type-characters

17/00 Apparatus or local circuits for transmitting or receiving codes wherein each character is represented by the same number of equal-length code elements, e.g. Baudot code

- 17/02 • Apparatus or circuits at the transmitting end
- 17/04 • • with keyboard co-operating with code-bars
- 17/06 • • • Contact operating means
- 17/08 • • • combined with perforating apparatus

- 17/10 • • with keyboard co-operating with code-discs
- 17/12 • • Automatic transmitters, e.g. controlled by perforated tape
- 17/14 • • • with optical sensing means
- 17/16 • Apparatus or circuits at the receiving end
- 17/18 • • Code selection mechanisms
- 17/20 • • using perforating recorders
- 17/22 • • using mechanical translation and type-bar printing
- 17/24 • • using mechanical translation and type-head printing, e.g. type-wheel, type-cylinder
- 17/26 • • using aggregate motion translation
- 17/28 • • using pneumatic or hydraulic translation
- 17/30 • • using electric or electronic translation

19/00 Apparatus or local circuits for step-by-step systems

21/00 Apparatus or local circuits for mosaic printer telegraph systems

- 21/02 • at the transmitting end
- 21/04 • at the receiving end

23/00 Apparatus or local circuits for telegraphic systems other than those covered by groups H04L 15/00-H04L 21/00

- 23/02 • adapted for orthogonal signalling **[2]**

25/00 Baseband systems

- 25/02 • Details
- 25/03 • • Shaping networks in transmitter or receiver, e.g. adaptive shaping networks **[2]**
- 25/04 • • • Passive shaping networks **[2]**
- 25/05 • • Electric or magnetic storage of signals before transmitting or retransmitting for changing the transmission rate **[7]**
- 25/06 • • Dc level restoring means; Bias distortion correction
- 25/08 • • Modifications for reducing interference; Modifications for reducing effects due to line faults
- 25/10 • • Compensating for variations in line balance
- 25/12 • • Compensating for variations in line impedance
- 25/14 • • Channel dividing arrangements
- 25/17 • • Interpolating arrangements **[4]**
- 25/18 • • Arrangements for inductively generating telegraphic signals
- 25/20 • • Repeater circuits; Relay circuits
- 25/22 • • • Repeaters for converting two wires to four wires; Repeaters for converting single current to double current
- 25/24 • • • Relay circuits using discharge tubes or semiconductor devices
- 25/26 • • • Circuits with optical sensing means
- 25/28 • • • Repeaters using modulation and subsequent demodulation
- 25/30 • Non-synchronous systems
- 25/32 • • characterised by the code employed
- 25/34 • • • using three or more different amplitudes, e.g. cable code
- 25/38 • Synchronous or start-stop systems, e.g. for Baudot code
- 25/40 • • Transmitting circuits; Receiving circuits
- 25/42 • • • using mechanical distributors
- 25/44 • • • using relay distributors
- 25/45 • • • using electronic distributors **[2]**
- 25/46 • • • using tuning forks or vibrating reeds

- 25/48 • • • characterised by the code employed (H04L 25/49 takes precedence) [2]
- 25/49 • • • using code conversion at the transmitter; using predistortion; using insertion of idle bits for obtaining a desired frequency spectrum; using three or more amplitude levels [2]
- 25/493 • • • • by transition coding, i.e. the time-position or direction of a transition being encoded before transmission [3]
- 25/497 • • • • by correlative coding, e.g. partial response coding or echo modulation coding [3]
- 25/52 • • Repeater circuits; Relay circuits
- 25/54 • • • using mechanical distributors
- 25/56 • • • Non-electrical regenerative repeaters
- 25/58 • • • using relay distributors
- 25/60 • • • Regenerative repeaters with electromagnetic switches
- 25/62 • • • using tuning forks or vibrating reeds
- 25/64 • • • Start-stop regenerative repeaters using discharge tubes or semiconductor devices
- 25/66 • • • Synchronous repeaters using discharge tubes or semiconductor devices
- 27/00 Modulated-carrier systems**
- 27/01 • Equalisers [5]
- 27/02 • Amplitude-modulated carrier systems, e.g. using on/off keying; Single sideband or vestigial sideband modulation (H04L 27/32 takes precedence) [2, 5]
- 27/04 • • Modulator circuits; Transmitter circuits
- 27/06 • • Demodulator circuits; Receiver circuits
- 27/08 • • Amplitude regulation arrangements
- 27/10 • Frequency-modulated carrier systems, i.e. using frequency-shift keying (H04L 27/32 takes precedence) [5]
- 27/12 • • Modulator circuits; Transmitter circuits
- 27/14 • • Demodulator circuits; Receiver circuits
- 27/144 • • • with demodulation using spectral properties of the received signal, e.g. by using frequency selective- or frequency sensitive elements [6]
- 27/148 • • • • using filters, including PLL-type filters [6]
- 27/152 • • • • using controlled oscillators, e.g. PLL arrangements [6]
- 27/156 • • • with demodulation using temporal properties of the received signal, e.g. detecting pulse width [6]
- 27/16 • • Frequency regulation arrangements
- 27/18 • Phase-modulated carrier systems, i.e. using phase-shift keying (H04L 27/32 takes precedence) [5]
- 27/20 • • Modulator circuits; Transmitter circuits
- 27/22 • • Demodulator circuits; Receiver circuits
- 27/227 • • • using coherent demodulation [6]
- 27/233 • • • using non-coherent demodulation [6]
- 27/24 • • Half-wave signalling systems
- 27/26 • Systems using multi-frequency codes (H04L 27/32 takes precedence) [5]
- 27/28 • • with simultaneous transmission of different frequencies each representing one code element
- 27/30 • • wherein each code element is represented by a combination of frequencies
- 27/32 • Carrier systems characterised by combinations of two or more of the types covered by groups H04L 27/02, H04L 27/10, H04L 27/18, or H04L 27/26 [5]
- 27/34 • • Amplitude- and phase-modulated carrier systems, e.g. quadrature-amplitude modulated carrier systems [5]
- 27/36 • • • Modulator circuits; Transmitter circuits [5]
- 27/38 • • • Demodulator circuits; Receiver circuits [5]
- 29/00 Arrangements, apparatus, circuits or systems, not covered by a single one of groups H04L 1/00-H04L 27/00 [5]**
- 29/02 • Communication control; Communication processing (H04L 29/12, H04L 29/14 take precedence) [5]
- 29/04 • • for plural communication lines [5]
- 29/06 • • characterised by a protocol [5]
- 29/08 • • • Transmission control procedure, e.g. data link level control procedure [5]
- 29/10 • • characterised by an interface, e.g. the interface between the data link level and the physical level [5]
- 29/12 • characterised by the data terminal [5]
- 29/14 • Counter-measures to a fault [5]