CPC COOPERATIVE PATENT CLASSIFICATION

G PHYSICS
(NOTES omitted)

INSTRUMENTS

G01 MEASURING; TESTING
(NOTES omitted)

G01R MEASURING ELECTRIC VARIABLES; MEASURING MAGNETIC VARIABLES
(indicating correct tuning of resonant circuits H03J 3/12)

NOTES

1. This subclass covers:
   - measuring all kinds of electric or magnetic variables directly or by derivation from other electric or magnetic variables;
   - measuring all kinds of electric or magnetic properties of materials;
   - testing electric or magnetic devices, apparatus or networks, (e.g. discharge tubes, amplifiers) or measuring their characteristics;
   - indicating presence or sign of current or voltage;
   - NMR, EPR or other spin-effect apparatus, not specially adapted for a particular application;
   - equipment for generating signals to be used for carrying out such tests and measurements.
2. In this subclass, the following terms or expressions are used with the meanings indicated:
   - "measuring" includes investigating;
   - "instruments" or "measuring instruments" means electro-mechanical measuring mechanisms;
   - "arrangements for measuring" means apparatus, circuits, or methods for measuring;
3. Attention is drawn to the Notes following the title of class G01.
4. In this subclass, instruments or arrangements for measuring electric variables are classified in the following way:
   - Electromechanical instruments where the measured electric variables directly effect the indication of the measured value, including combined effects of two or more values, are classified in groups G01R 5/00 - G01R 11/00.
   - Details common to different types of the instruments covered by groups G01R 5/00 - G01R 11/00 are classified in group G01R 1/00.
   - Arrangements involving circuitry to obtain an indication of a measured value by deriving, calculating or otherwise processing electric variables, e.g. by comparison with another value, are classified in groups G01R 17/00 - G01R 29/00.
   - Details common to different types of arrangements covered by groups G01R 17/00 - G01R 29/00 are classified in group G01R 15/00.
5. In this subclass, group G01R 17/00 takes precedence over groups G01R 19/00 - G01R 31/00.

WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

1/00 **Details of instruments or arrangements of the types included in groups G01R 5/00 - G01R 13/00 and G01R 31/00** (constructional details particular to {electromechanical} arrangements for measuring the electric consumption G01R 11/02)

1/02 . General constructional details

1/025 . . {concerning dedicated user interfaces, e.g. GUI, or dedicated keyboards (G01R 31/31912 takes precedence)}

1/04 . . Housings; Supporting members; Arrangements of terminals

1/0408 . . . {Test fixtures or contact fields; Connectors or connecting adaptors; Test clips; Test sockets (G01R 1/067 takes precedence; mass production testing systems G01R 31/59; testing of connections G01R 31/66; for testing printed circuit boards G01R 31/2808)}

1/0416 . . . . {Connectors, terminals (G01R 1/0425 and G01R 1/0433 take precedence; with measurement function for battery poles G01R 31/364)}

1/0425 . . . . {Test clips, e.g. for IC's}

1/0433 . . . . {Sockets for IC's or transistors}

1/0441 . . . . . {Details}

1/045 . . . . . {Sockets or component fixtures for RF or HF testing}

1/0458 . . . . . {related to environmental aspects, e.g. temperature}

1/0466 . . . . . {concerning contact pieces or mechanical details, e.g. hinges or cams; Shielding}

1/0475 . . . . . {for TAB IC's}

1/0483 . . . . . {Sockets for un-leaded IC's having matrix type contact fields, e.g. BGA or PGA devices; Sockets for unpackaged, naked chips (for IC's with connecting points around the edges only G01R 1/0433)}
1/0491 . . . . {for testing integrated circuits on wafers, e.g. wafer-level test cartridge}
1/06 . . Measuring leads; Measuring probes (G01R 19/145, G01R 19/165 take precedence)
1/067 . . . Measuring probes
1/06705 . . . . {Apparatus for holding or moving single probes (for moving multiple probe heads or ICs under test G01R 31/2886)}
1/06711 . . . . {Probe needles; Cantilever beams; "Bump" contacts; Replaceable probe pins}
1/06716 . . . . . {Elastic}
1/06722 . . . . . {Spring-loaded}
1/06727 . . . . . {Cantilever beams}

WARNING

This group is not complete pending a reorganisation; see also other subgroups of G01R 1/06711

1/06733 . . . . . {Geometry aspects (G01R 1/06727 takes precedence)}
1/06738 . . . . . {related to tip portion}
1/06744 . . . . . {Microprobes, i.e. having dimensions as IC details}
1/0675 . . . . . {Needle-like}
1/06755 . . . . . {Material aspects}
1/06761 . . . . . {related to layers}
1/06766 . . . . {Input circuits therefor}
1/06772 . . . . {High frequency probes}
1/06777 . . . . {High voltage probes}
1/06783 . . . . {containing liquids}
1/06788 . . . . {Hand-held or hand-manipulated probes, e.g. for oscilloscopes or for portable test instruments (end pieces terminating in a probe H01R 11/18)}
1/06794 . . . . {Devices for sensing when probes are in contact, or in position to contact, with measured object}
1/07 . . . . Non contact-making probes
1/071 . . . . . {containing electro-optic elements}
1/072 . . . . . {containing ionised gas}
1/073 . . . . Multiple probes
1/07307 . . . . . {with individual probe elements, e.g. needles, cantilever beams or bump contacts, fixed in relation to each other, e.g. bed of nails fixture or probe card}
1/07314 . . . . . {the body of the probe being perpendicular to test object, e.g. bed of nails or probe with bump contacts on a rigid support (on an elastic support, e.g. a film, G01R 1/0735)}
1/07321 . . . . . {the probes being of different lengths}
1/07328 . . . . . {for testing printed circuit boards}
1/07335 . . . . . {for double-sided contacting or for testing boards with surface-mounted devices (SMD's)}
1/07342 . . . . . {the body of the probe being at an angle other than perpendicular to test object, e.g. probe card}
1/0735 . . . . . {arranged on a flexible frame or film}
1/07357 . . . . . {with flexible bodies, e.g. buckling beams}
1/07364 . . . . . {with provisions for altering position, number or connection of probe tips; Adapting to differences in pitch}
1/07371 . . . . . {using an intermediate card or back card with apertures through which the probes pass}
1/07378 . . . . . {using an intermediate adapter, e.g. space transformers (G01R 1/07371 takes precedence)}
1/07385 . . . . . {using switching of signals between probe tips and test bed, i.e. the standard contact matrix which in its turn connects to the tester}
1/07392 . . . . . {manipulating each probe element or tip individually}
1/08 . . Pointers; Scales; Scale illumination
1/10 . . Arrangements of bearings
1/12 . . . of strip or wire bearings
1/14 . . Braking arrangements; Damping arrangements
1/16 . . Magnets
1/18 . . Screening arrangements against electric or magnetic fields, e.g. against earth's field
1/20 . Modifications of basic electric elements for use in electric measuring instruments; Structural combinations of such elements with such instruments
1/203 . . {Resistors used for electric measuring, e.g. decade resistors standards, resistors for comparators, series resistors, shunts (resistors in general H01C; microwave or radiowave terminations H01P 1/26; coupling devices H01R)}
1/206 . . {Switches for connection of measuring instruments or electric motors to measuring loads (switches in general H01H)}
1/22 . . Tong testers acting as secondary windings of current transformers
1/24 . . Transmission-line, e.g. waveguide, measuring sections, e.g. slotted section
1/26 . . . with linear movement of probe
1/28 . Provision in measuring instruments for reference values, e.g. standard voltage, standard waveform
1/30 . Structural combination of electric measuring instruments with basic electronic circuits, e.g. with amplifier
1/36 . Overload-protection arrangements or circuits for electric measuring instruments
1/38 . Arrangements for altering the indicating characteristic, e.g. by modifying the air gap
1/40 . Modifications of instruments to indicate the maximum or the minimum value reached in a time interval, e.g. by maximum indicator pointer
1/42 . . thermally operated
1/44 . Modifications of instruments for temperature compensation

3/00 Apparatus or processes specially adapted for the manufacture {or maintenance} of measuring instruments {, e.g. of probe tips}

5/00 Instruments for converting a single current or a single voltage into a mechanical displacement

5/02 . Moving-coil instruments
5/04 . . with magnet external to the coil
5/06 . . with core magnet
5/08 . . specially adapted for wide angle deflection; with eccentrically-pivoted moving coil
5/10 . String galvanometers
5/12 . Loop galvanometers
5/14 . Moving-iron instruments
5/16 . . with pivoting magnet
5/18 . . with pivoting soft iron, e.g. needle galvanometer
5/20 . Induction instruments, e.g. Ferraris instruments
5/22 . Thermoelectric instruments
5/24 . . operated by elongation of a strip or wire or by expansion of a gas or fluid
5/26 . . operated by deformation of a bimetallic element
5/28 . Electrostatic instruments
5/30 . . Leaf electrometers
5/32 . . Wire electrometers; Needle electrometers
5/34 . . Quadrant electrometers

7/00 Instruments capable of converting two or more currents or voltages into a single mechanical displacement (G01R 9/00 takes precedence)
7/02 . for forming a sum or a difference
7/04 . for forming a quotient (for measuring resistance G01R 27/08)
7/06 . . moving-iron type

NOTE

This group covers all crossed-coil meters, i.e. logometers having a magnetic rotor

7/08 . . moving-coil type, e.g. crossed-coil type
7/10 . . . having more than two moving coils
7/12 . for forming product
7/14 . . moving-iron type
7/16 . . having both fixed and moving coils, i.e. dynamometers
7/18 . . . with iron core magnetically coupling fixed and moving coils

9/00 Instruments employing mechanical resonance
9/02 . Vibration galvanometers, e.g. for measuring current
9/04 . using vibrating reeds, e.g. for measuring frequency
9/06 . . magnetically driven
9/08 . . piezoelectrically driven

11/00 Electromechanical arrangements for measuring time integral of electric power or current, e.g. of consumption (monitoring electric consumption of electrically-propelled vehicles B60L 3/00)

NOTES

1. Groups G01R 11/48 - G01R 11/56 take precedence over groups G01R 11/30 - G01R 11/46.

   {This Note corresponds to IPC Note (1) relating to G01R 11/30 - G01R 11/46.}
2. For the definition of "arrangement" see Note (2) under G01R

11/02 . Constructional details
11/04 . . Housings; Supporting racks; Arrangements of terminals
11/06 . . Magnetic circuits of induction meters
11/067 . . . Coils therefor
11/073 . . . Armatures therefor
11/09 . . . . Disc armatures
11/10 . . Braking magnets; Damping arrangements
11/12 . . Arrangements of bearings
11/14 . . . with magnetic relief
11/16 . . Adaptations of counters to electricity meters
11/17 . . Compensating for errors; Adjusting or regulating means therefor
11/18 . . . Compensating for variations in ambient conditions
11/185 . . . . Temperature compensation
11/19 . . . Compensating for errors caused by disturbing torque, e.g. rotating-field errors of polyphase meters
11/20 . . . Compensating for phase errors in induction meters
11/21 . . . Compensating for errors caused by damping effects of the current, e.g. adjustment in the overload range
11/22 . . . Adjusting torque, e.g. adjusting starting torque, adjusting of polyphase meters for obtaining equal torques
11/23 . . . Compensating for errors caused by friction, e.g. adjustment in the light load range
11/24 . . Arrangements for avoiding or indicating fraudulent use
11/25 . . Arrangements for indicating or signalling faults
11/30 . Dynamo-electric motor meters
11/32 . . Watt-hour meters
11/34 . . Ampere-hour meters
11/36 . Induction meters, e.g. Ferraris meters
11/38 . . for single-phase operation
11/40 . . for polyphase operation
11/42 . . . Circuitry therefor
11/46 . Electrically-operated clockwork meters; Oscillatory meters; Pendulum meters
11/465 . . {Oscillatory meters}
11/48 . Meters specially adapted for measuring real or reactive components; Meters specially adapted for measuring apparent energy
11/50 . . for measuring real component
11/52 . . for measuring reactive component
11/54 . . for measuring simultaneously at least two of the following three variables: real component, reactive component, apparent energy
11/56 . Special tariff meters
11/57 . . Multi-rate meters (G01R 11/63 takes precedence)
11/58 . . . Tariff-switching devices therefor
11/60 . . Subtraction meters; Meters measuring maximum or minimum load hours
11/63 . . Over-consumption meters, e.g. measuring consumption while a predetermined level of power is exceeded
11/64 . . Maximum meters, e.g. tariff for a period is based on maximum demand within that period
11/66 . . . Circuitry

13/00 Arrangements for displaying electric variables or waveforms
13/02 . for displaying measured electric variables in digital form
13/0209 . . {in numerical form}
13/0218 . . {Circuits therefor}

13/0227 . . . {Controlling the intensity or colour of the display}
13/0236 . . . {for presentation of more than one variable}
13/0245 . . . {for inserting reference markers}
13/0254 . . . {for triggering, synchronisation}
13/0263 . . . . {for non-recurrent functions, e.g. transients}
13/0272 . . . {for sampling}
13/0281 . . {using electro-optic elements}
13/029 . . {Software therefor}
13/04 . for producing permanent records
13/06 . . Modifications for recording transient disturbances, e.g. by starting or accelerating a recording medium
13/08 . . Electromechanical recording systems using a mechanical direct-writing method
13/10 . . . with intermittent recording by representing the variable by the length of a stroke or by the position of a dot
13/12 . . Chemical recording, e.g. clydonographs (G01R 13/14 takes precedence)
13/14 . . Recording on a light-sensitive material
13/16 . . Recording on a magnetic medium
13/18 . . . using boundary displacement
13/20 . Cathode-ray oscilloscopes
13/202 . . {Non-electric appliances, e.g. scales, masks (luminescent screens for CRT provided with permanent marks or references H01J 29/34; optical or photographic arrangements combined with CRT vessels H01J 29/89)}
13/204 . . {Using means for generating permanent registrations, e.g. photographs (optical or photographic arrangements combined with CRT vessel H01J 29/89)}
13/206 . . {Arrangements for obtaining a 3- dimensional representation (stereoscopic T.V. H04N 13/00)}
13/208 . . {Arrangements for measuring with C.R. oscilloscopes, e.g. vectorscope}
13/22 . . Circuits therefor
13/225 . . . {particularly adapted for storage oscilloscopes}
13/24 . . . Time-base deflection circuits
13/245 . . . . {for generating more than one, not overlapping time-intervals on the screen}
13/26 . . . Circuits for controlling the intensity of the electron beam {or the colour of the display}
13/28 . . . Circuits for simultaneous or sequential presentation of more than one variable
13/30 . . . Circuits for inserting reference markers, e.g. for timing, for calibrating, for frequency marking
13/305 . . . . {for time marking}
13/32 . . . Circuits for displaying non-recurrent functions such as transients; Circuits for triggering; Circuits for synchronisation; Circuits for time-base expansion
13/325 . . . . {for displaying non-recurrent functions such as transients}
13/34 . . . Circuits for representing a single waveform by sampling, e.g. for very high frequencies
13/342 . . . . {for displaying periodic H.F. signals (G01R 13/345 takes precedence)}
13/345 . . . . {for displaying sampled signals by using digital processors by intermediate A.D. and D.A. convertors (control circuits for CRT indicators)}
13/347 . . . . {using electro-optic elements}
13/36 . using length of glow discharge, e.g. glowlight oscilloscopes
13/38 . using the steady or oscillatory displacement of a light beam by an electromechanical measuring system
13/40 . using modulation of a light beam otherwise than by mechanical displacement, e.g. by Kerr effect {(visual indication of correct tuning H03J 3/14)}
13/401 . . {for continuous analogue, or simulated analogue, display}
13/402 . . . {using active, i.e. light-emitting display devices, e.g. electroluminescent display (G01R 13/36 and G01R 13/42 take precedence)}
13/403 . . . {using passive display devices, e.g. liquid crystal display or Kerr effect display devices}
13/404 . . {for discontinuous display, i.e. display of discrete values (analogue/digital conversion H03M 1/00)}
13/405 . . . {using a plurality of active, i.e. light emitting, e.g. electro-luminescent elements, i.e. bar graphs}
13/406 . . . . {representing measured value by a dot or a single line (G01R 13/408 takes precedence)}
13/407 . . . {using a plurality of passive display elements, e.g. liquid crystal or Kerr-effect display elements (G01R 13/408 takes precedence)}
13/408 . . . {Two or three dimensional representation of measured values}
13/42 . Instruments using length of spark discharge, e.g. by measuring maximum separation of electrodes to produce spark

15/00 Details of measuring arrangements of the types provided for in groups G01R 17/00 - G01R 29/00, G01R 33/00 - G01R 33/26 or G01R 35/00

15/002 . {Switches for altering the measuring range or for multitesters}
15/005 . {Circuits for altering the indicating characteristic, e.g. making it non-linear}
15/007 . . {by zero-suppression}
15/04 . Voltage dividers
15/06 . . having reactive components, e.g. capacitive transformer
15/08 . Circuits for altering the measuring range
15/09 . . Autoranging circuits
15/12 . Circuits for multi-testers {, i.e. multimeters}, e.g. for measuring voltage, current, or impedance at will
15/125 . . {for digital multimeters}
15/14 . Adaptations providing voltage or current isolation, e.g. for high-voltage or high-current networks
15/142 . . {Arrangements for simultaneous measurements of several parameters employing techniques covered by groups G01R 15/14 - G01R 15/26}
15/144 . . {Measuring arrangements for voltage not covered by other subgroups of G01R 15/14}
15/146 . . {Measuring arrangements for current not covered by other subgroups of G01R 15/14, e.g. using current dividers, shunts, or measuring a voltage drop (if no voltage isolation is involved G01R 1/203 or G01R 19/0092)}
15/148 . . . {involving the measuring of a magnetic field or electric field (G01R 15/18, G01R 15/20, G01R 15/24, G01R 15/26 take precedence)}
15/16 . . using capacitive devices

15/165 . . . {measuring electrostatic potential, e.g. with electrostatic voltmeters or electrometers, when the design of the sensor is essential (electrometers with passively moving electrodes G01R 5/28; measuring electrostatic fields G01R 29/12; measuring charge G01R 29/24; measuring in circuits with high internal resistance G01R 19/0023)}

15/18 . . using inductive devices, e.g. transformers

15/181 . . . {using coils without a magnetic core, e.g. Rogowski coils}

15/183 . . . {using transformers with a magnetic core}

15/185 . . . . {with compensation or feedback windings or interacting coils, e.g. 0-flux sensors (using galvano-magnetic field sensors G01R 15/20; conversion of DC into AC using transductors G01R 19/20)}

15/186 . . . {using current transformers with a core consisting of two or more parts, e.g. clamp-on type (G01R 15/142 - G01R 15/16 take precedence; tong testers G01R 1/22)}

15/188 . . . {comprising rotatable parts, e.g. moving coils (galvanometers G01R 5/02, G01R 5/14)}

15/20 . . using galvano-magnetic devices, e.g. Hall-effect devices {, i.e. measuring a magnetic field via the interaction between a current and a magnetic field, e.g. magneto resistive or Hall effect devices}

15/202 . . . {using Hall-effect devices (Hall elements in arrangements for measuring electrical power G01R 21/08)}

15/205 . . . {using magneto-resistance devices, e.g. field plates}

15/207 . . . {Constructional details independent of the type of device used}

15/22 . . using light-emitting devices, e.g. LED, optocouplers {(G01R 31/31901 takes precedence)}

15/24 . . using light-modulating devices

15/241 . . . {using electro-optical modulators, e.g. electro-absorption (probes containing electro-optic elements G01R 1/071)}

15/242 . . . . {based on the Pockels effect, i.e. linear electro-optic effect}

15/243 . . . . {based on the Kerr effect, i.e. quadratic electro-optic effect}

15/245 . . . {using magneto-optical modulators, e.g. based on the Faraday or Cotton-Mouton effect}

15/246 . . . . {based on the Faraday, i.e. linear magneto-optic, effect}

15/247 . . . {Details of the circuitry or construction of devices covered by G01R 15/241 - G01R 15/246}

15/248 . . . {using a constant light source and electro-mechanically driven deflectors}

15/26 . . using modulation of waves other than light, e.g. radio or acoustic waves

17/00 Measuring arrangements involving comparison with a reference value, e.g. bridge

17/02 . Arrangements in which the value to be measured is automatically compared with a reference value

17/04 . . in which the reference value is continuously or periodically swept over the range of values to be measured

17/06 . . Automatic balancing arrangements

17/08 . . . in which a force or torque representing the measured value is balanced by a force or torque representing the reference value

17/10 . AC or DC measuring bridges

17/105 . . {for measuring impedance or resistance}

17/12 . . using comparison of currents, e.g. bridges with differential current output

17/14 . . with indication of measured value by calibrated null indicator, e.g. percent bridge, tolerance bridge (G01R 17/12, G01R 17/16 take precedence)

17/16 . . with discharge tubes or semiconductor devices in one or more arms of the bridge, e.g. voltmeter using a difference amplifier

17/18 . . with more than four branches

17/20 . AC or DC potentiometric measuring arrangements

17/22 . . with indication of measured value by calibrated null indicator

19/00 Arrangements for measuring currents or voltages or for indicating presence or sign thereof (G01R 5/00 takes precedence; for measuring bioelectric currents or voltages A61B 5/24)

NOTE

Within groups G01R 19/02 - G01R 19/32, group G01R 19/28 takes precedence. Groups G01R 19/18 - G01R 19/257 take precedence over groups G01R 19/02 - G01R 19/17 and G01R 19/30.

19/0007 . {Frequency selective voltage or current level measuring (measuring frequency G01R 23/00; testing attenuation in line transmission systems H04B 3/48; monitoring testing in transmission systems H04B 17/00)}

19/0015 . . {separating AC and DC}

19/0023 . {Measuring currents or voltages from sources with high internal resistance by means of measuring circuits with high input impedance, e.g. OP-amplifiers (electrostatic instruments G01R 5/28; measuring electrostatic potential G01R 15/165; measuring electrostatic fields G01R 29/12; amplifiers per se H03F)}

19/003 . {Measuring mean values of current or voltage during a given time interval}

19/0038 . {Circuits for comparing several input signals and for indicating the result of this comparison, e.g. equal, different, greater, smaller (comparing pulses or pulse trains according to amplitude)}

19/0046 . {characterised by a specific application or detail not covered by any other subgroup of G01R 19/00}

19/0053 . . {Noise discrimination; Analog sampling; Measuring transients (measuring characteristics of individual pulses G01R 29/02; digital sampling G01R 19/2509; measuring noise figure G01R 29/26)}

19/0061 . . {Measuring currents of particle-beams, currents from electron multipliers, photocurrents, ion currents; Measuring in plasmas}

19/0069 . . {measuring voltage or current standards}

19/0076 . . {using thermionic valves}

19/0084 . {measuring voltage only (all subgroups of G01R 19/00 take precedence)}

19/0092 . {measuring current only (all subgroups of G01R 19/00 take precedence)}
19/02 . Measuring effective values, i.e. root-mean-square values
19/03 . . using thermoconverters
19/04 . Measuring peak values {or amplitude or envelope} of ac or of pulses
19/06 . Measuring real component; Measuring reactive component
19/08 . Measuring current density
19/10 . Measuring sum, difference or ratio
19/12 . Measuring rate of change
19/14 . Indicating direction of current; Indicating polarity of voltage
19/145 . Indicating the presence of current or voltage
19/15 . . Indicating the presence of current
19/155 . . Indicating the presence of voltage
19/165 . Indicating that current or voltage is either above or below a predetermined value or within or outside a predetermined range of values
19/16504 . . {characterised by the components employed}
19/16509 . . . {using electromagnetic relays, e.g. reed relay (magnetically driven reeds G01R 9/06)}
19/16514 . . . {using electronic tubes}
19/16519 . . . {using FET's}
19/16523 . . . {using diodes, e.g. Zener diodes}
19/16528 . . {using digital techniques or performing arithmetic operations (using digital techniques to measure a voltage or a current, see G01R 19/25)}
19/16533 . . {characterised by the application}
19/16538 . . . {in AC or DC supplies (G01R 19/16519 and G01R 19/16528 take precedence)}
19/16542 . . . . {for batteries (charge condition monitoring in G01R 31/36)}
19/16547 . . . . {voltage or current in AC supplies (switching for protection H02H; circuits for emergency power supply H02J 9/00)}
19/16552 . . . . {in I.C. power supplies}
19/16557 . . . {Logic probes, i.e. circuits indicating logic state (high, low, O); (modifications of electronic switches or gates for indicating state of switch H03K 17/18)}
19/16561 . . . {in hand-held circuit testers (see also G01R 19/155)}
19/16566 . . {Circuits and arrangements for comparing voltage or current with one or several thresholds and for indicating the result not covered by subgroups G01R 19/16504, G01R 19/16528, G01R 19/16533}
19/16571 . . . {comparing AC or DC current with one threshold, e.g. load current, over-current, surge current or fault current (G01R 19/16514, G01R 19/16519, G01R 19/16528, G01R 19/16533, G01R 19/1659 take precedence; measuring currents by using elements sensitive to the magnetic field generated G01R 15/14; measuring earth resistance G01R 27/18; testing for leakage or short circuits in electrical apparatus G01R 31/52)}
19/16576 . . . {comparing DC or AC voltage with one threshold (G01R 19/16514, G01R 19/16519, G01R 19/16528, G01R 19/16533 and G01R 19/1659 take precedence)}
19/1658 . . . . {AC voltage or recurrent signals}
19/16585 . . . {for individual pulses, ripple or noise and other applications where timing or duration is of importance (G01R 19/16519, G01R 19/16538 and G01R 19/16595 take precedence; for pulse duration and rise time, see G01R 29/02 and subgroups)}
19/1659 . . . {to indicate that the value is within or outside a predetermined range of values (window) (G01R 19/16514, G01R 19/16519, G01R 19/16528 and G01R 19/16533 take precedence)}
19/16595 . . . . {with multi level indication (G01R 19/16519 and G01R 19/16533 take precedence)}
19/17 . . giving an indication of the number of times this occurs {, i.e. multi-channel analysers}
19/175 . Indicating the instants of passage of current or voltage through a given value, e.g. passage through zero
19/18 . using conversion of DC into AC, e.g. with choppers
19/20 . . using transductors {, i.e. a magnetic core transducer the saturation of which is cyclically reversed by an AC source on the secondary side}
19/22 . using conversion of ac into dc
19/225 . . {by means of thermocouples or other heat sensitive elements}
2019/24 . . {using thermocouples}
19/25 . using digital measurement techniques
19/2503 . . {for measuring voltage only, e.g. digital volt meters (DVM's) (G01R 19/2506 - G01R 19/257 take precedence)}
19/2506 . . {Arrangements for conditioning or analysing measured signals, e.g. for indicating peak values (G01R 19/003 takes precedence); Details concerning sampling, digitizing or waveform capturing (displaying waveforms G01R 13/00; analog sampling G01R 19/0053)}
19/2509 . . . {Details concerning sampling, digitizing or waveform capturing}
19/2513 . . {Arrangements for monitoring electric power systems, e.g. power lines or loads; Logging}
19/2516 . . {Modular arrangements for computer based systems; using personal computers (PC's), e.g. "virtual instruments"}
19/252 . . using analogue/digital converters of the type with conversion of voltage or current into frequency and measuring of this frequency
19/255 . . using analogue/digital converters of the type with counting of pulses during a period of time proportional to voltage or current, delivered by a pulse generator with fixed frequency
19/257 . . using analogue/digital converters of the type with comparison of different reference values with the value of voltage or current, e.g. using step-by-step method
19/28 . adapted for measuring in circuits having distributed constants
19/30 . Measuring the maximum or the minimum value of current or voltage reached in a time interval (G01R 19/04 takes precedence)
19/32 . Compensating for temperature change

21/00 **Arrangements for measuring electric power or power factor** (G01R 7/12 takes precedence)

21/001 . {Measuring real or reactive component; Measuring apparent energy (G01R 21/01, G01R 21/02, G01R 21/08, G01R 21/10 and G01R 21/127 take precedence)}
21/002 . . {Measuring real component}
21/003 . . {Measuring reactive component}
21/005 . . {Measuring apparent power}
21/006 . {Measuring power factor}
21/007 . {Adapted for special tariff measuring (G01R 21/01, G01R 21/02, G01R 21/08, G01R 21/10, G01R 21/1278 and G01R 21/1333 take precedence)}
21/008 . . {Measuring maximum demand}
21/01 . in circuits having distributed constants (G01R 21/04, G01R 21/07, G01R 21/09, G01R 21/12 take precedence)
21/02 . by thermal methods {, e.g. calorimetric}
21/04 . . in circuits having distributed constants
21/06 . by measuring current and voltage (G01R 21/08 - G01R 21/133 take precedence)
21/07 . . in circuits having distributed constants (G01R 21/09 takes precedence)
21/08 . by using galvanomagnetic-effect devices, e.g. Hall-effect devices
21/09 . . in circuits having distributed constants
21/10 . by using square-law characteristics of circuit elements, e.g. diodes, to measure power absorbed by loads of known impedance (G01R 21/02 takes precedence)
21/12 . . in circuits having distributed constants
21/127 . by using pulse modulation (G01R 21/133 takes precedence)
21/1271 . . {Measuring real or reactive component, measuring apparent energy}
21/1273 . . . {Measuring real component}
21/1275 . . . {Measuring reactive component}
21/1276 . . . {Measuring apparent energy}
21/1278 . . {Adapted for special tariff measuring}
21/133 . by using digital technique
21/1331 . . {Measuring real or reactive component, measuring apparent energy}
21/1333 . . {adapted for special tariff measuring}
21/1335 . . . {Tariff switching circuits}
21/1336 . . . {Measuring overconsumption}
21/1338 . . . {Measuring maximum demand}
21/14 . Compensating for temperature change

22/00 Arrangements for measuring time integral of electric power or current, e.g. electricity meters

NOTE

An arrangement for measuring time integral of electric power is classified in group G01R 21/00 if the essential characteristic is the measuring of electric power.

22/02 . by electrolytic methods
22/04 . by calorimetric methods
22/06 . by electronic methods
22/061 . . {Details of electronic electricity meters}
22/063 . . . {related to remote communication}
22/065 . . . {related to mechanical aspects}
22/066 . . . {Arrangements for avoiding or indicating fraudulent use}
22/068 . . . {Arrangements for indicating or signaling faults}
22/08 . . using analogue techniques
22/10 . . using digital techniques

23/00 Arrangements for measuring frequencies; Arrangements for analysing frequency spectra

23/005 . {Circuits for comparing several input signals and for indicating the result of this comparison, e.g. equal, different, greater, smaller (comparing phase or frequency of 2 mutually independent oscillations in demodulators)}
23/02 . Arrangements for measuring frequency, e.g. pulse repetition rate; Arrangements for measuring period of current or voltage
23/04 . . adapted for measuring in circuits having distributed constants
23/06 . . by converting frequency into an amplitude of current or voltage
23/07 . . . using response of circuits tuned on resonance, e.g. grid-drip meter
23/08 . . . using response of circuits tuned off resonance
23/09 . . . using analogue integrators, e.g. capacitors establishing a mean value by balance of input signals and defined discharge signals or leakage
23/10 . . by converting frequency into a train of pulses, which are then counted {, i.e. converting the signal into a square wave}
23/12 . . by converting frequency into phase shift
23/14 . . by heterodyning; by beat-frequency comparison
23/145 . . . {by heterodyning or by beat-frequency comparison with the harmonic of an oscillator}
23/15 . . Indicating that frequency of pulses is either above or below a predetermined value or within or outside a predetermined range of values, by making use of non-linear or digital elements {(indicating that pulse width is above or below a certain limit)}
23/155 . . . {giving an indication of the number of times this occurs, i.e. multi-channel analysers (for pulse characteristics)}
23/16 . Spectrum analysis; Fourier analysis
23/163 . . adapted for measuring in circuits having distributed constants
23/165 . . using filters
23/167 . . . with digital filters
23/17 . . with optical {or acoustical} auxiliary devices
23/173 . . Wobbulating devices similar to swept panoramic receivers
23/175 . . by delay means, e.g. tapped delay lines
23/177 . . Analysis of very low frequencies
23/18 . . with provision for recording frequency spectrum
23/20 . . Measurement of non-linear distortion

25/00 Arrangements for measuring phase angle between a voltage and a current or between voltages or currents

25/005 . {Circuits for comparing several input signals and for indicating the result of this comparison, e.g. equal, different, greater, smaller, or for passing one of the input signals as output signal}
25/02 . in circuits having distributed constants
25/04 . involving adjustment of a phase shifter to produce a predetermined phase difference, e.g. zero difference

25/06 . employing quotient instrument
25/08 . by counting of standard pulses

27/00 Arrangements for measuring resistance, reactance, impedance, or electric characteristics derived therefrom

27/02 . Measuring real or complex resistance, reactance, impedance, or other two-pole characteristics derived therefrom, e.g. time constant (by measuring phase angle only G01R 25/00)

NOTE

Groups G01R 27/02 - G01R 27/22 cover variables that directly or indirectly can be measured over two poles of a component or a Thevenin two-pole equivalent. Subgroup G01R 27/26 also covers other techniques, e.g. using electro magnetic waves or network analyzers

27/025 . . {Measuring very high resistances, e.g. isolation resistances, i.e. megohm-meters}
27/04 . . in circuits having distributed constants {, e.g. having very long conductors or involving high frequencies}
27/06 . . . Measuring reflection coefficients; Measuring standing-wave ratio
27/08 . . Measuring resistance by measuring both voltage and current
27/10 . . . using two-coil or crossed-coil instruments forming quotient
27/12 . . . . using hand generators, e.g. meggers
27/14 . . Measuring resistance by measuring current or voltage obtained from a reference source (G01R 27/16, G01R 27/20, G01R 27/22 take precedence)
27/16 . . Measuring impedance of element or network through which a current is passing from another source, e.g. cable, power line
27/18 . . . Measuring resistance to earth {, i.e. line to ground}
27/20 . . Measuring earth resistance; Measuring contact resistance, {e.g.} of earth connections, e.g. plates
27/205 . . . {Measuring contact resistance of connections, e.g. of earth connections}
27/22 . . Measuring resistance of fluids
27/26 . . Measuring inductance or capacitance; Measuring quality factor, e.g. by using the resonance method; Measuring loss factor; Measuring dielectric constants {; Measuring impedance or related variables}
27/2605 . . . {Measuring capacitance (capacitive sensors G01D 5/24)}
27/2611 . . . {Measuring inductance}
27/2617 . . . {Measuring dielectric properties, e.g. constants (testing dielectric strength G01R 31/12; detecting insulation faults G01R 31/52; G01R 27/2688 takes precedence)}
27/2623 . . . . {Measuring-systems or electronic circuits (G01R 27/2635, G01R 27/2682 take precedence)}
27/2629 . . . . . {Bridge circuits (bridges for measuring loss angle G01R 27/2694)}
27/2635 . . . . {Sample holders, electrodes or excitation arrangements, e.g. sensors or measuring cells}
27/2641 . . . . . {of plate type, i.e. with the sample sandwiched in the middle}
27/2647 . . . . . {of coaxial or concentric type, e.g. with the sample in a coaxial line}
27/2652 . . . . . {open-ended type, e.g. abutting against the sample}
27/2658 . . . . . {Cavities, resonators, free space arrangements, reflexion or interference arrangements (G01R 27/2647 takes precedence; optical methods G01R 27/2682)}
27/2664 . . . . . {Transmission line, wave guide (closed or open-ended) or strip - or microstrip line arrangements}
27/267 . . . . . {Coils or antennae arrangements, e.g. coils surrounding the sample or transmitter/ receiver antennae}
27/2676 . . . . . {Probes}
27/2682 . . . . {using optical methods or electron beams}
27/2688 . . . {Measuring quality factor or dielectric loss, e.g. loss angle, or power factor (power factor related to power measurements G01R 21/006; testing capacitors G01R 31/016)}
27/2694 . . . . {Measuring dielectric loss, e.g. loss angle, loss factor or power factor}
27/28 . Measuring attenuation, gain, phase shift or derived characteristics of electric four pole networks, i.e. two-port networks; Measuring transient response (in line transmission systems H04B 3/46)
27/30 . . with provision for recording characteristics, e.g. by plotting Nyquist diagram
27/32 . . in circuits having distributed constants {, e.g. having very long conductors or involving high frequencies}

29/00 Arrangements for measuring or indicating electric quantities not covered by groups G01R 19/00 - G01R 27/00

29/02 . Measuring characteristics of individual pulses, e.g. deviation from pulse flatness, rise time or duration
29/023 . . {Measuring pulse width}
29/027 . . Indicating that a pulse characteristic is either above or below a predetermined value or within or beyond a predetermined range of values
29/0273 . . . {the pulse characteristic being duration, i.e. width (indicating that frequency of pulses is above or below a certain limit)}
29/0276 . . . {the pulse characteristic being rise time (measuring rate of change G01R 19/12)}
29/033 . . . giving an indication of the number of times this occurs {, i.e. multi-channel analysers (the characteristic being frequency)}
29/04 . Measuring form factor, i.e. quotient of root-mean-square value and arithmetic mean of instantaneous value; Measuring peak factor, i.e. quotient of maximum value and root-mean-square value
29/06 . Measuring depth of modulation
29/08 . Measuring electromagnetic field characteristics
29/0807 . . {characterised by the application}

29/0814 . . . {Field measurements related to measuring influence on or from apparatus, components or humans (EMC, EMI and similar testing in general G01R 31/001), e.g. in ESD, EMI, EMC, EMP testing, measuring radiation leakage; detecting presence of micro- or radiowave emitters; dosimetry; testing shielding; measurements related to lightning}

29/0821 . . . . {rooms and test sites therefor, e.g. anechoic chambers, open field sites or TEM cells (for testing antennas G01R 29/105)}

29/0828 . . . . . {TEM-cells}

29/0835 . . . . {Testing shielding, e.g. for efficiency}

29/0842 . . . . {Measurements related to lightning, e.g. measuring electric disturbances, warning systems}

29/085 . . . . {for detecting presence or location of electric lines or cables (fault detection G01R 31/50; fault location G01R 31/08)}

29/0857 . . . . {Dosimetry, i.e. measuring the time integral of radiation intensity; Level warning devices for personal safety use (nuclear radiation dosimetry G01T)}

29/0864 . . {characterised by constructional or functional features}

29/0871 . . . {Complete apparatus or systems; circuits, e.g. receivers or amplifiers (G01R 29/0878, G01R 29/0892 take precedence; dosimeters, warning devices G01R 29/0857)}

29/0878 . . . {Sensors; antennas; probes; detectors (wave guide measuring sections G01R 1/24)}

29/0885 . . . . {using optical probes, e.g. electro-optical, luminescent, glow discharge, or optical interferometers}

29/0892 . . . {Details related to signal analysis or treatment; presenting results, e.g. displays; measuring specific signal features other than field strength, e.g. polarisation, field modes, phase, envelope, maximum value}

29/10 . . Radiation diagrams of antennas

29/105 . . . {using anechoic chambers; Chambers or open field sites used therefor (test sites used for measuring on other objects than aerials G01R 29/0828; wave absorbing devices H01Q 17/00)}

29/12 . Measuring electrostatic fields {or voltage-potential}

29/14 . . Measuring field distribution

29/16 . Measuring asymmetry of polyphase networks

29/18 . Indicating phase sequence; Indicating synchronism

29/20 . Measuring number of turns; Measuring transformation ratio or coupling factor of windings

29/22 . Measuring piezoelectric properties

29/24 . Arrangements for measuring quantities of charge

29/26 . Measuring noise figure; Measuring signal-to-noise ratio

31/00 Arrangements for testing electric properties; Arrangements for locating electric faults; Arrangements for electrical testing characterised by what is being tested not provided for elsewhere ({measuring superconductive properties G01R 33/1238;} testing or measuring semiconductors or solid state devices during manufacture {H01L 22/00}; testing line transmission systems H04B 3/46)

NOTE

Groups G01R 31/08, G01R 31/12, G01R 31/327, G01R 31/24, G01R 31/26, G01R 31/34, G01R 31/36, G01R 31/40, G01R 31/44 take precedence over group G01R 31/50.

31/001 . {Measuring interference from external sources to, or emission from, the device under test, e.g. EMC, EMI, EMP or ESD testing (measuring electromagnetic fields G01R 29/08; circuits for generating HV pulses in dielectric strength testing G01R 31/14)}

31/002 . . {where the device under test is an electronic circuit}

31/003 . {Environmental or reliability tests (of individual semiconductors G01R 31/2642; of PCB's G01R 31/2817; of IC's G01R 31/2855; of other circuits G01R 31/2849)}

31/005 . {Testing of electric installations on transport means}

31/006 . . {on road vehicles, e.g. automobiles or trucks (testing of ignition installations peculiar to internal combustion engines F02P 17/00)}

31/007 . . . {using microprocessors or computers}

31/008 . . {on air- or spacecraft, railway rolling stock or sea-going vessels}

31/01 . Subjecting similar articles in turn to test, e.g. "go/no-go" tests in mass production; Testing objects at points as they pass through a testing station (testing of cables continuously passing the testing apparatus G01R 31/59; testing dielectric strength or breakdown voltage G01R 31/12)

31/013 . . {Testing passive components (testing relays G01R 31/3278; testing electrical windings, e.g. inductors G01R 31/72)}

31/016 . . . {Testing of capacitors (measuring capacitance G01R 27/2605)}

31/08 . Locating faults in cables, transmission lines, or networks

31/081 . . {according to type of conductors}

31/083 . . . {in cables, e.g. underground}

31/085 . . . {in power transmission or distribution lines, e.g. overhead}

31/086 . . . {in power transmission or distribution networks, i.e. with interconnected conductors}

31/088 . . {Aspects of digital computing}

31/10 . . by increasing destruction at fault, e.g. burning-in by using a pulse generator operating a special programme

31/11 . . using pulse reflection methods

31/12 . Testing dielectric strength or breakdown voltage {; Testing or monitoring effectiveness or level of insulation, e.g. of a cable or of an apparatus, for example using partial discharge measurements; Electrostatic testing (G01R 31/08, G01R 31/327 and G01R 31/72 take precedence; measuring in plasmas G01R 19/0061; measuring dielectric constants G01R 27/2617; ESD, EMC or EMP testing of circuits G01R 31/002)}

31/1209 . . {using acoustic measurements (acoustic measurements G01H 3/00)}

31/1218 . . {using optical methods; using charged particle, e.g. electron, beams or X-rays}

31/1227 . . {of components, parts or materials (G01R 31/1209, G01R 31/1218, G01R 31/18 take precedence; circuits therefor G01R 31/14; testing vessels of electrodes G01R 31/16)}

31/1236 . . . {of surge arresters (monitoring overvoltage diverters or arresters H02H 3/048)}

31/1245 . . . {of line insulators or spacers, e.g. ceramic overhead line cap insulators; of insulators in HV bushings}

31/1254 . . . {of gas-insulated power appliances or vacuum gaps (testing switches G01R 31/327; detecting electrical or mechanical defects in encased switchgear H02B 13/065)}

31/1263 . . . {of solid or fluid materials, e.g. insulation films, bulk material; of semiconductors or LV electronic components or parts; of cable, line or wire insulation}

31/1272 . . . . {of cable, line or wire insulation, e.g. using partial discharge measurements (locating faults in cables G01R 31/083)}

31/1281 . . . . {of liquids or gases}

31/129 . . . . {of components or parts made of semiconducting materials; of LV components or parts (G01R 31/18 takes precedence)}

31/14 . . Circuits therefor {, e.g. for generating test voltages, sensing circuits (G01R 31/1209 - G01R 31/1227 take precedence; for testing switches G01R 31/327)}

31/16 . . Construction of testing vessels; Electrodes therefor

31/18 . . Subjecting similar articles in turn to test, e.g. go/no-go tests in mass production

31/20 . . Preparation of articles or specimens to facilitate testing

31/24 . Testing of discharge tubes (during manufacture H01J 9/42)

31/245 . . {Testing of gas discharge tubes}

31/25 . . Testing of vacuum tubes

31/252 . . . {Testing of electron multipliers, e.g. photo-multipliers}

31/255 . . . {Testing of transit-time tubes, e.g. klystrons, magnetrons}

31/257 . . . {Testing of beam-tubes, e.g. cathode-ray tubes, image pick-up tubes (of channel image intensifier arrays G01R 31/252; of transit time tubes G01R 31/255)}

31/26 . Testing of individual semiconductor devices (testing or measuring during manufacture or treatment {H01L 22/00}; testing of photovoltaic devices H02S 50/10)

31/2601 . . {Apparatus or methods therefor (G01R 31/2607, G01R 31/2642 take precedence)}

31/2603 . . . {for curve tracing of semiconductor characteristics, e.g. on oscilloscope}

31/2607 . . {Circuits therefor (G01R 31/2642 takes precedence)}

31/2608 . . . {for testing bipolar transistors}

31/261 . . . . {for measuring break-down voltage or punch through voltage therefor}

31/2612 . . . . {for measuring frequency response characteristics, e.g. cut-off frequency thereof}

31/2614 . . . . {for measuring gain factor thereof}

31/2616 . . . . {for measuring noise (measuring noise factor in general G01R 29/26)}

31/2617 . . . . {for measuring switching properties thereof}

31/2619 . . . . {for measuring thermal properties thereof}

31/2621 . . . {for testing field effect transistors, i.e. FET's}

31/2623 . . . . {for measuring break-down voltage therefor}

31/2625 . . . . {for measuring gain factor thereof}

31/2626 . . . . {for measuring noise (measuring noise factor in general G01R 29/26)}

31/2628 . . . . {for measuring thermal properties thereof}

31/263 . . . {for testing thyristors}

31/2632 . . . {for testing diodes}

31/2633 . . . . {for measuring switching properties thereof}

31/2635 . . . . {Testing light-emitting diodes, laser diodes or photodiodes}

31/2637 . . . {for testing other individual devices (G01R 31/2608 - G01R 31/2632, G01R 31/27 take precedence)}

31/2639 . . . . {for testing field-effect devices, e.g. of MOS-capacitors (G01R 31/2621 takes precedence)}

31/2641 . . . {for testing charge coupled devices}

31/2642 . . {Testing semiconductor operation lifetime or reliability, e.g. by accelerated life tests}

31/2644 . . {Adaptations of individual semiconductor devices to facilitate the testing thereof}

31/2646 . . {for measuring noise (G01R 31/2616, G01R 31/2626 take precedence)}

31/2648 . . {Characterising semiconductor materials (testing of materials or semi-finished products G01R 31/2831; testing during manufacture H01L 22/00)}

31/265 . . Contactless testing {(of circuits, also in wafer-form G01R 31/302)}

31/2653 . . . {using electron beams}

31/2656 . . . {using non-ionising electromagnetic radiation, e.g. optical radiation}

31/27 . . Testing of devices without physical removal from the circuit of which they form part, e.g. compensating for effects surrounding elements {(testing printed circuit boards G01R 31/2801)}

31/275 . . . {for testing individual semiconductor components within integrated circuits}

31/28 . Testing of electronic circuits, e.g. by signal tracer ({EMC, EMP or similar testing of electronic circuits G01R 31/002;} testing for short-circuits, discontinuities, leakage or incorrect line connection G01R 31/50; checking computers {or computer components} G06F 11/00; checking static stores for correct operation G11C 29/00 {; testing receivers or transmitters of transmission systems H04B 17/00})

31/2801 . . {Testing of printed circuits, backplanes, motherboards, hybrid circuits or carriers for multichip packages [MCP] (G01R 31/318508 takes precedence; contactless testing G01R 31/302; testing contacts or connections G01R 31/66)}

31/2803 . . . {by means of functional tests, e.g. logic-circuit-simulation or algorithms therefor (testing electronic digital computers G06F 11/00)}

31/2805 . . . {Bare printed circuit boards}

31/2806 . . . {Apparatus therefor, e.g. test stations, drivers, analysers, conveyors (G01R 31/2805, G01R 31/281, G01R 31/2818 take precedence)}

31/2808 . . . . {Holding, conveying or contacting devices, e.g. test adapters, edge connectors, extender boards (probe, multiprobe, probe manipulator or probe fixture G01R 1/067)}

31/281 . . . {Specific types of tests or tests for a specific type of fault, e.g. thermal mapping, shorts testing (G01R 31/2818 takes precedence)}

31/2812 . . . . {Checking for open circuits or shorts, e.g. solder bridges; Testing conductivity, resistivity or impedance (of connections G01R 31/66)}

31/2813 . . . . {Checking the presence, location, orientation or value, e.g. resistance, of components or conductors (orientation of the DUT with respect to the test fixture G01R 1/06705, G01R 31/281)}

31/2815 . . . . {Functional tests, e.g. boundary scans, using the normal I/O contacts (contacting devices G01R 31/2808; testing digital circuits G01R 31/317, G06F 11/00)}

31/2817 . . . . {Environmental-, stress-, or burn-in tests (of IC's G01R 31/2855; of individual semiconductors G01R 31/2642; of other circuits G01R 31/2849)}

31/2818 . . . {using test structures on, or modifications of, the card under test, made for the purpose of testing, e.g. additional components or connectors (G01R 31/2805 takes precedence; printed circuits having, e.g. symbols, test patterns or visualisation means H05K 1/0266)}

31/282 . . {Testing of electronic circuits specially adapted for particular applications not provided for elsewhere (G01R 31/2801 and G01R 31/2851 take precedence)}

NOTE

References listed below indicate CPC places which could also be of interest when carrying out a search in respect of the subject matter covered by the preceding group:

- testing of individual LEDs G01R 31/2635
- testing of lamps G01R 31/44
- testing of displays and display drivers, e.g. LCDs G09G 3/006
- testing of ADCs or DACs H03M 1/1071

31/2822 . . . {of microwave or radiofrequency circuits (of attenuation, gain, e.g. using network analyzers G01R 27/28)}

31/2824 . . . . {testing of oscillators or resonators}

31/2825 . . . {in household appliances or professional audio/video equipment (testing LAN's H04L 43/50; testing TV systems H04N 17/00; testing loudspeakers H04R 29/00)}

31/2827 . . . {Testing of electronic protection circuits (testing switches G01R 31/327; checking alarm systems G08B 29/00; self test of summation current transformers H02H 3/335)}

31/2829 . . . {Testing of circuits in sensor or actuator systems (testing of apparatus for measuring electric or magnetic variables G01R 35/00; testing of indicating or recording apparatus G01D; in airbag systems B60R 21/0173; checking gas analysers G01N 33/007; monitoring or fail-safe circuits for electromagnets H01F 7/1844)}

31/2831 . . . {Testing of materials or semi-finished products, e.g. semiconductor wafers or substrates (G01R 31/318511 takes precedence; testing during manufacture H01L 22/00)}

31/2832 . . {Specific tests of electronic circuits not provided for elsewhere (G01R 31/2801, G01R 31/316 take precedence)}

31/2834 . . . {Automated test systems [ATE]; using microprocessors or computers (G01R 31/317 takes precedence; ATE for detection of defective computer hardware G06F 11/2736)}

31/2836 . . . {Fault-finding or characterising (G01R 31/2822 - G01R 31/2831 take precedence)}

31/2837 . . . . {Characterising or performance testing, e.g. of frequency response (transient response G01R 27/28)}

31/2839 . . . . {using signal generators, power supplies or circuit analysers (G01R 31/2879 takes precedence; multimeters G01R 15/12, network analysers G01R 27/28)}

31/2841 . . . . . {Signal generators}

31/2843 . . . . {In-circuit-testing}

31/2844 . . . . {using test interfaces, e.g. adapters, test boxes, switches, PIN drivers (G01R 31/2889 takes precedence)}

31/2846 . . . . {using hard- or software simulation or using knowledge-based systems, e.g. expert systems, artificial intelligence or interactive algorithms}

31/2848 . . . . . {using simulation}

31/2849 . . . . {Environmental or reliability testing, e.g. burn-in or validation tests (of individual semiconductors G01R 31/2642; of printed circuits boards G01R 31/2817; of IC's G01R 31/2855)}

31/2851 . . {Testing of integrated circuits [IC] (G01R 31/317 takes precedence; testing individual devices G01R 31/26; testing printed circuits G01R 31/2801)}

31/2853 . . . {Electrical testing of internal connections or -isolation, e.g. latch-up or chip-to-lead connections (G01R 31/31717 takes precedence; test of chip-to-PCB or lead-to-PCB connections G01R 31/66)}

31/2855 . . . {Environmental, reliability or burn-in testing}

31/2856 . . . . {Internal circuit aspects, e.g. built-in test features; Test chips; Measuring material aspects, e.g. electro migration [EM]}

31/2858 . . . . . {Measuring of material aspects, e.g. electro-migration [EM], hot carrier injection}
31/286 . . . . {External aspects, e.g. related to chambers, contacting devices or handlers}
31/2862 . . . . . {Chambers or ovens; Tanks}
31/2863 . . . . . {Contacting devices, e.g. sockets, burn-in boards or mounting fixtures (in general G01R 1/04)}
31/2865 . . . . . {Holding devices, e.g. chucks; Handlers or transport devices (having contacts G01R 31/2863)}
31/2867 . . . . . {Handlers or transport devices, e.g. loaders, carriers, trays}
31/2868 . . . . . {Complete testing stations; systems; procedures; software aspects}
31/287 . . . . . {Procedures; Software aspects}
31/2872 . . . . {related to electrical or environmental aspects, e.g. temperature, humidity, vibration, nuclear radiation}
31/2874 . . . . . {related to temperature}
31/2875 . . . . . {related to heating}
31/2877 . . . . . {related to cooling}
31/2879 . . . . . {related to electrical aspects, e.g. to voltage or current supply or stimuli or to electrical loads}
31/2881 . . . . . {related to environmental aspects other than temperature, e.g. humidity or vibrations}
31/2882 . . . {Testing timing characteristics}
31/2884 . . . {using dedicated test connectors, test elements or test circuits on the IC under test (G01R 31/2855 takes precedence)}
31/2886 . . . {Features relating to contacting the IC under test, e.g. probe heads; chucks (G01R 31/2865 takes precedence, test connections, e.g. test sockets, or probes per se, G01R 1/04 or G01R 1/06)}
31/2887 . . . . {involving moving the probe head or the IC under test; docking stations (moving single probes G01R 1/06705; moving individual probes in multiple probes G01R 1/07392)}
31/2889 . . . . {Interfaces, e.g. between probe and tester (G01R 31/31905 and G01R 1/07364 take precedence)}
31/2891 . . . . {related to sensing or controlling of force, position, temperature (G01R 31/2874 takes precedence; sensing of force G01L; sensing of position G01B, G01D; sensing of temperature G01K; controlling in general G05)}
31/2893 . . . {Handling, conveying or loading, e.g. belts, boats, vacuum fingers (G01R 31/2867 takes precedence; handling semiconductor devices or wafers during manufacture or treatment H01L 21/67)}
31/2894 . . . {Aspects of quality control [QC] (G01R 31/31718 takes precedence; program control for QC G05B 19/41875)}
31/2896 . . . {Testing of IC packages; Test features related to IC packages (containers per se H01L 23/02, encapsulations per se H01L 23/28)}
31/2898 . . . {Sample preparation, e.g. removing encapsulation, etching (sample preparation in general G01N 1/00)}
31/30 . . Marginal testing, e.g. by varying supply voltage (testing computers during standby operation or idle time G06F 11/22)
31/3004 . . . {Current or voltage test}
31/3008 . . . . {Quiescent current [IDDQ] test or leakage current test}
31/3012 . . . . {Built-In-Current test [BIC]}
31/3016 . . . {Delay or race condition test, e.g. race hazard test}
31/302 . . Contactless testing {(G01R 31/66 takes precedence)}
31/3025 . . . {Wireless interface with the DUT}
31/303 . . . of integrated circuits (G01R 31/305 - G01R 31/315 take precedence)
31/304 . . . of printed or hybrid circuits (G01R 31/305 - G01R 31/315 take precedence)
31/305 . . . using electron beams {(investigating or analysing materials by measuring photoelectric effect G01N 23/227)}
31/306 . . . . of printed or hybrid circuits
31/307 . . . . of integrated circuits
31/308 . . . using non-ionising electromagnetic radiation, e.g. optical radiation {(investigating or analysing materials by the use of optical means G01N 21/00; image analysis G06T 7/00)}
31/309 . . . . of printed or hybrid circuits {or circuit substrates}
31/311 . . . . of integrated circuits {(G01R 31/31728 takes precedence)}
31/312 . . . by capacitive methods
31/315 . . . by inductive methods
31/316 . . Testing of analog circuits {(G01R 31/2851 takes precedence)}
31/3161 . . . Marginal testing
31/3163 . . . Functional testing
31/3167 . . Testing of combined analog and digital circuits {(testing ADC's H03M 1/1071)}
31/317 . . Testing of digital circuits

WARNING

The following subgroups of G01R 31/317 are not complete due to an ongoing reorganisation : G01R 31/31702, G01R 31/31708, G01R 31/31711, G01R 31/31717, G01R 31/31718, G01R 31/31728, G01R 31/31901. See also G01R 31/317 and its other subgroups

31/31701 . . . {Arrangements for setting the Unit Under Test [UUT] in a test mode}
31/31702 . . . {Testing digital circuits including elements other than semiconductor transistors, e.g. biochips, nanofabrics, mems, chips with magnetic elements}
31/31703 . . . {Comparison aspects, e.g. signature analysis, comparators (concerning scan tests G01R 31/318566; concerning testers G01R 31/3193)}
31/31704 . . . {Design for test; Design verification (concerning scan tests G01R 31/318583; computer-aided design G06F 30/00)}

31/31705 . . . {Debugging aspects, e.g. using test circuits for debugging, using dedicated debugging test circuits (generation of test sequences therefor G01R 31/31835, using scan test therefor G01R 31/318544)}

31/31706 . . . {involving differential digital signals, e.g. testing differential signal circuits, using differential signals for testing}

31/31707 . . . {Test strategies (methods for generation of test sequences G01R 31/318371)}

31/31708 . . . {Analysis of signal quality (G01R 31/31901 takes precedence; measuring frequencies or analysing frequency spectra per se G01R 23/00; measuring non-linear distortion per se G01R 23/20)}

31/31709 . . . . {Jitter measurements; Jitter generators (measuring jitter, noise figure or signal-to-noise ratio per se G01R 29/26; analysis of tester signals G01R 31/31901)}

31/3171 . . . . {BER [Bit Error Rate] test}

31/31711 . . . . {Evaluation methods, e.g. shmoo plots}

31/31712 . . . {Input or output aspects}

31/31713 . . . . {Input or output interfaces for test, e.g. test pins, buffers (for scan test G01R 31/318572)}

31/31715 . . . . {Testing of input or output circuits; test of circuitry between the I/C pins and the functional core, e.g. testing of input or output driver, receiver, buffer}

31/31716 . . . . {Testing of input or output with loop-back}

31/31717 . . . . {Interconnect testing (by scan techniques see G01R 31/31855)}

31/31718 . . . {Logistic aspects, e.g. binning, selection, sorting of devices under test, tester/handler interaction networks, Test management software, e.g. software for test statistics or test evaluation, yield analysis (mechanical aspects G01R 31/2808, G01R 31/2851)}

31/31719 . . . {Security aspects, e.g. preventing unauthorised access during test}

31/3172 . . . {Optimisation aspects, e.g. using functional pin as test pin, pin multiplexing}

31/31721 . . . {Power aspects, e.g. power supplies for test circuits, power saving during test (for scan test G01R 31/318575)}

31/31722 . . . {Addressing or selecting of test units, e.g. transmission protocols for selecting test units (for scan test G01R 31/318558)}

31/31723 . . . {Hardware for routing the test signal within the device under test to the circuits to be tested, e.g. multiplexer for multiple core testing, accessing internal nodes (routing the test signal to or from the device under test G01R 31/31926)}

31/31724 . . . {Test controller, e.g. BIST state machine (for scan test G01R 31/318555)}

31/31725 . . . {Timing aspects, e.g. clock distribution, skew, propagation delay (for tester hardware G01R 31/31937)}

31/31726 . . . . {Synchronization, e.g. of test, clock or strobe signals; Signals in different clock domains; Generation of Vernier signals; Comparison and adjustment of the signals}

31/31727 . . . {Clock circuits aspects, e.g. test clock circuit details, timing aspects for signal generation, circuits for testing clocks (G01R 31/31725 takes precedence; concerning scan test G01R 31/318552, for tester hardware G01R 31/31922)}

31/31728 . . . {Optical aspects, e.g. opto-electronics used for testing, optical signal transmission for testing electronic circuits, electro-optic components to be tested in combination with electronic circuits, measuring light emission of digital circuits (probes having electro-optic elements G01R 1/071; electro-optic sampling for oscilloscopes G01R 13/347; contactless testing of individual semiconductor devices by optical means G01R 31/2656)}

31/3173 . . . Marginal testing

31/3177 . . . Testing of logic operation, e.g. by logic analysers

31/3181 . . . Functional testing (G01R 31/3177 takes precedence)

31/31813 . . . . {Test pattern generators}

31/31816 . . . . {Soft error testing; Soft error rate evaluation; Single event testing}

31/3183 . . . . Generation of test inputs, e.g. test vectors, patterns or sequences

31/318307 . . . . . {computer-aided, e.g. automatic test program generator [ATPG], program translations, test program debugging}

31/318314 . . . . . {Tools, e.g. program interfaces, test suite, test bench, simulation hardware, test compiler, test program languages (simulation software G01R 31/318357; emulators G06F 11/261)}

31/318321 . . . . . {for combinational circuits}

31/318328 . . . . . {for delay tests}

31/318335 . . . . . {Test pattern compression or decompression (compression or decompression of scan patterns G01R 31/318547; compression or decompression hardware G01R 31/31921)}

31/318342 . . . . . {by preliminary fault modelling, e.g. analysis, simulation}

31/31835 . . . . . {Analysis of test coverage or failure detectability}

31/318357 . . . . . {Simulation (computer simulation of digital circuits G06F 30/3308)}

31/318364 . . . . . {as a result of hardware simulation, e.g. in an HDL environment (computer-aided simulation of circuits G06F 30/3308)}

31/318371 . . . . . {Methodologies therefor, e.g. algorithms, procedures}

31/318378 . . . . . {of patterns for devices arranged in a network}

31/318385 . . . . . {Random or pseudo-random test pattern}

31/318392 . . . . . {for sequential circuits (G01R 31/318544 takes precedence)}

31/3185 . . . . Reconfiguring for testing, e.g. LSSD, partitioning

31/318502 . . . . . {Test of Combinational circuits}

31/318505 . . . . . {Test of Modular systems, e.g. Wafers, MCM's}

31/318508 . . . . . {Board Level Test, e.g. P1500 Standard (features related to boundary scan G01R 31/318533)}
31/318511 . . . . . {Wafer Test}
31/318513 . . . . . {Test of Multi-Chip-Moduls}
31/318516 . . . . . {Test of programmable logic devices [PLDs]}
31/318519 . . . . . {Test of field programmable gate arrays [FPGA]}
31/318522 . . . . . {Test of Sequential circuits (test of microprocessors G06F 11/2236, test of ALU's G06F 11/2226)}
31/318525 . . . . . {Test of flip-flops or latches}
31/318527 . . . . . {Test of counters}
31/3853 . . . . . {Test of registers}
31/318533 . . . . . {using scanning techniques, e.g. LSSD, Boundary Scan, JTAG}
31/318536 . . . . . {Scan chain arrangements, e.g. connections, test bus, analog signals}
31/318538 . . . . . {Topological or mechanical aspects}
31/318541 . . . . . {Scan latches or cell details}
31/318544 . . . . . {Scanning methods, algorithms and patterns (G01R 31/3183 takes precedence)}
31/318547 . . . . . {Data generators or compressors}
31/31855 . . . . . {Interconnection testing, e.g. crosstalk, shortcircuits}
31/318552 . . . . . {Clock circuits details}
31/318555 . . . . . {Control logic}
31/318558 . . . . . {Addressing or selecting of subparts of the device under test}
31/318561 . . . . . {Identification of the subpart}
31/318563 . . . . . {Multiple simultaneous testing of subparts}
31/318566 . . . . . {Comparators; Diagnosing the device under test}
31/318569 . . . . . {Error indication, logging circuits}
31/318572 . . . . . {Input/Output interfaces}
31/318575 . . . . . {Power distribution; Power saving}
31/318577 . . . . . {AC testing, e.g. current testing, burn-in}
31/31858 . . . . . {Delay testing}
31/318583 . . . . . {Design for test}
31/318586 . . . . . {with partial scan or non-scannable parts}
31/318588 . . . . . {Security aspects}
31/318591 . . . . . {Tools}
31/318594 . . . . . {Timing aspects (clock circuits G01R 31/318552)}
31/318597 . . . . . {JTAG or boundary scan test of memory devices (other scan testing of memories G11C 29/32)}
31/3187 . . . . Built-in tests
31/319 . . . . Tester hardware, i.e. output processing circuits
31/31901 . . . . . {Analysis of tester Performance; Tester characterization}
31/31903 . . . . . {tester configuration}
31/31905 . . . . . {Interface with the device under test [DUT], e.g. arrangements between the test head and the DUT, mechanical aspects, fixture}
31/31907 . . . . . {Modular tester, e.g. controlling and coordinating instruments in a bus based architecture}
31/31908 . . . . . {Tester set-up, e.g. configuring the tester to the device under test [DUT], down loading test patterns}
31/3191 . . . . . {Calibration}
31/31912 . . . . . {Tester/user interface}
31/31914 . . . . . {Portable Testers}
31/31915 . . . . . {In-circuit Testers}
31/31917 . . . . . {Stimuli generation or application of test patterns to the device under test [DUT]}
31/31919 . . . . . {Storing and outputting test patterns (G01R 31/31924 takes precedence; arithmetic and random test patterns generator)}
31/31921 . . . . . {using compression techniques, e.g. patterns sequencer}
31/31922 . . . . . {Timing generation or clock distribution (G01R 31/3191 takes precedence)}
31/31924 . . . . . {Voltage or current aspects, e.g. driver, receiver}
31/31926 . . . . . {Routing signals to or from the device under test [DUT], e.g. switch matrix, pin multiplexing}
31/31928 . . . . . {Formatter (driver, receiver details G01R 31/31924)}
31/3193 . . . . . with comparison between actual response and known fault free response {(receiver details G01R 31/31924)}
31/31932 . . . . . {Comparators}
31/31935 . . . . . {Storing data, e.g. failure memory}
31/31937 . . . . . {Timing aspects, e.g. measuring propagation delay (G01R 31/3191 and G01R 31/31922 take precedence; marginal testing G06F 11/24)}
31/327 . Testing of circuit interrupters, switches or circuit-breakers
31/3271 . . {of high voltage or medium voltage devices (G01R 31/333 takes precedence)}
31/3272 . . . {Apparatus, systems or circuits therefor (G01R 31/3275 takes precedence)}
31/3274 . . . . {Details related to measuring, e.g. sensing, displaying or computing; Measuring of variables related to the contact pieces, e.g. wear, position or resistance (measuring contact resistance G01R 27/205)}
31/3275 . . . {Fault detection or status indication}
31/3277 . . {of low voltage devices, e.g. domestic or industrial devices, such as motor protections, relays, rotation switches}
31/3278 . . . {of relays, solenoids or reed switches (measuring contact resistance G01R 27/205; high voltage magnetic switches G01R 31/3271, G01R 31/333; testing electric windings G01R 31/72; monitoring of fail safe circuits H01H 47/002)}
31/333 . . Testing of the switching capacity of high-voltage circuit-breakers {; Testing of breaking capacity or related variables, e.g. post arc current or transient recovery voltage}
31/3333 . . . {Apparatus, systems or circuits therefor}

31/3336 . . . . {Synthetic testing, i.e. with separate current and voltage generators simulating distance fault conditions}
31/34 . Testing dynamo-electric machines
31/343 . . {in operation}
31/346 . . {Testing of armature or field windings}
31/36 . Arrangements for testing, measuring or monitoring the electrical condition of accumulators or electric batteries, e.g. capacity or state of charge [SoC]

NOTE

{This group covers arrangements for measuring, testing or indicating electrical conditions or variables of accumulators or electric batteries. Arrangements for monitoring, measuring, testing or indicating condition structurally associated with the battery are covered by H01M, e.g. by group H01M 10/48}

31/364 . . Battery terminal connectors with integrated measuring arrangements
31/3644 . . {Constructional arrangements}
31/3646 . . . {for indicating electrical conditions or variables, e.g. visual or audible indicators}
31/3647 . . . {for determining the ability of a battery to perform a critical function, e.g. cranking}
31/3648 . . . {comprising digital calculation means, e.g. for performing an algorithm}
31/367 . . Software therefor, e.g. for battery testing using modelling or look-up tables
31/371 . . with remote indication, e.g. on external chargers
31/374 . . with means for correcting the measurement for temperature or ageing
31/378 . . specially adapted for the type of battery or accumulator
31/379 . . . for lead-acid batteries
31/38 . . . {Primary cells, i.e. not rechargeable}
31/382 . . Arrangements for monitoring battery or accumulator variables, e.g. SoC
31/3828 . . . using current integration
31/3832 . . . . without measurement of battery voltage
31/3833 . . . . . {using analog integrators, e.g. coulomb-meters}
31/3835 . . . involving only voltage measurements
31/3842 . . . combining voltage and current measurements
31/385 . . Arrangements for measuring battery or accumulator variables (for monitoring G01R 31/382)
31/386 . . . {using test-loads}
31/3865 . . . {related to manufacture, e.g. testing after manufacture}
31/387 . . . Determining ampere-hour charge capacity or SoC
31/388 . . . . involving voltage measurements
31/389 . . Measuring internal impedance, internal conductance or related variables
31/392 . . Determining battery ageing or deterioration, e.g. state of health
31/396 . . Acquisition or processing of data for testing or for monitoring individual cells or groups of cells within a battery
31/40 . Testing power supplies (testing photovoltaic devices H02S 50/10)
31/42 . . AC power supplies
31/44 . Testing lamps
31/50 . Testing of electric apparatus, lines, cables or components for short-circuits, continuity, leakage current or incorrect line connections (testing of sparking plugs H01T 13/58)
31/52 . . Testing for short-circuits, leakage current or ground faults
31/54 . . Testing for continuity
31/55 . . Testing for incorrect line connections
31/56 . . Testing of electric apparatus (testing of transformers G01R 31/62; testing of connections G01R 31/66)
31/58 . . Testing of lines, cables or conductors (testing of electric windings G01R 31/72)
31/59 . . . while the cable continuously passes the testing apparatus, e.g. during manufacture
31/60 . . . Identification of wires in a multicore cable
31/62 . . Testing of transformers
31/64 . . Testing of capacitors
31/66 . . Testing of connections, e.g. of plugs or non-disconnectable joints (testing for incorrect line connections G01R 31/55)
31/67 . . . Testing the correctness of wire connections in electric apparatus or circuits
31/68 . . . Testing of releasable connections, e.g. of terminals mounted on a printed circuit board
31/69 . . . . of terminals at the end of a cable or a wire harness; of plugs; of sockets, e.g. wall sockets or power sockets in appliances
31/70 . . . Testing of connections between components and printed circuit boards (G01R 31/68 takes precedence)
31/71 . . . . Testing of solder joints
31/72 . . Testing of electric windings (testing of transformers G01R 31/62)
31/74 . . Testing of fuses

33/00 Arrangements or instruments for measuring magnetic variables

33/0005 . {Geometrical arrangement of magnetic sensor elements; Apparatus combining different magnetic sensor types (G01R 33/0206 takes precedence)}
33/0011 . {comprising means, e.g. flux concentrators, flux guides, for guiding or concentrating the magnetic flux, e.g. to the magnetic sensor}
33/0017 . {Means for compensating offset magnetic fields or the magnetic flux to be measured; Means for generating calibration magnetic fields}
33/0023 . {Electronic aspects, e.g. circuits for stimulation, evaluation, control; Treating the measured signals; calibration (G01R 33/0017 takes precedence)}
33/0029 . . {Treating the measured signals, e.g. removing offset or noise}
33/0035 . . {Calibration of single magnetic sensors, e.g. integrated calibration}
33/0041 . . {using feed-back or modulation techniques}
33/0047 . {Housings or packaging of magnetic sensors (packaging of semiconductor devices H01L 23/00); Holders}
33/0052 . {Manufacturing aspects; Manufacturing of single devices, i.e. of semiconductor magnetic sensor chips (devices based on galvano-magnetic effect or the like H10N 50/85)}
33/0058 . {using bistable elements, e.g. Reed switches}

33/0064 . {comprising means for performing simulations, e.g. of the magnetic variable to be measured}
33/007 . {Environmental aspects, e.g. temperature variations, radiation, stray fields (G01R 33/025 takes precedence)}
33/0076 . . {Protection, e.g. with housings against stray fields}
33/0082 . . {Compensation, e.g. compensating for temperature changes}
33/0088 . {use of bistable or switching devices, e.g. Reed-switches}
33/0094 . {Sensor arrays}
33/02 . Measuring direction or magnitude of magnetic fields or magnetic flux (G01R 33/20 takes precedence)

NOTE

Groups G01R 33/022, G01R 33/10 take precedence over groups G01R 33/025 - G01R 33/09.

33/0206 . . {Three-component magnetometers}
33/0213 . . {using deviation of charged particles by the magnetic field}
33/022 . . Measuring gradient
33/025 . . Compensating stray fields {(G01R 33/0017 takes precedence)}
33/028 . . Electrodynamic magnetometers
33/0283 . . . {in which a current or voltage is generated due to relative movement of conductor and magnetic field}
33/0286 . . . {comprising microelectromechanical systems [MEMS] (MEMS devices in general B81B)}
33/032 . . using magneto-optic devices, e.g. Faraday {or Cotton-Mouton effect}
33/0322 . . . {using the Faraday or Voigt effect}
33/0325 . . . {using the Kerr effect}
33/0327 . . . {with application of magnetostriction}
33/035 . . using superconductive devices
33/0352 . . . {Superconductive magneto-resistances}
33/0354 . . . {SQUIDS}
33/0356 . . . . {with flux feedback}
33/0358 . . . . {coupling the flux to the SQUID (gradiometer coils G01R 33/022; coils with superconductive winding H01F 6/06)}
33/038 . . using permanent magnets, e.g. balances, torsion devices
33/0385 . . . {in relation with magnetic force measurements (magnetic force microscopes G01Q 60/50)}
33/04 . . using the flux-gate principle
33/045 . . . {in single-, or multi-aperture elements}
33/05 . . . in thin-film element
33/06 . . using galvano-magnetic devices
33/063 . . . {Magneto-impedance sensors; Nanocristallin sensors}
33/066 . . . {field-effect magnetic sensors, e.g. magnetic transistor}
33/07 . . . Hall effect devices
33/072 . . . . {Constructional adaptation of the sensor to specific applications}
33/075 . . . . . {Hall devices configured for spinning current measurements}
33/077 . . . . {Vertical Hall-effect devices}
33/09 . . . Magnetoresistive devices
33/091 . . . . {Constructional adaptation of the sensor to specific applications}
33/093 . . . . {using multilayer structures, e.g. giant magnetoresistance sensors (thin magnetic films H01F 10/00)}
33/095 . . . . {extraordinary magnetoresistance sensors}
33/096 . . . . {anisotropic magnetoresistance sensors}
33/098 . . . . {comprising tunnel junctions, e.g. tunnel magnetoresistance sensors}
33/10 . . Plotting field distribution {; Measuring field distribution}
33/12 . Measuring magnetic properties of articles or specimens of solids or fluids (involving magnetic resonance G01R 33/20)
33/1207 . . {Testing individual magnetic storage devices, e.g. records carriers or digital storage elements (functional testing G06F 11/00, G06F 11/28)}
33/1215 . . {Measuring magnetisation; Particular magnetometers therefor (G01R 33/14 takes precedence; electrodynamic magnetometers G01R 33/028)}
33/1223 . . {Measuring permeability, i.e. permeameters (G01R 33/14 takes precedence)}
33/123 . . {Measuring loss due to hysteresis (G01R 33/14 takes precedence)}
33/1238 . . {Measuring superconductive properties}
33/1246 . . . {Measuring critical current}
33/1253 . . {Measuring galvano-magnetic properties}
33/1261 . . {using levitation techniques}
33/1269 . . {of molecules labeled with magnetic beads (magnetic particles for bio assay G01N 33/54326)}
33/1276 . . {of magnetic particles, e.g. imaging of magnetic nanoparticles (G01R 33/1269 takes precedence)}
33/1284 . . {Spin resolved measurements; Influencing spins during measurements, e.g. in spintronics devices (G01R 33/093 takes precedence; semiconductor devices using spin polarized carriers H01L 29/66984)}
33/1292 . . {Measuring domain wall position or domain wall motion}
33/14 . . Measuring or plotting hysteresis curves {(G01R 33/1207 takes precedence)}
33/16 . . Measuring susceptibility {(G01R 33/1238 takes precedence)}
33/18 . . Measuring magnetostrictive properties
33/20 . involving magnetic resonance (medical aspects A61B 5/055; magnetic resonance gyrometers G01C 19/60)
33/24 . . for measuring direction or magnitude of magnetic fields or magnetic flux
33/243 . . . {Spatial mapping of the polarizing magnetic field}
33/246 . . . {Spatial mapping of the RF magnetic field B1}
33/26 . . . using optical pumping
33/28 . . Details of apparatus provided for in groups G01R 33/44 - G01R 33/64
33/281 . . . {Means for the use of in vitro contrast agents (G01R 33/282 takes precedence; involving use of a contrast agent in MR imaging G01R 33/5601; in vivo contrast agents A61K 49/0002)}

33/282 . . . {Means specially adapted for hyperpolarisation or for hyperpolarised contrast agents, e.g. for the generation of hyperpolarised gases using optical pumping cells, for storing hyperpolarised contrast agents or for the determination of the polarisation of a hyperpolarised contrast agent}

33/283 . . . {Intercom or optical viewing arrangements, structurally associated with NMR apparatus}

33/285 . . . {Invasive instruments, e.g. catheters or biopsy needles, specially adapted for tracking, guiding or visualization by NMR}

33/286 . . . . {involving passive visualization of interventional instruments, i.e. making the instrument visible as part of the normal MR process}

33/287 . . . . {involving active visualization of interventional instruments, e.g. using active tracking RF coils or coils for intentionally creating magnetic field inhomogeneities}

33/288 . . . {Provisions within MR facilities for enhancing safety during MR, e.g. reduction of the specific absorption rate [SAR], detection of ferromagnetic objects in the scanner room}

33/30 . . . Sample handling arrangements, e.g. sample cells, spinning mechanisms

33/302 . . . . {Miniaturized sample handling arrangements for sampling small quantities, e.g. flow-through microfluidic NMR chips}

33/305 . . . . {specially adapted for high-pressure applications}

33/307 . . . . {specially adapted for moving the sample relative to the MR system, e.g. spinning mechanisms, flow cells or means for positioning the sample inside a spectrometer}

33/31 . . . . Temperature control thereof

33/32 . . . Excitation or detection systems, e.g. using radio frequency signals

33/323 . . . . {Detection of MR without the use of RF or microwaves, e.g. force-detected MR, thermally detected MR, MR detection via electrical conductivity, optically detected MR}

33/326 . . . . . {involving a SQUID}

33/34 . . . . Constructional details, e.g. resonators {, specially adapted to MR}

33/34007 . . . . . {Manufacture of RF coils, e.g. using printed circuit board technology; additional hardware for providing mechanical support to the RF coil assembly or to part thereof, e.g. a support for moving the coil assembly relative to the remainder of the MR system}

33/34015 . . . . . {Temperature-controlled RF coils}

33/34023 . . . . . {Superconducting RF coils}

33/3403 . . . . . {Means for cooling of the RF coils, e.g. a refrigerator or a cooling vessel specially adapted for housing an RF coil}

33/34038 . . . . . {Loopless coils, i.e. linear wire antennas}

33/34046 . . . . . {Volume type coils, e.g. bird-cage coils; Quadrature bird-cage coils; Circularly polarised coils}

33/34053 . . . . . {Solenoid coils; Toroidal coils}

33/34061 . . . . . {Helmholtz coils}

33/34069 . . . . . {Saddle coils}

33/34076 . . . . . {Birdcage coils}

33/34084 . . . . . {implantable coils or coils being geometrically adaptable to the sample, e.g. flexible coils or coils comprising mutually movable parts}

33/34092 . . . . . {RF coils specially adapted for NMR spectrometers}

33/341 . . . . . comprising surface coils

33/3415 . . . . . comprising arrays of sub-coils {, i.e. phased-array coils with flexible receiver channels}

33/343 . . . . . of slotted-tube or loop-gap type

33/345 . . . . . of waveguide type (G01R 33/343 takes precedence)

33/3453 . . . . . {Transverse electromagnetic [TEM] coils}

33/3456 . . . . . {Stripline resonators}

33/36 . . . . Electrical details, e.g. matching or coupling of the coil to the receiver

33/3607 . . . . . {RF waveform generators, e.g. frequency generators, amplitude-, frequency- or phase modulators or shifters, pulse programmers, digital to analog converters for the RF signal, means for filtering or attenuating of the RF signal}

33/3614 . . . . . {RF power amplifiers}

33/3621 . . . . . {NMR receivers or demodulators, e.g. preamplifiers, means for frequency modulation of the MR signal using a digital down converter, means for analog to digital conversion [ADC] or for filtering or processing of the MR signal such as bandpass filtering, resampling, decimation or interpolation}

33/3628 . . . . . {Tuning/matching of the transmit/receive coil}

33/3635 . . . . . {Multi-frequency operation}

33/3642 . . . . . {Mutual coupling or decoupling of multiple coils, e.g. decoupling of a receive coil from a transmission coil, or intentional coupling of RF coils, e.g. for RF magnetic field amplification}

33/365 . . . . . {Decoupling of multiple RF coils wherein the multiple RF coils have the same function in MR, e.g. decoupling of a receive coil from another receive coil in a receive coil array, decoupling of a transmission coil from another transmission coil in a transmission coil array}

33/3657 . . . . . {Decoupling of multiple RF coils wherein the multiple RF coils do not have the same function in MR, e.g. decoupling of a transmission coil from a receive coil}

33/3664 . . . . . {Switching for purposes other than coil coupling or decoupling, e.g. switching between a phased array mode and a quadrature mode, switching between surface coil modes of different geometrical shapes, switching from a whole body reception coil to a local reception coil or switching for automatic coil selection in moving table MR or for changing the field-of-view (G01R 33/3671 takes precedence)}

33/3671 . . . . . {involving modulation of the quality factor of the RF coil (G01R 33/3642 takes precedence)}

33/3678 . . . . . {involving quadrature drive or detection, e.g. a circularly polarized RF magnetic field}

33/3685 . . . . . {Means for reducing sheath currents, e.g. RF traps, baluns}

33/3692 . . . . . {involving signal transmission without using electrically conductive connections, e.g. wireless communication or optical communication of the MR signal or an auxiliary signal other than the MR signal}

33/38 . . . Systems for generation, homogenisation or stabilisation of the main or gradient magnetic field

33/3802 . . . . {Manufacture or installation of magnet assemblies; Additional hardware for transportation or installation of the magnet assembly or for providing mechanical support to components of the magnet assembly}

33/3804 . . . . {Additional hardware for cooling or heating of the magnet assembly, for housing a cooled or heated part of the magnet assembly or for temperature control of the magnet assembly}

33/3806 . . . . {Open magnet assemblies for improved access to the sample, e.g. C-type or U-type magnets}

33/3808 . . . . {Magnet assemblies for single-sided MR wherein the magnet assembly is located on one side of a subject only; Magnet assemblies for inside-out MR, e.g. for MR in a borehole or in a blood vessel, or magnet assemblies for fringe-field MR}

33/381 . . . . using electromagnets

33/3815 . . . . . with superconducting coils, e.g. power supply therefor

33/383 . . . . using permanent magnets

33/385 . . . . using gradient magnetic field coils

33/3852 . . . . . {Gradient amplifiers; means for controlling the application of a gradient magnetic field to the sample, e.g. a gradient signal synthesizer}

33/3854 . . . . . {means for active and/or passive vibration damping or acoustical noise suppression in gradient magnet coil systems}

33/3856 . . . . . {Means for cooling the gradient coils or thermal shielding of the gradient coils}

33/3858 . . . . . {Manufacture and installation of gradient coils, means for providing mechanical support to parts of the gradient-coil assembly (manufacture of inductances or coils in general H01F 41/00)}

33/387 . . . . Compensation of inhomogeneities

33/3873 . . . . . using ferromagnetic bodies {; Passive shimming}

33/3875 . . . . . using correction coil assemblies, e.g. active shimming

33/389 . . . . Field stabilisation {, e.g. by field measurements and control means or indirectly by current stabilisation}

33/42 . . . Screening

33/421 . . . . of main or gradient magnetic field

33/4215 . . . . . {of the gradient magnetic field, e.g. using passive or active shielding of the gradient magnetic field}

33/422 . . . . of the radio frequency field

33/44 . . using nuclear magnetic resonance [NMR] (G01R 33/24, G01R 33/62 take precedence)

33/441 . . . {Nuclear Quadrupole Resonance [NQR] Spectroscopy and Imaging}

33/443 . . . {Assessment of an electric or a magnetic field, e.g. spatial mapping, determination of a B0 drift or dosimetry}

33/445 . . . {MR involving a non-standard magnetic field B0, e.g. of low magnitude as in the earth's magnetic field or in nanoTesla spectroscopy, comprising a polarizing magnetic field for pre-polarisation, B0 with a temporal variation of its magnitude or direction such as field cycling of B0 or rotation of the direction of B0, or spatially inhomogeneous B0 like in fringe-field MR or in stray-field imaging}

33/446 . . . {Multifrequency selective RF pulses, e.g. multinuclear acquisition mode (spatially selective RF pulses G01R 33/4833)}

33/448 . . . {Relaxometry, i.e. quantification of relaxation times or spin density (G01R 33/50 takes precedence)}

33/46 . . . NMR spectroscopy

33/4608 . . . . {RF excitation sequences for enhanced detection, e.g. NOE, polarisation transfer, selection of a coherence transfer pathway}

33/4616 . . . . {using specific RF pulses or specific modulation schemes, e.g. stochastic excitation, adiabatic RF pulses, composite pulses, binomial pulses, Shinnar-le-Roux pulses, spectrally selective pulses not being used for spatial selection}

33/4625 . . . . {Processing of acquired signals, e.g. elimination of phase errors, baseline fitting, chemometric analysis}

33/4633 . . . . {Sequences for multi-dimensional NMR}

33/4641 . . . . {Sequences for NMR spectroscopy of samples with ultrashort relaxation times such as solid samples}

33/465 . . . . applied to biological material, e.g. in vitro testing

33/48 . . . NMR imaging systems

33/4802 . . . . {Travelling-wave MR}

33/4804 . . . . {Spatially selective measurement of temperature or pH}

33/4806 . . . . {Functional imaging of brain activation}

33/4808 . . . . {Multimodal MR, e.g. MR combined with positron emission tomography [PET], MR combined with ultrasound or MR combined with computed tomography [CT]}

33/481 . . . . . {MR combined with positron emission tomography [PET] or single photon emission computed tomography [SPECT]}

33/4812 . . . . . {MR combined with X-ray or computed tomography [CT]}

33/4814 . . . . . {MR combined with ultrasound}

33/4816 . . . . {NMR imaging of samples with ultrashort relaxation times such as solid samples, e.g. MRI using ultrashort TE [UTE], single point imaging, constant time imaging}

33/4818 . . . . {MR characterised by data acquisition along a specific k-space trajectory or by the temporal order of k-space coverage, e.g. centric or segmented coverage of k-space}

33/482 . . . . . {using a Cartesian trajectory}

33/4822 . . . . . {in three dimensions}

33/4824 . . . . . {using a non-Cartesian trajectory}

33/4826 . . . . . {in three dimensions}

33/4828 . . . . {Resolving the MR signals of different chemical species, e.g. water-fat imaging}

33/483 . . . . with selection of signals or spectra from particular regions of the volume, e.g. in vivo spectroscopy

33/4831 . . . . . {using B1 gradients, e.g. rotating frame techniques, use of surface coils}

33/4833 . . . . . {using spatially selective excitation of the volume of interest, e.g. selecting non-orthogonal or inclined slices}

33/4835 . . . . . {of multiple slices}

33/4836 . . . . . {using an RF pulse being spatially selective in more than one spatial dimension, e.g. a 2D pencil-beam excitation pulse}

33/4838 . . . . . {using spatially selective suppression or saturation of MR signals}

33/485 . . . . . based on chemical shift information {[CSI] or spectroscopic imaging, e.g. to acquire the spatial distributions of metabolites}

33/50 . . . . based on the determination of relaxation times {, e.g. T1 measurement by IR sequences; T2 measurement by multiple-echo sequences}

33/54 . . . . Signal processing systems, e.g. using pulse sequences {; Generation or control of pulse sequences; Operator console}

33/543 . . . . . {Control of the operation of the MR system, e.g. setting of acquisition parameters prior to or during MR data acquisition, dynamic shimming, use of one or more scout images for scan plane prescription (G01R 33/546 takes precedence)}

33/546 . . . . . {Interface between the MR system and the user, e.g. for controlling the operation of the MR system or for the design of pulse sequences}

33/56 . . . . . Image enhancement or correction, e.g. subtraction or averaging techniques {, e.g. improvement of signal-to-noise ratio and resolution}

33/5601 . . . . . {involving use of a contrast agent for contrast manipulation, e.g. a paramagnetic, super-paramagnetic, ferromagnetic or hyperpolarised contrast agent}

33/5602 . . . . . {by filtering or weighting based on different relaxation times within the sample, e.g. T1 weighting using an inversion pulse}

33/5604 . . . . . {Microscopy; Zooming}

33/5605 . . . . . {by transferring coherence or polarization from a spin species to another, e.g. creating magnetization transfer contrast [MTC], polarization transfer using nuclear Overhauser enhancement [NOE]}

33/5607 . . . . . {by reducing the NMR signal of a particular spin species, e.g. of a chemical species for fat suppression, or of a moving spin species for black-blood imaging}

33/5608 . . . . . {Data processing and visualization specially adapted for MR, e.g. for feature analysis and pattern recognition on the basis of measured MR data, segmentation of measured MR data, edge contour detection on the basis of measured MR data, for enhancing measured MR data in terms of signal-to-noise ratio by means of noise filtering or apodization, for enhancing measured MR data in terms of resolution by means for deblurring, windowing, zero filling, or generation of gray-scaled images, colour-coded images or images displaying vectors instead of pixels (image data processing or generation, in general G06T)}

33/561 . . . . . by reduction of the scanning time, i.e. fast acquiring systems, e.g. using echo-planar pulse sequences

33/5611 . . . . . {Parallel magnetic resonance imaging, e.g. sensitivity encoding [SENSE], simultaneous acquisition of spatial harmonics [SMASH], unaliasing by Fourier encoding of the overlaps using the temporal dimension [UNFOLD], k-t-broad-use linear acquisition speed-up technique [k-t-BLAST], k-t-SENSE (structural details of arrays of sub-coils G01R 33/3415)}

33/5612 . . . . . {Parallel RF transmission, i.e. RF pulse transmission using a plurality of independent transmission channels}

33/5613 . . . . . {Generating steady state signals, e.g. low flip angle sequences [FLASH]}

33/5614 . . . . . {using a fully balanced steady-state free precession [bSSFP] pulse sequence, e.g. trueFISP}

33/5615 . . . . . {Echo train techniques involving acquiring plural, differently encoded, echo signals after one RF excitation, e.g. using gradient refocusing in echo planar imaging [EPI], RF refocusing in rapid acquisition with relaxation enhancement [RARE] or using both RF and gradient refocusing in gradient and spin echo imaging [GRASE]}

33/5616 . . . . . {using gradient refocusing, e.g. EPI}

33/5617 . . . . . {using RF refocusing, e.g. RARE}

33/5618 . . . . . {using both RF and gradient refocusing, e.g. GRASE}

33/5619 . . . . . {by temporal sharing of data, e.g. keyhole, block regional interpolation scheme for k-Space [BRISK]}

33/563 . . . . . of moving material, e.g. flow contrast angiography

33/56308 . . . . . {Characterization of motion or flow; Dynamic imaging}

33/56316 . . . . . {involving phase contrast techniques}

33/56325 . . . . . {Cine imaging}

33/56333 . . . . . {Involving spatial modulation of the magnetization within an imaged region, e.g. spatial modulation of magnetization [SPAMM] tagging (perfusion imaging based on arterial spin tagging G01R 33/56366)}

33/56341 . . . . . {Diffusion imaging}

33/5635 . . . . . {Angiography, e.g. contrast-enhanced angiography [CE-MRA] or time-of-flight angiography [TOF-MRA]}

33/56358 . . . . . {Elastography}

33/56366 . . . . . {Perfusion imaging}

33/56375 . . . . . {Intentional motion of the sample during MR, e.g. moving table imaging}

33/56383 . . . . . {involving motion of the sample as a whole, e.g. multistation MR or MR with continuous table motion}

33/56391 . . . . . {involving motion of a part of the sample with respect to another part of the sample, e.g. MRI of active joint motion}

33/565 . . . . . Correction of image distortions, e.g. due to magnetic field inhomogeneities

33/56509 . . . . . {due to motion, displacement or flow, e.g. gradient moment nulling (G01R 33/567 takes precedence)}

33/56518 . . . . . {due to eddy currents, e.g. caused by switching of the gradient magnetic field}

NOTE

This group only covers correction of artifacts caused by gradient-non-linearity

33/56527 . . . . . {due to chemical shift effects}

33/56536 . . . . . {due to magnetic susceptibility variations}

33/56545 . . . . . {caused by finite or discrete sampling, e.g. Gibbs ringing, truncation artefacts, phase aliasing artefacts}

33/56554 . . . . . {caused by acquiring plural, differently encoded echo signals after one RF excitation, e.g. correction for readout gradients of alternating polarity in EPI}

33/56563 . . . . . {caused by a distortion of the main magnetic field B0, e.g. temporal variation of the magnitude or spatial inhomogeneity of B0 (G01R 33/56509, G01R 33/56518, G01R 33/56536 take precedence)}

33/56572 . . . . . {caused by a distortion of a gradient magnetic field, e.g. non-linearity of a gradient magnetic field (G01R 33/56509, G01R 33/56518, G01R 33/56536 take precedence)}

33/56581 . . . . . {due to Maxwell fields, i.e. concomitant fields}

33/5659 . . . . . {caused by a distortion of the RF magnetic field, e.g. spatial inhomogeneities of the RF magnetic field (G01R 33/56509, G01R 33/56518, G01R 33/56536 take precedence)}

33/567 . . . . . gated by physiological signals {, i.e. synchronization of acquired MR data with periodical motion of an object of interest, e.g. monitoring or triggering system for cardiac or respiratory gating}

33/5673 . . . . . {Gating or triggering based on a physiological signal other than an MR signal, e.g. ECG gating or motion monitoring using optical systems for monitoring the motion of a fiducial marker}

33/5676 . . . . . {Gating or triggering based on an MR signal, e.g. involving one or more navigator echoes for motion monitoring and correction}

33/58 . . . . Calibration of imaging systems, e.g. using test probes {, Phantoms; Calibration objects or fiducial markers such as active or passive RF coils surrounding an MR active material}

33/583 . . . . . {Calibration of signal excitation or detection systems, e.g. for optimal RF excitation power or frequency (G01R 33/246 takes precedence)}

33/586 . . . . . {for optimal flip angle of RF pulses}

33/60 . . using electron paramagnetic resonance (G01R 33/24, G01R 33/62 take precedence)

33/62 . . using double resonance (G01R 33/24 takes precedence)

33/64 . . using cyclotron resonance (G01R 33/24 takes precedence)

35/00 Testing or calibrating of apparatus covered by the other groups of this subclass

35/002 . {of cathode ray oscilloscopes}

35/005 . {Calibrating; Standards or reference devices, e.g. voltage or resistance standards, "golden" references (G01R 33/0035, G01R 35/002 take precedence)}

35/007 . . {Standards or reference devices, e.g. voltage or resistance standards, "golden references"}

35/02 . of auxiliary devices, e.g. of instrument transformers according to prescribed transformation ratio, phase angle, or wattage rating

35/04 . of instruments for measuring time integral of power or current

35/06 . . by stroboscopic methods