

ECLA**EUROPEAN 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 [H03J3/12](#); monitoring electronic pulse counters [H03K21/40](#); monitoring operation of communication systems H04)

Notes

1. This subclass covers:

- measuring all kinds of electric or magnetic variables directly or by derivation from other electric or magnetic variables;
- measuring all kinds of electric or magnetic properties of materials;
- testing electric or magnetic devices, apparatus or networks, (e.g. discharge tubes, amplifiers) or measuring their characteristics;
- indicating presence or sign of current or voltage;
- NMR, EPR or other spin-effect apparatus, not specially adapted for a particular application;
- equipment for generating signals to be used for carrying out such tests and measurements.

2. In this subclass, the following terms or expressions are used with the meanings indicated :

- "measuring" includes investigating;
- "instruments" or "measuring instruments" means electro-mechanical measuring mechanisms;
- "arrangements for measuring" means apparatus, circuits, or methods for measuring;

3. Attention is drawn to the Notes following the title of class G01.

4. In this subclass, group [G01R17/00](#) takes precedence over groups [G01R19/00](#) to [G01R31/00](#).

G01R1/00

Details of instruments or arrangements of the types included in groups [G01R5/00](#) to [G01R13/00](#) and [G01R31/00](#) (constructional details particular to [N: electromechanical] arrangements for measuring the electric consumption [G01R11/02](#)) [C0409]

G01R1/02

- . General constructional details (details of a kind applicable to measuring arrangements not specially adapted for a specific variable [G01D7/00](#))

G01R1/02A

- . . [N: concerning dedicated user interfaces, e.g. GUI, or dedicated keyboards ([G01R31/319C5](#) takes precedence)] [N1110]

G01R1/04

- . . Housings; Supporting members; Arrangements of terminals ("burn-in" aspects [G01R31/28G2B](#); terminals H01R; terminal strips or boards H02B; housings for electrical apparatus H05K) [C0612]

G01R1/04S

- . . . [N: Test fixtures or contact fields; Connectors or connecting adaptors; Test

clips; Test sockets ([G01R1/067](#) takes precedence; mass production testing systems [G01R31/01](#); testing of connections [G01R31/04](#); for testing printed circuit boards [G01R31/28B4B](#)) [[C0501](#)]

- G01R1/04S1 [N: Connectors, terminals ([G01R1/04S2](#) and [G01R1/04S3](#) take precedence; with measurement function for battery poles [G01R31/36V9P](#); in general [H01R](#))] [[N1204](#)]
- G01R1/04S2 [N: Test clips, e.g. for IC`s] [[N0009](#)]
- G01R1/04S3 [N: Sockets for IC`s or transistors] [[N0009](#)]
- G01R1/04S3D [N: Details] [[N0009](#)]
- G01R1/04S3D1 [N: Sockets or component fixtures for RF or HF testing] [[N0009](#)]
- G01R1/04S3D2 [N: related to environmental aspects, e.g. temperature] [[N0009](#)]
[[C1110](#)]
- G01R1/04S3D3 [N: concerning contact pieces or mechanical details, e.g. hinges or cams; Shielding] [[N0009](#)]
- G01R1/04S3T [N: for TAB IC`s] [[N0009](#)]
- G01R1/04S3U [N: 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 [G01R1/04S3](#))] [[N0009](#)]
- G01R1/04S4 [N: for testing integrated circuits on wafers, e.g. wafer-level test cartridge] [[N0501](#)] [[C1110](#)]
- G01R1/06 . . Measuring leads; Measuring probes ([G01R19/145](#), [G01R19/165](#) take precedence; end pieces for leads [H01R11/00](#))
- G01R1/067 . . . Measuring probes [N: (plugs, sockets or clips [G01R1/04S](#); testing of connections [G01R31/04](#); contacting IC`s for test purposes when probe design is not the essential feature [G01R31/28G5](#); using radiation beam as probe [G01R31/302](#); end pieces for wires terminating in a probe [H01R11/18](#))] [[C0501](#)]
- G01R1/067B [N: Apparatus for holding or moving single probes (for moving multiple probe heads or ICs under test [G01R31/28G5](#))] [[C0501](#)]
- G01R1/067C [N: Probe needles; Cantilever beams; "Bump" contacts; Replaceable probe pins] [[C0706](#)] [[M1112](#)]
- G01R1/067C2 [N: Elastic] [[N9703](#)] [[C0706](#)] [[M1112](#)]
- G01R1/067C2A [N: Spring-loaded] [[N0706](#)]
- G01R1/067C2C [N: Cantilever beams] [[N0902](#)]
- [N: **WARNING** [[N0902](#)]
This group is not complete pending a reorganisation; see also other subgroups of [G01R1/067C](#)
]
- G01R1/067C3 [N: Geometry aspects ([G01R1/067C2C](#) takes precedence)] [[N0706](#)]
[[C0902](#)]
- G01R1/067C3A [N: related to tip portion] [[N0706](#)]
- G01R1/067C3B [N: Microprobes, i.e. having dimensions as IC details] [[N0706](#)]
- G01R1/067C3C [N: Needle-like] [[N0706](#)]
- G01R1/067C4 [N: Material aspects] [[N0706](#)]
- G01R1/067C4A [N: related to layers] [[N0706](#)] [[C0804](#)]
- G01R1/067D [N: Input circuits therefor]
- G01R1/067H [N: High frequency probes]
- G01R1/067K [N: High voltage probes]

G01R1/067L	. . . .	[N: containing liquids]
G01R1/067P	. . . .	[N: Hand-held or hand-manipulated probes, e.g. for oscilloscopes or for portable test instruments (end pieces terminating in a probe H01R11/18)] [N9609] [C9703] [M1112]
G01R1/067S	. . . .	[N: Devices for sensing when probes are in contact, or in position to contact, with measured object] [C9506]
G01R1/07	. . . .	Non-contact-making probes [N: (wireless interface with the DUT G01R31/302W)] [C1110]
G01R1/07E	. . . . .	[N: containing electro-optic elements] [N9602]
G01R1/07G	. . . . .	[N: containing ionised gas] [N9602]
G01R1/073	. . . .	Multiple probes [N: (G01R1/067L , G01R1/067S , G01R1/07E , G01R1/07G take precedence)] [C0501]
G01R1/073B	. . . . .	[N: 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] [C9703]
G01R1/073B2	. . . . .	[N: 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, G01R1/073B6)] [C9703]
G01R1/073B2B	. . . . .	{7 dots} [N: the probes being of different lengths]
G01R1/073B2C	. . . . .	{7 dots} [N: for testing printed circuit boards]
G01R1/073B2C2	. . . . .	{8 dots} [N: for double-sided contacting or for testing boards with surface-mounted devices (SMD`s)]
G01R1/073B4	. . . . .	[N: the body of the probe being at an angle other than perpendicular to test object, e.g. probe card]
G01R1/073B6	. . . . .	[N: arranged on a flexible frame or film]
G01R1/073B8	. . . . .	[N: with flexible bodies, e.g. buckling beams]
G01R1/073B9	. . . . .	[N: with provisions for altering position, number or connection of probe tips; Adapting to differences in pitch] [N9703] [M1207]
G01R1/073B9B	. . . . .	{7 dots} [N: using an intermediate card or back card with apertures through which the probes pass] [N9703]
G01R1/073B9C	. . . . .	{7 dots} [N: using an intermediate adapter, e.g. space transformers (G01R1/073B9B takes precedence)] [N9703] [M1207]
G01R1/073B9D	. . . . .	{7 dots} [N: using switching of signals between probe tips and test bed, i.e. the standard contact matrix which in its turn connects to the tester] [N9703]
G01R1/073E	. . . . .	[N: manipulating each probe element or tip individually] [N9703]
G01R1/08	. .	Pointers; Scales; Scale illumination
G01R1/10	. .	Arrangements of bearings (bearings in general F16C)
G01R1/12	. . .	of strip or wire bearings
G01R1/14	. .	Braking arrangements; Damping arrangements
G01R1/16	. .	Magnets (in general H01E)
G01R1/18	. .	Screening arrangements against electric or magnetic fields, e.g. against earth`s field [N: (measuring shielding efficiency H05K9/00G)] [C9506]
G01R1/20	. .	Modifications of basic electric elements for use in electric measuring instruments; Structural combinations of such elements with such instruments (instrument transformers per se H01F38/20)
G01R1/20B	. .	[N: Resistors used for electric measuring e.g. decade resistors standards, resistors for comparators, series resistors, shunts (resistors in general H01C ; microwave or

- radiowave terminations [H01P1/26](#); coupling devices [H01R](#)] [C9506]
- G01R1/20D . . [N: Switches for connection of measuring instruments or electric motors to measuring loads (switches in general H01H)]
- G01R1/22 . . Tong testers acting as secondary windings of current transformers (voltage or current isolation using transformers [G01R15/18](#))
- G01R1/24 . . Transmission-line, e.g. waveguide, measuring sections, e.g. slotted section
- G01R1/26 . . . with linear movement of probe
- G01R1/28 . Provision in measuring instruments for reference values, e.g. standard voltage, standard waveform
- G01R1/30 . Structural combination of electric measuring instruments with basic electronic circuits, e.g. with amplifier
- G01R1/36 . Overload protection arrangements or circuits for electric measuring instruments (in general [H02H](#))
- G01R1/38 . Arrangements for altering the indicating characteristic, e.g. by modifying the air gap [N: (circuits [G01R15/00C](#))]
- G01R1/40 . Modifications of instruments to indicate the maximum or the minimum value reached in a time interval, e.g. by maximum indicator pointer
- G01R1/42 . . thermally operated
- G01R1/44 . Modifications of instruments for temperature compensation [N: (When measuring current or voltage [G01R19/32](#))] [C0006]
- G01R3/00 Apparatus or processes specially adapted for the manufacture [N: or maintenance] of measuring instruments, [N: e.g. of probe tips] [C0006]**
- G01R5/00 Instruments for converting a single current or a single voltage into a mechanical displacement (vibration galvanometers [G01R9/02](#))**
- G01R5/02 . Moving-coil instruments
- G01R5/04 . . with magnet external to the coil
- G01R5/06 . . with core magnet
- G01R5/08 . . specially adapted for wide angle deflection; with eccentrically-pivoted moving coil
- G01R5/10 . String galvanometers
- G01R5/12 . Loop galvanometers
- G01R5/14 . Moving-iron instruments
- G01R5/16 . . with pivoting magnet
- G01R5/18 . . with pivoting soft iron, e.g. needle galvanometer
- G01R5/20 . Induction instruments e.g. Ferraris instruments
- G01R5/22 . Thermoelectric instruments (measuring effective values of currents or voltages using thermoconverters [G01R19/03](#))

- G01R5/24 . . . operated by elongation of a strip or wire or by expansion of a gas or fluid
- G01R5/26 . . . operated by deformation of a bimetallic element
- G01R5/28 . Electrostatic instruments ([combined with radiation detector G01T](#); [N: electrometers without passively moving electrodes 15/16B; measuring electrostatic fields [G01R29/12](#); measuring charge [G01R29/24](#)])
- G01R5/30 . . . Leaf electrometers
- G01R5/32 . . . Wire electrometers; Needle electrometers
- G01R5/34 . . . Quadrant electrometers

- G01R7/00** **Instruments capable of converting two or more currents or voltages into a single mechanical displacement ([G01R9/00](#) takes precedence)**

- G01R7/02 . . . for forming a sum or a difference
- G01R7/04 . . . for forming a quotient ([for measuring resistance G01R27/08](#))
- G01R7/06 . . . moving-iron type
 - [N: **Note**
This group covers all crossed-coil meters, i.e. logometers having a magnetic rotor
]
- G01R7/08 . . . moving-coil type, e.g. crossed-coil type
- G01R7/10 having more than two moving coils
- G01R7/12 . . . for forming product
- G01R7/14 . . . moving-iron type
- G01R7/16 . . . having both fixed and moving coils, i.e. dynamometers
- G01R7/18 with iron core magnetically coupling fixed and moving coils

- G01R9/00** **Instruments employing mechanical resonance**

- G01R9/02 . . . Vibration galvanometers, e.g. for measuring current
- G01R9/04 . . . using vibrating reeds, e.g. for measuring frequency
- G01R9/06 . . . magnetically driven
- G01R9/08 . . . piezo-electrically driven

- G01R11/00** **Electromechanical arrangements for measuring time integral of electric power [N: i.e. electric energy] or current, e.g. of consumption ([N: other arrangements for measuring time integral of electric power or current [G01R22/00](#); Boards, panels, desks for energy meters, [H02B1/03](#)]; monitoring electric consumption of electrically-propelled vehicles [B60L3/00](#)) [C1103]**
 - [N: **Note** [N1103]
For the definition of "arrangement" see Note (2) under G01R
]

- G01R11/02 . . . Constructional details ([applicable to electric measuring instruments in general G01R1/00](#))

- G01R11/04 . . Housings; Supporting racks; Arrangements of terminals
- G01R11/06 . . Magnetic circuits of induction meters
- G01R11/067 . . . Coils therefor
- G01R11/073 . . . Armatures therefor
- G01R11/09 Disc armatures
- G01R11/10 . . Braking magnets; Damping arrangements
- G01R11/12 . . Arrangements of bearings ([bearings in general F16C](#))
- G01R11/14 . . . with magnetic relief
- G01R11/16 . . Adaptations of counters to electricity meters
- G01R11/17 . . Compensating for errors; Adjusting or regulating means therefor
- G01R11/18 . . . Compensating for variations in ambient conditions
- G01R11/185 Temperature compensation
- G01R11/19 . . . Compensating for errors caused by disturbing torque, e.g. rotating-field errors of polyphase meters
- G01R11/20 . . . Compensating for phase errors in induction meters
- G01R11/21 . . . Compensating for errors caused by damping effects of the current, e.g. adjustment in the overload range
- G01R11/22 . . . Adjusting torque, e.g. adjusting starting torque, adjusting of polyphase meters for obtaining equal torques
- G01R11/23 . . . Compensating for errors caused by friction, e.g. adjustment in the light load range
- G01R11/24 . . Arrangements for avoiding or indicating fraudulent use [**N**: (**measures against unauthorised operation of bolts, nuts or pins F16B41/00C**; **security seals G09F3/03**; **preventing of tampering with detection circuits in signaling or alarm circuits G08B29/04B**)] [**C1004**]
- G01R11/25 . . Arrangements for indicating or signalling faults (**seals G09F3/03**; **preventing tampering with detection circuits in signalling or alarm circuits G08B29/04B**) [**C0605**]

Note

Groups 11/48 to 11/66 take precedence over groups [G01R11/30](#) to [G01R11/46](#).

- G01R11/30 . Dynamo-electric motor meters
- G01R11/32 . . Watt-hour meters
- G01R11/34 . . Ampere-hour meters
- G01R11/36 . Induction meters, e.g. Ferraris meters ([Ferraris instruments G01R5/20](#))
- G01R11/38 . . for single-phase operation
- G01R11/40 . . for polyphase operation
- G01R11/42 . . . Circuitry therefor
- G01R11/46 . Electrically-operated clockwork meters; Oscillatory meters; Pendulum meters
- G01R11/46B . . [**N**: **Oscillatory meters**]
- G01R11/48 . Meters specially adapted for measuring real or reactive components; Meters specially adapted for measuring apparent energy
- G01R11/50 . . for measuring real component

- G01R11/52 . . for measuring reactive component
- G01R11/54 . . for measuring simultaneously at least two of the following three variables: real component, reactive component, apparent energy
- G01R11/56 . Special tariff meters ([tariff metering in general G01D4/00](#))
- G01R11/57 . . Multi-rate meters ([G01R11/63 takes precedence](#))
- G01R11/58 . . . Tariff-switching devices therefor
- G01R11/60 . . Subtraction meters; Meters measuring maximum or minimum load hours
- G01R11/63 . . Over-consumption meters, e.g. measuring consumption while a predetermined level of power is exceeded
- G01R11/64 . . Maximum meters, e.g. tariff for a period is based on maximum demand within that period
- G01R11/66 . . . Circuitry

- G01R13/00** **Arrangements for displaying electric variables or waveforms** ([display by mechanical displacement only G01R5/00, G01R7/00, G01R9/00; recording frequency spectrum G01R23/18](#))

- G01R13/02 . for displaying measured electric variables in digital form ([\[N: using LCD's or LED's G01R13/40\]; counters G06M; analogue/digital conversion in general H03M1/00](#)) [[C9506](#)]
- G01R13/02B . . [\[N: in numerical form\] \[N9905\]](#)
- G01R13/02C . . [\[N: Circuits therefor\] \[N9905\]](#)
- G01R13/02C2 . . . [\[N: Controlling the intensity or colour of the display\] \[N9905\]](#)
- G01R13/02C3 . . . [\[N: for presentation of more than one variable\] \[N9905\]](#)
- G01R13/02C4 . . . [\[N: for inserting reference markers\] \[N9905\]](#)
- G01R13/02C5 . . . [\[N: for triggering, synchronisation\] \[N9905\]](#)
- G01R13/02C5B [\[N: for non-recurrent functions, e.g. transients\] \[N9905\]](#)
- G01R13/02C6 . . . [\[N: for sampling\] \[N9905\]](#)
- G01R13/02D . . [\[N: using electro-optic elements\] \[N9905\]](#)
- G01R13/02E . . [\[N: Software therefor\] \[N9905\]](#)

- G01R13/04 . for producing permanent records
- G01R13/06 . . Modifications for recording transient disturbances e.g. by starting or accelerating a recording medium
- G01R13/08 . . Electromechanical recording systems using a mechanical direct-writing method
- G01R13/10 . . . with intermittent recording by representing the variable by the length of a stroke or by the position of a dot
- G01R13/12 . . Chemical recording, e.g. clydonographs ([G01R13/14 takes precedence](#))
- G01R13/14 . . Recording on a light-sensitive material
- G01R13/16 . . Recording on a magnetic medium
- G01R13/18 . . . using boundary displacement

- G01R13/20 . Cathode-ray oscilloscopes; [\[N: Oscilloscopes using other screens than CRT's, e.g. LCD's; \(control arrangements or circuits for cathode-ray tube indicators G09G1/00; cathode ray tubes H01J31/00\)\] \[C9506\]](#)
- G01R13/20B . . [\[N: Non-electric appliances, e.g. scales, masks \(luminescent screens for CRT](#)

- provided with permanent marks or references [H01J29/34](#); optical or photographic arrangements combined with CRT vessels [H01J29/89](#)]
- G01R13/20C . . [N: Using means for generating permanent registrations, e.g. photographs (optical or photographic arrangements combined with CRT vessel [H01J 29/89](#))]
- G01R13/20D . . [N: Arrangements for obtaining a 3- dimensional representation (stereoscopic T.V. [H04N13/00](#))]
- G01R13/20E . . [N: Arrangements for measuring with C.R. oscilloscopes, e.g. vectorscope]
- G01R13/22 . . Circuits therefor (circuits for generating pulses, e.g. saw-tooth waveforms [H03K3/00](#))
- G01R13/22B . . . [N: particularly adapted for storage oscilloscopes]
- G01R13/24 . . . Time-base deflection circuits
- G01R13/24B [N: for generating more than one, not overlapping time-intervals on the screen]
- G01R13/26 . . . Circuits for controlling the intensity of the electron beam [N: or the colour of the display] (brilliance control [H01J29/98](#)) [C9506]
- G01R13/28 . . . Circuits for simultaneous or sequential presentation of more than one variable (electronic switches [H03K17/00](#))
- G01R13/30 . . . Circuits for inserting reference markers, e.g. for timing, for calibrating, for frequency marking
- G01R13/30B [N: for time marking]
- G01R13/32 . . . Circuits for displaying non-recurrent functions such as transients; Circuits for triggering; Circuits for synchronisation; Circuits for time-base expansion
- G01R13/32B [N: for displaying non-recurrent functions such as transients]
- G01R13/34 . . . Circuits for representing a single waveform by sampling, e.g. for very high frequencies (sample and hold arrangements [G11C27/02](#))
- G01R13/34B [N: for displaying periodic H.F. signals ([G01R13/34C](#) takes precedence)]
- G01R13/34C [N: for displaying sampled signals by using digital processors by intermediate A.D. and D.A. convertors (control circuits for CRT indicators)] [C9802]
- G01R13/34D [N: using electro-optic elements]
- G01R13/36 . using length of glow discharge, e.g. glowlight oscilloscopes (discharge tubes [H01J](#))
- G01R13/38 . using the steady or oscillatory displacement of a light beam by an electromechanical measuring system (such measuring systems per se [G01R5/00](#), [G01R7/00](#), [G01R9/00](#))
- G01R13/40 . using modulation of a light beam otherwise than by mechanical displacement, e.g. by Kerr effect [N: (visual indication of correct tuning [H03J3/14](#))]
- G01R13/40B . . [N: for continuous analogue, or simulated analogue, display] [C0006]
- G01R13/40B2 . . . [N: using active, i.e. light-emitting display devices, e.g. electroluminescent display ([G01R13/36](#) and [G01R13/42](#) take precedence)]
- G01R13/40B3 . . . [N: using passive display devices, e.g. liquid crystal display or Kerr effect display devices]
- G01R13/40C . . [N: for discontinuous display, i.e. display of discrete values (analogue/digital conversion [H03M1/00](#))]
- G01R13/40C2 . . . [N: using a plurality of active, i.e. light emitting, e.g. electro-luminescent elements, i.e. bar graphs]
- G01R13/40C2B [N: representing measured value by a dot or a single line ([G01R13/40C4](#) takes precedence)]

- G01R13/40C3 . . . [N: using a plurality of passive display elements, e.g. liquid crystal or Kerr-effect display elements ([G01R13/40C4](#) takes precedence)]
- G01R13/40C4 . . . [N: Two or three dimensional representation of measured values]
- G01R13/42 . Instruments using length of spark discharge e.g. by measuring maximum separation of electrodes to produce spark

- G01R15/00** **Details of measuring arrangements of the types provided for in groups [G01R17/00](#) to [G01R29/00](#) and [G01R33/00](#) to [G01R35/00](#) (details of instruments [G01R1/00](#); overload protection arrangements [G01R1/36](#))**

- G01R15/00B . [N: Switches for altering the measuring range or for multitesters]
- G01R15/00C . [N: Circuits for altering the indicating characteristic, e.g. making it non-linear]
- G01R15/00C2 . . [N: by zero-suppression]

- G01R15/04 . Voltage dividers [C9506]
- G01R15/06 . . having reactive components, e.g. capacitive transformer [N: (when the HV capacitor/sensor as such is the essential [G01R15/16](#))] [C9506]

- G01R15/08 . Circuits for altering the measuring range
- G01R15/09 . . Autoranging circuits

- G01R15/12 . Circuits for multi-testers, [N: i.e. multimeters], e.g. for measuring voltage, current, or impedance at will
- G01R15/12B . . [N: for digital multimeters]

- G01R15/14 . Adaptations providing voltage or current isolation, e.g. for high-voltage or high-current networks (instrument transformers [H01F38/20](#); voltage dividers [G01R15/04](#); [N: means for converting the output of a sensing member to another variable [G01D5/00](#); visible signalling arrangements or devices [G08B5/00](#); transmission systems for measured values [G08C17/00](#), [G08C23/00](#)])
- G01R15/14B . . [N: Arrangements for simultaneous measurements of several parameters employing techniques covered by groups [G01R15/14](#) to [G01R15/26](#)] [C0006]
- G01R15/14C . . [N: Measuring arrangements for voltage not covered by other subgroups of [G01R15/14](#)]
- G01R15/14D . . [N: Measuring arrangements for current not covered by other subgroups of 15/14, e.g. using current dividers, shunts, or measuring a voltage drop (if no voltage isolation is involved [G01R1/20B](#) or [G01R19/00G](#))] [C0006]
- G01R15/14D2 . . . [N: involving the measuring of a magnetic field or electric field ([G01R15/18](#), [G01R15/20](#), [G01R15/24](#), [G01R15/26](#) take precedence)] [N1109]

- [N: **WARNING**
[N1109] Not complete pending reorganization; see also [G01R15/20](#)
]

- G01R15/16 . . using capacitive devices [N: (circuits constituting a voltage divider [G01R15/06](#))]
- G01R15/16B . . . [N: measuring electrostatic potential, e.g. with electrostatic voltmeters or electrometers, when the design of the sensor is essential (electrometers with passively moving electrodes [G01R5/28](#); measuring electrostatic fields [G01R29/12](#); measuring charge [G01R29/24](#); measuring in circuits with high internal resistance [G01R19/00B](#))]

- G01R15/18 . . . using inductive devices, e.g. transformers [C9810]
- G01R15/18B . . . [N: using coils without a magnetic core, e.g. Rogowski coils] [M1112]
- G01R15/18C . . . [N: using transformers with a magnetic core] [C0006]
- G01R15/18C2 [N: with compensation or feedback windings or interacting coils, e.g. 0-flux sensors (using galvano-magnetic field sensors [G01R15/20](#); conversion of DC into AC using transducers [G01R19/20](#))] [C1109]
- G01R15/18D . . . [N: using current transformers with a core consisting of two or more parts, e.g. clamp-on type ([G01R15/14B](#) to [G01R15/16](#) take precedence; tong testers [G01R1/22](#))] [C9409]
- G01R15/18E . . . [N: comprising rotatable parts, e.g. moving coils (galvanometers [G01R5/02](#), [G01R5/14](#))]
- G01R15/20 . . . using galvano-magnetic devices, e.g. Hall-effect devices, [N: 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, [G01R5/00](#), [G01R7/00](#), [G01R9/00](#); measuring magnetic fields [G01R33/02](#))] [C1109]
- G01R15/20B . . . [N: using Hall-effect devices (Hall elements in arrangements for measuring electrical power [G01R21/08](#))]
- G01R15/20C . . . [N: using magneto-resistance devices, e.g. field plates]
- G01R15/20D . . . [N: Constructional details independent of the type of device used]
- G01R15/22 . . . using light-emitting devices, e.g. LED, optocouplers [N: (G01R31/319A takes precedence)] [C0703]
- G01R15/24 . . . using light-modulating devices
- G01R15/24B [N: using electro-optical modulators, e.g. electro-absorption (probes containing electro-optic elements [G01R1/07E](#))] [C0006]
- G01R15/24B2 [N: based on the Pockels effect, i.e. linear electro-optic effect]
- G01R15/24B3 [N: based on the Kerr effect, i.e. quadratic electro-optic effect]
- G01R15/24C [N: using magneto-optical modulators, e.g. based on the Faraday or Cotton-Mouton effect]
- G01R15/24C2 [N: based on the Faraday, i.e. linear magneto-optic, effect]
- G01R15/24D [N: Details of the circuitry or construction of devices covered by 15/24B to 15/24C2]
- G01R15/24E [N: using a constant light source and electro-mechanically driven deflectors]
- G01R15/26 . . . using modulation of waves other than light, e.g. radio or acoustic waves

G01R17/00 Measuring arrangements involving comparison with a reference value, e.g. bridge

- G01R17/02 . . . Arrangements in which the value to be measured is automatically compared with a reference value
- G01R17/04 . . . in which the reference value is continuously or periodically swept over the range of values to be measured
- G01R17/06 . . . Automatic balancing arrangements
- G01R17/08 in which a force or torque representing the measured value is balanced by a force or torque representing the reference value
- G01R17/10 . . . ac or dc measuring bridges (automatic comparison or re-balancing arrangements [G01R17/02](#))
- G01R17/10B . . . [N: for measuring impedance or resistance] [C0501]

- G01R17/12 . . . using comparison of currents, e.g. bridges with differential current output
- G01R17/14 . . . with indication of measured value by calibrated null indicator, e.g. percent bridge, tolerance bridge ([G01R17/12](#), [G01R17/16](#) take precedence)
- G01R17/16 . . . with discharge tubes or semiconductor devices in one or more arms of the bridge, e.g. voltmeter using a difference amplifier
- G01R17/18 . . . with more than four branches
- G01R17/20 . . . ac or dc potentiometric measuring arrangements (automatic comparison or re-balancing arrangements [G01R17/02](#))
- G01R17/22 . . . with indication of measured value by calibrated null indicator

- G01R19/00** **Arrangements for measuring currents or voltages or for indicating presence or sign thereof** ([G01R5/00](#) takes precedence; [N: voltage measurements using secondary electron emission when testing electronic circuits [G01R31/305](#)]; for measuring bio-electric currents or voltages [A61B5/04](#)) [C1109]

Note [C0409]
 Within groups [G01R19/02](#) to [G01R19/32](#), group [G01R19/28](#) takes precedence. Groups [G01R19/18](#) to [G01R19/257](#) take precedence over groups [G01R19/02](#) to [G01R19/17](#) and [G01R19/30](#).
- G01R19/00A . . . [N: Frequency selective voltage or current level measuring (measuring frequency [G01R23/00](#); testing attenuation in line transmission systems [H04B3/48](#); monitoring testing in transmission systems [H04B17/00](#))] [C1109]
- G01R19/00A2 . . . [N: separating AC and DC]
- G01R19/00B . . . [N: 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 [G01R5/28](#); measuring electrostatic potential [G01R15/16B](#); measuring electrostatic fields [G01R29/12](#); amplifiers per se [H03F](#))] [C9602]
- G01R19/00C . . . [N: Measuring mean values of current or voltage during a given time interval]
- G01R19/00D . . . [N: 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)] [C9802]
- G01R19/00E . . . [N: characterised by a specific application or detail not covered by any other subgroup of [G01R19/00](#) (contains no documents)]
- G01R19/00E2 . . . [N: Noise discrimination; Analog sampling; Measuring transients (measuring characteristics of individual pulses [G01R29/02](#); digital sampling [G01R19/25C2](#); measuring noise figure [G01R29/26](#))] [C0006]
- G01R19/00E3 . . . [N: Measuring currents of particle-beams, currents from electron multipliers, photocurrents, ion currents; Measuring in plasmas]
- G01R19/00E4 . . . [N: measuring voltage or current standards]
- G01R19/00E5 . . . [N: using thermionic valves]
- G01R19/00F . . . [N: measuring voltage only (all subgroups of [G01R19/00](#) take precedence)]
- G01R19/00G . . . [N: measuring current only (all subgroups of [G01R19/00](#) take precedence)]
- G01R19/02 . . . Measuring effective values, i.e. root-mean-square values [C0409]

- G01R19/03 . . . using thermoconverters [N: using ac-dc conversion by means of thermocouples or other heat sensitive elements [G01R19/22T](#)]
- G01R19/04 . Measuring peak values [N: or amplitude or envelope] of ac or of pulses [C9703]
- G01R19/06 . Measuring real component; Measuring reactive component
- G01R19/08 . Measuring current density
- G01R19/10 . Measuring sum, difference or ratio [C1004]
- G01R19/12 . Measuring rate of change [N: (emergency protective circuit arrangements responsive to the rate of change of electrical quantities [H02H3/44](#))]
- G01R19/14 . Indicating direction of current; Indicating polarity of voltage
- G01R19/145 . Indicating the presence of current or voltage [N: measuring probes in general [G01R1/06](#); indicating continuity or short circuits in electric apparatus or lines or components [G01R31/02C](#)]
- G01R19/15 . . . Indicating the presence of current [N: see provisionally also [G01R19/145](#)]
- G01R19/155 . . . Indicating the presence of voltage [N: see provisionally also [G01R19/145](#)]
- G01R19/165 . 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 [H03K3/00](#); threshold switches [H03K17/00](#))
- G01R19/165E . . . [N: characterised by the components employed (contains no documents)]
- G01R19/165E2 [N: using electromagnetic relays, e.g. reed relay (magnetically driven reeds [G01R9/06](#))]
- G01R19/165E3 [N: using electronic tubes]
- G01R19/165E4 [N: using FET`s]
- G01R19/165E5 [N: using diodes, e.g. Zener diodes] [N9602]
- G01R19/165F . . . [N: using digital techniques or performing arithmetic operations (using digital techniques to measure a voltage or a current, see [G01R19/25](#))]
- G01R19/165G . . . [N: characterised by the application (contains no documents)]
- G01R19/165G2 [N: in AC or DC supplies ([G01R19/165E4](#) and [G01R19/165F](#) take precedence)] [C9810]
- G01R19/165G2B [N: for batteries (charge condition monitoring in [G01R31/36](#))]
- G01R19/165G2C [N: voltage or current in AC supplies (switching for protection [H02H](#); circuits for emergency power supply [H02J9/00](#))] [C9506]
- G01R19/165G2D [N: in I.C. power supplies]
- G01R19/165G3 [N: Logic probes, i.e. circuits indicating logic state (high, low, O); (modifications of electronic switches or gates for indicating state of switch [H03K17/18](#))]
- G01R19/165G4 [N: in hand-held circuit testers (see also [G01R19/155](#))]
- G01R19/165H . . . [N: Circuits and arrangements for comparing voltage or current with one or several thresholds and for indicating the result not covered by subgroups [G01R19/165E](#), [G01R19/165F](#), [G01R19/165G](#) (contains no documents)]
- G01R19/165H2 [N: comparing AC or DC current with one threshold, e.g. load current, over-current, surge current or fault current ([G01R19/165E3](#), [G01R19/165E4](#), [G01R19/165F](#), [G01R19/165G](#), [G01R19/165H5](#) take precedence; measuring currents by using elements sensitive to the magnetic field generated

- [G01R15/14](#); measuring earth resistance [G01R27/18](#); testing for leakage or short circuits in electrical apparatus [G01R31/02C2](#)) [N9703] [C1109]
- [G01R19/165H3](#) . . . [N: comparing DC or AC voltage with one threshold ([G01R19/165E3](#), [G01R19/165E4](#), [G01R19/165F](#), [G01R19/165G](#) and [G01R19/165H5](#) take precedence)]
- [G01R19/165H3B](#) [N: AC voltage or recurrent signals]
- [G01R19/165H4](#) . . . [N: for individual pulses, ripple or noise and other applications where timing or duration is of importance ([G01R19/165E4](#), [G01R19/165G2](#) and [G01R19/165H5B](#) take precedence; for pulse duration and rise time, see [G01R29/02](#) and subgroups)]
- [G01R19/165H5](#) . . . [N: to indicate that the value is within or outside a predetermined range of values (window) ([G01R19/165E3](#), [G01R19/165E4](#), [G01R19/165F](#) and [G01R19/165G](#) take precedence)]
- [G01R19/165H5B](#) [N: with multi level indication ([G01R19/165E4](#) and [G01R19/165G](#) take precedence)]
- [G01R19/17](#) . . giving an indication of the number of times this occurs, [N: i.e. multi-channel analysers]
- [G01R19/175](#) . Indicating the instants of passage of current or voltage through a given value, e.g. passage through zero [C9810]
- [G01R19/18](#) . using conversion of dc into ac, e.g. with choppers [N: DC amplifiers with modulators at input and demodulator at output [H03F3/38](#)]
- [G01R19/20](#) . . using transducers [N: 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, [G01R15/18C2](#); magnetic amplifiers [H03F9/00](#))] [C9703]
- [G01R19/22](#) . using conversion of ac into dc
- [G01R19/22T](#) . . [N: by means of thermocouples or other heat sensitive elements] [N0409]
- [G01R19/25](#) . using digital measurement techniques (arrangements for displaying measured electric variables in digital form [G01R13/02](#)) [N: Analogue/digital conversion [H03M](#)] [C9602]
- [G01R19/25B](#) . . [N: for measuring voltage only, e.g. digital volt meters (DVM`s) ([G01R19/25C](#) to [G01R19/257](#) take precedence)] [N9803]
- [G01R19/25C](#) . . [N: Arrangements for conditioning or analysing measured signals, e.g. for indicating peak values ([G01R19/00C](#) takes precedence); Details concerning sampling, digitizing or waveform capturing (displaying waveforms [G01R13/00](#); analog sampling [G01R19/00E2](#))] [N9803]
- [G01R19/25C2](#) . . . [N: Details concerning sampling, digitizing or waveform capturing] [N9803]
- [G01R19/25D](#) . . [N: Arrangements for monitoring electric power systems, e.g. power lines or loads; Logging] [N9803]
- [G01R19/25E](#) . . [N: Modular arrangements for computer based systems; using personal computers (PC`s), e.g. "virtual instruments"] [N9803]
- [G01R19/252](#) . . using analogue/digital converters of the type with conversion of voltage or current into frequency and measuring of this frequency
- [G01R19/255](#) . . 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
- [G01R19/257](#) . . 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
- [G01R19/28](#) . adapted for measuring in circuits having distributed constants

- G01R19/30 . Measuring the maximum or the minimum value of current or voltage reached in a time interval ([G01R19/04](#) takes precedence; modifications of instruments to indicate the maximum or the minimum value reached in a time interval [G01R1/40](#); [N: using digital methods [G01R19/25C](#)]) [C9803]
- G01R19/32 . Compensating for temperature change ([N: [G01R19/02](#) to [G01R19/30](#) take precedence]; modifications of instruments for temperature compensation [G01R1/44](#)) [C0409]
- G01R21/00** **Arrangements for measuring electric power or power factor ([G01R7/12](#) takes precedence)**
- G01R21/00A . [N: Measuring real or reactive component; Measuring apparent energy ([G01R21/01](#), [G01R21/02](#), [G01R21/08](#), [G01R21/10](#) and [G01R21/127](#) take precedence)]
- G01R21/00A2 . . [N: Measuring real component]
- G01R21/00A4 . . [N: Measuring reactive component]
- G01R21/00A6 . . [N: Measuring apparent power] [C0006]
- G01R21/00B . [N: Measuring power factor]
- G01R21/00D . [N: Adapted for special tariff measuring ([G01R21/01](#), [G01R21/02](#), [G01R21/08](#), [G01R21/10](#), [G01R21/127C](#) and [G01R21/133C](#) take precedence)]
- G01R21/00D2 . . [N: Measuring maximum demand]
- G01R21/01 . in circuits having distributed constants ([G01R21/04](#), [G01R21/07](#), [G01R21/09](#), [G01R21/12](#) take precedence)
- G01R21/02 . by thermal methods [N: e.g. calorimetric]
- G01R21/04 . . in circuits having distributed constants
- G01R21/06 . by measuring current and voltage ([G01R21/08](#) to [G01R21/133](#) take precedence) [C9602]
- G01R21/07 . . in circuits having distributed constants ([G01R21/09](#) takes precedence)
- G01R21/08 . by using galvanomagnetic effect devices, e.g. Hall effect devices (such devices per se [H01L](#); [N: for current measurements only, see [G01R15/20](#)])
- G01R21/09 . . in circuits having distributed constants
- G01R21/10 . by using square-law characteristics of circuit elements, e.g. diodes, to measure power absorbed by loads of known impedance ([G01R21/02](#) takes precedence)
- G01R21/12 . . in circuits having distributed constants
- G01R21/127 . by using pulse modulation ([G01R21/133](#) takes precedence; [N: digital multiplication via delta sigma modulation [G06F7/60](#)]) [C9602]
- G01R21/127B . . [N: Measuring real or reactive component, measuring apparent energy]
- G01R21/127B1 . . . [N: Measuring real component]
- G01R21/127B2 . . . [N: Measuring reactive component]
- G01R21/127B3 . . . [N: Measuring apparent energy]
- G01R21/127C . . [N: Adapted for special tariff measuring]

- G01R21/133 . by using digital technique
- G01R21/133B . . [N: Measuring real or reactive component, measuring apparent energy]
- G01R21/133C . . [N: adapted for special tariff measuring]
- G01R21/133C1 . . . [N: Tariff switching circuits]
- G01R21/133C2 . . . [N: Measuring overconsumption]
- G01R21/133C3 . . . [N: Measuring maximum demand]

- G01R21/14 . Compensating for temperature change

- G01R22/00** **Arrangements for measuring time integral of electric power or current, e.g. by electricity meters (electromechanical arrangements therefor G01R11/00; monitoring electric consumption of electrically-propelled vehicles B60L3/00; coin freed devices G07F15/00)] [C0706]**

- Note**
An arrangement for measuring time integral of electric power is classified in group [G01R21/00](#) if the essential characteristic is the measuring of electric power.

- G01R22/02 . by electrolytic methods
- G01R22/04 . by calorimetric methods
- G01R22/06 . by electronic methods [N0409]

- [N: **WARNING**
[N0801]
IPC8 group [G01R22/06](#) and subgroups, introduced in the ECLA scheme in September 2004, might be temporarily incomplete as a number of documents presently classified in group [G01R22/00](#) needs reclassification to these IPC groups
]
- G01R22/06D . . [N: Details of electronic electricity meters] [N1103]
- G01R22/06D1 . . . [N: related to remote communication] [N1103]
- G01R22/06D2 . . . [N: related to mechanical aspects] [N1103]
- G01R22/06D3 . . . [N: Arrangements for avoiding or indicating fraudulent use] [N1109]

- [N: **WARNING**
[N1109] Not complete pending reorganization; see also [G01R11/24](#)
]
- G01R22/06D4 . . . [N: Arrangements for indicating or signaling faults] [N1109]

- [N: **WARNING**
[N1109] Not complete pending reorganization; see also [G01R11/25](#)
]
- G01R22/08 . . using analogue techniques [N0409]
- G01R22/10 . . using digital techniques [N0409]

- G01R23/00** **Arrangements for measuring frequencies; Arrangements for analysing frequency spectra (frequency discriminators [H03D](#); [N: high frequency probes [G01R1/067H](#))]**

- G01R23/00D . [N: 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)] [C9802]

- G01R23/02 . Arrangements for measuring frequency, e.g. pulse repetition rate [N: (using vibrating reeds [G01R9/04](#))] Arrangements for measuring period of current or voltage (measuring short-time intervals [G04F](#)) [C0006]
- G01R23/04 . . adapted for measuring in circuits having distributed constants
- G01R23/06 . . by converting frequency into an amplitude of current or voltage
- G01R23/07 . . . using response of circuits tuned on resonance, e.g. grid-drip meter
- G01R23/08 . . . using response of circuits tuned off resonance
- G01R23/09 . . . 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 [G01T1/15](#))
- G01R23/10 . . by converting frequency into a train of pulses, which are then counted, [N: i.e. converting the signal into a square wave] [C9506]
- G01R23/12 . . by converting frequency into phase shift
- G01R23/14 . . by heterodyning; by beat-frequency comparison (generation of oscillations by beating unmodulated signals of different frequencies [H03B21/00](#))
- G01R23/14B . . . [N: by heterodyning or by beat-frequency comparison with the harmonic of an oscillator]
- G01R23/15 . . 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 [N: (indicating that pulse width is above or below a certain limit)] [C9802]
- G01R23/15B . . . [N: giving an indication of the number of times this occurs, i.e. multi-channel analysers (for pulse characteristics)] [C9802]
- G01R23/16 . Spectrum analysis; Fourier analysis [N: (computing with Fourier series or Walsh functions [G06F17/14](#), [G06G7/19](#); spectral data processing)] [C9802]
- G01R23/163 . . adapted for measuring in circuits having distributed constants
- G01R23/165 . . using filters
- G01R23/167 . . . with digital filters
- G01R23/17 . . with optical [N: or acoustical] auxiliary devices
- G01R23/173 . . Wobbling devices similar to swept panoramic receivers (panoramic receivers per se [H03J7/32](#))
- G01R23/175 . . by delay means, e.g. tapped delay lines
- G01R23/177 . . Analysis of very low frequencies
- G01R23/18 . . with provision for recording frequency spectrum
- G01R23/20 . . Measurement of non-linear distortion, [N: e.g. harmonics or noise, (G01R31/317J takes precedence; noise figure [G01R29/26](#))] [C0703]
- G01R25/00** **Arrangements for measuring phase angle between a voltage and a current, or between voltages or currents (measuring power factor [G01R21/00](#); measuring position of individual pulses in a pulse train [G01R29/02](#); phase discriminators [H03D](#))**
- G01R25/00D . [N: 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]

- G01R25/02 . in circuits having distributed constants
- G01R25/04 . involving adjustment of a phase shifter to produce a predetermined phase difference, e.g. zero difference
- G01R25/06 . employing quotient instrument
- G01R25/08 . by counting of standard pulses ([measuring time intervals G04F](#))
- G01R27/00** **Arrangements for measuring resistance, reactance, impedance, or electric characteristics derived therefrom** [N: ([measuring super-conductive properties G01R33/12G](#))]
- G01R27/02 . Measuring real or complex resistance, reactance, impedance, or other two-pole characteristics derived therefrom, e.g. time constant ([by measuring phase angle only G01R25/00](#))
 - [N: **Note**
Groups [G01R27/02](#) to [G01R27/22](#) cover variables that directly or indirectly can be measured over two poles of a component or a Thevenin two-pole equivalent. Subgroup [G01R27/26](#) also covers other techniques, e.g. using electro magnetic waves or network analyzers
]
- G01R27/02B . . [N: Measuring very high resistances, e.g. isolation resistances, i.e. megohm-meters]
- G01R27/04 . . in circuits having distributed constants, [N: e.g. having very long conductors or involving high frequencies] [C0501]
- G01R27/06 . . . Measuring reflection coefficients; Measuring standing-wave ratio
- G01R27/08 . . Measuring resistance by measuring both voltage and current
- G01R27/10 . . . using two-coil or crossed-coil instruments forming quotient
- G01R27/12 using hand generators, e.g. meggers
- G01R27/14 . . Measuring resistance by measuring current or voltage obtained from a reference source ([G01R27/16](#), [G01R27/20](#), [G01R27/22](#) take precedence)
- G01R27/16 . . Measuring impedance of element or network through which a current is passing from another source, e.g. cable, power line
- G01R27/18 . . . Measuring resistance to earth, [N: i.e. line to ground] [C9506]
- G01R27/20 . . Measuring earth resistance; Measuring contact resistance, [N: e.g.] of earth connections, e.g. plates [C9506]
- G01R27/20B . . . [N: Measuring contact resistance of connections, e.g. of earth connections]
- G01R27/22 . . Measuring resistance of fluids ([measuring vessels, electrodes therefor G01N27/07](#))
- G01R27/26 . . Measuring inductance or capacitance; Measuring quality factor, e.g. by using the resonance method; Measuring loss factor; Measuring dielectric constants; [N: Measuring impedance or related variables] [C9506]
- G01R27/26B . . . [N: Measuring capacitance (capacitive sensors G01D5/24)] [C0605]
- G01R27/26C . . . [N: Measuring inductance]
- G01R27/26D . . . [N: Measuring dielectric properties, e.g. constants ([testing dielectric strength G01R31/12](#); [detecting insulation faults G01R31/02C2](#); [G01R27/26E](#) takes precedence)]
- G01R27/26D3 [N: Measuring-systems or electronic circuits ([G01R27/26D4](#), [G01R27/26D5](#))

- take precedence]
- G01R27/26D3B [N: Bridge circuits (bridges for measuring loss angle [G01R27/26E2](#))]
- G01R27/26D4 [N: Sample holders, electrodes or excitation arrangements, e.g. sensors or measuring cells]
- G01R27/26D4B [N: of plate type, i.e. with the sample sandwiched in the middle]
- G01R27/26D4C [N: of coaxial or concentric type, e.g. with the sample in a coaxial line]
- G01R27/26D4C2 [N: open-ended type, e.g. abutting against the sample]
- G01R27/26D4D [N: Cavities, resonators, free space arrangements, reflexion or interference arrangements ([G01R27/26D4C](#) takes precedence; optical methods [G01R27/26D5](#))]
- G01R27/26D4D2 [N: Transmission line, wave guide (closed or open-ended) or strip - or microstrip line arrangements]
- G01R27/26D4E [N: Coils or antennae arrangements, e.g. coils surrounding the sample or transmitter/receiver antennae]
- G01R27/26D4P [N: Probes]
- G01R27/26D5 [N: using optical methods or electron beams]
- G01R27/26E [N: Measuring quality factor or dielectric loss, e.g. loss angle, or power factor (power factor related to power measurements [G01R21/00B](#); testing capacitors [G01R31/01B2](#))] [C9703]
- G01R27/26E2 [N: Measuring dielectric loss, e.g. loss angle, loss factor or power factor]
- G01R27/28 Measuring attenuation, gain, phase shift or derived characteristics of electric four pole networks, i.e. two-port networks [N: using network analysers] Measuring transient response (in line transmission systems [H04B3/46](#)) [C0006]
- G01R27/30 with provision for recording characteristics, e.g. by plotting Nyquist diagram
- G01R27/32 in circuits having distributed constants, [N: e.g. having very long conductors or involving high frequencies] [C9703]
- G01R29/00** **Arrangements for measuring or indicating electric quantities not covered by groups [G01R19/00](#) to [G01R27/00](#)**
- G01R29/02 Measuring characteristics of individual pulses, e.g. deviation from pulse flatness, rise time, duration (of amplitude [G01R19/00](#); of repetition rate [G01R23/00](#); of phase difference of two cyclic pulse trains [G01R25/00](#); monitoring pattern of pulse trains [H03K5/19](#))
- G01R29/02P [N: Measuring pulse width] [N0605] [C0706] [C0706]
- [N: **WARNING**
This group is incomplete pending a reorganisation. See also [G01R29/02](#) and [G01R29/027C](#)
]
- G01R29/027 Indicating that a pulse characteristic is either above or below a predetermined value or within or beyond a predetermined range of values
- G01R29/027C [N: the pulse characteristic being duration i.e. width (indicating that frequency of pulses is above or below a certain limit)] [C9802]
- G01R29/027D [N: the pulse characteristic being rise time (measuring rate of change 19/12)]
- G01R29/033 giving an indication of the number of times this occurs, [N: i.e. multi-channel analysers (the characteristic being frequency)] [C9802]
- G01R29/04 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

- G01R29/06 . Measuring depth of modulation
- G01R29/08 . Measuring electromagnetic field characteristics [N: measuring electrostatic fields [G01R29/12](#); for determining a voltage [G01R15/14](#); measuring magnetic fields [G01R33/00](#); Receiver signal strength indication (RSSI) [H04B17/00B1](#)] [C9703]
- G01R29/08A . . [N: characterised by the application (not used, see subgroups)] [N9609]
- G01R29/08A3 . . . [N: Field measurements related to measuring influence on or from apparatus, components or humans (EMC, EMI and similar testing in general [G01R31/00E](#)), 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] [N9609]
- G01R29/08A3B [N: rooms and test sites therefor, e.g. anechoic chambers, open field sites or TEM cells (for testing antennas [G01R29/10B](#))] [N9609]
- G01R29/08A3B2 [N: TEM-cells] [N9609]
- G01R29/08A3C [N: Testing shielding, e.g. for efficiency] [N9609]
- G01R29/08A3D [N: Measurements related to lightning, e.g. measuring electric disturbances, warning systems] [N9609]
- G01R29/08A3E [N: for detecting presence or location of electric lines or cables (fault detection [G01R31/02](#); fault location [G01R31/08](#))] [N9609]
- G01R29/08A3F [N: Dosimetry, i.e. measuring the time integral of radiation intensity; Level warning devices for personal safety use (Nuclear radiation dosimetry [G01T](#))] [N9609]
- G01R29/08E . . [N: characterised by constructional or functional features (not used, see subgroups)] [N9609]
- G01R29/08E2 . . . [N: Complete apparatus or systems; circuits, e.g. receivers or amplifiers ([G01R29/08E3](#), [G01R29/08E4](#) take precedence; dosimeters, warning devices [29/08A3F](#))] [N9609]
- G01R29/08E3 . . . [N: Sensors; antennas; probes; detectors (Wave guide measuring sections [G01R1/24](#))] [N9609]
- G01R29/08E3B [N: using optical probes, e.g. electro-optical, luminiscent, glow discharge, or optical interferometers] [N9703]
- G01R29/08E4 . . . [N: 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] [N9609]
- G01R29/10 . . Radiation diagrams of aerials; [N: Antenna testing in general] [C9609]
- G01R29/10B . . . [N: using anechoic chambers; Chambers or open field sites used therefor (test sites used for measuring on other objects than aerials [G01R29/08A3B2](#); wave absorbing devices [H01Q17/00](#))] [C9609]
- G01R29/12 . Measuring electrostatic fields [N: or voltage-potential] [C9506]
- G01R29/14 . . Measuring field distribution
- G01R29/16 . Measuring asymmetry of polyphase networks
- G01R29/18 . Indicating phase sequence; Indicating synchronism
- G01R29/20 . Measuring number of turns; Measuring transformation ratio or coupling factor of windings ([N: testing or] calibrating instrument transformers [G01R35/02](#)) [M1112]

- G01R29/22 . Measuring piezo-electric properties
- G01R29/24 . Arrangements for measuring quantities of charge (electrostatic instruments [G01R5/28](#); indicating presence of current [G01R19/15](#); electrolytic meters, calorimetric meters, for measuring time integral of electric current [G01R22/02](#), [G01R22/04](#))
- G01R29/26 . Measuring noise figure; Measuring signal-to-noise ratio [N: Measuring jitter, i.e. phase noise, (distortion [G01R23/20](#); noise measuring in individual transistors [G01R31/26C2N](#), [G01R31/26C3N](#))] [C0006]
- G01R31/00** **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 [G01R1/06](#); [N: measuring superconductive properties [G01R33/12G](#); data processing equipment for testing or function monitoring [G06F15/20B](#)]; indicating electrical condition of switchgear or protective devices [H01H71/04](#), [H01H73/12](#), [H02B11/10](#), [H02H3/04](#); testing or measuring semiconductors or solid state devices during manufacture [H01L22/00](#); testing substation equipment, e.g. mobile phones [H04M1/24](#); testing or monitoring of control systems [G05B23/02](#); [N: testing or monitoring transmitters or receivers [H04B17/00](#)]) [M1205]
- G01R31/00E . [N: Measuring interference from external sources to, or emission from, the device under test, e.g. EMC, EMI, EMP or ESD testing (measuring electromagnetic fields [G01R29/08](#); circuits for generating HV pulses in dielectric strength testing [G01R31/14](#))] [N9609]
- G01R31/00E2 . . [N: where the device under test is an electronic circuit] [N9609]
- G01R31/00F . [N: Environmental or reliability tests (of individual semiconductors [G01R31/26E](#); of PCB's [G01R31/28B5E](#); of IC's [G01R31/28G2](#); of other circuits [G01R31/28F4G](#))] [N1109]
 [N: **WARNING**
 [N1109] Not complete pending reorganization; see also [G01R31/28F4G](#)
]
- G01R31/00T . [N: Testing of electric installations on transport means]
- G01R31/00T2 . . [N: on road vehicles, e.g. automobiles or trucks (testing of ignition installations peculiar to internal combustion engines [F02P17/00](#))] [C1103]
- G01R31/00T2B . . . [N: using microprocessors or computers]
- G01R31/00T3 . . [N: on air- or spacecraft, railway rolling stock or sea-going vessels]
- G01R31/01 . 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 ([G01R31/18](#) takes precedence; [N: for testing batteries [G01R31/36](#)]) [C9703]
- G01R31/01B . . [N: Testing passive components (relays [G01R31/327C2](#); electrical windings, e.g. inductors [G01R31/06](#))] [C9506]
- G01R31/01B2 . . . [N: Testing of capacitors (measuring capacitance [G01R27/26B](#))] [C1004]
- G01R31/02 . Testing of electric apparatus, lines or components, for short-circuits, discontinuities, leakage [N: of current], or incorrect line connection [N: ([G01R31/00E](#), [G01R31/00T](#), [G01R31/01](#), [G01R31/08](#), [G01R31/12](#), [G01R31/24](#), [G01R31/26](#), [G01R31/28](#), [G01R31/327](#), [G01R31/34](#), [G01R31/36](#), [G01R31/40](#), [G01R31/44](#) take precedence; measuring electromagnetic field leakage [G01R29/08A3B](#); testing of sparking plugs [H01T13/58](#))] [C1109]

- G01R31/02B . . [N: Testing of cables or conductors (testing of electric windings [G01R31/06](#); testing of insulation of cables [G01R31/12F5B](#); testing LANs [H04L12/26T](#); testing line transmission systems [H04B3/46](#))] [C1103] [M1112]
- G01R31/02B2 . . . [N: Testing while the cable or conductor passes continuously the testing apparatus, e.g. during manufacturing]
- G01R31/02B3 . . . [N: Identification of wires in a multicore cable]
- G01R31/02C . . [N: Arrangements for indicating continuity or short-circuits in electric apparatus or lines, leakage or ground faults (in electric windings [G01R31/06](#); measuring resistance to earth [G01R27/18](#))] [C1103] [M1112]
- G01R31/02C2 . . . [N: Testing short circuits, leakage or ground faults (detecting failure within the drive train of electrically-propelled vehicles [B60L3/00F](#))] [C1103]
- G01R31/02C4 . . . [N: Testing continuity ([G01R31/44](#) takes precedence)]
- G01R31/02D . . [N: Testing of transformers (testing of electric windings [G01R31/06](#))] [N1103]
- G01R31/02E . . [N: Testing of capacitors] [N1103]
- G01R31/04 . . Testing connections, e.g. of plugs, of non-disconnectable joints [N: (G01R31/317K7 takes precedence; testing of connections in integrated circuits, chip-to-lead connections, bond wires [G01R31/28G1](#))] [C0703]
- G01R31/04B . . . [N: Testing of correct wire connections in electrical apparatus and circuits (details concerning insertion or connection of batteries [H02J7/00E2](#))] [C9803]
- G01R31/04C . . . [N: of releaseable connections, e.g. terminals mounted on a printed circuit board] [N9803]
- G01R31/04C2 [N: of plugs, sockets or terminals at the end of a cable or a wire harness; of wall sockets; of power sockets in appliances] [N9803]
- G01R31/04D [N: of connections between components and printed circuit boards (PCB`s) ([G01R31/04C](#) takes precedence)] [N9803]
- G01R31/04D2 [N: Details concerning testing solder joints] [N9803]
- G01R31/06 . . Testing of electric windings [N: e.g. of solenoids, inductors], e.g. for polarity [N: [G01R31/02D](#) and [G01R31/34C](#) take precedence] (measuring number of turns, transformation ratio, or coupling factor [G01R29/20](#); [N: monitoring or fail-safe circuits for electromagnets [H01F7/18C](#))] [C1112]
- G01R31/07 . . Testing of fuses (means for indicating condition of fuse structurally associated with the fuse [H01H85/30](#))
- G01R31/08 . . Locating faults in cables, transmission lines, or networks (emergency protective circuit arrangements [H02H](#)) [N: installing, maintaining, repairing or dismantling electric cables or lines [H02G1/00](#); testing LAN`s [H04L12/26T](#)] [C9602] [M1112]
- G01R31/08D . . [N: according to type of conductors] [N1103]
- G01R31/08D2 . . . [N: in cables, e.g. underground] [N1103] [M1112]
- G01R31/08D3 . . . [N: in power transmission or distribution lines, e.g. overhead] [N1103] [M1112]
- G01R31/08D4 . . . [N: in power transmission or distribution networks, i.e. with interconnected conductors] [N1103] [M1112]
- G01R31/08F . . [N: Aspects of digital computing] [N1103]
- G01R31/10 . . by increasing destruction at fault, e.g. burning-in by using a pulse generator operating a special programme
- G01R31/11 . . using pulse reflection methods
- G01R31/12 . . Testing dielectric strength or breakdown voltage; [N: 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 ([G01R31/06](#), [G01R31/08](#) and [G01R31/327](#) take precedence; measuring in plasmas [G01R19/00E3](#); Measuring dielectric constants [G01R27/26D](#); ESD, EMC or EMP testing of circuits

-)] [C9506]
- G01R31/12D . . [N: using acoustic measurements ([acoustic measurements G01H3/00](#))]
- G01R31/12E . . [N: using optical methods; using charged particle, e.g. electron, beams or X-rays] [N9506]
- G01R31/12F . . [N: of components, parts or materials ([G01R31/12D](#), [G01R31/12E](#), [G01R31/18](#) take precedence; circuits therefor [G01R31/14](#); testing vessels of electrodes [G01R31/16](#))] [N9506] [M1112]
- G01R31/12F2 . . . [N: of surge arresters ([Monitoring overvoltage diverters or arresters H02H3/04E](#))] [N9506] [C9609]
- G01R31/12F3 . . . [N: of line insulators or spacers, e.g. ceramic overhead line cap insulators; of insulators in HV bushings] [N9506]
- G01R31/12F4 . . . [N: of gas-insulated power appliances or vacuum gaps ([testing switches G01R31/327](#); [detecting electrical or mechanical defects in encased switchgear H02B13/065](#))] [N9506] [C9703]
- G01R31/12F5 . . . [N: 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] [N9506]
- G01R31/12F5B [N: of cable, line or wire insulation, e.g. using partial discharge measurements ([locating faults in cables G01R31/08B2](#))] [N9506]
- G01R31/12F5C [N: of liquids or gases] [N9506]
- G01R31/12F5D [N: of components or parts made of semiconducting materials; of LV components or parts ([G01R31/18](#) takes precedence)] [N9506]
- G01R31/14 . . Circuits therefor, [N: e.g. for generating test voltages, sensing circuits ([G01R31/12D](#) to [G01R31/12F](#) take precedence; for testing switches [G01R31/327](#))] [C9506]
- G01R31/16 . . Construction of testing vessels; Electrodes therefor
- G01R31/18 . . Subjecting similar articles in turn to test, e.g. go/no-go tests in mass production
- G01R31/20 . . Preparation of articles or specimens to facilitate testing

- G01R31/24 . Testing of discharge tubes ([during manufacture H01J9/42](#))
- G01R31/24B . . [N: Testing of gas discharge tubes]
- G01R31/25 . . Testing of vacuum tubes
- G01R31/25E . . . [N: Testing of electron multipliers, e.g. photo-multipliers]
- G01R31/25H . . . [N: Testing of transit-time tubes, e.g. klystrons, magnetrons]
- G01R31/25S . . . [N: Testing of beam-tubes, e.g. cathode-ray tubes, image pick-up tubes ([of channel image intensifier arrays G01R31/25E](#); of transit time tubes [G01R31/25H](#))]

- G01R31/26 . Testing of individual semiconductor devices ([measurement of impurity content of materials G01N](#))
- G01R31/26A . . [N: Apparatus or methods therefor ([G01R31/26C](#), [G01R31/26E](#) take precedence)]
- G01R31/26A2 . . . [N: for curve tracing of semiconductor characteristics, e.g. on oscilloscope]
- G01R31/26A3 . . . [N: for testing individual solar cells] [N1109]
- G01R31/26C . . [N: Circuits therefor ([G01R31/26E](#) takes precedence)]
- G01R31/26C2 . . . [N: for testing bipolar transistors]
- G01R31/26C2B [N: for measuring break-down voltage or punch through voltage therefor]
- G01R31/26C2F [N: for measuring frequency response characteristics, e.g. cut-off frequency]

- thereof]
- G01R31/26C2G [N: for measuring gain factor thereof]
 - G01R31/26C2N [N: for measuring noise (measuring noise factor in general [G01R29/26](#))]
 - G01R31/26C2S [N: for measuring switching properties thereof]
 - G01R31/26C2T [N: for measuring thermal properties thereof]
 - G01R31/26C3 [N: for testing field effect transistors, i.e. FET`s]
 - G01R31/26C3B [N: for measuring break-down voltage therefor]
 - G01R31/26C3G [N: for measuring gain factor thereof]
 - G01R31/26C3N [N: for measuring noise (measuring noise factor in general [G01R29/26](#))]
 - G01R31/26C3T [N: for measuring thermal properties thereof]
 - G01R31/26C4 [N: for testing thyristors]
 - G01R31/26C6 [N: for testing diodes]
 - G01R31/26C6S [N: for measuring switching properties thereof]
 - G01R31/26C6T [N: Testing light-emitting diodes, laser diodes or photodiodes] [M1112]
 - G01R31/26C8 [N: for testing other individual devices ([G01R31/26C2](#) to [G01R31/26C6](#), [G01R31/27](#) take precedence)]
 - G01R31/26C8M [N: for testing field-effect devices, e.g. of MOS-capacitors ([G01R31/26C3](#) takes precedence)]
 - G01R31/26C10 [N: for testing charge coupled devices]
 - G01R31/26E [N: Testing semiconductor operation lifetime or reliability, e.g. by accelerated life tests]
 - G01R31/26M [N: Adaptations of individual semiconductor devices to facilitate the testing thereof]
 - G01R31/26N [N: for measuring noise ([G01R31/26C2N](#), [G01R31/26C3N](#) take precedence)]
 - G01R31/26P [N: Characterising semiconductor materials (testing of materials or semi-finished products [G01R31/28E11](#); testing during manufacture [H01L22/00](#))] [M1205]
 - G01R31/265 Contactless testing [N: (of circuits, also in wafer-form [G01R31/302](#))] [C1205]
 - G01R31/265B [N: using electron beams]
 - G01R31/265C [N: using non-ionising electromagnetic radiation, e.g. optical radiation]
 - G01R31/27 Testing of devices without physical removal from the circuit of which they form part, e.g. compensating for effects surrounding elements [N: (testing printed circuit boards [G01R31/28B](#))]
 - G01R31/27B [N: for testing individual semiconductor components within integrated circuits]
 - G01R31/28 Testing of electronic circuits, e.g. by signal tracer ([N: EMC, EMP or similar testing of electronic circuits [G01R31/00E2](#)]; testing for short-circuits, discontinuities, leakage or incorrect line connection [G01R31/02](#); checking computers [N: or computer components] [G06F11/00](#); checking static stores for correct operation [G11C29/00](#); [N: testing receivers or transmitters of transmission systems [H04B17/00](#))] [C9703]
 - G01R31/28B [N: Testing of printed circuits, backplanes, motherboards, hybrid circuits or carriers for multichip packages (MCP) ([G01R31/3185M1](#) takes precedence; contactless testing [G01R31/302](#); testing contacts or connections [G01R31/04](#))] [C0703]
 - G01R31/28B2 [N: by means of functional tests, e.g. logic-circuit-simulation or algorithms therefor (testing electronic digital computers [G06F11/00](#))]
 - G01R31/28B3 [N: Bare printed circuit boards]
 - G01R31/28B4 [N: Apparatus therefor, e.g. test stations, drivers, analysers, conveyers ([G01R31/28B3](#), [G01R31/28B5](#), [G01R31/28B6](#) take precedence)] [C9602]
 - G01R31/28B4B [N: Holding, conveying or contacting devices, e.g. test adapters, edge

- connectors, extender boards (probe, multiprobe, probe manipulator or probe fixture [G01R1/067](#)) [[C9506](#)]
- G01R31/28B5 . . . [N: Specific types of tests or tests for a specific type of fault, e.g. thermal mapping, shorts testing ([G01R31/28B6](#) takes precedence)] [[C9602](#)]
- G01R31/28B5B [N: Checking for open circuits or shorts, e.g. solder bridges; Testing conductivity, resistivity or impedance (of connections [G01R31/04](#))]
- G01R31/28B5C [N: Checking the presence, location, orientation or value, e.g. resistance, of components or conductors (orientation of the DUT with respect to the test fixture [G01R1/067B](#), [G01R31/28B5](#))]
- G01R31/28B5D [N: Functional tests, e.g. boundary scans, using the normal I/O contacts (contacting devices [G01R31/28B4B](#); testing digital circuits [G01R31/317](#), [G06F11](#))] [[C9411](#)]
- G01R31/28B5E [N: Environmental-, stress-, or burn-in tests (of IC's [G01R31/28G2](#); of individual semiconductors [G01R31/26E](#); of other circuits [G01R31/28F4G](#))] [[C1109](#)]
- G01R31/28B6 [N: using test structures on, or modifications of, the card under test, made for the purpose of testing, e.g. additional components or connectors ([G01R31/28B3](#) takes precedence; printed circuits having e.g. symbols, test patterns or visualisation means [H05K1/02D](#))] [[C1109](#)]
- G01R31/28E . . . [N: Testing of electronic circuits specially adapted for particular applications not provided for elsewhere ([G01R31/28B](#) and [G01R31/28G](#) take precedence)] [[C1109](#)]
- [N: **Informative note**
[[C0404](#)]
References listed below indicate ECLA 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 [G01R31/26C6T](#)

- testing of lamps [G01R31/44](#)
- testing of displays and display drivers, e.g. LCDs
[G09G3/00E](#)
- testing of ADCs or DACs [H03M1/10T](#)
]
- G01R31/28E3 [N: of microwave or radiofrequency circuits (of attenuation, gain, e.g. using network analyzers [G01R27/28](#))]
- G01R31/28E3B [N: testing of oscillators or resonators]
- G01R31/28E6 [N: in household appliances or professional audio/video equipment (testing loudspeakers [H04R29/00](#), testing LAN's [H04L12/26T](#); testing TV systems [H04N17/00](#))] [[C0006](#)]
- G01R31/28E8 [N: Testing of electronic protection circuits (testing switches [G01R31/327](#); checking alarm systems [G08B29/00](#); self test of summation current transformers [H02H3/33E2](#))] [[C1109](#)]
- G01R31/28E9 N: Testing of circuits in sensor or actuator systems (testing of apparatus for measuring electric or magnetic variables [G01R35/00](#); testing of indicating or recording apparatus [G01D](#); in airbag systems [B60R21/00B4D](#); checking gas analysers [G01N33/00D2F](#); monitoring or fail-safe circuits for electromagnets [H01F7/18C](#))] [[C0006](#)] [[M1112](#)]
- G01R31/28E11 [N: Testing of materials or semi-finished products, e.g. semiconductor wafers or substrates ([G01R31/3185M3](#) takes precedence; testing during manufacture [H01L22/00](#))] [[M1205](#)]
- G01R31/28F . . . [N: Specific tests of electronic circuits not provided for elsewhere (contains no documents; [G01R31/28B](#) and [G01R31/316](#) take precedence)]

- G01R31/28F3 . . . [N: Automated test systems (ATE); using microprocessors or computers ([G01R31/317](#) takes precedence; ATE for detection of defective computer hardware [G06F11/273A](#); special purpose computers for testing [G06F15/20B](#))] [C9409]
- G01R31/28F4 . . . [N: Fault-finding or characterising ([G01R31/28E3](#) to [G01R31/28E11](#) take precedence)] [C9409]
- G01R31/28F4B [N: Characterising or performance testing, e.g. of frequency response (transient response [G01R27/28](#))] [C9409]
- G01R31/28F4C [N: using signal generators, power supplies or circuit analysers ([G01R31/28G2D2](#) takes precedence; multimeters [G01R15/12](#), network analysers [G01R27/28](#))] [C0612]
- G01R31/28F4C2 [N: Signal generators]
- G01R31/28F4D [N: In-circuit-testing]
- G01R31/28F4E [N: using test interfaces, e.g. adapters, test boxes, switches, PIN drivers ([G01R31/28G5C](#) takes precedence)] [C0612]
- G01R31/28F4F [N: using hard- or software simulation or using knowledge-based systems, e.g. expert systems, artificial intelligence or interactive algorithms]
- G01R31/28F4F2 [N: using simulation]
- G01R31/28F4G [N: Environmental or reliability testing, e.g. burn-in or validation tests (of individual semiconductors [G01R31/26E](#); of printed circuits boards [G01R31/28B5E](#); of IC's [G01R31/28G2](#))] [C0907]
- G01R31/28G . . . [N: Testing of integrated circuits (IC) ([G01R31/317](#) takes precedence; testing individual devices [G01R31/26](#); testing printed circuits [G01R31/28B](#))] [N0501]
- G01R31/28G1 . . . [N: Electrical testing of internal connections or -isolation, e.g. latch-up or chip-to-lead connections ([G01R31/317K7](#) takes precedence; test of chip-to-PCB or lead-to-PCB connections [G01R31/04](#))] [C0703]
- G01R31/28G2 . . . [N: Environmental, reliability or burn-in testing] [N0501]
- G01R31/28G2A [N: Internal circuit aspects, e.g. built-in test features; Test chips; Measuring material aspects, e.g. electro migration (EM)] [N0612]
- G01R31/28G2A1 [N: Measuring of material aspects, e.g. electro-migration (EM), hot carrier injection] [N0612]
- G01R31/28G2B [N: External aspects, e.g. related to chambers, contacting devices or handlers] [N0612]
- G01R31/28G2B1 [N: Chambers or ovens; Tanks] [N0612]
- G01R31/28G2B2 [N: Contacting devices, e.g. sockets, burn-in boards or mounting fixtures (in general [G01R1/04](#))] [N0612]
- G01R31/28G2B3 [N: Holding devices, e.g. chucks; Handlers or transport devices (having contacts [G01R31/28G2B2](#))] [N0612]
- G01R31/28G2B3A [N: Handlers or transport devices, e.g. loaders, carriers, trays] [N0612]
- G01R31/28G2B4 [N: Complete testing stations; systems; procedures; software aspects] [N0612]
- G01R31/28G2B4A [N: Procedures; Software aspects] [N0612]
- G01R31/28G2D [N: related to electrical or environmental aspects, e.g. temperature, humidity, vibration, nuclear radiation] [N0612] [C1103]
- G01R31/28G2D1 [N: related to temperature] [N0612]
- G01R31/28G2D1A [N: related to heating] [N0612]
- G01R31/28G2D1B [N: related to cooling] [N0612]
- G01R31/28G2D2 [N: related to electrical aspects, e.g. to voltage or current supply or stimuli or to electrical loads] [N0612]

- G01R31/28G2D3 [N: related to environmental aspects other than temperature, e.g. humidity or vibrations] [N0612]
- G01R31/28G3 [N: Testing timing characteristics] [N0501]
- G01R31/28G4 [N: using dedicated test connectors, test elements or test circuits on the IC under test (G01R31/28G2 takes precedence)] [N0501] [C0612]
- G01R31/28G5 [N: Features relating to contacting the IC under test, e.g. probe heads; chucks (G01R31/28G2B3 takes precedence, test connections, e.g. test sockets, or probes per se, G01R1/04 or G01R1/06)] [N0501] [C0612]
- G01R31/28G5B [N: involving moving the probe head or the IC under test; docking stations (moving single probes G01R1/067B; moving individual probes in multiple probes G01R1/073E)] [N0501]
- G01R31/28G5C [N: Interfaces, e.g. between probe and tester (G01R31/319C1 and G01R1/073B9 take precedence)] [N0501]
- G01R31/28G5D [N: related to sensing or controlling of force, position, temperature (G01R31/28G2D1 takes precedences; sensing of force G01L; sensing of position G01B, G01D; sensing of temperature G01K; controlling in general G05)] [N0508] [C0612]
- G01R31/28G6 [N: Handling, conveying or loading, e.g. belts, boats, vacuum fingers (G01R31/28G2B3A takes precedence; handling semiconductor devices or wafers during manufacture or treatment H01L21/67)] [N0508] [C0612]
- G01R31/28G7 [N: Aspects of quality control (QC) (G01R31/317L takes precedence; program control for QC G05B19/418Q)] [C0703]
- G01R31/28G8 [N: Testing of IC packages; Test features related to IC packages (containers per se H01L23/02, encapsulations per se H01L23/28)] [N0508][N0508]
- G01R31/28G9 [N: Sample preparation, e.g. removing encapsulation, etching (sample preparation in general G01N1/00)] [N0508]
- G01R31/30 . . . Marginal testing, e.g. varying supply voltage (marginal testing of computers G06)
- G01R31/30C [N: Current or voltage test] [N9903]
- G01R31/30C1 [N: Quiescent current [IDDQ] test or leakage current test] [N0505] [M1111]
- G01R31/30C3 [N: Built-In-Current test (BIC)] [N0505]
- G01R31/30D [N: Delay or race condition test, e.g. race hazard test] [N9903] [M1111]
- G01R31/302 . . . Contactless testing (non contact-making probes G01R1/07) [N: (G01R31/04 takes precedence)] [C9803]
- G01R31/302W [N: Wireless interface with the DUT] [N1110]
- G01R31/303 of integrated circuits (G01R31/305 to G01R31/315 take precedence)
- G01R31/304 of printed or hybrid circuits (G01R31/305 to G01R31/315 take precedence)
- G01R31/305 using electron beams [N: (investigating or analysing materials by measuring photoelectric effect G01N23/227)]
- G01R31/306 of printed or hybrid circuits
- G01R31/307 of integrated circuits
- G01R31/308 using non-ionising electromagnetic radiation, e.g. optical radiation[N: (investigating or analysing materials by the use of optical meansG01N21/00; image analysis G06T7/00)] [C0605]
- G01R31/309 of printed or hybrid circuits [N: or circuit substrates] [C0006]
- G01R31/311 of integrated circuits [N: (G01R31/317W takes precedence)] [C0703]
- G01R31/312 by capacitive methods
- G01R31/315 by inductive methods
- G01R31/316 . . . Testing of analog circuits [N: (G01R31/28G takes precedence)] [C0501]

- G01R31/3161 . . . Marginal testing
- G01R31/3163 . . . Functional testing
- G01R31/3167 . . . Testing of combined analog and digital circuits [N: (testing ADC`s [H03M1/10T](#)) [[C9602](#)]
- G01R31/317 . . . Testing of digital circuits [N: WARNING: The following subgroups of G01R31/317 are not complete due to an ongoing reorganisation : G01R31/317B, G01R31/317J, G01R31/317J5, G01R31/317K7, G01R31/317L, G01R31/317W, G01R31/319A. See also G01R31/317 and its other subgroups]
- G01R31/317A . . . [N: Arrangements for setting the Unit Under Test (UUT) in a test mode] [N9903]
- G01R31/317B . . . [N: Testing digital circuits including elements other than semiconductor transistors, e.g. biochips, nano-fabrics, mems, chips with magnetic elements] [N0703]
- G01R31/317C . . . [N: Comparison aspects, e.g. signature analysis, comparators (concerning scan tests [G01R31/3185S7](#); concerning testers [G01R31/3193](#))] [N0505]
- G01R31/317D . . . [N: Design for test; Design verification (concerning scan tests [G01R31/3185S12](#); computer-aided design [G06F17/50](#))] [N0505] [M1111]
- G01R31/317F . . . [N: Debugging aspects, e.g. using test circuits for debugging, using dedicated debugging test circuits (generation of test sequences therefor [G01R31/3183F1](#), using scan test therefor [G01R31/3185S3](#))] [N0505]
- G01R31/317G . . . [N: involving differential digital signals, e.g. testing differential signal circuits, using differential signals for testing] [N0812]
- G01R31/317H . . . [N: Test strategies (methods for generation of test sequences [G01R31/3183M](#))] [N0505]
- G01R31/317J . . . [N: Analysis of signal quality (G01R31/319A takes precedence; measuring frequencies or analysing frequency spectra per se G01R23/00; measuring non-linear distortion per se G01R23/20)] [N0703]
- G01R31/317J1 [N: Jitter measurements; Jitter generators (measuring jitter, noise figure or signal-to-noise ratio per se [G01R29/26](#); analysis of tester signals [G01R31/319A](#))] [N0703] [M1111]
- G01R31/317J3 [N: BER (Bit Error Rate) test] [N0703]
- G01R31/317J5 [N: Evaluation methods, e.g. shmoo plots] [N0703]
- G01R31/317K [N: Input or output aspects] [N0505]
- G01R31/317K1 [N: Input or output interfaces for test, e.g. test pins, buffers (for scan test [G01R31/3185S9](#))] [N0505]
- G01R31/317K3 [N: 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] [N0505]
- G01R31/317K5 [N: Testing of input or output with loop-back] [N0505]
- G01R31/317K7 [N: Interconnect testing (by scan techniques see [G01R31/3185S3I](#))] [N0703]
- G01R31/317L . . . [N: 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 [G01R31/28B4B](#), [G01R31/28G](#))] [N0703]
- G01R31/317M . . . [N: Security aspects, e.g. preventing unauthorised access during test] [N0505]
- G01R31/317N . . . [N: Optimisation aspects, e.g. using functional pin as test pin, pin multiplexing] [N0507]
- G01R31/317P . . . [N: Power aspects, e.g. power supplies for test circuits, power saving during test (for scan test [G01R31/3185S10](#))] [N0505]
- G01R31/317Q . . . [N: Addressing or selecting of test units, e.g. transmission protocols for selecting test units (for scan test [G01R31/3185S6](#))] [N0505]

- G01R31/317R . . . [N: 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 [G01R31/319S4](#))] [N0505]
- G01R31/317S . . . [N: Test controller, e.g. BIST state machine (for scan test [G01R31/3185S5](#))] [N0505]
- G01R31/317T . . . [N: Timing aspects, e.g. clock distribution, skew, propagation delay (for tester hardware [G01R31/3193T](#))] [N0505]
- G01R31/317T1 [N: Synchronization, e.g. of test, clock or strobe signals; Signals in different clock domains; Generation of Vernier signals; Comparison and adjustment of the signals] [N0812]
- G01R31/317U . . . [N: Clock circuits aspects, e.g. test clock circuit details, timing aspects for signal generation, circuits for testing clocks ([G01R31/317T](#) takes precedence; concerning scan test [G01R31/3185S4](#), for tester hardware [G01R31/319S2](#))] [N0505]
- G01R31/317W . . . [N: 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 G01R1/07E; electro-optic sampling for oscilloscopes G01R13/34D; contactless testing of individual semiconductor devices by optical means G01R31/265C)] [N0703]
- G01R31/3173 . . . Marginal testing
- G01R31/3177 . . . Testing of logic operation, e.g. by logic analysers
- G01R31/3181 . . . Functional testing ([G01R31/3177](#) takes precedence)
- G01R31/3181G [N: Test pattern generators] [N9903]
- G01R31/3181S [N: Soft error testing; Soft error rate evaluation; Single event testing] [N0812]
- G01R31/3183 Generation of test inputs, e.g. test vectors, patterns or sequence
- G01R31/3183A [N: computer-aided, e.g. automatic test program generator (ATPG), program translations, test program debugging] [N9903]
- G01R31/3183B [N: Tools, e.g. program interfaces, test suite, test bench, simulation hardware, test compiler, test program languages (simulation software G01R31/3183F3; emulators G06F11/26S2)] [N0703]
- G01R31/3183C [N: for combinational circuits] [N9903]
- G01R31/3183D [N: for delay tests] [N9903]
- G01R31/3183E [N: Test pattern compression or decompression (compression or decompression of scan patterns G01R31/3185S3D; compression or decompression hardware G01R31/319S1C)] [N0703]
- G01R31/3183F [N: by preliminary fault modelling, e.g. analysis, simulation] [N9903]
- G01R31/3183F1 [N: Analysis of test coverage or failure detectability] [N9903]
- G01R31/3183F3 [N: Simulation (computer simulation of digital circuits G06F17/50C)] [N0701]
- G01R31/3183H [N: as a result of hardware simulation, e.g. in an HDL environment (computer-aided simulation of circuits [G06F17/50C](#))] [N0703]
- G01R31/3183M [N: Methodologies therefor, e.g. algorithms, procedures] [N9903]
- G01R31/3183N [N: of patterns for devices arranged in a network] [N0812]
- G01R31/3183R [N: Random or pseudo-random test pattern] [N0703]
- G01R31/3183S [N: for sequential circuits ([G01R31/3185S3](#) takes precedence)] [N9903]
- G01R31/3185 Reconfiguring for testing, e.g. LSSD, partitioning
- G01R31/3185C [N: Test of Combinational circuits] [N9903]

G01R31/3185M	. . . . .	[N: Test of Modular systems, e.g. Wafers, MCM`s] [N9903]
G01R31/3185M1	. . . . .	[N: Board Level Test, e.g. P1500 Standard (features related to boundary scan G01R31/3185S)] [N0703]
G01R31/3185M3	. . . . .	[N: Wafer Test] [N0703]
G01R31/3185M5	. . . . .	[N: Test of Multi-Chip-Moduls] [N0703]
G01R31/3185P	. . . . .	[N: Test of programmable logic devices [PLDs]] [N9903] [M1111]
G01R31/3185P1	. . . . .	[N: Test of field programmable gate arrays (FPGA)] [N0703]
G01R31/3185R	. . . . .	[N: Test of Sequential circuits (test of microprocessors G06F11/267P , test of ALU`s G06F11/267H)] [N9903]
G01R31/3185R1	. . . . .	[N: Test of flip-flops or latches] [N9903]
G01R31/3185R2	. . . . .	[N: Test of counters] [N9903]
G01R31/3185R3	. . . . .	[N: Test of registers] [N9903]
G01R31/3185S	. . . . .	[N: using scanning techniques, e.g. LSSD, Boundary Scan, JTAG] [N9611]
G01R31/3185S1	. . . . .	[N: Scan chain arrangements, e.g. connections, test bus, analog signals] [N9611]
G01R31/3185S1T	. . . . .	{7 dots} [N: Topological or mechanical aspects] [N9611]
G01R31/3185S2	. . . . .	[N: Scan latches or cell details] [N9611]
G01R31/3185S3	. . . . .	[N: Scanning methods, algorithms and patterns (G01R31/3183 takes precedence)] [N9611]
G01R31/3185S3D	. . . . .	{7 dots} [N: Data generators or compressors] [N9611]
G01R31/3185S3I	. . . . .	{7 dots} [N: Interconnection testing, e.g. crosstalk, shortcircuits] [N9611]
G01R31/3185S4	. . . . .	[N: Clock circuits details] [N9611]
G01R31/3185S5	. . . . .	[N: Control logic] [N9611]
G01R31/3185S6	. . . . .	[N: Addressing or selecting of subparts of the device under test] [N9611]
G01R31/3185S6I	. . . . .	{7 dots} [N: Identification of the subpart] [N9611]
G01R31/3185S6M	. . . . .	{7 dots} [N: Multiple simultaneous testing of subparts] [N9611]
G01R31/3185S7	. . . . .	[N: Comparators; Diagnosing the device under test] [N9611]
G01R31/3185S8	. . . . .	[N: Error indication, logging circuits] [N9611]
G01R31/3185S9	. . . . .	[N: Input/Output interfaces] [N9611]
G01R31/3185S10	. . . . .	[N: Power distribution; Power saving] [N9611] [C0812]
G01R31/3185S11	. . . . .	[N: AC testing, e.g. current testing, burn-in] [N9611]
G01R31/3185S11D	. . . . .	{7 dots} [N: Delay testing] [N9611]
G01R31/3185S12	. . . . .	[N: Design for test] [N9611]
G01R31/3185S12N	. . . . .	{7 dots} [N: with partial scan or non-scannable parts] [N9611]
G01R31/3185S12S	. . . . .	{7 dots} [N: Security aspects] [N1103]
G01R31/3185S12T	. . . . .	{7 dots} [N: Tools] [N9611]
G01R31/3185S13	. . . . .	[N: Timing aspects (clock circuits G01R31/3185S4)] [N0505]
G01R31/3185S14	. . . . .	[N: JTAG or boundary scan test of memory devices (other scan testing of memories G11C29/32)] [N1103]
G01R31/3187	. . . . .	Built-in tests
G01R31/319	. . . . .	Tester hardware, i.e. output processing circuit [N: (logic analyzers G01R31/3177 , Memory tester hardware G11C29/00T)] [C9903]

- G01R31/319A [N: Analysis of tester Performance; Tester characterization] [N0703]
- G01R31/319C [N: tester configuration] [N9811]
- G01R31/319C1 [N: Interface with the device under test (DUT), e.g. arrangements between the test head and the DUT, mechanical aspects, fixture] [N9811]
- G01R31/319C2 [N: Modular tester, e.g. controlling and coordinating instruments in a bus based architecture] [N9811]
- G01R31/319C4 [N: Tester set-up, e.g. configuring the tester to the device under test (DUT), down loading test patterns] [N9811]
- G01R31/319C4C {7 dots} [N: Calibration] [N9811]
- G01R31/319C5 [N: Tester/user interface] [N9811]
- G01R31/319C6 [N: Portable Testers] [N9903]
- G01R31/319C7 [N: In-circuit Testers] [N9903]
- G01R31/319S [N: Stimuli generation or application of test patterns to the device under test (DUT)] [N9811]
- G01R31/319S1 [N: Storing and outputting test patterns ([G01R31/319S3](#) takes precedence; arithmetic and random test patterns generator [G06F11/273G](#))] [N9811]
- G01R31/319S1C {7 dots} [N: using compression techniques, e.g. patterns sequencer] [N9811]
- G01R31/319S2 [N: Timing generation or clock distribution ([G01R31/319C4C](#) takes precedence)] [N9811]
- G01R31/319S3 [N: Voltage or current aspects, e.g. driver, receiver] [N9811]
- G01R31/319S4 [N: Routing signals to or from the device under test (DUT), e.g. switch matrix, pin multiplexing] [N9811]
- G01R31/319S5 [N: Formatter (driver, receiver details [G01R31/319S3](#))] [N0505]
- G01R31/3193 with comparison between actual response and known fault free response [N: (receiver details 31/319S3)] [N9811]
- G01R31/3193C [N: Comparators] [N0505]
- G01R31/3193S [N: Storing data, e.g. failure memory] [N9811]
- G01R31/3193T [N: Timing aspects, e.g. measuring propagation delay ([G01R31/319C4C](#) and [G01R31/319S2](#) take precedence; marginal testing [G06F11/24](#))] [N9811]

- G01R31/327 Testing of circuit interrupters, switches or circuit-breakers (structural association with switches [H01H](#); [N: detecting faults in encased switchgear [H02B13/065](#); monitoring in addition to disconnection by a protective circuit [H02H3/04](#)]) [C0501]
- G01R31/327B [N: of high voltage or medium voltage devices ([G01R31/333](#) takes precedence)] [N9506]
- G01R31/327B2 [N: Apparatus, systems or circuits therefor ([G01R31/327B3](#) takes precedence)] [N9506]
- G01R31/327B2B [N: 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 [G01R27/20B](#))] [N9506]
- G01R31/327B3 [N: Fault detection or status indication] [N9506] [C0501]
- G01R31/327C [N: of low voltage devices, e.g. domestic or industrial devices, such as motor protections, relays, rotation switches] [N9506]
- G01R31/327C2 [N: of relays, solenoids or reed switches (measuring contact resistance [G01R27/20B](#); testing electric windings [G01R31/06](#); high voltage magnetic

- [switches G01R31/327B](#), [G01R31/333](#); [monitoring of fail safe circuits H01H47/00C](#)] [[N9506](#)] [[M1112](#)]
- G01R31/333 . . Testing of the switching capacity of high-voltage circuit-breakers; [[N: 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 H01H9/50, 33/26](#)) [[C9506](#)]
- G01R31/333B . . . [[N: Apparatus, systems or circuits therefor](#)] [[N9506](#)]
- G01R31/333B2 [[N: Synthetic testing, i.e. with separate current and voltage generators simulating distance fault conditions](#)] [[N9506](#)]
- G01R31/34 . Testing dynamo-electric machines ([testing electric windings G01R31/06](#) methods or apparatus specially adapted for manufacturing, assembling, maintaining or repairing dynamo-electric machines [H02K15/00](#)) [[N: testing of armature or field winding of dynamo-electric machines G01R31/06B](#)]
- G01R31/34B . . [[N: in operation](#)]
- G01R31/34C . . [[N: Testing of armature or field windings](#)] [[N1112](#)]
- G01R31/36 . 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 H01M10/48](#); [circuit arrangements for charging, or depolarising batteries or for supplying loads from batteries H02J7/00](#); [[N: Coulomb meters G01R22/00](#); [indicating the condition of the power supply in clocks or watches G04C10/04](#); [methods for controlling fuel cells H01M8/04H](#)]) [[C0605](#)]
- [N: 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 [H01M10/48](#) and subgroups]
- G01R31/36N . . [[N: 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 \[SoH\] \(G01R31/36T, G01R31/36V take precedence\)](#)] [[N1204](#)]
- G01R31/36N1 . . . [[N: using current integration](#)] [[N1204](#)]
- G01R31/36N1B [[N: without voltage measurement](#)] [[N1204](#)]
- G01R31/36N1B1 [[N: using analog integrators, e.g. coulomb-meters](#)] [[N1204](#)]
- G01R31/36N2 . . . [[N: based on measuring voltage only \(by comparing voltage with a reference value G01R19/165G2B\)](#)] [[N1204](#)]
- G01R31/36N3 . . . [[N: based on combined voltage and current measurement \(G01R31/36N1 takes precedence\)](#)] [[N1204](#)]
- G01R31/36T . . [[N: Testing, i.e. making a one-time determination of some variables, e.g. testing ampere-hour charge capacity \(\[G01R31/36V takes precedence\]\(#\)\)](#)] [[N0304](#)] [[C1205](#)]
- G01R31/36T2 . . . [[N: based on the use of test loads](#)] [[N0304](#)]
- G01R31/36T3 . . . [[N: for determining the ampere-hour charge capacity or state-of-charge \(SoC\) \(\[G01R31/36T2 takes precedence\]\(#\)\)](#)] [[N0304](#)] [[C1103](#)]
- G01R31/36T3V [[N: based on voltage measurements](#)] [[N0304](#)]
- G01R31/36T4 . . . [[N: related to manufacture, e.g. testing after manufacture](#)] [[N0304](#)]
- G01R31/36V . . [[N: Various constructional arrangements](#)] [[N1204](#)]
- G01R31/36V1 . . . [[N: comprising digital calculation means, e.g. for performing an algorithm](#)] [[N0304](#)]

- G01R31/36V1A [N: Software aspects, e.g. battery modeling, using look-up tables, neural networks] [N0304] [C1103]
- G01R31/36V1B [N: the digital calculation means being combined with the battery or battery pack] [N0304]
- G01R31/36V2 [N: for testing or monitoring individual cells or groups of cells in a battery] [N0304]
- G01R31/36V3 [N: involving measuring the internal battery impedance, conductance or related variables] [N0304]
- G01R31/36V4 [N: whereby the type of battery is of primary emphasis, e.g. determining the type of battery] [N0304]
- G01R31/36V4L [N: Lead-acid batteries] [N0304]
- G01R31/36V4P [N: Primary cells, i.e. not rechargeable] [N0304]
- G01R31/36V5 [N: for compensating for temperature or ageing] [N0304]
- G01R31/36V6 [N: for determining battery ageing or deterioration, e.g. state-of-health (SoH), state-of-life (SoL)] [N0304] [C1103]
- G01R31/36V7 [N: for indicating electrical conditions or variables, e.g. visual or audible indicators] [N0304]
- G01R31/36V7B [N: the indicator being combined with the battery] [N0304]
- G01R31/36V7R [N: the indication being remote from the battery] [N1103]
- G01R31/36V8 [N: for determining the ability of a battery to perform a critical function, e.g. cranking] [N0304]
- G01R31/36V9 [N: Battery pole connectors combined with measurement function (end pieces for connections to batteries [H01R11/28B](#))] [N1103] [C1205]

- G01R31/40 Testing power supplies [N: (comparing current or voltage with a reference level in AC or DC supplies [G01R19/165G2](#))] [C0006]
- G01R31/40B [N: Electrical testing of electrical aspects of solar panel power supplies (of individual solar cells [G01R31/26A3](#))] [N1109] [M1112]
- G01R31/42 AC power supplies [N: ([G01R31/40B](#) takes precedence)] [M1109]
- G01R31/44 Testing lamps (discharge lamps [G01R31/24](#); structurally associated with light source circuit arrangements for detecting lamp failure [H05B37/03](#))

- G01R33/00** **Arrangements or instruments for measuring magnetic variables**

- G01R33/00A [N: Geometrical arrangement of magnetic sensor elements; Apparatus combining different magnetic sensor types ([G01R33/02A](#) takes precedence)] [N1001]
- G01R33/00B [N: comprising means, e.g. flux concentrators, flux guides, for guiding or concentrating the magnetic flux, e.g. to the magnetic sensor] [N1201]
- G01R33/00C [N: Means for compensating offset magnetic fields or the magnetic flux to be measured; Means for generating calibration magnetic fields] [N1201]
- G01R33/00E [N: Electronic aspects, e.g. circuits for stimulation, evaluation, control; Treating the measured signals; calibration ([G01R33/00C](#) takes precedence)] [N1001] [C1201]
- G01R33/00E2 [N: Treating the measured signals, e.g. removing offset or noise] [N1001]
- G01R33/00E3 [N: Calibration of single magnetic sensors, e.g. integrated calibration] [N1001]
- G01R33/00E5 [N: using feed-back or modulation techniques] [N1204]

- G01R33/00H . [N: Housings or packaging of magnetic sensors ([packaging of semiconductor devices H01L23/00](#)); Holders] [N1001]
 - G01R33/00M . [N: Manufacturing aspects; Manufacturing of single devices, i.e. of semiconductor magnetic sensor chips ([devices based on galvano-magnetic effect or the like H01L43/12](#))] [N1001]
 - G01R33/00R . using bistable elements, e.g. Reed switches [N1207]
 - G01R33/00S . [N: comprising means for performing simulations, e.g. of the magnetic variable to be measured] [N1201]
 - G01R33/00T . [N: Environmental aspects, e.g. temperature variations, radiation, stray fields ([G01R33/025 takes precedence](#))] [N1201]
 - G01R33/00T1 . . [N: Protection, e.g. with housings against stray fields] [N1201]
 - G01R33/00T3 . . [N: Compensation, e.g. compensating for temperature changes] [N1201]
 - G01R33/00U . [N: use of bistable or switching devices, e.g. Reed-switches] [N1204]
 - G01R33/00V . [N: Sensor arrays] [N1204]
 - G01R33/02 . Measuring direction or magnitude of magnetic fields or magnetic flux ([G01R33/20 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 [G01V3/00](#))
- Note**
Groups [G01R33/022](#), [G01R33/10](#) take precedence over groups [G01R33/025](#) to [G01R33/09](#).
- G01R33/02A . . [N: Three-component magnetometers]
 - G01R33/02E . . [N: using deviation of charged particles by the magnetic field]
 - G01R33/022 . . Measuring gradient
 - G01R33/025 . . Compensating stray fields [N: ([compensating compasses G01C17/38](#))([G01R33/00C takes precedence](#))] [C1201]
 - G01R33/028 . . Electrodynamic magnetometers
 - G01R33/028B . . . [N: in which a current or voltage is generated due to relative movement of conductor and magnetic field]
 - G01R33/028M . . . [N: comprising micro-electromechanical systems [MEMS] (MEMS devices in general B81B)] [N1103]
 - G01R33/032 . . using magneto-optic devices, e.g. Faraday, [N: Cotton-Mouton effect ([magneto-optics in general G02F1/09](#))] [C9409]
 - G01R33/032B . . . [N: using the Faraday or Voigt effect] [N9409]
 - G01R33/032C . . . [N: using the Kerr effect] [N9409]
 - G01R33/032F . . . [N: with application of magnetostriction] [N9409]
 - G01R33/035 . . using superconductive devices [N: ([manufacture of superconducting elements H01L39/00](#))]
 - G01R33/035B . . . [N: Superconductive magneto-resistances]
 - G01R33/035C . . . [N: SQUIDS]
 - G01R33/035C2 [N: with flux feedback]

- G01R33/035C3 [N: coupling the flux to the SQUID (gradiometer coils [G01R33/022](#); coils with superconductive winding [H01F6/06](#))]
- G01R33/038 . . using permanent magnets, e.g. balances, torsion devices [N: electro-dynamic magnetometers [G01R33/028](#)]
- G01R33/038B . . . [N: in relation with magnetic force measurements (magnetic force microscopes [G01Q60/50](#))] [N9409] [C0902]
- G01R33/04 . . using the flux-gate principle
- G01R33/04B . . . [N: in single-, or multi-aperture elements]
- G01R33/05 . . . in thin-film element
- G01R33/06 . . using galvano-magnetic devices, e.g. Hall effect devices; using magneto-resistive devices [N: (manufacture of galvano-magnetic elements [H01L43/00](#))]
- G01R33/06A . . . [N: Magneto-impedance sensors; Nanocrystallin sensors] [N1001]
- G01R33/06T . . . [N: field-effect magnetic sensors, e.g. magnetic transistor] [N1204]
- G01R33/07 . . . Hall effect devices [N9409]
- G01R33/07A [N: Constructional adaptation of the sensor to specific applications] [N1001]
- G01R33/07A1 [N: Hall devices configured for spinning current measurements] [N1204]
- G01R33/07V [N: Vertical Hall-effect devices] [N1201]
- G01R33/09 . . . Magneto-resistive devices [N9409]
- G01R33/09A [N: Constructional adaptation of the sensor to specific applications] [N1001]
- G01R33/09B [N: using multilayer structures, e.g. giant magnetoresistance sensors (thin magnetic films [H01F10/00](#))] [N1204]
- G01R33/09E [N: extraordinary magnetoresistance sensors] [N1204]
- G01R33/09R [N: anisotropic magnetoresistance sensors] [N1204]
- G01R33/09T [N: comprising tunnel junctions, e.g. tunnel magnetoresistance sensors] [N1204]
- G01R33/10 . . Plotting field distribution; [N: Measuring field distribution] [C9409]
- G01R33/12 . Measuring magnetic properties of articles or specimens of solids or fluids (involving magnetic resonance [G01R33/20](#)) [N: using magnetic-optic devices [G01R33/032](#)]
- G01R33/12B . . [N: Testing individual magnetic storage devices e.g. records carriers or digital storage elements (functional testing [G06F11/00](#), [G06F11/28](#))]
- G01R33/12C . . [N: Measuring magnetisation; Particular magnetometers therefor ([G01R33/14](#) takes precedence; electrodynamic magnetometers [G01R33/028](#))]
- G01R33/12D . . [N: Measuring permeability, i.e. permeameters ([G01R33/14](#) takes precedence)]
- G01R33/12E . . [N: Measuring loss due to hysteresis ([G01R33/14](#) takes precedence)] [M1201]
- G01R33/12G . . [N: Measuring super-conductive properties]
- G01R33/12G2 . . . [N: Measuring critical current]
- G01R33/12H . . [N: Measuring galvano-magnetic properties] [M1201]
- G01R33/12L . . [N: using levitation techniques] [N1204]
- G01R33/12M . . [N: of molecules labeled with magnetic beads (magnetic particles for bio assay [G01N33/543D4](#))] [N0812]
- G01R33/12P . . [N: of magnetic particles, e.g. imaging of magnetic nanoparticles ([G01R33/12M](#) takes precedence)] [N1201]
- G01R33/12S . . [N: Spin resolved measurements; Influencing spins during measurements, e.g. in spintronics devices ([G01R33/09B](#) takes precedence; semiconductor devices using spin polarized carriers [H01L29/66S](#))] [N0812]

- G01R33/12W . . [N: Measuring domain wall position or domain wall motion] [N1103]
- G01R33/14 . . Measuring or plotting hysteresis curves [N: [G01R33/12B](#) takes precedence]
- G01R33/16 . . Measuring susceptibility [N: [G01R33/12G](#) takes precedence]
- G01R33/18 . . Measuring magnetostrictive properties

- G01R33/20 . involving magnetic resonance ([medical aspects A61B5/055](#); [magnetic resonance gyrometers G01C19/00](#) [N: [investigating materials using NMR G01N24/00](#); [prospecting or detecting using NMR G01V3/00](#)]) [C9506]
- G01R33/24 . . for measuring direction or magnitude of magnetic fields or magnetic flux
- G01R33/24A . . . [N: Spatial mapping of the polarizing magnetic field] [N1204]
 [N: **WARNING**[M1207]
 Not complete pending reclassification, see also [G01R33/44](#)
]
- G01R33/24C . . . [N: Spatial mapping of the RF magnetic field B1] [N1204]
 [N: **WARNING** [M1207]
 Not complete pending reclassification, see also [G01R33/44](#)
]
- G01R33/26 . . . using optical pumping [N: [optical pumping in general G01N24/00D](#)]
- G01R33/28 . . Details of apparatus provided for in groups [G01R33/44](#) to [G01R33/64](#) [M1108]
 [N: **WARNING**
 [N1108] Groups [G01R33/28A](#) - [G01R33/28S](#) are not complete pending reclassification. See also this group
]
- G01R33/28A . . . [N: Means for the use of in vitro contrast agents ([G01R33/28B](#) takes precedence; involving use of a contrast agent in MR imaging [G01R33/56B](#); in vivo contrast agents [A61K49/00F](#))] [N1204]
- G01R33/28B . . . [N: 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] [N1204]
- G01R33/28F . . . [N: Intercom or optical viewing arrangements, structurally associated with NMR apparatus] [N9506]
- G01R33/28H . . . [N: Invasive instruments, e.g. catheters or biopsy needles, specially adapted for tracking, guiding or visualization by NMR] [N9805]
- G01R33/28H1 [N: involving passive visualization of interventional instruments, i.e. making the instrument visible as part of the normal MR process] [N1008]
- G01R33/28H2 [N: involving active visualization of interventional instruments, e.g. using active tracking RF coils or coils for intentionally creating magnetic field inhomogeneities] [N1008]
- G01R33/28S . . . [N: 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] [N1108] [C1112]
- G01R33/30 . . . Sample handling arrangements, e.g. sample cells, spinning mechanisms [C9506]
- G01R33/30M [N: Miniaturized sample handling arrangements for sampling small quantities, e.g. flow-through micro-fluidic NMR chips] [N1008]
- G01R33/30P [N: specially adapted for high-pressure applications] [N0506]
- G01R33/30S [N: 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] [N1108] [
- G01R33/31 Temperature control thereof [N9506]
- G01R33/32 Excitation or detection systems, e.g. using radio frequency signals [C1108]
- G01R33/32A [N: 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] [N1108]
- [N: **WARNING**
[N1108] Not complete pending reclassification, see also [G01R33/36](#)
]
- G01R33/32A1 [N: involving a SQUID] [N1108]
- G01R33/34 Constructional details, e.g. resonators, [N: specially adapted to MR (aerials in general H01Q)] [C1108]
- G01R33/34A [N: 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] [N1108]
- G01R33/34B [N: Temperature-controlled RF coils] [N1108]
- G01R33/34B1 [N: Superconducting RF coils] [N1108]
- G01R33/34B2 [N: Means for cooling of the RF coils, e.g. a refrigerator or a cooling vessel specially adapted for housing an RF coil] [N1108]
- G01R33/34C [N: Loopless coils, i.e. linear wire antennas] [N1108]
- G01R33/34F [N: Volume type coils, e.g. bird-cage coils; Quadrature bird-cage coils; Circularly polarised coils] [N9506]
- G01R33/34F1 [N: Solenoid coils; Toroidal coils] [N1008]
- G01R33/34F2 [N: Helmholtz coils] [N1008]
- G01R33/34F3 [N: Saddle coils] [N1008]
- G01R33/34F4 [N: Birdcage coils] [N1008]
- G01R33/34G [N: implantable coils or coils being geometrically adaptable to the sample, e.g. flexible coils or coils comprising mutually movable parts] [N1008]
- G01R33/34S [N: RF coils specially adapted for NMR spectrometers] [N1108]
- G01R33/341 comprising surface coils [N9506]
- G01R33/3415 comprising arrays of sub-coils, [N: i.e. phased-array coils with multiple receiver channels] [N1108] [M1108]
- G01R33/343 of slotted-tube or loop-gap type [N9506]
- G01R33/345 [N: of waveguide type ([G01R33/343](#) takes precedence)] [N9506]
- G01R33/345A [N: Transverse electromagnetic [TEM] coils] [N1008]
- G01R33/345A1 {7 dots} [N: Stripline resonators] [N1108]
- G01R33/36 Electrical details, e.g. matching or coupling of the coil to the receiver
- G01R33/36A [N: 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] [N9610] [C1108]
- [N: **WARNING**
[N1108] Not complete pending reclassification, see also [G01R33/36](#)
]

- G01R33/36B [N: RF power amplifiers] [N1108]
- G01R33/36C [N: 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] [N1108]
- G01R33/36G [N: Tuning/matching of the transmit/receive coil] [N9610]
- G01R33/36G2 [N: Multi-frequency operation] [N9610]
- G01R33/36H [N: 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] [N1008] [C1108]
- [N: **WARNING**
[N1108] Not complete pending reclassification, see also [G01R33/36](#)]
- G01R33/36H1 [N: 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] [N1108]
- G01R33/36H2 [N: 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] [N1108]
- G01R33/36K [N: 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 ([G01R33/36M](#) takes precedence)] [N1108] [C1205]
- [N: **WARNING**
[N1108] Not complete pending reclassification, see also [G01R33/36](#)]
- G01R33/36M [N: involving modulation of the quality factor of the RF coil (G01R33/36H takes precedence)] [N1204]
- G01R33/36Q [N: involving quadrature drive or detection, e.g. a circularly polarized RF magnetic field] [N1108]
- [N: **WARNING**
[N1108] Not complete pending reclassification, see also [G01R33/36](#)]
- G01R33/36T [N: Means for reducing sheath currents, e.g. RF traps, baluns] [N1108]
- [N: **WARNING**
[N1108] Not complete pending reclassification, see also [G01R33/36](#)]
- G01R33/36W [N: 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] [N1008]
- G01R33/38 Systems for generation, homogenisation or stabilisation of the main or gradient magnetic field [M1108]
- G01R33/38A [N: 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] [N1108]

- G01R33/38C [N: 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] [N1108]
- G01R33/38F [N: Open magnet assemblies for improved access to the sample, e.g. C-type or U-type magnets] [N9506] [C1008]
- G01R33/38H [N: 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] [N1008] [M1108]
- G01R33/381 using electromagnets ([electromagnets per se H01F7/06](#)) [N9506]
- G01R33/3815 with superconducting coils, e.g. power supply therefor ([superconductive magnets H01F6/00](#)) [N9506]
- G01R33/383 using permanent magnets ([permanent magnets per se H01F7/02](#)) [N9506]
- G01R33/385 using gradient magnetic field coils [N9506]
- G01R33/385A [N: Gradient amplifiers; means for controlling the application of a gradient magnetic field to the sample, e.g. a gradient signal synthesizer] [N9610] [C1108]
- [N: **WARNING**
[N1108] Not complete pending reclassification, see also [G01R33/385](#)
]
- G01R33/385F [N: means for active and/or passive vibration damping or acoustical noise suppression in gradient magnet coil systems] [N9506]
- G01R33/385H [N: Means for cooling the gradient coils or thermal shielding of the gradient coils] [N1008] [C1108]
- G01R33/385M [N: 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 H01F41/00](#))] [N1108]
- G01R33/387 Compensation of inhomogeneities ([screening G01R33/42](#)) [N9506]
- G01R33/3873 using ferromagnetic bodies; [N: Passive shimming] [N9506]
- G01R33/3875 using correction coil assemblies, e.g. active shimming [N9506] [M1108]
- G01R33/389 Field stabilisation, [N: e.g. by field measurements and control means or indirectly by current stabilisation] [N9506]
- G01R33/42 Screening ([screening in general H05K9/00](#)) [C9506]
- G01R33/421 of main or gradient magnetic field [N9506]
- G01R33/421A [N: of the gradient magnetic field, e.g. using passive or active shielding of the gradient magnetic field] [N9610] [M1108]
- G01R33/422 of the radio frequency field [N9506] [M1108]
- G01R33/44 using nuclear magnetic resonance [NMR] ([G01R33/24](#), [G01R33/62](#) take precedence) [M1108]
- [N: **WARNING**
[N1108] Groups [G01R33/44B](#) - [G01R33/44M](#) are not complete pending reclassification. See also this group
]
- G01R33/44F [N: Nuclear Quadrupole Resonance (NQR) Spectroscopy and Imaging] [N9506]
- G01R33/44M [N: Assessment of an electric or a magnetic field, e.g. spatial mapping, determination of a B0 drift or dosimetry] [N1008] [C1108]

[N: **WARNING**

- [N1108] Groups [G01R33/44M1](#) - [G01R33/44M3](#) are not complete pending reclassification. See also this group]
- G01R33/44N . . . [N: 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] [N1108]
- G01R33/44P . . . [N: Multifrequency selective RF pulses, e.g. multinuclear acquisition mode (**spatially selective RF pulses** [G01R33/483B](#))] [N1108]
- [N: **WARNING** [N1108]
Not complete pending reclassification, see also [G01R33/48](#)
]
- G01R33/44R . . . [N: Relaxometry, i.e. quantification of relaxation times or spin density ([G01R33/50](#) takes precedence)] [N1108]
- [N: **WARNING** [N1108]
Not complete pending reclassification, see also [G01R33/44](#) and [G01R33/44A](#)
]
- G01R33/46 . . . NMR spectroscopy [M1108]
- G01R33/46A [N: RF excitation sequences for enhanced detection, e.g. NOE, polarisation transfer, selection of a coherence transfer pathway] [N9610]
- G01R33/46B [N: 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] [N9610] [M1108]
- G01R33/46C [N: Processing of acquired signals, e.g. elimination of phase errors, baseline fitting, chemometric analysis] [N9610] [C1008]
- G01R33/46M [N: Sequences for multi-dimensional NMR] [N9610]
- G01R33/46S [N: Sequences for NMR spectroscopy of samples with ultrashort relaxation times such as solid samples] [N9610] [C1008]
- G01R33/465 applied to biological material, e.g. in vitro testing [N9506]
- G01R33/48 . . . NMR imaging systems [M1108]
- G01R33/48B [N: Travelling-wave MR] [N1008] [M1108]
- G01R33/48G [N: Spatially selective measurement of temperature or pH] [N9506] [M1109]
- G01R33/48K [N: Functional imaging of brain activation] [N1008]
- G01R33/48M [N: Multimodal MR, e.g. MR combined with positron emission tomography [PET], MR combined with ultrasound or MR combined with computed tomography [CT]] [N1008]
- G01R33/48M1 [N: MR combined with positron emission tomography [PET] or single photon emission computed tomography [SPECT]] [N1108]
- [N: **WARNING** [N1108]
Not complete pending reclassification, see also [G01R33/48M](#)
]
- G01R33/48M2 [N: MR combined with X-ray or computed tomography [CT]] [N1108]
- [N: **WARNING** [N1108]

				Not complete pending reclassification, see also G01R33/48M]
G01R33/48M3	.	.	.	[N: MR combined with ultrasound] [N1108]
				[N: WARNING [N1108] Not complete pending reclassification, see also G01R33/48M]
G01R33/48S	.	.	.	[N: 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] [N1108]
G01R33/48T	.	.	.	[N: 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] [N1108]
G01R33/48T1	.	.	.	[N: using a Cartesian trajectory] [N1108]
G01R33/48T1A	.	.	.	[N: in three dimensions] [N1108]
G01R33/48T2	.	.	.	[N: using a non-Cartesian trajectory] [N1108]
G01R33/48T2A	.	.	.	[N: in three dimensions] [N1108]
				[N: WARNING [N1108] Not complete pending reclassification, see also G01R33/48T]
G01R33/48W	.	.	.	[N: Resolving the MR signals of different chemical species, e.g. water-fat imaging] [N1108]
G01R33/483	.	.	.	with selection of signals or spectra from particular regions of the volume, e.g. in vivo spectroscopy [N9506] [M1108]
G01R33/483A	.	.	.	[N: using B1 gradients, e.g. rotating frame techniques, use of surface coils] [N9610]
G01R33/483B	.	.	.	[N: using spatially selective excitation of the volume of interest, e.g. selecting non-orthogonal or inclined slices] [N9610] [M1108]
G01R33/483B1	.	.	.	[N: of multiple slices] [N1108]
G01R33/483B3	.	.	.	[N: using an RF pulse being spatially selective in more than one spatial dimension, e.g. a 2D pencil-beam excitation pulse] [N1108]
				[N: WARNING [N1108] Not complete pending reclassification, see also G01R33/483B]
G01R33/483C	.	.	.	[N: using spatially selective suppression or saturation of MR signals] [N1108]
G01R33/485	.	.	.	based on chemical shift information [N: CSI or spectroscopic imaging, e.g. to acquire the spatial distributions of metabolites] [N9506]
G01R33/50	.	.	.	based on the determination of relaxation times, [N: e.g. T1 measurement by IR sequences; T2 measurement by multiple-echo sequences]
G01R33/54	.	.	.	Signal processing systems, e.g. using pulse sequences, [N: Generation or control of pulse sequences (in general H03K); Operator Console] [C1108]
G01R33/54C	.	.	.	[N: 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 (G01R33/54D takes precedence)] [N1204]
				[N: WARNING [C1205]

			Not complete pending reclassification, see also G01R33/54]
G01R33/54D	. . . . .	[N: 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] [N1008]	
G01R33/56	. . . . .	Image enhancement or correction, e.g. subtraction or averaging techniques, [N: e.g. improvement of signal-to-noise ratio and resolution (image data processing in general G06T)] [M1108]	
G01R33/56B	. . . . .	[N: involving use of a contrast agent for contrast manipulation, e.g. a paramagnetic, super-paramagnetic, ferromagnetic or hyperpolarised contrast agent] [N1008]	
G01R33/56C	. . . . .	[N: by filtering or weighting based on different relaxation times within the sample, e.g. T1 weighting using an inversion pulse] [N1008] [M1108]	
G01R33/56F	. . . . .	[N: Microscopy; Zooming] [N9506]	
G01R33/56H	. . . . .	[N: 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]] [N1008] [M1108]	
G01R33/56J	. . . . .	[N: 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][N1204]	
		[N: WARNING Not complete pending reclassification, see also G01R33/56]	
G01R33/56P	. . . . .	[N: 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)] [N1108]	
		[N: WARNING [N1108] Not complete pending reclassification, see also G01R33/56]	
G01R33/561	. . . . .	by reduction of the scanning time, i.e. fast acquiring systems, e.g. using echo-planar pulse sequences [N9506] [M1108]	
G01R33/561A	. . . . .	{7 dots} [N: 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 G01R33/3415)] [N0305] [M1108]	
G01R33/561A1	. . . . .	{8 dots} [N: Parallel RF transmission, i.e. RF pulse transmission using a plurality of independent transmission channels] [N1008]	
G01R33/561B	. . . . .	{7 dots} [N: Generating steady state signals, e.g. low flip angle sequences (FLASH)] [N9610]	
G01R33/561B1	. . . . .	{8 dots} [N: using a fully balanced steady-state free precession	

		bSSFP] pulse sequence, e.g. trueFISP] [N1008]
G01R33/561D	. . . . .	{7 dots} [N: 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]] [N9610] [M1108]
G01R33/561D1	. . . . .	{8 dots} [N: using gradient refocusing, e.g. EPI] [N1008]
G01R33/561D2	. . . . .	{8 dots} [N: using RF refocusing, e.g. RARE] [N1008]
G01R33/561D3	. . . . .	{8 dots} [N: using both RF and gradient refocusing, e.g. GRASE] [N1008]
G01R33/561K	. . . . .	{7 dots} [N: by temporal sharing of data, e.g. keyhole, block regional interpolation scheme for k-Space [BRISK]] [N1008] [M1108]
G01R33/563	. . . . .	of moving material, e.g. flow contrast angiography [N9506] [M1108]
G01R33/563A	. . . . .	{7 dots} [N: Characterization of motion or flow; Dynamic imaging] [N9610] [C1108]
G01R33/563A1	. . . . .	{8 dots} [N: involving phase contrast techniques] [N1008]
G01R33/563A3	. . . . .	{8 dots} Please delete WARNING [N1204]
G01R33/563A4	. . . . .	{8 dots} [N: 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 G01R33/563P)] [N1108]
G01R33/563C	. . . . .	{7 dots} [N: Diffusion imaging] [N9610]
G01R33/563K	. . . . .	{7 dots} [N: Angiography, e.g. contrast-enhanced angiography [CE-MRA] or time-of-flight angiography [TOF-MRA]] [N1008] [M1108]
G01R33/563M	. . . . .	{7 dots} [N: Elastography] [N1008]
G01R33/563P	. . . . .	{7 dots} [N: Perfusion imaging] [N1008]
G01R33/563T	. . . . .	{7 dots} [N: Intentional motion of the sample during MR, e.g. moving table imaging] [N0502] [M1108]
G01R33/563T1	. . . . .	{8 dots} [N: involving motion of the sample as a whole, e.g. multistation MR or MR with continuous table motion] [N1108]
		[N: WARNING [N1108] Not complete pending reclassification, see also G01R33/563T]
G01R33/563T2	. . . . .	{8 dots} [N: involving motion of a part of the sample with respect to another part of the sample, e.g. MRI of active joint motion] [N1108]
		[N: WARNING [N1108] Not complete pending reclassification, see also G01R33/563]
G01R33/565	. . . . .	Correction of image distortions, e.g. due to magnetic field inhomogeneities [N9506] [M1108]
G01R33/565A	. . . . .	{7 dots} [N: due to motion, displacement or flow, e.g. gradient moment nulling (G01R33/567 takes precedence)] [N1008] [M1108]
G01R33/565B	. . . . .	{7 dots} [N: due to eddy currents, e.g. caused by switching of the gradient magnetic field] [N9610] [M1108]
		[N: Note [N1008]

		This group only covers correction of artifacts caused by gradient-non-linearity]
G01R33/565C	. . . . .	{7 dots} [N: due to chemical shift effects] [N9610] [C1008]
G01R33/565H	. . . . .	{7 dots} [N: due to magnetic susceptibility variations] [N1008]
G01R33/565I	. . . . .	{7 dots} [N: caused by finite or discrete sampling, e.g. Gibbs ringing, truncation artefacts, phase aliasing artefacts] [N1108]
		[N: WARNING [N1108] Not complete pending reclassification, see also G01R33/565]
G01R33/565J	. . . . .	{7 dots} [N: caused by acquiring plural, differently encoded echo signals after one RF excitation, e.g. correction for readout gradients of alternating polarity in EPI] [N1108]
G01R33/565K	. . . . .	{7 dots} [N: caused by a distortion of the main magnetic field B ₀ , e.g. temporal variation of the magnitude or spatial inhomogeneity of B ₀ (G01R33/565A, G01R33/565B, G01R33/565H take precedence)] [N1204]
G01R33/565P	. . . . .	{7 dots} [N: caused by a distortion of a gradient magnetic field, e.g. non-linearity of a gradient magnetic field (G01R33/565A, G01R33/565B, G01R33/565H take precedence)] [N1204]
G01R33/565P1	. . . . .	{8 dots} [N: due to Maxwell fields, i.e. concomitant fields] [N1108]
G01R33/565R	. . . . .	{7 dots} [N: caused by a distortion of the RF magnetic field, e.g. spatial inhomogeneities of the RF magnetic field (G01R33/565A , G01R33/565B , G01R33/565H take precedence)] [N1204]
		[N: WARNING Not complete pending reclassification, see also G01R33/565]
G01R33/567	. . . . .	gated by physiological signals [N: 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] [N9506] [M1108]
G01R33/567A	. . . . .	{7 dots} [N: 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] [N9610] [M1108]
G01R33/567B	. . . . .	{7 dots} [N: Gating or triggering based on an MR signal, e.g. involving one or more navigator echoes for motion monitoring and correction] [N9610] [M1108]
G01R33/58	. . . . .	Calibration of imaging systems, e.g. using test probes [N: , Phantoms; Calibration objects or fiducial markers such as active or passive RF coils surrounding an MR active material] [M1108]
G01R33/58F	. . . . .	[N: Calibration of signal excitation or detection systems, e.g. for optimal RF excitation power or frequency (G01R33/24C takes precedence)] [N1204]
		[N: WARNING Not complete pending reclassification, see also G01R33/58 [N1208]]
G01R33/58F1	. . . . .	[N: for optimal flip angle of RF pulses] [N1108]
		[N: WARNING [N1108]

Not complete pending reclassification, see also [G01R33/58](#)
]

- G01R33/60 . . using electron paramagnetic resonance ([G01R33/24](#), [G01R33/62](#) take precedence)
- G01R33/62 . . using double resonance ([G01R33/24](#) takes precedence)
- G01R33/64 . . using cyclotron resonance ([G01R33/24](#) takes precedence) [N: Omegatrons per se [H01J49/38](#)]

- G01R35/00** **Testing or calibrating of apparatus covered by the preceding groups [N: (G01R31/319A takes precedence)] [C0703]**

- G01R35/00B . [N: of cathode ray oscilloscopes]
- G01R35/00C . [N: Calibrating; Standards or reference devices, e.g. voltage or resistance standards, "golden" references ([G01R33/00E3](#), [G01R35/00B](#) take precedence)] [N9703] [C1201]
- G01R35/00C2 . . [N: Standards or reference devices, e.g. voltage or resistance standards, "golden references"] [N9807]

- G01R35/02 . of auxiliary devices, e.g. of instrument transformers according to prescribed transformation ratio, phase angle, or wattage rating

- G01R35/04 . of instruments for measuring time integral of power or current
- G01R35/06 . . by stroboscopic methods