

CPC**COOPERATIVE PATENT CLASSIFICATION****G01R****MEASURING ELECTRIC VARIABLES; MEASURING MAGNETIC VARIABLES**

(measuring physical variables of any kind by conversion into electric variables, see Note (4) following the title of class [G01](#); measuring diffusion of ions in an electric field, e.g. electrophoresis, electro-osmosis [G01N](#); investigating non-electric or non-magnetic properties of materials by using electric or magnetic methods [G01N](#); indicating correct tuning of resonant circuits [H03J 3/12](#) ; monitoring electronic pulse counters [H03K 21/40](#) ; monitoring operation of communication systems [H04](#))

NOTE

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.

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;

Attention is drawn to the Notes following the title of class [G01](#).

In this subclass, group [G01R 17/00](#) takes precedence over groups [G01R 19/00](#) to [G01R 31/00](#) .

G01R 1/00

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

G01R 1/02

. General constructional details (details of a kind applicable to measuring arrangements not specially adapted for a specific variable [G01D 7/00](#))

G01R 1/025

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

G01R 1/04

.. Housings; Supporting members; Arrangements of terminals ("burn-in" aspects [G01R 31/286](#) ; terminals [H01R](#); terminal strips or boards [H02B](#); housings for electrical apparatus [H05K](#))

G01R 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 31/01](#) ; testing of connections [G01R 31/04](#) ; for testing printed circuit boards [G01R 31/2808](#)) }

G01R 1/0416

.... { Connectors, terminals ([G01R 1/0425](#) and [G01R 1/0433](#) take precedence;

		with measurement function for battery poles G01R 31/36V9P ; in general H01R)}
G01R 1/0425	....	{ Test clips, e.g. for IC`s }
G01R 1/0433	....	{ Sockets for IC`s or transistors }
G01R 1/0441	.....	{ Details }
G01R 1/045	.....	{ Sockets or component fixtures for RF or HF testing }
G01R 1/0458	.....	{ related to environmental aspects, e.g. temperature }
G01R 1/0466	.....	{ concerning contact pieces or mechanical details, e.g. hinges or cams; Shielding }
G01R 1/0475	.....	{ for TAB IC`s }
G01R 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)}
G01R 1/0491	....	{ for testing integrated circuits on wafers, e.g. wafer-level test cartridge }
G01R 1/06	..	Measuring leads; Measuring probes (G01R 19/145 , G01R 19/165 take precedence; end pieces for leads H01R 11/00)
G01R 1/067	...	Measuring probes {(plugs, sockets or clips G01R 1/0408 ; testing of connections G01R 31/04 ; contacting IC`s for test purposes when probe design is not the essential feature G01R 31/2886 ; using radiation beam as probe G01R 31/302 ; end pieces for wires terminating in a probe H01R 11/18)}
G01R 1/06705	....	{ Apparatus for holding or moving single probes (for moving multiple probe heads or ICs under test G01R 31/2886)}
G01R 1/06711	....	{ Probe needles; Cantilever beams; "Bump" contacts; Replaceable probe pins }
G01R 1/06716	.....	{ Elastic }
G01R 1/06722	.....	{ Spring-loaded }
G01R 1/06727	.....	{ Cantilever beams }

WARNING

This group is not complete pending a reorganisation; see also other subgroups of [G01R 1/067 C](#)

G01R 1/06733	.....	{ Geometry aspects (G01R 1/06727 takes precedence)}
G01R 1/06738	.....	{ related to tip portion }
G01R 1/06744	.....	{ Microprobes, i.e. having dimensions as IC details }
G01R 1/0675	.....	{ Needle-like }
G01R 1/06755	.....	{ Material aspects }
G01R 1/06761	.....	{ related to layers }
G01R 1/06766	....	{ Input circuits therefor }
G01R 1/06772	....	{ High frequency probes }
G01R 1/06777	....	{ High voltage probes }
G01R 1/06783	....	{ containing liquids }
G01R 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)}
G01R 1/06794	....	{ Devices for sensing when probes are in contact, or in position to contact, with measured object }

G01R 1/07	....	Non-contact-making probes {(wireless interface with the DUT G01R 31/3025)}
G01R 1/071	.....	{ containing electro-optic elements }
G01R 1/072	.....	{ containing ionised gas }
G01R 1/073	....	Multiple probes {(G01R 1/06783 , G01R 1/06794 , G01R 1/071 , G01R 1/072 take precedence)}
G01R 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 }
G01R 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) }
G01R 1/07321	.....	{ the probes being of different lengths }
G01R 1/07328	.....	{ for testing printed circuit boards }
G01R 1/07335	.....	{ for double-sided contacting or for testing boards with surface-mounted devices (SMD`s) }
G01R 1/07342	.....	{ the body of the probe being at an angle other than perpendicular to test object, e.g. probe card }
G01R 1/0735	.....	{ arranged on a flexible frame or film }
G01R 1/07357	.....	{ with flexible bodies, e.g. buckling beams }
G01R 1/07364	.....	{ with provisions for altering position, number or connection of probe tips; Adapting to differences in pitch }
G01R 1/07371	.....	{ using an intermediate card or back card with apertures through which the probes pass }
G01R 1/07378	.....	{ using an intermediate adapter, e.g. space transformers (G01R 1/07371 takes precedence) }
G01R 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 }
G01R 1/07392	.....	{ manipulating each probe element or tip individually }
G01R 1/08	..	Pointers; Scales; Scale illumination
G01R 1/10	..	Arrangements of bearings (bearings in general F16C)
G01R 1/12	...	of strip or wire bearings
G01R 1/14	..	Braking arrangements; Damping arrangements
G01R 1/16	..	Magnets (in general H01F)
G01R 1/18	..	Screening arrangements against electric or magnetic fields, e.g. against earth`s field {(measuring shielding efficiency H05K 9/0069)}
G01R 1/20	.	Modifications of basic electric elements for use in electric measuring instruments; Structural combinations of such elements with such instruments (instrument transformers per se H01F 38/20)
G01R 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) }
G01R 1/206	..	{ Switches for connection of measuring instruments or electric motors to measuring loads (switches in general H01H) }
G01R 1/22	..	Tong testers acting as secondary windings of current transformers (voltage or current isolation using transformers G01R 15/18)
G01R 1/24	..	Transmission-line, e.g. waveguide, measuring sections, e.g. slotted section

- G01R 1/26 . . . with linear movement of probe
- G01R 1/28 . Provision in measuring instruments for reference values, e.g. standard voltage, standard waveform
- G01R 1/30 . Structural combination of electric measuring instruments with basic electronic circuits, e.g. with amplifier
- G01R 1/36 . Overload protection arrangements or circuits for electric measuring instruments (in general [H02H](#))
- G01R 1/38 . Arrangements for altering the indicating characteristic, e.g. by modifying the air gap {(circuits [G01R 15/005](#))}
- G01R 1/40 . Modifications of instruments to indicate the maximum or the minimum value reached in a time interval, e.g. by maximum indicator pointer
- G01R 1/42 . . thermally operated
- G01R 1/44 . Modifications of instruments for temperature compensation {(When measuring current or voltage [G01R 19/32](#))}
- G01R 3/00 Apparatus or processes specially adapted for the manufacture { or maintenance } of measuring instruments, { e.g. of probe tips }**
- G01R 5/00 Instruments for converting a single current or a single voltage into a mechanical displacement (vibration galvanometers [G01R 9/02](#))**
- G01R 5/02 . Moving-coil instruments
- G01R 5/04 . . with magnet external to the coil
- G01R 5/06 . . with core magnet
- G01R 5/08 . . specially adapted for wide angle deflection; with eccentrically-pivoted moving coil
- G01R 5/10 . String galvanometers
- G01R 5/12 . Loop galvanometers
- G01R 5/14 . Moving-iron instruments
- G01R 5/16 . . with pivoting magnet
- G01R 5/18 . . with pivoting soft iron, e.g. needle galvanometer
- G01R 5/20 . Induction instruments e.g. Ferraris instruments
- G01R 5/22 . Thermoelectric instruments (measuring effective values of currents or voltages using thermoconverters [G01R 19/03](#))
- G01R 5/24 . . operated by elongation of a strip or wire or by expansion of a gas or fluid
- G01R 5/26 . . operated by deformation of a bimetallic element
- G01R 5/28 . Electrostatic instruments (combined with radiation detector [G01T](#); { electrometers without passively moving electrodes [G01R 15/165](#); measuring electrostatic fields [G01R 29/12](#) ; measuring charge [G01R 29/24](#) })

- G01R 5/30 . . Leaf electrometers
- G01R 5/32 . . Wire electrometers; Needle electrometers
- G01R 5/34 . . Quadrant electrometers

G01R 7/00 Instruments capable of converting two or more currents or voltages into a single mechanical displacement ([G01R 9/00](#) takes precedence)

- G01R 7/02 . for forming a sum or a difference
- G01R 7/04 . for forming a quotient (for measuring resistance [G01R 27/08](#))
- G01R 7/06 . . moving-iron type

NOTE

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

- G01R 7/08 . . moving-coil type, e.g. crossed-coil type
- G01R 7/10 . . . having more than two moving coils
- G01R 7/12 . for forming product
- G01R 7/14 . . moving-iron type
- G01R 7/16 . . having both fixed and moving coils, i.e. dynamometers
- G01R 7/18 . . . with iron core magnetically coupling fixed and moving coils

G01R 9/00 Instruments employing mechanical resonance

- G01R 9/02 . Vibration galvanometers, e.g. for measuring current
- G01R 9/04 . using vibrating reeds, e.g. for measuring frequency
- G01R 9/06 . . magnetically driven
- G01R 9/08 . . piezo-electrically driven

G01R 11/00 Electromechanical arrangements for measuring time integral of electric power { i.e. electric energy } or current, e.g. of consumption ({ other arrangements for measuring time integral of electric power or current [G01R 22/00](#) ; Boards, panels, desks for energy meters, [H02B 1/03](#) } ; monitoring electric consumption of electrically-propelled vehicles [B60L 3/00](#))

NOTE

For the definition of "arrangement" see Note (2) under [G01R](#)

- G01R 11/02 . Constructional details (applicable to electric measuring instruments in general [G01R 1/00](#))
- G01R 11/04 . . Housings; Supporting racks; Arrangements of terminals
- G01R 11/06 . . Magnetic circuits of induction meters
- G01R 11/067 . . . Coils therefor

- G01R 11/073 . . . Armatures therefor
- G01R 11/09 Disc armatures
- G01R 11/10 . . Braking magnets; Damping arrangements
- G01R 11/12 . . Arrangements of bearings ([bearings in general F16C](#))
- G01R 11/14 . . . with magnetic relief
- G01R 11/16 . . Adaptations of counters to electricity meters
- G01R 11/17 . . Compensating for errors; Adjusting or regulating means therefor
- G01R 11/18 . . . Compensating for variations in ambient conditions
- G01R 11/185 Temperature compensation
- G01R 11/19 . . . Compensating for errors caused by disturbing torque, e.g. rotating-field errors of polyphase meters
- G01R 11/20 . . . Compensating for phase errors in induction meters
- G01R 11/21 . . . Compensating for errors caused by damping effects of the current, e.g. adjustment in the overload range
- G01R 11/22 . . . Adjusting torque, e.g. adjusting starting torque, adjusting of polyphase meters for obtaining equal torques
- G01R 11/23 . . . Compensating for errors caused by friction, e.g. adjustment in the light load range
- G01R 11/24 . . Arrangements for avoiding or indicating fraudulent use ({ [measures against unauthorised operation of bolts, nuts or pins F16B 41/005](#) ; security seals [G09F 3/03](#) ; preventing of tampering with detection circuits in signaling or alarm circuits [G08B 29/046](#) })
- G01R 11/25 . . Arrangements for indicating or signalling faults ([seals G09F 3/03](#) ; preventing tampering with detection circuits in signalling or alarm circuits [G08B 29/046](#))

NOTE

Groups 11/48 to 11/66 take precedence over groups [G01R 11/30](#) to [G01R 11/46](#) .

- G01R 11/30 . Dynamo-electric motor meters
- G01R 11/32 . . Watt-hour meters
- G01R 11/34 . . Ampere-hour meters
- G01R 11/36 . Induction meters, e.g. Ferraris meters ([Ferraris instruments G01R 5/20](#))
- G01R 11/38 . . for single-phase operation
- G01R 11/40 . . for polyphase operation
- G01R 11/42 . . . Circuitry therefor
- G01R 11/46 . Electrically-operated clockwork meters; Oscillatory meters; Pendulum meters
- G01R 11/465 . . { [Oscillatory meters](#) }
- G01R 11/48 . Meters specially adapted for measuring real or reactive components; Meters specially adapted for measuring apparent energy
- G01R 11/50 . . for measuring real component
- G01R 11/52 . . for measuring reactive component
- G01R 11/54 . . for measuring simultaneously at least two of the following three variables: real

component, reactive component, apparent energy

- G01R 11/56 . Special tariff meters ([tariff metering in general G01D 4/00](#))
- G01R 11/57 . . Multi-rate meters ([G01R 11/63 takes precedence](#))
- G01R 11/58 . . . Tariff-switching devices therefor
- G01R 11/60 . . Subtraction meters; Meters measuring maximum or minimum load hours
- G01R 11/63 . . Over-consumption meters, e.g. measuring consumption while a predetermined level of power is exceeded
- G01R 11/64 . . Maximum meters, e.g. tariff for a period is based on maximum demand within that period
- G01R 11/66 . . . Circuitry

- G01R 13/00** **Arrangements for displaying electric variables or waveforms ([display by mechanical displacement only G01R 5/00](#) , [G01R 7/00](#) , [G01R 9/00](#) ; recording frequency spectrum [G01R 23/18](#))**

- G01R 13/02 . for displaying measured electric variables in digital form ({ [using LCD's or LED's G01R 13/40](#) } ; counters [G06M](#) ; analogue/digital conversion in general [H03M 1/00](#))
- G01R 13/0209 . . { in numerical form }
- G01R 13/0218 . . { Circuits therefor }
- G01R 13/0227 . . . { Controlling the intensity or colour of the display }
- G01R 13/0236 . . . { for presentation of more than one variable }
- G01R 13/0245 . . . { for inserting reference markers }
- G01R 13/0254 . . . { for triggering, synchronisation }
- G01R 13/0263 { for non-recurrent functions, e.g. transients }
- G01R 13/0272 . . . { for sampling }
- G01R 13/0281 . . { using electro-optic elements }
- G01R 13/029 . . { Software therefor }

- G01R 13/04 . for producing permanent records
- G01R 13/06 . . Modifications for recording transient disturbances e.g. by starting or accelerating a recording medium
- G01R 13/08 . . Electromechanical recording systems using a mechanical direct-writing method
- G01R 13/10 . . . with intermittent recording by representing the variable by the length of a stroke or by the position of a dot
- G01R 13/12 . . Chemical recording, e.g. clydonographs ([G01R 13/14 takes precedence](#))
- G01R 13/14 . . Recording on a light-sensitive material
- G01R 13/16 . . Recording on a magnetic medium
- G01R 13/18 . . . using boundary displacement

- G01R 13/20 . Cathode-ray oscilloscopes; { [Oscilloscopes using other screens than CRT's, e.g. LCD's](#); ([control arrangements or circuits for cathode-ray tube indicators G09G 1/00](#) ; cathode ray tubes [H01J 31/00](#)) }
- G01R 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](#)) }
- G01R 13/204 . . { [Using means for generating permanent registrations, e.g. photographs](#) ([optical](#)

- or photographic arrangements combined with CRT vessel [H01J 29/89](#))}
- G01R 13/206 .. { Arrangements for obtaining a 3- dimensional representation (stereoscopic T.V. [H04N 13/00](#))}
- G01R 13/208 .. { Arrangements for measuring with C.R. oscilloscopes, e.g. vectorscope }
- G01R 13/22 .. Circuits therefor (circuits for generating pulses, e.g. saw-tooth waveforms [H03K 3/00](#))
- G01R 13/225 ... { particularly adapted for storage oscilloscopes }
- G01R 13/24 ... Time-base deflection circuits
- G01R 13/245 { for generating more than one, not overlapping time-intervals on the screen }
- G01R 13/26 ... Circuits for controlling the intensity of the electron beam { or the colour of the display } (brilliance control [H01J 29/98](#))
- G01R 13/28 ... Circuits for simultaneous or sequential presentation of more than one variable (electronic switches [H03K 17/00](#))
- G01R 13/30 ... Circuits for inserting reference markers, e.g. for timing, for calibrating, for frequency marking
- G01R 13/305 { for time marking }
- G01R 13/32 ... Circuits for displaying non-recurrent functions such as transients; Circuits for triggering; Circuits for synchronisation; Circuits for time-base expansion
- G01R 13/325 { for displaying non-recurrent functions such as transients }
- G01R 13/34 ... Circuits for representing a single waveform by sampling, e.g. for very high frequencies (sample and hold arrangements [G11C 27/02](#))
- G01R 13/342 { for displaying periodic H.F. signals ([G01R 13/345](#) takes precedence)}
- G01R 13/345 { for displaying sampled signals by using digital processors by intermediate A.D. and D.A. convertors (control circuits for CRT indicators)}
- G01R 13/347 { using electro-optic elements }
- G01R 13/36 . using length of glow discharge, e.g. glowlight oscilloscopes (discharge tubes [H01J](#))
- G01R 13/38 . using the steady or oscillatory displacement of a light beam by an electromechanical measuring system (such measuring systems per se [G01R 5/00](#) , [G01R 7/00](#) , [G01R 9/00](#))
- G01R 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](#))}
- G01R 13/401 .. { for continuous analogue, or simulated analogue, display }
- G01R 13/402 ... { using active, i.e. light-emitting display devices, e.g. electroluminescent display ([G01R 13/36](#) and [G01R 13/42](#) take precedence)}
- G01R 13/403 ... { using passive display devices, e.g. liquid crystal display or Kerr effect display devices }
- G01R 13/404 .. { for discontinuous display, i.e. display of discrete values (analogue/digital conversion [H03M 1/00](#))}
- G01R 13/405 ... { using a plurality of active, i.e. light emitting, e.g. electro-luminescent elements, i.e. bar graphs }
- G01R 13/406 { representing measured value by a dot or a single line ([G01R 13/408](#) takes precedence)}
- G01R 13/407 ... { using a plurality of passive display elements, e.g. liquid crystal or Kerr-effect display elements ([G01R 13/408](#) takes precedence)}
- G01R 13/408 ... { Two or three dimensional representation of measured values }

- G01R 13/42 . Instruments using length of spark discharge e.g. by measuring maximum separation of electrodes to produce spark
- G01R 15/00** **Details of measuring arrangements of the types provided for in groups [G01R 17/00](#) to [G01R 29/00](#) and [G01R 33/00](#) to [G01R 35/00](#) (details of instruments [G01R 1/00](#) ; overload protection arrangements [G01R 1/36](#))**
- G01R 15/002 . { Switches for altering the measuring range or for multitesters }
- G01R 15/005 . { Circuits for altering the indicating characteristic, e.g. making it non-linear }
- G01R 15/007 . . { by zero-suppression }
- G01R 15/04 . Voltage dividers
- G01R 15/06 . . having reactive components, e.g. capacitive transformer {(when the HV capacitor/sensor as such is the essential [G01R 15/16](#))}
- G01R 15/08 . Circuits for altering the measuring range
- G01R 15/09 . . Autoranging circuits
- G01R 15/12 . Circuits for multi-testers, { i.e. multimeters }, e.g. for measuring voltage, current, or impedance at will
- G01R 15/125 . . { for digital multimeters }
- G01R 15/14 . Adaptations providing voltage or current isolation, e.g. for high-voltage or high-current networks (instrument transformers [H01F 38/20](#) ; voltage dividers [G01R 15/04](#) ; { means for converting the output of a sensing member to another variable [G01D 5/00](#) ; visible signalling arrangements or devices [G08B 5/00](#) ; transmission systems for measured values [G08C 17/00](#) , [G08C 23/00](#))}
- G01R 15/142 . . { Arrangements for simultaneous measurements of several parameters employing techniques covered by groups [G01R 15/14](#) to [G01R 15/26](#) }
- G01R 15/144 . . { Measuring arrangements for voltage not covered by other subgroups of [G01R 15/14](#) }
- G01R 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](#))}
- G01R 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)}
- WARNING**
- Not complete pending reorganization; see also [G01R 15/20](#)
- G01R 15/16 . . using capacitive devices {(circuits constituting a voltage divider [G01R 15/06](#))}
- G01R 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](#))}
- G01R 15/18 . . using inductive devices, e.g. transformers
- G01R 15/181 . . . { using coils without a magnetic core, e.g. Rogowski coils }

- G01R 15/183 . . . { using transformers with a magnetic core }
- G01R 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 transducers [G01R 19/20](#)) }
- G01R 15/186 . . . { using current transformers with a core consisting of two or more parts, e.g. clamp-on type ([G01R 15/142](#) to [G01R 15/16](#) take precedence; tong testers [G01R 1/22](#)) }
- G01R 15/188 . . . { comprising rotatable parts, e.g. moving coils (galvanometers [G01R 5/02](#) , [G01R 5/14](#)) }
- G01R 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 (electromechanical such devices, [G01R 5/00](#) , [G01R 7/00](#) , [G01R 9/00](#) ; measuring magnetic fields [G01R 33/02](#)) }
- G01R 15/202 . . . { using Hall-effect devices (Hall elements in arrangements for measuring electrical power [G01R 21/08](#)) }
- G01R 15/205 . . . { using magneto-resistance devices, e.g. field plates }
- G01R 15/207 . . . { Constructional details independent of the type of device used }
- G01R 15/22 . . using light-emitting devices, e.g. LED, optocouplers { ([G01R 31/31901](#) takes precedence) }
- G01R 15/24 . . using light-modulating devices
- G01R 15/241 . . . { using electro-optical modulators, e.g. electro-absorption (probes containing electro-optic elements [G01R 1/071](#)) }
- G01R 15/242 { based on the Pockels effect, i.e. linear electro-optic effect }
- G01R 15/243 { based on the Kerr effect, i.e. quadratic electro-optic effect }
- G01R 15/245 . . . { using magneto-optical modulators, e.g. based on the Faraday or Cotton-Mouton effect }
- G01R 15/246 { based on the Faraday, i.e. linear magneto-optic, effect }
- G01R 15/247 . . . { Details of the circuitry or construction of devices covered by [G01R 15/241](#) to [G01R 15/246](#) }
- G01R 15/248 . . . { using a constant light source and electro-mechanically driven deflectors }
- G01R 15/26 . . using modulation of waves other than light, e.g. radio or acoustic waves

G01R 17/00 Measuring arrangements involving comparison with a reference value, e.g. bridge

- G01R 17/02 . Arrangements in which the value to be measured is automatically compared with a reference value
- G01R 17/04 . . in which the reference value is continuously or periodically swept over the range of values to be measured
- G01R 17/06 . . Automatic balancing arrangements
- G01R 17/08 . . . in which a force or torque representing the measured value is balanced by a force or torque representing the reference value
- G01R 17/10 . ac or dc measuring bridges (automatic comparison or re-balancing arrangements [G01R 17/02](#))
- G01R 17/105 . . { for measuring impedance or resistance }
- G01R 17/12 . . using comparison of currents, e.g. bridges with differential current output
- G01R 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)

- G01R 17/16 . . with discharge tubes or semiconductor devices in one or more arms of the bridge, e.g. voltmeter using a difference amplifier
- G01R 17/18 . . with more than four branches
- G01R 17/20 . ac or dc potentiometric measuring arrangements ([automatic comparison or re-balancing arrangements G01R 17/02](#))
- G01R 17/22 . . with indication of measured value by calibrated null indicator

- G01R 19/00** **Arrangements for measuring currents or voltages or for indicating presence or sign thereof** ([G01R 5/00](#) takes precedence; { voltage measurements using secondary electron emission when testing electronic circuits [G01R 31/305](#) } ; for measuring bio-electric currents or voltages [A61B 5/04](#))

- NOTE**
 Within groups [G01R 19/02](#) to [G01R 19/32](#) , group [G01R 19/28](#) takes precedence. Groups [G01R 19/18](#) to [G01R 19/257](#) take precedence over groups [G01R 19/02](#) to [G01R 19/17](#) and [G01R 19/30](#) .

- G01R 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](#)) }
- G01R 19/0015 . . { separating AC and DC }
- G01R 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](#)) }
- G01R 19/003 . { Measuring mean values of current or voltage during a given time interval }
- G01R 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](#)) }
- G01R 19/0046 . { characterised by a specific application or detail not covered by any other subgroup of [G01R 19/00](#) (contains no documents) }
- G01R 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](#)) }
- G01R 19/0061 . . { Measuring currents of particle-beams, currents from electron multipliers, photocurrents, ion currents; Measuring in plasmas }
- G01R 19/0069 . . { measuring voltage or current standards }
- G01R 19/0076 . . { using thermionic valves }
- G01R 19/0084 . { measuring voltage only (all subgroups of [G01R 19/00](#) take precedence) }
- G01R 19/0092 . { measuring current only (all subgroups of [G01R 19/00](#) take precedence) }
- G01R 19/02 . Measuring effective values, i.e. root-mean-square values
- G01R 19/03 . . using thermoconverters { using ac-dc conversion by means of thermocouples or other heat sensitive elements [G01R 19/225](#) }

- G01R 19/04 . Measuring peak values { or amplitude or envelope } of ac or of pulses
- G01R 19/06 . Measuring real component; Measuring reactive component
- G01R 19/08 . Measuring current density
- G01R 19/10 . Measuring sum, difference or ratio
- G01R 19/12 . Measuring rate of change { (emergency protective circuit arrangements responsive to the rate of change of electrical quantities [H02H 3/44](#)) }
- G01R 19/14 . Indicating direction of current; Indicating polarity of voltage
- G01R 19/145 . Indicating the presence of current or voltage { measuring probes in general [G01R 1/06](#) ; indicating continuity or short circuits in electric apparatus or lines or components [G01R 31/024](#) }
- G01R 19/15 . . . Indicating the presence of current { see provisionally also [G01R 19/145](#) }
- G01R 19/155 . . . Indicating the presence of voltage { see provisionally also [G01R 19/145](#) }
- G01R 19/165 . Indicating that current or voltage is either above or below a predetermined value or within or outside a predetermined range of values (circuits with regenerative action, e.g. Schmitt trigger [H03K 3/00](#) ; threshold switches [H03K 17/00](#))
- G01R 19/16504 . . { characterised by the components employed (contains no documents) }
- G01R 19/16509 . . . { using electromagnetic relays, e.g. reed relay (magnetically driven reeds [G01R 9/06](#)) }
- G01R 19/16514 . . . { using electronic tubes }
- G01R 19/16519 . . . { using FET's }
- G01R 19/16523 . . . { using diodes, e.g. Zener diodes }
- G01R 19/16528 . . { using digital techniques or performing arithmetic operations (using digital techniques to measure a voltage or a current, see [G01R 19/25](#)) }
- G01R 19/16533 . . { characterised by the application (contains no documents) }
- G01R 19/16538 . . . { in AC or DC supplies ([G01R 19/16519](#) and [G01R 19/16528](#) take precedence) }
- G01R 19/16542 { for batteries (charge condition monitoring in [G01R 31/36](#)) }
- G01R 19/16547 { voltage or current in AC supplies (switching for protection [H02H](#) ; circuits for emergency power supply [H02J 9/00](#)) }
- G01R 19/16552 { in I.C. power supplies }
- G01R 19/16557 . . . { Logic probes, i.e. circuits indicating logic state (high, low, 0); (modifications of electronic switches or gates for indicating state of switch [H03K 17/18](#)) }
- G01R 19/16561 . . . { in hand-held circuit testers (see also [G01R 19/155](#)) }
- G01R 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](#) (contains no documents) }
- G01R 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 31/025](#)) }

- G01R 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) }
- G01R 19/1658 { AC voltage or recurrent signals }
- G01R 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) }
- G01R 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) }
- G01R 19/16595 { with multi level indication ([G01R 19/16519](#) and [G01R 19/16533](#) take precedence) }
- G01R 19/17 . . giving an indication of the number of times this occurs, { i.e. multi-channel analysers }
- G01R 19/175 . Indicating the instants of passage of current or voltage through a given value, e.g. passage through zero
- G01R 19/18 . using conversion of dc into ac, e.g. with choppers { DC amplifiers with modulators at input and demodulator at output [H03F 3/38](#) }
- G01R 19/20 . . using transducers { i.e. a magnetic core transducer the saturation of which is cyclically reversed by an AC source on the secondary side (other DC current transducers, e.g. using the 0-flux principle, [G01R 15/185](#) ; magnetic amplifiers [H03F 9/00](#)) }
- G01R 19/22 . using conversion of ac into dc
- G01R 19/225 . . { by means of thermocouples or other heat sensitive elements }
- G01R 19/25 . using digital measurement techniques (arrangements for displaying measured electric variables in digital form [G01R 13/02](#)) { Analogue/digital conversion [H03M](#) }
- G01R 19/2503 . . { for measuring voltage only, e.g. digital volt meters (DVM`s) ([G01R 19/2506](#) to [G01R 19/257](#) take precedence) }
- G01R 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](#)) }
- G01R 19/2509 . . . { Details concerning sampling, digitizing or waveform capturing }
- G01R 19/2513 . . { Arrangements for monitoring electric power systems, e.g. power lines or loads; Logging }
- G01R 19/2516 . . { Modular arrangements for computer based systems; using personal computers (PC`s), e.g. "virtual instruments" }
- G01R 19/252 . . using analogue/digital converters of the type with conversion of voltage or current into frequency and measuring of this frequency
- G01R 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
- G01R 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
- G01R 19/28 . adapted for measuring in circuits having distributed constants
- G01R 19/30 . Measuring the maximum or the minimum value of current or voltage reached in a time

interval ([G01R 19/04](#) takes precedence; modifications of instruments to indicate the maximum or the minimum value reached in a time interval [G01R 1/40](#) ; { using digital methods [G01R 19/2506](#) })

- G01R 19/32 . Compensating for temperature change ({ [G01R 19/02](#) to [G01R 19/30](#) take precedence } ; modifications of instruments for temperature compensation [G01R 1/44](#))

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

- G01R 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) }
- G01R 21/002 . . { Measuring real component }
- G01R 21/003 . . { Measuring reactive component }
- G01R 21/005 . . { Measuring apparent power }
- G01R 21/006 . { Measuring power factor }
- G01R 21/007 . { Adapted for special tariff measuring ([G01R 21/01](#) , [G01R 21/02](#) , [G01R 21/08](#) , [G01R 21/10](#) , [G01R 21/127](#) and [G01R 21/133](#) take precedence) }
- G01R 21/008 . . { Measuring maximum demand }
- G01R 21/01 . in circuits having distributed constants ([G01R 21/04](#) , [G01R 21/07](#) , [G01R 21/09](#) , [G01R 21/12](#) take precedence)
- G01R 21/02 . by thermal methods { e.g. calorimetric }
- G01R 21/04 . . in circuits having distributed constants
- G01R 21/06 . by measuring current and voltage ([G01R 21/08](#) to [G01R 21/133](#) take precedence)
- G01R 21/07 . . in circuits having distributed constants ([G01R 21/09](#) takes precedence)
- G01R 21/08 . by using galvanomagnetic effect devices, e.g. Hall effect devices (such devices per se [H01L](#) ; { for current measurements only, see [G01R 15/20](#) })
- G01R 21/09 . . in circuits having distributed constants
- G01R 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)
- G01R 21/12 . . in circuits having distributed constants
- G01R 21/127 . by using pulse modulation ([G01R 21/133](#) takes precedence; { digital multiplication via delta sigma modulation [G06F 7/60](#) })
- G01R 21/1271 . . { Measuring real or reactive component, measuring apparent energy }
- G01R 21/1273 . . . { Measuring real component }
- G01R 21/1275 . . . { Measuring reactive component }
- G01R 21/1276 . . . { Measuring apparent energy }
- G01R 21/1278 . . { Adapted for special tariff measuring }
- G01R 21/133 . by using digital technique

- G01R 21/1331 . . { Measuring real or reactive component, measuring apparent energy }
- G01R 21/1333 . . { adapted for special tariff measuring }
- G01R 21/1335 . . . { Tariff switching circuits }
- G01R 21/1336 . . . { Measuring overconsumption }
- G01R 21/1338 . . . { Measuring maximum demand }

- G01R 21/14 . Compensating for temperature change

G01R 22/00 Arrangements for measuring time integral of electric power or current, e.g. by electricity meters (electromechanical arrangements therefor [G01R 11/00](#) ; monitoring electric consumption of electrically-propelled vehicles [B60L 3/00](#) ; coin freed devices [G07F 15/00](#))]

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.

- G01R 22/02 . by electrolytic methods
- G01R 22/04 . by calorimetric methods
- G01R 22/06 . by electronic methods

WARNING

IPC8 group [G01R 22/06](#) and subgroups, introduced in the CPC scheme in September 2004, might be temporarily incomplete as a number of documents presently classified in group [G01R 22/00](#) needs reclassification to these IPC groups

- G01R 22/061 . . { Details of electronic electricity meters }
- G01R 22/063 . . . { related to remote communication }
- G01R 22/065 . . . { related to mechanical aspects }
- G01R 22/066 . . . { Arrangements for avoiding or indicating fraudulent use }

WARNING

Not complete pending reorganization; see also [G01R 11/24](#)

- G01R 22/068 . . . { Arrangements for indicating or signaling faults }

WARNING

Not complete pending reorganization; see also [G01R 11/25](#)

- G01R 22/08 . . using analogue techniques
- G01R 22/10 . . using digital techniques

G01R 23/00 Arrangements for measuring frequencies; Arrangements for analysing frequency spectra (frequency discriminators [H03D](#) ; { high frequency probes [G01R 1/06772](#) }

- G01R 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)}
- G01R 23/02 . Arrangements for measuring frequency, e.g. pulse repetition rate {(using vibrating reeds [G01R 9/04](#))}Arrangements for measuring period of current or voltage (measuring short-time intervals [G04F](#))
- G01R 23/04 . . . adapted for measuring in circuits having distributed constants
- G01R 23/06 . . . by converting frequency into an amplitude of current or voltage
- G01R 23/07 . . . using response of circuits tuned on resonance, e.g. grid-drip meter
- G01R 23/08 . . . using response of circuits tuned off resonance
- G01R 23/09 . . . using analogue integrators, e.g. capacitors establishing a mean value by balance of input signals and defined discharge signals or leakage (radiation-measuring instruments in which pulses generated by a radiation detector are integrated [G01T 1/15](#))
- G01R 23/10 . . by converting frequency into a train of pulses, which are then counted, { i.e. converting the signal into a square wave }
- G01R 23/12 . . by converting frequency into phase shift
- G01R 23/14 . . by heterodyning; by beat-frequency comparison (generation of oscillations by beating unmodulated signals of different frequencies [H03B 21/00](#))
- G01R 23/145 . . . { by heterodyning or by beat-frequency comparison with the harmonic of an oscillator }
- G01R 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)}
- G01R 23/155 . . . { giving an indication of the number of times this occurs, i.e. multi-channel analysers (for pulse characteristics)}
- G01R 23/16 . . Spectrum analysis; Fourier analysis {(computing with Fourier series or Walsh functions [G06F 17/14](#) , [G06G 7/19](#) ; spectral data processing)}
- G01R 23/163 . . adapted for measuring in circuits having distributed constants
- G01R 23/165 . . using filters
- G01R 23/167 . . . with digital filters
- G01R 23/17 . . with optical { or acoustical }auxiliary devices
- G01R 23/173 . . Wobblating devices similar to swept panoramic receivers (panoramic receivers per se [H03J 7/32](#))
- G01R 23/175 . . by delay means, e.g. tapped delay lines
- G01R 23/177 . . Analysis of very low frequencies
- G01R 23/18 . . with provision for recording frequency spectrum
- G01R 23/20 . . Measurement of non-linear distortion, { e.g. harmonics or noise, ([G01R 31/31708](#) takes precedence; noise figure [G01R 29/26](#))}
- G01R 25/00** **Arrangements for measuring phase angle between a voltage and a current, or between voltages or currents (measuring power factor [G01R 21/00](#) ; measuring position of individual pulses in a pulse train [G01R 29/02](#) ; phase discriminators [H03D](#))**
- G01R 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 }

- G01R 25/02 . in circuits having distributed constants
- G01R 25/04 . involving adjustment of a phase shifter to produce a predetermined phase difference, e.g. zero difference
- G01R 25/06 . employing quotient instrument
- G01R 25/08 . by counting of standard pulses ([measuring time intervals G04F](#))

G01R 27/00 **Arrangements for measuring resistance, reactance, impedance, or electric characteristics derived therefrom** {([measuring super-conductive properties G01R 33/1238](#))}

- G01R 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](#) to [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

- G01R 27/025 . . { [Measuring very high resistances, e.g. isolation resistances, i.e. megohm-meters](#) }
- G01R 27/04 . . in circuits having distributed constants, { [e.g. having very long conductors or involving high frequencies](#) }
- G01R 27/06 . . . Measuring reflection coefficients; Measuring standing-wave ratio
- G01R 27/08 . . Measuring resistance by measuring both voltage and current
- G01R 27/10 . . . using two-coil or crossed-coil instruments forming quotient
- G01R 27/12 using hand generators, e.g. meggers
- G01R 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)
- G01R 27/16 . . Measuring impedance of element or network through which a current is passing from another source, e.g. cable, power line
- G01R 27/18 . . . Measuring resistance to earth, { [i.e. line to ground](#) }
- G01R 27/20 . . Measuring earth resistance; Measuring contact resistance, { [e.g.](#) } of earth connections, e.g. plates
- G01R 27/205 . . . { [Measuring contact resistance of connections, e.g. of earth connections](#) }
- G01R 27/22 . . Measuring resistance of fluids ([measuring vessels, electrodes therefor G01N 27/07](#))
- G01R 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](#) }
- G01R 27/2605 . . . { [Measuring capacitance \(capacitive sensors G01D 5/24 \)](#) }
- G01R 27/2611 . . . { [Measuring inductance](#) }
- G01R 27/2617 . . . { [Measuring dielectric properties, e.g. constants \(testing dielectric strength G01R 31/12 ; detecting insulation faults G01R 31/025 ; G01R 27/2688 takes precedence \)](#) }

- G01R 27/2623 { Measuring-systems or electronic circuits ([G01R 27/2635](#) , [G01R 27/2682](#) take precedence) }
- G01R 27/2629 { Bridge circuits (bridges for measuring loss angle [G01R 27/2694](#)) }
- G01R 27/2635 { Sample holders, electrodes or excitation arrangements, e.g. sensors or measuring cells }
- G01R 27/2641 { of plate type, i.e. with the sample sandwiched in the middle }
- G01R 27/2647 { of coaxial or concentric type, e.g. with the sample in a coaxial line }
- G01R 27/2652 { open-ended type, e.g. abutting against the sample }
- G01R 27/2658 { Cavities, resonators, free space arrangements, reflexion or interference arrangements ([G01R 27/2647](#) takes precedence; optical methods [G01R 27/2682](#)) }
- G01R 27/2664 { Transmission line, wave guide (closed or open-ended) or strip - or microstrip line arrangements }
- G01R 27/267 { Coils or antennae arrangements, e.g. coils surrounding the sample or transmitter/receiver antennae }
- G01R 27/2676 { Probes }
- G01R 27/2682 { using optical methods or electron beams }
- G01R 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](#)) }
- G01R 27/2694 { Measuring dielectric loss, e.g. loss angle, loss factor or power factor }
- G01R 27/28 . . Measuring attenuation, gain, phase shift or derived characteristics of electric four pole networks, i.e. two-port networks { using network analysers } Measuring transient response (in line transmission systems [H04B 3/46](#))
- G01R 27/30 . . with provision for recording characteristics, e.g. by plotting Nyquist diagram
- G01R 27/32 . . in circuits having distributed constants, { e.g. having very long conductors or involving high frequencies }

G01R 29/00 Arrangements for measuring or indicating electric quantities not covered by groups [G01R 19/00](#) to [G01R 27/00](#)

- G01R 29/02 . . Measuring characteristics of individual pulses, e.g. deviation from pulse flatness, rise time, duration (of amplitude [G01R 19/00](#) ; of repetition rate [G01R 23/00](#) ; of phase difference of two cyclic pulse trains [G01R 25/00](#) ; monitoring pattern of pulse trains [H03K 5/19](#))
- G01R 29/023 . . { Measuring pulse width }

WARNING

This group is incomplete pending a reorganisation. See also [G01R 29/02](#) and [G01R 29/027 C](#)

- G01R 29/027 . . Indicating that a pulse characteristic is either above or below a predetermined value or within or beyond a predetermined range of values
- G01R 29/0273 . . . { the pulse characteristic being duration i.e. width (indicating that frequency of pulses is above or below a certain limit) }
- G01R 29/0276 . . . { the pulse characteristic being rise time (measuring rate of change [G01R 19/12](#)) }
- G01R 29/033 . . . giving an indication of the number of times this occurs, { i.e. multi-channel

analysers (the characteristic being frequency)}

- G01R 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
- G01R 29/06 . Measuring depth of modulation
- G01R 29/08 . Measuring electromagnetic field characteristics { measuring electrostatic fields [G01R 29/12](#) ; for determining a voltage [G01R 15/14](#) ; measuring magnetic fields [G01R 33/00](#) ; Receiver signal strength indication (RSSI) [H04B 17/0042](#) }
- G01R 29/0807 . . { characterised by the application (not used, see subgroups)}
- G01R 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 }
- G01R 29/0821 { rooms and test sites therefor, e.g. anechoic chambers, open field sites or TEM cells (for testing antennas [G01R 29/105](#))}
- G01R 29/0828 { TEM-cells }
- G01R 29/0835 { Testing shielding, e.g. for efficiency }
- G01R 29/0842 { Measurements related to lightning, e.g. measuring electric disturbances, warning systems }
- G01R 29/085 { for detecting presence or location of electric lines or cables (fault detection [G01R 31/02](#) ; fault location [G01R 31/08](#))}
- G01R 29/0857 { Dosimetry, i.e. measuring the time integral of radiation intensity; Level warning devices for personal safety use (Nuclear radiation dosimetry [G01T](#))}
- G01R 29/0864 . . { characterised by constructional or functional features (not used, see subgroups)}
- G01R 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](#))}
- G01R 29/0878 . . . { Sensors; antennas; probes; detectors (Wave guide measuring sections [G01R 1/24](#))}
- G01R 29/0885 { using optical probes, e.g. electro-optical, luminiscent, glow discharge, or optical interferometers }
- G01R 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 }
- G01R 29/10 . . Radiation diagrams of aerials; { Antenna testing in general }
- G01R 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](#))}
- G01R 29/12 . Measuring electrostatic fields { or voltage-potential }
- G01R 29/14 . . Measuring field distribution
- G01R 29/16 . Measuring asymmetry of polyphase networks
- G01R 29/18 . Indicating phase sequence; Indicating synchronism
- G01R 29/20 . Measuring number of turns; Measuring transformation ratio or coupling factor of

- windings ({ testing or } calibrating instrument transformers [G01R 35/02](#))
- G01R 29/22 . Measuring piezo-electric properties
- G01R 29/24 . Arrangements for measuring quantities of charge (electrostatic instruments [G01R 5/28](#) ; indicating presence of current [G01R 19/15](#) ; electrolytic meters, calorimetric meters, for measuring time integral of electric current [G01R 22/02](#) , [G01R 22/04](#))
- G01R 29/26 . Measuring noise figure; Measuring signal-to-noise ratio { Measuring jitter, i.e. phase noise, (distortion [G01R 23/20](#) ; noise measuring in individual transistors [G01R 31/2616](#) , [G01R 31/2626](#)) }
- G01R 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 leads, measuring probes [G01R 1/06](#) ; { measuring superconductive properties [G01R 33/1238](#) ; data processing equipment for testing or function monitoring [G06F 15/20B](#) } ; indicating electrical condition of switchgear or protective devices [H01H 71/04](#) , [H01H 73/12](#) , [H02B 11/10](#) , [H02H 3/04](#) ; testing or measuring semiconductors or solid state devices during manufacture [H01L 22/00](#) ; testing substation equipment, e.g. mobile phones [H04M 1/24](#) ; testing or monitoring of control systems [G05B 23/02](#) ; { testing or monitoring transmitters or receivers [H04B 17/00](#) })
- G01R 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](#)) }
- G01R 31/002 . . { where the device under test is an electronic circuit }
- G01R 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](#)) }
- G01R 31/005 . { Testing of electric installations on transport means }
- G01R 31/006 . . { on road vehicles, e.g. automobiles or trucks (testing of ignition installations peculiar to internal combustion engines [F02P 17/00](#)) }
- G01R 31/007 . . . { using microprocessors or computers }
- G01R 31/008 . . { on air- or spacecraft, railway rolling stock or sea-going vessels }
- G01R 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 ([G01R 31/18](#) takes precedence; { for testing batteries [G01R 31/36](#) })
- G01R 31/013 . . { Testing passive components (relays [G01R 31/3278](#) ; electrical windings, e.g. inductors [G01R 31/06](#)) }
- G01R 31/016 . . . { Testing of capacitors (measuring capacitance [G01R 27/2605](#)) }
- G01R 31/02 . Testing of electric apparatus, lines or components, for short-circuits, discontinuities, leakage { of current }, or incorrect line connection ({ [G01R 31/001](#) , [G01R 31/005](#) , [G01R 31/01](#) , [G01R 31/08](#) , [G01R 31/12](#) , [G01R 31/24](#) , [G01R 31/26](#) , [G01R 31/28](#) , [G01R 31/327](#) , [G01R 31/34](#) , [G01R 31/36](#) , [G01R 31/40](#) , [G01R 31/44](#) take precedence; measuring electromagnetic field leakage [G01R 29/0821](#) ; testing of sparking plugs [H01T 13/58](#) })
- G01R 31/021 . . { Testing of cables or conductors (testing of electric windings [G01R 31/06](#) ; testing

- of insulation of cables [G01R 31/1272](#) ; testing LANs [H04L 12/2697](#) ; testing line transmission systems [H04B 3/46](#))}
- G01R 31/022 . . . { Testing while the cable or conductor passes continuously the testing apparatus, e.g. during manufacturing }
- G01R 31/023 . . . { Identification of wires in a multicore cable }
- G01R 31/024 . . { Arrangements for indicating continuity or short-circuits in electric apparatus or lines, leakage or ground faults (in electric windings [G01R 31/06](#) ; measuring resistance to earth [G01R 27/18](#))}
- G01R 31/025 . . . { Testing short circuits, leakage or ground faults (detecting failure within the drive train of electrically-propelled vehicles [B60L 3/0023](#))}
- G01R 31/026 . . . { Testing continuity ([G01R 31/44](#) takes precedence)}
- G01R 31/027 . . { Testing of transformers (testing of electric windings [G01R 31/06](#))}
- G01R 31/028 . . { Testing of capacitors }
- G01R 31/04 . . Testing connections, e.g. of plugs, of non-disconnectable joints {([G01R 31/31717](#) takes precedence; testing of connections in integrated circuits, chip-to-lead connections, bond wires [G01R 31/2853](#))}
- G01R 31/041 . . . { Testing of correct wire connections in electrical apparatus and circuits (details concerning insertion or connection of batteries [H02J 7/0045](#))}
- G01R 31/043 . . . { of releaseable connections, e.g. terminals mounted on a printed circuit board }
- G01R 31/045 { of plugs, sockets or terminals at the end of a cable or a wire harness; of wall sockets; of power sockets in appliances }
- G01R 31/046 . . . { of connections between components and printed circuit boards (PCB`s) ([G01R 31/043](#) takes precedence)}
- G01R 31/048 { Details concerning testing solder joints }
- G01R 31/06 . . Testing of electric windings { e.g. of solenoids, inductors }, e.g. for polarity { [G01R 31/027](#) and [G01R 31/346](#) take precedence } (measuring number of turns, transformation ratio, or coupling factor [G01R 29/20](#) ; { monitoring or fail-safe circuits for electromagnets [H01F 7/1844](#) })}
- G01R 31/07 . . Testing of fuses (means for indicating condition of fuse structurally associated with the fuse [H01H 85/30](#))}
- G01R 31/08 . Locating faults in cables, transmission lines, or networks (emergency protective circuit arrangements [H02H](#)) { installing, maintaining, repairing or dismantling electric cables or lines [H02G 1/00](#) ;testing LAN`s [H04L 12/2697](#) }
- G01R 31/081 . . { according to type of conductors }
- G01R 31/083 . . . { in cables, e.g. underground }
- G01R 31/085 . . . { in power transmission or distribution lines, e.g. overhead }
- G01R 31/086 . . . { in power transmission or distribution networks, i.e. with interconnected conductors }
- G01R 31/088 . . { Aspects of digital computing }
- G01R 31/10 . . by increasing destruction at fault, e.g. burning-in by using a pulse generator operating a special programme
- G01R 31/11 . . using pulse reflection methods
- G01R 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 31/06](#) , [G01R 31/08](#) and [G01R 31/327](#) take precedence; measuring in plasmas [G01R 19/0061](#) ; Measuring dielectric constants [G01R 27/2617](#) ; ESD, EMC or EMP testing of circuits [G01R 31/002](#))}

- G01R 31/1209 .. { using acoustic measurements ([acoustic measurements G01H 3/00](#)) }
- G01R 31/1218 .. { using optical methods; using charged particle, e.g. electron, beams or X-rays }
- G01R 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](#)) }
- G01R 31/1236 ... { of surge arresters ([Monitoring overvoltage diverters or arresters H02H 3/048](#)) }
- G01R 31/1245 ... { of line insulators or spacers, e.g. ceramic overhead line cap insulators; of insulators in HV bushings }
- G01R 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](#)) }
- G01R 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 }
- G01R 31/1272 { of cable, line or wire insulation, e.g. using partial discharge measurements ([locating faults in cables G01R 31/08B2](#)) }
- G01R 31/1281 { of liquids or gases }
- G01R 31/129 { of components or parts made of semiconducting materials; of LV components or parts ([G01R 31/18](#) takes precedence) }
- G01R 31/14 .. Circuits therefor, { e.g. for generating test voltages, sensing circuits ([G01R 31/1209](#) to [G01R 31/1227](#) take precedence; for testing switches [G01R 31/327](#)) }
- G01R 31/16 .. Construction of testing vessels; Electrodes therefor
- G01R 31/18 .. Subjecting similar articles in turn to test, e.g. go/no-go tests in mass production
- G01R 31/20 .. Preparation of articles or specimens to facilitate testing
- G01R 31/24 . Testing of discharge tubes ([during manufacture H01J 9/42](#))
- G01R 31/245 .. { Testing of gas discharge tubes }
- G01R 31/25 .. Testing of vacuum tubes
- G01R 31/252 ... { Testing of electron multipliers, e.g. photo-multipliers }
- G01R 31/255 ... { Testing of transit-time tubes, e.g. klystrons, magnetrons }
- G01R 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](#)) }
- G01R 31/26 . Testing of individual semiconductor devices ([measurement of impurity content of materials G01N](#))
- G01R 31/2601 .. { Apparatus or methods therefor ([G01R 31/2607](#) , [G01R 31/2642](#) take precedence) }
- G01R 31/2603 ... { for curve tracing of semiconductor characteristics, e.g. on oscilloscope }
- G01R 31/2605 ... { for testing individual solar cells }
- G01R 31/2607 .. { Circuits therefor ([G01R 31/2642](#) takes precedence) }
- G01R 31/2608 ... { for testing bipolar transistors }
- G01R 31/261 { for measuring break-down voltage or punch through voltage therefor }
- G01R 31/2612 { for measuring frequency response characteristics, e.g. cut-off frequency thereof }
- G01R 31/2614 { for measuring gain factor thereof }
- G01R 31/2616 { for measuring noise ([measuring noise factor in general G01R 29/26](#)) }

G01R 31/2617	....	{ for measuring switching properties thereof }
G01R 31/2619	....	{ for measuring thermal properties thereof }
G01R 31/2621	...	{ for testing field effect transistors, i.e. FET's }
G01R 31/2623	....	{ for measuring break-down voltage therefor }
G01R 31/2625	....	{ for measuring gain factor thereof }
G01R 31/2626	....	{ for measuring noise (measuring noise factor in general G01R 29/26) }
G01R 31/2628	....	{ for measuring thermal properties thereof }
G01R 31/263	...	{ for testing thyristors }
G01R 31/2632	...	{ for testing diodes }
G01R 31/2633	....	{ for measuring switching properties thereof }
G01R 31/2635	....	{ Testing light-emitting diodes, laser diodes or photodiodes }
G01R 31/2637	...	{ for testing other individual devices (G01R 31/2608 to G01R 31/2632 , G01R 31/27 take precedence) }
G01R 31/2639	....	{ for testing field-effect devices, e.g. of MOS-capacitors (G01R 31/2621 takes precedence) }
G01R 31/2641	...	{ for testing charge coupled devices }
G01R 31/2642	..	{ Testing semiconductor operation lifetime or reliability, e.g. by accelerated life tests }
G01R 31/2644	..	{ Adaptations of individual semiconductor devices to facilitate the testing thereof }
G01R 31/2646	..	{ for measuring noise (G01R 31/2616 , G01R 31/2626 take precedence) }
G01R 31/2648	..	{ Characterising semiconductor materials (testing of materials or semi-finished products G01R 31/2831 ; testing during manufacture H01L 22/00) }
G01R 31/265	..	Contactless testing {(of circuits, also in wafer-form G01R 31/302) }
G01R 31/2653	...	{ using electron beams }
G01R 31/2656	...	{ using non-ionising electromagnetic radiation, e.g. optical radiation }
G01R 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) }
G01R 31/275	...	{ for testing individual semiconductor components within integrated circuits }
G01R 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 31/02 ; 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) }
G01R 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 31/04) }
G01R 31/2803	...	{ by means of functional tests, e.g. logic-circuit-simulation or algorithms therefor (testing electronic digital computers G06F 11/00) }
G01R 31/2805	...	{ Bare printed circuit boards }
G01R 31/2806	...	{ Apparatus therefor, e.g. test stations, drivers, analysers, conveyers (G01R 31/2805 , G01R 31/281 , G01R 31/2818 take precedence) }
G01R 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) }
G01R 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) }

G01R 31/2812	....	{ Checking for open circuits or shorts, e.g. solder bridges; Testing conductivity, resistivity or impedance (of connections G01R 31/04) }
G01R 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) }
G01R 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 , G06F11) }
G01R 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) }
G01R 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) }
G01R 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 3/00](#) E

- testing of ADCs or DACs [H03M 1/10](#) T

G01R 31/2822	...	{ of microwave or radiofrequency circuits (of attenuation, gain, e.g. using network analyzers G01R 27/28) }
G01R 31/2824	....	{ testing of oscillators or resonators }
G01R 31/2825	...	{ in household appliances or professional audio/video equipment (testing loudspeakers H04R 29/00 , testing LAN's H04L 12/2697 ; testing TV systems H04N 17/00) }
G01R 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) }
G01R 31/2829	...	N: 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) }
G01R 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) }
G01R 31/2832	..	{ Specific tests of electronic circuits not provided for elsewhere (contains no documents; G01R 31/2801 and G01R 31/316 take precedence) }
G01R 31/2834	...	{ Automated test systems (ATE); using microprocessors or computers (G01R 31/317 takes precedence; ATE for detection of defective computer hardware G06F 11/273A ; special purpose computers for testing G06F 15/20B) }
G01R 31/2836	...	{ Fault-finding or characterising (G01R 31/2822 to G01R 31/2831 take precedence) }

G01R 31/2837	....	{ Characterising or performance testing, e.g. of frequency response (transient response G01R 27/28) }
G01R 31/2839	....	{ using signal generators, power supplies or circuit analysers (G01R 31/2879 takes precedence ; multimeters G01R 15/12 , network analysers G01R 27/28) }
G01R 31/2841	.....	{ Signal generators }
G01R 31/2843	....	{ In-circuit-testing }
G01R 31/2844	....	{ using test interfaces, e.g. adapters, test boxes, switches, PIN drivers (G01R 31/2889 takes precedence) }
G01R 31/2846	....	{ using hard- or software simulation or using knowledge-based systems, e.g. expert systems, artificial intelligence or interactive algorithms }
G01R 31/2848	.....	{ using simulation }
G01R 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) }
G01R 31/2851	..	{ Testing of integrated circuits (IC) (G01R 31/317 takes precedence ; testing individual devices G01R 31/26 ; testing printed circuits G01R 31/2801) }
G01R 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 31/04) }
G01R 31/2855	...	{ Environmental, reliability or burn-in testing }
G01R 31/2856	....	{ Internal circuit aspects, e.g. built-in test features; Test chips; Measuring material aspects, e.g. electro migration (EM) }
G01R 31/2858	.....	{ Measuring of material aspects, e.g. electro-migration (EM), hot carrier injection }
G01R 31/286	....	{ External aspects, e.g. related to chambers, contacting devices or handlers }
G01R 31/2862	.....	{ Chambers or ovens; Tanks }
G01R 31/2863	.....	{ Contacting devices, e.g. sockets, burn-in boards or mounting fixtures (in general G01R 1/04) }
G01R 31/2865	.....	{ Holding devices, e.g. chucks; Handlers or transport devices (having contacts G01R 31/2863) }
G01R 31/2867	.....	{ Handlers or transport devices, e.g. loaders, carriers, trays }
G01R 31/2868	.....	{ Complete testing stations; systems; procedures; software aspects }
G01R 31/287	.....	{ Procedures; Software aspects }
G01R 31/2872	....	{ related to electrical or environmental aspects, e.g. temperature, humidity, vibration, nuclear radiation }
G01R 31/2874	.....	{ related to temperature }
G01R 31/2875	.....	{ related to heating }
G01R 31/2877	.....	{ related to cooling }
G01R 31/2879	.....	{ related to electrical aspects, e.g. to voltage or current supply or stimuli or to electrical loads }
G01R 31/2881	.....	{ related to environmental aspects other than temperature, e.g. humidity or vibrations }
G01R 31/2882	...	{ Testing timing characteristics }
G01R 31/2884	...	{ using dedicated test connectors, test elements or test circuits on the IC under test (G01R 31/2855 takes precedence) }

G01R 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) }
G01R 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) }
G01R 31/2889	....	{ Interfaces, e.g. between probe and tester (G01R 31/31905 and G01R 1/07364 take precedence) }
G01R 31/2891	....	{ related to sensing or controlling of force, position, temperature (G01R 31/2874 takes precedences; sensing of force G01L ; sensing of position G01B , G01D ; sensing of temperature G01K ; controlling in general G05) }
G01R 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) }
G01R 31/2894	...	{ Aspects of quality control (QC) (G01R 31/31718 takes precedence; program control for QC G05B 19/41875) }
G01R 31/2896	...	{ Testing of IC packages; Test features related to IC packages (containers per se H01L 23/02 , encapsulations per se H01L 23/28) }
G01R 31/2898	...	{ Sample preparation, e.g. removing encapsulation, etching (sample preparation in general G01N 1/00) }
G01R 31/30	..	Marginal testing, e.g. varying supply voltage (marginal testing of computers G06)
G01R 31/3004	...	{ Current or voltage test }
G01R 31/3008	....	{ Quiescent current [IDDQ] test or leakage current test }
G01R 31/3012	....	{ Built-In-Current test (BIC) }
G01R 31/3016	...	{ Delay or race condition test, e.g. race hazard test }
G01R 31/302	..	Contactless testing (non contact-making probes G01R 1/07) {(G01R 31/04 takes precedence) }
G01R 31/3025	...	{ Wireless interface with the DUT }
G01R 31/303	...	of integrated circuits (G01R 31/305 to G01R 31/315 take precedence)
G01R 31/304	...	of printed or hybrid circuits (G01R 31/305 to G01R 31/315 take precedence)
G01R 31/305	...	using electron beams {(investigating or analysing materials by measuring photoelectric effect G01N 23/227) }
G01R 31/306	....	of printed or hybrid circuits
G01R 31/307	....	of integrated circuits
G01R 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) }
G01R 31/309	....	of printed or hybrid circuits { or circuit substrates }
G01R 31/311	....	of integrated circuits {(G01R 31/31728 takes precedence) }
G01R 31/312	...	by capacitive methods
G01R 31/315	...	by inductive methods
G01R 31/316	..	Testing of analog circuits {(G01R 31/2851 takes precedence) }
G01R 31/3161	...	Marginal testing
G01R 31/3163	...	Functional testing
G01R 31/3167	..	Testing of combined analog and digital circuits {(testing ADC's H03M 1/1071) }
G01R 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 ,

		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 }
G01R 31/31701	...	{ Arrangements for setting the Unit Under Test (UUT) in a test mode }
G01R 31/31702	...	{ Testing digital circuits including elements other than semiconductor transistors, e.g. biochips, nano-fabrics, mems, chips with magnetic elements }
G01R 31/31703	...	{ Comparison aspects, e.g. signature analysis, comparators (concerning scan tests G01R 31/318566 ; concerning testers G01R 31/3193) }
G01R 31/31704	...	{ Design for test; Design verification (concerning scan tests G01R 31/318583 ; computer-aided design G06F 17/50) }
G01R 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) }
G01R 31/31706	...	{ involving differential digital signals, e.g. testing differential signal circuits, using differential signals for testing }
G01R 31/31707	...	{ Test strategies (methods for generation of test sequences G01R 31/318371) }
G01R 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) }
G01R 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) }
G01R 31/3171	....	{ BER (Bit Error Rate) test }
G01R 31/31711	....	{ Evaluation methods, e.g. shmoo plots }
G01R 31/31712	...	{ Input or output aspects }
G01R 31/31713	....	{ Input or output interfaces for test, e.g. test pins, buffers (for scan test G01R 31/318572) }
G01R 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 }
G01R 31/31716	....	{ Testing of input or output with loop-back }
G01R 31/31717	....	{ Interconnect testing (by scan techniques see G01R 31/3185S3L) }
G01R 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) }
G01R 31/31719	...	{ Security aspects, e.g. preventing unauthorised access during test }
G01R 31/3172	...	{ Optimisation aspects, e.g. using functional pin as test pin, pin multiplexing }
G01R 31/31721	...	{ Power aspects, e.g. power supplies for test circuits, power saving during test (for scan test G01R 31/318575) }
G01R 31/31722	...	{ Addressing or selecting of test units, e.g. transmission protocols for selecting test units (for scan test G01R 31/318558) }
G01R 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) }
G01R 31/31724	...	{ Test controller, e.g. BIST state machine (for scan test G01R 31/318555) }
G01R 31/31725	...	{ Timing aspects, e.g. clock distribution, skew, propagation delay (for tester hardware G01R 31/31937) }
G01R 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 }
G01R 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) }
G01R 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) }
G01R 31/3173	...	Marginal testing
G01R 31/3177	...	Testing of logic operation, e.g. by logic analysers
G01R 31/3181	...	Functional testing (G01R 31/3177 takes precedence)
G01R 31/31813	....	{ Test pattern generators }
G01R 31/31816	....	{ Soft error testing; Soft error rate evaluation; Single event testing }
G01R 31/3183	....	Generation of test inputs, e.g. test vectors, patterns or sequence
G01R 31/318307	.....	{ computer-aided, e.g. automatic test program generator (ATPG), program translations, test program debugging }
G01R 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 11/26S2) }
G01R 31/318321	.....	{ for combinational circuits }
G01R 31/318328	.....	{ for delay tests }
G01R 31/318335	.....	{ Test pattern compression or decompression (compression or decompression of scan patterns G01R 31/318547 ; compression or decompression hardware G01R 31/31921) }
G01R 31/318342	.....	{ by preliminary fault modelling, e.g. analysis, simulation }
G01R 31/31835	.....	{ Analysis of test coverage or failure detectability }
G01R 31/318357	.....	{ Simulation (computer simulation of digital circuits G06F 17/5009) }
G01R 31/318364	.....	{ as a result of hardware simulation, e.g. in an HDL environment (computer-aided simulation of circuits G06F 17/5009) }
G01R 31/318371	.....	{ Methodologies therefor, e.g. algorithms, procedures }
G01R 31/318378	.....	{ of patterns for devices arranged in a network }
G01R 31/318385	.....	{ Random or pseudo-random test pattern }
G01R 31/318392	.....	{ for sequential circuits (G01R 31/318544 takes precedence) }
G01R 31/3185	....	Reconfiguring for testing, e.g. LSSD, partitioning
G01R 31/318502	.....	{ Test of Combinational circuits }
G01R 31/318505	.....	{ Test of Modular systems, e.g. Wafers, MCM's }
G01R 31/318508	.....	{ Board Level Test, e.g. P1500 Standard (features related to boundary scan G01R 31/318533) }
G01R 31/318511	.....	{ Wafer Test }
G01R 31/318513	.....	{ Test of Multi-Chip-Moduls }
G01R 31/318516	.....	{ Test of programmable logic devices [PLDs] }
G01R 31/318519	.....	{ Test of field programmable gate arrays (FPGA) }
G01R 31/318522	.....	{ Test of Sequential circuits (test of microprocessors G06F 11/267P , test of ALU's G06F 11/267H) }
G01R 31/318525	.....	{ Test of flip-flops or latches }

G01R 31/318527	.....	{ Test of counters }
G01R 31/31853	.....	{ Test of registers }
G01R 31/318533	.....	{ using scanning techniques, e.g. LSSD, Boundary Scan, JTAG }
G01R 31/318536	.....	{ Scan chain arrangements, e.g. connections, test bus, analog signals }
G01R 31/318538	.....	{ Topological or mechanical aspects }
G01R 31/318541	.....	{ Scan latches or cell details }
G01R 31/318544	.....	{ Scanning methods, algorithms and patterns (G01R 31/3183 takes precedence) }
G01R 31/318547	.....	{ Data generators or compressors }
G01R 31/31855	.....	{ Interconnection testing, e.g. crosstalk, shortcircuits }
G01R 31/318552	.....	{ Clock circuits details }
G01R 31/318555	.....	{ Control logic }
G01R 31/318558	.....	{ Addressing or selecting of subparts of the device under test }
G01R 31/318561	.....	{ Identification of the subpart }
G01R 31/318563	.....	{ Multiple simultaneous testing of subparts }
G01R 31/318566	.....	{ Comparators; Diagnosing the device under test }
G01R 31/318569	.....	{ Error indication, logging circuits }
G01R 31/318572	.....	{ Input/Output interfaces }
G01R 31/318575	.....	{ Power distribution; Power saving }
G01R 31/318577	.....	{ AC testing, e.g. current testing, burn-in }
G01R 31/31858	.....	{ Delay testing }
G01R 31/318583	.....	{ Design for test }
G01R 31/318586	.....	{ with partial scan or non-scannable parts }
G01R 31/318588	.....	{ Security aspects }
G01R 31/318591	.....	{ Tools }
G01R 31/318594	.....	{ Timing aspects (clock circuits G01R 31/318552) }
G01R 31/318597	.....	{ JTAG or boundary scan test of memory devices (other scan testing of memories G11C 29/32) }
G01R 31/3187	....	Built-in tests
G01R 31/319	....	Tester hardware, i.e. output processing circuit ((logic analyzers G01R 31/3177 , Memory tester hardware G11C 29/56)) }
G01R 31/31901	.....	{ Analysis of tester Performance; Tester characterization }
G01R 31/31903	.....	{ tester configuration }
G01R 31/31905	.....	{ Interface with the device under test (DUT), e.g. arrangements between the test head and the DUT, mechanical aspects, fixture }
G01R 31/31907	.....	{ Modular tester, e.g. controlling and coordinating instruments in a bus based architecture }
G01R 31/31908	.....	{ Tester set-up, e.g. configuring the tester to the device under test (DUT), down loading test patterns }
G01R 31/3191	.....	{ Calibration }
G01R 31/31912	.....	{ Tester/user interface }
G01R 31/31914	.....	{ Portable Testers }
G01R 31/31915	.....	{ In-circuit Testers }

G01R 31/31917	.....	{ Stimuli generation or application of test patterns to the device under test (DUT) }
G01R 31/31919	.....	{ Storing and outputting test patterns (G01R 31/31924 takes precedence; arithmetic and random test patterns generator G06F 11/273G) }
G01R 31/31921	.....	{ using compression techniques, e.g. patterns sequencer }
G01R 31/31922	.....	{ Timing generation or clock distribution (G01R 31/3191 takes precedence) }
G01R 31/31924	.....	{ Voltage or current aspects, e.g. driver, receiver }
G01R 31/31926	.....	{ Routing signals to or from the device under test (DUT), e.g. switch matrix, pin multiplexing }
G01R 31/31928	.....	{ Formatter (driver, receiver details G01R 31/31924) }
G01R 31/3193	.....	with comparison between actual response and known fault free response { (receiver details G01R 31/31924) }
G01R 31/31932	.....	{ Comparators }
G01R 31/31935	.....	{ Storing data, e.g. failure memory }
G01R 31/31937	.....	{ Timing aspects, e.g. measuring propagation delay (G01R 31/3191 and G01R 31/31922 take precedence; marginal testing G06F 11/24) }
G01R 31/327	.	Testing of circuit interrupters, switches or circuit-breakers (structural association with switches H01H ; { detecting faults in encased switchgear H02B 13/065 ; monitoring in addition to disconnection by a protective circuit H02H 3/04 })
G01R 31/3271	..	{ of high voltage or medium voltage devices (G01R 31/333 takes precedence) }
G01R 31/3272	...	{ Apparatus, systems or circuits therefor (G01R 31/3275 takes precedence) }
G01R 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) }
G01R 31/3275	...	{ Fault detection or status indication }
G01R 31/3277	..	{ of low voltage devices, e.g. domestic or industrial devices, such as motor protections, relays, rotation switches }
G01R 31/3278	...	{ of relays, solenoids or reed switches (measuring contact resistance G01R 27/205 ; testing electric windings G01R 31/06 ; high voltage magnetic switches G01R 31/3271 , G01R 31/333 ; monitoring of fail safe circuits H01H 47/002) }
G01R 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 } (means for detecting the presence of an arc or discharge in switching devices H01H 9/50 , H01H 33/26)
G01R 31/3333	...	{ Apparatus, systems or circuits therefor }
G01R 31/3336	....	{ Synthetic testing, i.e. with separate current and voltage generators simulating distance fault conditions }
G01R 31/34	.	Testing dynamo-electric machines (testing electric windings G01R 31/06 methods or apparatus specially adapted for manufacturing, assembling, maintaining or repairing dynamo-electric machines H02K 15/00) { testing of armature or field winding of dynamo-electric machines G01R 31/06B }
G01R 31/343	..	{ in operation }
G01R 31/346	..	{ Testing of armature or field windings }
G01R 31/36	.	Apparatus for testing electrical condition of accumulators or electric batteries, e.g. capacity or charge condition (accumulators combined with arrangements for

measuring, testing or indicating condition [H01M 10/48](#) ; circuit arrangements for charging, or depolarising batteries or for supplying loads from batteries [H02J 7/00](#) ; { Coulomb meters [G01R 22/00](#) ; indicating the condition of the power supply in clocks or watches [G04C 10/04](#) ; methods for controlling fuel cells [H01M 8/04298](#))}

NOTE

This group covers arrangements for measuring, testing or indicating electrical conditions or variables of accumulators or electric batteries. Accumulators combined with arrangements for measuring, testing or indicating condition, or arrangements for measuring, testing or indicating conditions or variables other than electrical, e.g. level or density of battery electrolyte, are covered by the group [H01M 10/48](#) and subgroups

- G01R 31/3606 . . { Monitoring, i.e. measuring or determining some variables continuously or repeatedly over time, e.g. current, voltage, temperature, state-of-charge [SoC] or state-of-health [SoH] ([G01R 31/3627](#) , [G01R 31/3644](#) take precedence)}
- G01R 31/361 . . . { using current integration }
- G01R 31/3613 { without voltage measurement }
- G01R 31/3617 { using analog integrators, e.g. coulomb-meters }
- G01R 31/362 . . . { based on measuring voltage only (by comparing voltage with a reference value [G01R 19/16542](#))}
- G01R 31/3624 . . . { based on combined voltage and current measurement ([G01R 31/361](#) takes precedence)}
- G01R 31/3627 . . { Testing, i.e. making a one-time determination of some variables, e.g. testing ampere-hour charge capacity ([G01R 31/3644](#) takes precedence)}
- G01R 31/3631 . . . { based on the use of test loads }
- G01R 31/3634 . . . { for determining the ampere-hour charge capacity or state-of-charge (SoC) ([G01R 31/3631](#) takes precedence)}
- G01R 31/3637 { based on voltage measurements }
- G01R 31/3641 . . . { related to manufacture, e.g. testing after manufacture }
- G01R 31/3644 . . { Various constructional arrangements }
- G01R 31/3648 . . . { comprising digital calculation means, e.g. for performing an algorithm }
- G01R 31/3651 { Software aspects, e.g. battery modeling, using look-up tables, neural networks }
- G01R 31/3655 { the digital calculation means being combined with the battery or battery pack }
- G01R 31/3658 . . . { for testing or monitoring individual cells or groups of cells in a battery }
- G01R 31/3662 . . . { involving measuring the internal battery impedance, conductance or related variables }
- G01R 31/3665 . . . { whereby the type of battery is of primary emphasis, e.g. determining the type of battery }
- G01R 31/3668 { Lead-acid batteries }
- G01R 31/3672 { Primary cells, i.e. not rechargeable }
- G01R 31/3675 . . . { for compensating for temperature or ageing }
- G01R 31/3679 . . . { for determining battery ageing or deterioration, e.g. state-of-health (SoH), state-of-life (SoL) }
- G01R 31/3682 . . . { for indicating electrical conditions or variables, e.g. visual or audible indicators }

- G01R 31/3686 { the indicator being combined with the battery }
- G01R 31/3689 { the indication being remote from the battery }
- G01R 31/3693 . . . { for determining the ability of a battery to perform a critical function, e.g. cranking }
- G01R 31/3696 . . . { Battery pole connectors combined with measurement function (end pieces for connections to batteries [H01R 11/281](#)) }
- G01R 31/40 . . Testing power supplies {(comparing current or voltage with a reference level in AC or DC supplies [G01R 19/16538](#)) }
- G01R 31/405 . . { Electrical testing of electrical aspects of solar panel power supplies (of individual solar cells [G01R 31/2605](#)) }
- G01R 31/42 . . AC power supplies {([G01R 31/405](#) takes precedence) }
- G01R 31/44 . . Testing lamps (discharge lamps [G01R 31/24](#) ; structurally associated with light source circuit arrangements for detecting lamp failure [H05B 37/03](#))

G01R 33/00 Arrangements or instruments for measuring magnetic variables

- G01R 33/0005 . . { Geometrical arrangement of magnetic sensor elements; Apparatus combining different magnetic sensor types ([G01R 33/0206](#) takes precedence) }
- G01R 33/0011 . . { comprising means, e.g. flux concentrators, flux guides, for guiding or concentrating the magnetic flux, e.g. to the magnetic sensor }
- G01R 33/0017 . . { Means for compensating offset magnetic fields or the magnetic flux to be measured; Means for generating calibration magnetic fields }
- G01R 33/0023 . . { Electronic aspects, e.g. circuits for stimulation, evaluation, control; Treating the measured signals; calibration ([G01R 33/0017](#) takes precedence) }
- G01R 33/0029 . . { Treating the measured signals, e.g. removing offset or noise }
- G01R 33/0035 . . { Calibration of single magnetic sensors, e.g. integrated calibration }
- G01R 33/0041 . . { using feed-back or modulation techniques }
- G01R 33/0047 . . { Housings or packaging of magnetic sensors (packaging of semiconductor devices [H01L 23/00](#)); Holders }
- G01R 33/0052 . . { Manufacturing aspects; Manufacturing of single devices, i.e. of semiconductor magnetic sensor chips (devices based on galvano-magnetic effect or the like [H01L 43/12](#)) }
- G01R 33/0058 . . using bistable elements, e.g. Reed switches
- G01R 33/0064 . . { comprising means for performing simulations, e.g. of the magnetic variable to be measured }
- G01R 33/007 . . { Environmental aspects, e.g. temperature variations, radiation, stray fields ([G01R 33/025](#) takes precedence) }
- G01R 33/0076 . . { Protection, e.g. with housings against stray fields }
- G01R 33/0082 . . { Compensation, e.g. compensating for temperature changes }
- G01R 33/0088 . . { use of bistable or switching devices, e.g. Reed-switches }

- G01R 33/0094 . { Sensor arrays }
- G01R 33/02 . Measuring direction or magnitude of magnetic fields or magnetic flux ([G01R 33/20](#) takes precedence ; measuring direction or magnitude of the earth's field for navigation or surveying [G01C](#) ; for prospecting, for measuring the magnetic field of the earth [G01V 3/00](#))

NOTE

Groups [G01R 33/022](#) , [G01R 33/10](#) take precedence over groups [G01R 33/025](#) to [G01R 33/09](#) .

- G01R 33/0206 .. { Three-component magnetometers }
- G01R 33/0213 .. { using deviation of charged particles by the magnetic field }
- G01R 33/022 .. Measuring gradient
- G01R 33/025 .. Compensating stray fields { (compensating compasses [G01C 17/38](#)) ([G01R 33/0017](#) takes precedence) }
- G01R 33/028 .. Electrodynamic magnetometers
- G01R 33/0283 ... { in which a current or voltage is generated due to relative movement of conductor and magnetic field }
- G01R 33/0286 ... { comprising micro-electromechanical systems [MEMS] (MEMS devices in general [B81B](#)) }
- G01R 33/032 .. using magneto-optic devices, e.g. Faraday, { Cotton-Mouton effect (magneto-optics in general [G02F 1/09](#)) }
- G01R 33/0322 ... { using the Faraday or Voigt effect }
- G01R 33/0325 ... { using the Kerr effect }
- G01R 33/0327 ... { with application of magnetostriction }
- G01R 33/035 .. using superconductive devices { (manufacture of superconducting elements [H01L 39/00](#)) }
- G01R 33/0352 ... { Superconductive magneto-resistances }
- G01R 33/0354 ... { SQUIDS }
- G01R 33/0356 { with flux feedback }
- G01R 33/0358 { coupling the flux to the SQUID (gradiometer coils [G01R 33/022](#) ; coils with superconductive winding [H01F 6/06](#)) }
- G01R 33/038 .. using permanent magnets, e.g. balances, torsion devices { electro-dynamic magnetometers [G01R 33/028](#) }
- G01R 33/0385 ... { in relation with magnetic force measurements (magnetic force microscopes [G01Q 60/50](#)) }
- G01R 33/04 .. using the flux-gate principle
- G01R 33/045 ... { in single-, or multi-aperture elements }
- G01R 33/05 ... in thin-film element
- G01R 33/06 .. using galvano-magnetic devices, e.g. Hall effect devices; using magneto-resistive devices { (manufacture of galvano-magnetic elements [H01L 43/00](#)) }
- G01R 33/063 ... { Magneto-impedance sensors; Nanocrystalline sensors }
- G01R 33/066 ... { field-effect magnetic sensors, e.g. magnetic transistor }
- G01R 33/07 ... Hall effect devices
- G01R 33/072 { Constructional adaptation of the sensor to specific applications }

- G01R 33/075 { Hall devices configured for spinning current measurements }
- G01R 33/077 { Vertical Hall-effect devices }
- G01R 33/09 ... Magnetoresistive devices
- G01R 33/091 { Constructional adaptation of the sensor to specific applications }
- G01R 33/093 { using multilayer structures, e.g. giant magnetoresistance sensors (thin magnetic films [H01F 10/00](#)) }
- G01R 33/095 { extraordinary magnetoresistance sensors }
- G01R 33/096 { anisotropic magnetoresistance sensors }
- G01R 33/098 { comprising tunnel junctions, e.g. tunnel magnetoresistance sensors }
- G01R 33/10 .. Plotting field distribution; { Measuring field distribution }

- G01R 33/12 . Measuring magnetic properties of articles or specimens of solids or fluids (involving magnetic resonance [G01R 33/20](#)) { using magnetic-optic devices [G01R 33/032](#) }
- G01R 33/1207 .. { Testing individual magnetic storage devices e.g. records carriers or digital storage elements (functional testing [G06F 11/00](#) , [G06F 11/28](#)) }
- G01R 33/1215 .. { Measuring magnetisation; Particular magnetometers therefor ([G01R 33/14](#) takes precedence; electrodynamic magnetometers [G01R 33/028](#)) }
- G01R 33/1223 .. { Measuring permeability, i.e. permeameters ([G01R 33/14](#) takes precedence) }
- G01R 33/123 .. { Measuring loss due to hysteresis ([G01R 33/14](#) takes precedence) }
- G01R 33/1238 .. { Measuring super-conductive properties }
- G01R 33/1246 ... { Measuring critical current }
- G01R 33/1253 .. { Measuring galvano-magnetic properties }
- G01R 33/1261 .. { using levitation techniques }
- G01R 33/1269 .. { of molecules labeled with magnetic beads (magnetic particles for bio assay [G01N 33/54326](#)) }
- G01R 33/1276 .. { of magnetic particles, e.g. imaging of magnetic nanoparticles ([G01R 33/1269](#) takes precedence) }
- G01R 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](#)) }
- G01R 33/1292 .. { Measuring domain wall position or domain wall motion }
- G01R 33/14 .. Measuring or plotting hysteresis curves { [G01R 33/1207](#) takes precedence }
- G01R 33/16 .. Measuring susceptibility { [G01R 33/1238](#) takes precedence }
- G01R 33/18 .. Measuring magnetostrictive properties

- G01R 33/20 . involving magnetic resonance (medical aspects [A61B 5/055](#) ; magnetic resonance gyrometers [G01C 19/00](#) { investigating materials using NMR [G01N 24/00](#) ; prospecting or detecting using NMR [G01V 3/00](#) })
- G01R 33/24 .. for measuring direction or magnitude of magnetic fields or magnetic flux
- G01R 33/243 ... { Spatial mapping of the polarizing magnetic field }

WARNING

Not complete pending reclassification, see also [G01R 33/44](#)

- G01R 33/246 ... { Spatial mapping of the RF magnetic field B1 }

WARNING

Not complete pending reclassification, see also [G01R 33/44](#)

- G01R 33/26 . . . using optical pumping { optical pumping in general [G01N 24/006](#) }
- G01R 33/28 . . Details of apparatus provided for in groups [G01R 33/44](#) to [G01R 33/64](#)

WARNING

Groups [G01R 33/281](#) - [G01R 33/288](#) are not complete pending reclassification. See also this group

- G01R 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](#)) }
- G01R 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 }
- G01R 33/283 . . . { Intercom or optical viewing arrangements, structurally associated with NMR apparatus }
- G01R 33/285 . . . { Invasive instruments, e.g. catheters or biopsy needles, specially adapted for tracking, guiding or visualization by NMR }
- G01R 33/286 { involving passive visualization of interventional instruments, i.e. making the instrument visible as part of the normal MR process }
- G01R 33/287 { involving active visualization of interventional instruments, e.g. using active tracking RF coils or coils for intentionally creating magnetic field inhomogeneities }
- G01R 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 }
- G01R 33/30 . . . Sample handling arrangements, e.g. sample cells, spinning mechanisms
- G01R 33/302 { Miniaturized sample handling arrangements for sampling small quantities, e.g. flow-through micro-fluidic NMR chips }
- G01R 33/305 { specially adapted for high-pressure applications }
- G01R 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 }[
- G01R 33/31 Temperature control thereof
- G01R 33/32 . . . Excitation or detection systems, e.g. using radio frequency signals
- G01R 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 }

WARNING

Not complete pending reclassification, see also [G01R 33/36](#)

- G01R 33/326 { involving a SQUID }
- G01R 33/34 Constructional details, e.g. resonators, { specially adapted to MR (aerials in general [H01Q](#)) }

G01R 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 }
G01R 33/34015	.....	{ Temperature-controlled RF coils }
G01R 33/34023	.....	{ Superconducting RF coils }
G01R 33/3403	.....	{ Means for cooling of the RF coils, e.g. a refrigerator or a cooling vessel specially adapted for housing an RF coil }
G01R 33/34038	.....	{ Loopless coils, i.e. linear wire antennas }
G01R 33/34046	.....	{ Volume type coils, e.g. bird-cage coils; Quadrature bird-cage coils; Circularly polarised coils }
G01R 33/34053	.....	{ Solenoid coils; Toroidal coils }
G01R 33/34061	.....	{ Helmholtz coils }
G01R 33/34069	.....	{ Saddle coils }
G01R 33/34076	.....	{ Birdcage coils }
G01R 33/34084	.....	{ implantable coils or coils being geometrically adaptable to the sample, e.g. flexible coils or coils comprising mutually movable parts }
G01R 33/34092	.....	{ RF coils specially adapted for NMR spectrometers }
G01R 33/341	.....	comprising surface coils
G01R 33/3415	.....	comprising arrays of sub-coils, { i.e. phased-array coils with fileiple receiver channels }
G01R 33/343	.....	of slotted-tube or loop-gap type
G01R 33/345	.....	{ of waveguide type (G01R 33/343 takes precedence) }
G01R 33/3453	.....	{ Transverse electromagnetic [TEM]coils}
G01R 33/3456	.....	{ Stripline resonators }
G01R 33/36	....	Electrical details, e.g. matching or coupling of the coil to the receiver
G01R 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 }

WARNING

Not complete pending reclassification, see also [G01R 33/36](#)

G01R 33/3614	.....	{ RF power amplifiers }
G01R 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}
G01R 33/3628	.....	{ Tuning/matching of the transmit/receive coil }
G01R 33/3635	.....	{ Multi-frequency operation }
G01R 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 }

WARNING

Not complete pending reclassification, see also [G01R 33/36](#)

- | | | |
|--------------|-------|--|
| G01R 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 } |
| G01R 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 } |
| G01R 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) } |

WARNING

Not complete pending reclassification, see also [G01R 33/36](#)

- | | | |
|--------------|-------|---|
| G01R 33/3671 | ..... | { involving modulation of the quality factor of the RF coil (G01R 33/3642 takes precedence) } |
| G01R 33/3678 | ..... | { involving quadrature drive or detection, e.g. a circularly polarized RF magnetic field } |

WARNING

Not complete pending reclassification, see also [G01R 33/36](#)

- | | | |
|--------------|-------|---|
| G01R 33/3685 | | { Means for reducing sheath currents, e.g. RF traps, baluns } |
|--------------|-------|---|

WARNING

Not complete pending reclassification, see also [G01R 33/36](#)

- | | | |
|--------------|-------|---|
| G01R 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 } |
| G01R 33/38 | ... | Systems for generation, homogenisation or stabilisation of the main or gradient magnetic field |
| G01R 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 } |
| G01R 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 } |
| G01R 33/3806 | .... | { Open magnet assemblies for improved access to the sample, e.g. C-type or U-type magnets } |
| G01R 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 } |

G01R 33/381	....	using electromagnets (electromagnets per se H01F 7/06)
G01R 33/3815	.....	with superconducting coils, e.g. power supply therefor (superconductive magnets H01F 6/00)
G01R 33/383	....	using permanent magnets (permanent magnets per se H01F 7/02)
G01R 33/385	....	using gradient magnetic field coils
G01R 33/3852	.....	{ Gradient amplifiers; means for controlling the application of a gradient magnetic field to the sample, e.g. a gradient signal synthesizer }

WARNING

Not complete pending reclassification, see also [G01R 33/385](#)

G01R 33/3854	.....	{ means for active and/or passive vibration damping or acoustical noise suppression in gradient magnet coil systems }
G01R 33/3856	.....	{ Means for cooling the gradient coils or thermal shielding of the gradient coils }
G01R 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) }
G01R 33/387	....	Compensation of inhomogeneities (screening G01R 33/42)
G01R 33/3873	.....	using ferromagnetic bodies; { Passive shimming }
G01R 33/3875	.....	using correction coil assemblies, e.g. active shimming
G01R 33/389	....	Field stabilisation, { e.g. by field measurements and control means or indirectly by current stabilisation }
G01R 33/42	...	Screening (screening in general H05K 9/00)
G01R 33/421	....	of main or gradient magnetic field
G01R 33/4215	.....	{ of the gradient magnetic field, e.g. using passive or active shielding of the gradient magnetic field }
G01R 33/422	....	of the radio frequency field
G01R 33/44	..	using nuclear magnetic resonance [NMR] (G01R 33/24 , G01R 33/62 take precedence)

WARNING

Groups [G01R 33/44B](#) - [G01R 33/443](#) are not complete pending reclassification. See also this group

G01R 33/441	...	{ Nuclear Quadrupole Resonance (NQR) Spectroscopy and Imaging }
G01R 33/443	...	{ Assessment of an electric or a magnetic field, e.g. spatial mapping, determination of a B0 drift or dosimetry }

WARNING

Groups [G01R 33/44M1](#) - [G01R 33/44M3](#) are not complete pending reclassification. See also this group

G01R 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 }
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G01R 33/446	...	{ Multifrequency selective RF pulses, e.g. multinuclear acquisition mode (spatially selective RF pulses G01R 33/4833) }
		<u>WARNING</u>
		Not complete pending reclassification, see also G01R 33/48
G01R 33/448	...	{ Relaxometry, i.e. quantification of relaxation times or spin density (G01R 33/50 takes precedence) }
		<u>WARNING</u>
		Not complete pending reclassification, see also G01R 33/44 and G01R 33/44 A
G01R 33/46	...	NMR spectroscopy
G01R 33/4608	....	{ RF excitation sequences for enhanced detection, e.g. NOE, polarisation transfer, selection of a coherence transfer pathway }
G01R 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 }
G01R 33/4625	....	{ Processing of acquired signals, e.g. elimination of phase errors, baseline fitting, chemometric analysis }
G01R 33/4633	....	{ Sequences for multi-dimensional NMR }
G01R 33/4641	....	{ Sequences for NMR spectroscopy of samples with ultrashort relaxation times such as solid samples }
G01R 33/465	....	applied to biological material, e.g. in vitro testing
G01R 33/48	...	NMR imaging systems
G01R 33/4802	....	{ Travelling-wave MR }
G01R 33/4804	....	{ Spatially selective measurement of temperature or pH }
G01R 33/4806	....	{ Functional imaging of brain activation }
G01R 33/4808	....	{ Multimodal MR, e.g. MR combined with positron emission tomography [PET], MR combined with ultrasound or MR combined with computed tomography [CT] }
G01R 33/481	.....	{ MR combined with positron emission tomography [PET] or single photon emission computed tomography [SPECT] }
		<u>WARNING</u>
		Not complete pending reclassification, see also G01R 33/48 M
G01R 33/4812	.....	{ MR combined with X-ray or computed tomography [CT] }
		<u>WARNING</u>
		Not complete pending reclassification, see also G01R 33/48 M
G01R 33/4814	.....	{ MR combined with ultrasound }
		<u>WARNING</u>

Not complete pending reclassification, see also [G01R 33/48 M](#)

G01R 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 }
G01R 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 }
G01R 33/482	.....	{ using a Cartesian trajectory }
G01R 33/4822	.....	{ in three dimensions }
G01R 33/4824	.....	{ using a non-Cartesian trajectory }
G01R 33/4826	.....	{ in three dimensions }

WARNING

Not complete pending reclassification, see also [G01R 33/48 T](#)

G01R 33/4828	....	{ Resolving the MR signals of different chemical species, e.g. water-fat imaging }
G01R 33/483	....	with selection of signals or spectra from particular regions of the volume, e.g. in vivo spectroscopy
G01R 33/4831	.....	{ using B1 gradients, e.g. rotating frame techniques, use of surface coils }
G01R 33/4833	.....	{ using spatially selective excitation of the volume of interest, e.g. selecting non-orthogonal or inclined slices }
G01R 33/4835	.....	{ of multiple slices }
G01R 33/4836	.....	{ using an RF pulse being spatially selective in more than one spatial dimension, e.g. a 2D pencil-beam excitation pulse }

WARNING

Not complete pending reclassification, see also [G01R 33/483 B](#)

G01R 33/4838	.....	{ using spatially selective suppression or saturation of MR signals }
G01R 33/485	.....	based on chemical shift information { CSI or spectroscopic imaging, e.g. to acquire the spatial distributions of metabolites }
G01R 33/50	....	based on the determination of relaxation times, { e.g. T1 measurement by IR sequences; T2 measurement by multiple-echo sequences }
G01R 33/54	....	Signal processing systems, e.g. using pulse sequences, { Generation or control of pulse sequences (in general H03K); Operator Console }
G01R 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) }

WARNING

Not complete pending reclassification, see also [G01R 33/54](#)

G01R 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 }
G01R 33/56	.....	Image enhancement or correction, e.g. subtraction or averaging

techniques, { e.g. improvement of signal-to-noise ratio and resolution
([image data processing in general G06T](#))}

G01R 33/5601	.....	{ involving use of a contrast agent for contrast manipulation, e.g. a paramagnetic, super-paramagnetic, ferromagnetic or hyperpolarised contrast agent }
G01R 33/5602	.....	{ by filtering or weighting based on different relaxation times within the sample, e.g. T1 weighting using an inversion pulse }
G01R 33/5604	.....	{ Microscopy; Zooming }
G01R 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] }
G01R 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 }

WARNING

Not complete pending reclassification, see also [G01R 33/56](#)

G01R 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)}
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WARNING

Not complete pending reclassification, see also [G01R 33/56](#)

G01R 33/561	by reduction of the scanning time, i.e. fast acquiring systems, e.g. using echo-planar pulse sequences
G01R 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)}
G01R 33/5612	.....	{ Parallel RF transmission, i.e. RF pulse transmission using a plurality of independent transmission channels }
G01R 33/5613	.....	{ Generating steady state signals, e.g. low flip angle sequences (FLASH) }
G01R 33/5614	.....	{ using a fully balanced steady-state free precession [bSSFP] pulse sequence, e.g. trueFISP }
G01R 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] }

G01R 33/5616	.....	{ using gradient refocusing, e.g. EPI }
G01R 33/5617	.....	{ using RF refocusing, e.g. RARE }
G01R 33/5618	.....	{ using both RF and gradient refocusing, e.g. GRASE }
G01R 33/5619	.....	{ by temporal sharing of data, e.g. keyhole, block regional interpolation scheme for k-Space [BRISK] }
G01R 33/563	.....	of moving material, e.g. flow contrast angiography
G01R 33/56308	.....	{ Characterization of motion or flow; Dynamic imaging }
G01R 33/56316	.....	{ involving phase contrast techniques }
G01R 33/56325	.....	Cine imaging
G01R 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) }
G01R 33/56341	.....	{ Diffusion imaging }
G01R 33/5635	.....	{ Angiography, e.g. contrast-enhanced angiography [CE-MRA] or time-of-flight angiography [TOF-MRA] }
G01R 33/56358	.....	{ Elastography }
G01R 33/56366	.....	{ Perfusion imaging }
G01R 33/56375	.....	{ Intentional motion of the sample during MR, e.g. moving table imaging }
G01R 33/56383	.....	{ involving motion of the sample as a whole, e.g. multistation MR or MR with continuous table motion }

WARNING

Not complete pending reclassification, see also
[G01R 33/563](#) T

G01R 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 }
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WARNING

Not complete pending reclassification, see also
[G01R 33/563](#)

G01R 33/565	Correction of image distortions, e.g. due to magnetic field inhomogeneities
G01R 33/56509	.....	{ due to motion, displacement or flow, e.g. gradient moment nulling (G01R 33/567 takes precedence) }
G01R 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

G01R 33/56527	.....	{ due to chemical shift effects }
G01R 33/56536	.....	{ due to magnetic susceptibility variations }
G01R 33/56545	.....	{ caused by finite or discrete sampling, e.g. Gibbs ringing,

truncation artefacts, phase aliasing artefacts }

WARNING

Not complete pending reclassification, see also [G01R 33/565](#)

G01R 33/5654	.....	{ caused by acquiring plural, differently encoded echo signals after one RF excitation, e.g. correction for readout gradients of alternating polarity in EPI }
G01R 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) }
G01R 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) }
G01R 33/56581	.....	{ due to Maxwell fields, i.e. concomitant fields }
G01R 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) }

WARNING

Not complete pending reclassification, see also [G01R 33/565](#)

G01R 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 }
G01R 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 }
G01R 33/5676	.....	{ Gating or triggering based on an MR signal, e.g. involving one or more navigator echoes for motion monitoring and correction }
G01R 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 }
G01R 33/583	.....	{ Calibration of signal excitation or detection systems, e.g. for optimal RF excitation power or frequency (G01R 33/246 takes precedence) }

WARNING

Not complete pending reclassification, see also [G01R 33/58](#)

G01R 33/586	{ for optimal flip angle of RF pulses }
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WARNING

Not complete pending reclassification, see also [G01R 33/58](#)

G01R 33/60	..	using electron paramagnetic resonance (G01R 33/24 , G01R 33/62 take precedence)
G01R 33/62	..	using double resonance (G01R 33/24 takes precedence)
G01R 33/64	..	using cyclotron resonance (G01R 33/24 takes precedence) { Omegatrons per se H01J 49/38 }

- G01R 35/00** **Testing or calibrating of apparatus covered by the preceding groups** ({ [G01R 31/31901](#) takes precedence })
- G01R 35/002** . { of cathode ray oscilloscopes }
- G01R 35/005** . { Calibrating; Standards or reference devices, e.g. voltage or resistance standards, "golden" references ([G01R 33/0035](#) , [G01R 35/002](#) take precedence) }
- G01R 35/007** . . { Standards or reference devices, e.g. voltage or resistance standards, "golden references" }
- G01R 35/02** . of auxiliary devices, e.g. of instrument transformers according to prescribed transformation ratio, phase angle, or wattage rating
- G01R 35/04** . of instruments for measuring time integral of power or current
- G01R 35/06** . . by stroboscopic methods
- G01R 2019/00** **Arrangements for measuring currents or voltages or for indicating presence or sign thereof** ([G01R 5/00](#) takes precedence; { voltage measurements using secondary electron emission when testing electronic circuits [G01R 31/305](#) } ; for measuring bio-electric currents or voltages [A61B 5/04](#))
- NOTE**
- Within groups [G01R 19/02](#) to [G01R 19/32](#) , group [G01R 19/28](#) takes precedence. Groups [G01R 19/18](#) to [G01R 19/257](#) take precedence over groups [G01R 19/02](#) to [G01R 19/17](#) and [G01R 19/30](#) .
- G01R 2019/22** . using conversion of ac into dc
- G01R 2019/24** . . using thermocouples
- G01R 2031/00** **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 leads, measuring probes [G01R 1/06](#) ; { measuring superconductive properties [G01R 33/1238](#) ; data processing equipment for testing or function monitoring [G06F 15/20B](#) } ; indicating electrical condition of switchgear or protective devices [H01H 71/04](#) , [H01H 73/12](#) , [H02B 11/10](#) , [H02H 3/04](#) ; testing or measuring semiconductors or solid state devices during manufacture [H01L 22/00](#) ; testing substation equipment, e.g. mobile phones [H04M 1/24](#) ; testing or monitoring of control systems [G05B 23/02](#) ; { testing or monitoring transmitters or receivers [H04B 17/00](#) })
- G01R 2031/36** . Apparatus for testing electrical condition of accumulators or electric batteries, e.g. capacity or charge condition (accumulators combined with arrangements for measuring, testing or indicating condition [H01M 10/48](#) ; circuit arrangements for charging, or depolarising batteries or for supplying loads from batteries [H02J 7/00](#) ; { Coulomb meters [G01R 22/00](#) ; indicating the condition of the power supply in clocks or watches [G04C 10/04](#) ; methods for controlling fuel cells [H01M 8/04298](#) })

NOTE

This group covers arrangements for measuring, testing or indicating electrical

conditions or variables of accumulators or electric batteries. Accumulators combined with arrangements for measuring, testing or indicating condition, or arrangements for measuring, testing or indicating conditions or variables other than electrical, e.g. level or density of battery electrolyte, are covered by the group [H01M 10/48](#) and subgroups

G01R 2031/3603 . . Deleted