

**CPC****COOPERATIVE PATENT CLASSIFICATION****H02M**

**APPARATUS FOR CONVERSION BETWEEN AC AND AC, BETWEEN AC AND DC, OR BETWEEN DC AND DC, AND FOR USE WITH MAINS OR SIMILAR POWER SUPPLY SYSTEMS; CONVERSION OF DC OR AC INPUT POWER INTO SURGE OUTPUT POWER; CONTROL OR REGULATION THEREOF** (systems for regulating electric or magnetic variables in general, e.g. using transformers, reactors or choke coils, combination of such systems with static converters [G05F](#) ; { digital function or clock generators } for digital computers [G06F 1/00](#), { [G06F 1/025](#), [G06F 1/04](#) } ; transformers [H01F](#) ; connection or control of one converter with regard to conjoint operation with a similar or other source of supply [H02J](#) ; dynamo-electric converters [H02K 47/00](#); controlling transformers, reactors or choke coils, control or regulation of electric motors, generators or dynamo-electric converters [H02P](#) ; pulse generators [H03K](#) ; { static converters specially adapted for igniting or operating discharge lamps [H05B 41/28](#) } )

**NOTE**

This subclass covers only circuits or apparatus for the conversion of electric power, or arrangements for control or regulation of such circuits or apparatus. The electrotechnical elements employed are dealt within the appropriate subclasses, e.g. inductors, transformers [H01F](#) , capacitors, electrolytic rectifiers [H01G](#) , mercury rectifying or other discharge tubes [H01J](#) , semiconductor devices [H01L](#) , impedance networks or resonant circuit not primarily concerned with the transfer of electric power [H03H](#) .

In this subclass, the following term is used with the meaning indicated:

- "conversion", in respect of an electric variable, e.g. voltage or current, means the change of one or more of the parameters of the variable, e.g. amplitude, frequency, phase, polarity.

**WARNING**

The following IPC groups are not used in the CPC scheme. Subject matter covered by these groups is classified in the following CPC groups :

[H02M 9/00](#) covered by [H03K 3/53](#)  
[H02M 9/02](#) covered by [H03K 3/53](#)  
[H02M 9/04](#) covered by [H03K 3/53](#)  
[H02M 9/06](#) covered by [H03K 3/53](#)

**Guidance heading:****H02M 1/00****Details of apparatus for conversion****H02M 1/0061**

. {using discharge tubes }

**H02M 1/02**

. Circuits specially adapted for the generation of grid-control or igniter-control voltages for discharge tubes incorporated in static converters

**H02M 1/04**

. . for tubes with grid control

- H02M 1/042      . . .      { wherein the phase of the control voltage is adjustable with reference to the AC voltage }
- H02M 1/045      . . . .      {for multiphase systems }
- H02M 1/047      . . . .      {for ignition at the zero-crossing of voltage or current }
  
- H02M 1/06      .      Circuits specially adapted for rendering non-conductive gas discharge tubes or equivalent semiconductor devices, e.g. thyratrons, thyristors
- H02M 1/065      . .      {for discharge tubes }
  
- H02M 1/08      .      Circuits specially adapted for the generation of control voltages for semiconductor devices incorporated in static converters
- H02M 1/081      . .      {wherein the phase of the control voltage is adjustable with reference to the AC source }
- H02M 1/082      . . .      {with digital control }
- H02M 1/083      . .      {for the ignition at the zero crossing of the voltage or the current }
- H02M 1/084      . .      using a control circuit common to several phases of a multi-phase system
- H02M 1/0845      . . .      {digitally controlled (or with digital control) }
- H02M 1/088      . .      for the simultaneous control of series or parallel connected semiconductor devices
- H02M 1/092      . . .      the control signals being transmitted optically
- H02M 1/096      . . .      the power supply of the control circuit being connected in parallel to the main switching element ([H02M 1/092 takes precedence](#))
  
- H02M 1/10      .      Arrangements incorporating converting means for enabling loads to be operated at will from different kinds of power supplies, e.g. from ac or dc
  
- H02M 1/12      .      Arrangements for reducing harmonics from ac input or output
- H02M 1/126      . .      {using passive filters }
  
- H02M 1/14      .      Arrangements for reducing ripples from dc input or output
- H02M 1/143      . .      {using compensating arrangements (for reducing noise from the supply in transmission systems [H04B 15/005](#)) }
- H02M 1/146      . .      {using discharge tubes }
- H02M 1/15      . .      using active elements
  
- H02M 1/16      .      Means for providing current step on switching, e.g. with saturable reactor
  
- H02M 1/20      .      Contact mechanisms of dynamic converters
- H02M 1/22      . .      incorporating collectors and brushes
- H02M 1/24      . .      incorporating rolling or tumbling contacts
- H02M 1/26      . .      incorporating cam-operated contacts
- H02M 1/28      . .      incorporating electromagnetically-operated vibrating contacts
- H02M 1/30      . .      incorporating liquid contacts
  
- H02M 1/32      .      Means for protecting converters other than automatic disconnection ([emergency protective circuit arrangements specially adapted for converters with automatic disconnection H02H 7/10](#))

**WARNING**

Group [H02M 1/32](#) and its subgroup are not complete, see provisionally also [H02M 1/32](#), [H02M 3/00](#) and subgroups, [H02M 7/00](#) and subgroups

[H02M 1/34](#) . . Snubber circuits

[H02M 1/36](#) . Means for starting or stoping converters

#### **WARNING**

Group [H02M 1/36](#) is not complete, see provisionally also [H02M 1/00S](#), [H02M 3/00](#) and subgroups, [H02M 7/00](#) and subgroups

[H02M 1/38](#) . Means for preventing simultaneous conduction of switches

#### **WARNING**

Group [H02M 1/38](#) is not complete, see provisionally also [H02M 1/00P2](#), [H02M 3/337](#) and subgroups, [H02M 7/538](#) and subgroups

[H02M 1/40](#) . Means for preventing magnetic saturation

#### **WARNING**

Group [H02M 1/40](#) is not complete, see provisionally also [H02M 3/335](#)

[H02M 1/42](#) . Circuits or arrangements for compensating for or adjusting power factor in converters or inverters

#### **WARNING**

Group [H02M 1/42](#) is not complete, see provisionally also [H02M 1/32](#) and subgroups

[H02M 1/4208](#) . . { Arrangements for improving power factor of AC input }

[H02M 1/4216](#) . . . { operating from a three-phase input voltage ([H02M 1/4233](#) takes precedence) }

[H02M 1/4225](#) . . . { using a non-isolated boost converter }

[H02M 1/4233](#) . . . { using a bridge converter consisting of active switches }

[H02M 1/4241](#) . . . { using a resonant converter }

[H02M 1/425](#) . . . { using a single converter stage both for correction of AC input power factor and generation of a high frequency AC output voltage }

[H02M 1/4258](#) . . . { using a single converter stage both for correction of AC input power factor and generation of a regulated and galvanically isolated DC output voltage ([H02M 1/4241](#) takes precedence) }

[H02M 1/4266](#) . . . { using passive elements }

- H02M 1/44 . Circuits or arrangements for compensating for electromagnetic interference in converters or inverters

**WARNING**

Group [H02M 1/44](#) is not complete, see provisionally also [H02M 7/00](#) and subgroups

**H02M 3/00 Conversion of dc power input into dc power output { (converters specially adapted for use in combination with a battery [H02J 7/0065](#)) }**

- H02M 3/005 . {using Cuk converters }
- H02M 3/02 . without intermediate conversion into ac
- H02M 3/04 . . by static converters
- H02M 3/06 . . . using resistors or capacitors, e.g. potential divider
- H02M 3/07 . . . . using capacitors charged and discharged alternately by semiconductor devices with control electrode, { e.g. charge pumps (for substrate bias voltage generators [G05F 3/205](#); for static stores [G11C 5/145](#), [G11C 16/06](#); charge pumping structures for internal polarisation [H01L 27/0222](#)) }
- H02M 3/073 . . . . . {Charge pumps of the SCHENKEL type }
- H02M 3/08 . . . using discharge tubes without control electrode or semiconductor devices without control electrode
- H02M 3/10 . . . using discharge tubes with control electrode or semiconductor devices with control electrode ([H02M 3/07](#) takes precedence)
- H02M 3/125 . . . . using devices of a thyatron or thyristor type requiring extinguishing means
- H02M 3/13 . . . . . using discharge tubes only
- H02M 3/135 . . . . . using semiconductor devices only
- H02M 3/137 . . . . . with automatic control of output voltage or current, e.g. switching regulators
- H02M 3/139 . . . . . with digital control
- H02M 3/142 . . . . . including plural semiconductor devices as final control devices for a single load
- H02M 3/145 . . . . using devices of a triode or transistor type requiring continuous application of a control signal
- H02M 3/15 . . . . . using discharge tubes only
- H02M 3/155 . . . . . using semiconductor devices only
- H02M 3/156 . . . . . with automatic control of output voltage or current, e.g. switching regulators
- H02M 3/1563 . . . . . {without using an external clock ([H02M 3/158](#) takes precedence) }
- H02M 3/157 . . . . . with digital control
- H02M 3/158 . . . . . including plural semiconductor devices as final control devices for a single load
- H02M 3/1582 . . . . . {Buck-boost converters ([H02M 3/1584](#) takes precedence) }
- H02M 3/1584 . . . . . {with a plurality of power processing stages connected in parallel }

H02M 3/1588	.....	{comprising at least one synchronous rectifier element ( <a href="#">H02M 3/1582</a> , <a href="#">H02M 3/1584</a> take precedence) }
H02M 3/16	..	by dynamic converters
H02M 3/18	...	using capacitors or batteries which are alternately charged and discharged, e.g. charged in parallel and discharged in series
H02M 3/20	..	by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
H02M 3/22	.	with intermediate conversion into ac
H02M 3/24	..	by static converters
H02M 3/26	...	using discharge tubes without control electrode or semiconductor devices without control electrode to produce the intermediate ac
H02M 3/28	...	using discharge tubes with control electrode or semiconductor devices with control electrode to produce the intermediate ac
H02M 3/285	....	{Single converters with a plurality of output stages connected in parallel (parallel operation of a plurality of converters in dc distribution networks <a href="#">H02J 1/10</a> ) }
H02M 3/305	....	using devices of a thyatron or thyristor type requiring extinguishing means
H02M 3/31	.....	using discharge tubes only
H02M 3/315	.....	using semiconductor devices only
H02M 3/3155	.....	{with automatic control of the output voltage or current }
H02M 3/325	....	using devices of a triode or a transistor type requiring continuous application of a control signal
H02M 3/33	.....	using discharge tubes only
H02M 3/335	.....	using semiconductor devices only
H02M 3/33507	.....	{with automatic control of the output voltage or current ( <a href="#">H02M 3/33561</a> , <a href="#">H02M 3/33569</a> take precedence) }
H02M 3/33515	.....	{with digital control }
H02M 3/33523	.....	{with galvanic isolation between input and output }
H02M 3/3353	.....	{having at least two simultaneously operating switches on the input side, e.g. "double forward" or "double (switched) flyback" converter }
H02M 3/33538	.....	{of the forward type ( <a href="#">H02M 3/3353</a> , <a href="#">H02M 3/33569</a> take precedence) }
H02M 3/33546	.....	{with automatic control of the output voltage or current ( <a href="#">H02M 3/33561</a> takes precedence) }
H02M 3/33553	.....	{with galvanic isolation between input and output }
H02M 3/33561	.....	{having more than one output with independent control }
H02M 3/33569	.....	{having several active switching elements ( <a href="#">H02M 3/3353</a> takes precedence) }
H02M 3/33576	.....	{having at least one active switching element at the secondary side of an isolation transformer }
H02M 3/33584	.....	{Bidirectional converters }
H02M 3/33592	.....	{having a synchronous rectifier circuit or a synchronous freewheeling circuit at the secondary side of an isolation transformer }
H02M 3/337	.....	in push-pull configuration { ( <a href="#">H02M 3/33576</a> takes precedence; with self-oscillating arrangements <a href="#">H02M 3/3382</a> and <a href="#">H02M 3/3385</a> ) }
H02M 3/3372	.....	{of the parallel type }

H02M 3/3374	.....	{with preregulator, e.g. current injected push-pull }
H02M 3/3376	.....	{with automatic control of output voltage or current }
H02M 3/3378	.....	{in a push-pull configuration of the parallel type ( <a href="#">H02M 3/3374</a> takes precedence) }
H02M 3/338	.....	in a self-oscillating arrangement ( <a href="#">H02M 3/337</a> takes precedence)
H02M 3/3381	.....	{using a single commutation path }
H02M 3/3382	.....	{in a push-pull circuit arrangement }
H02M 3/3384	.....	{of the parallel type }
H02M 3/3385	.....	{with automatic control of output voltage or current ( <a href="#">H02M 3/33561</a> takes precedence) }
H02M 3/3387	.....	{in a push-pull configuration }
H02M 3/3388	.....	{of the parallel type }
H02M 3/34	..	by dynamic converters
H02M 3/36	...	using mechanical parts to select progressively or to vary continuously the input potential
H02M 3/38	...	using mechanical contact-making and -breaking parts to interrupt a single potential
H02M 3/40	....	wherein the parts are rotating and collectors co-operate with brushes or rollers
H02M 3/42	....	with electromagnetically-operated vibrating contacts, e.g. chopper ( <a href="#">self-interrupters in general H01H 51/34</a> )
H02M 3/44	..	by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
<b>H02M 5/00</b>		<b>Conversion of ac power input into ac power output, e.g. for change of voltage, for change of frequency, for change of number of phases</b>
H02M 5/005	.	{using discharge tubes }
H02M 5/02	.	without intermediate conversion into dc
H02M 5/04	..	by static converters ( <a href="#">controlling transformers, reactors or choke coils, e.g. by tap changing H02P 13/00</a> )
H02M 5/06	...	using impedances
H02M 5/08	....	using capacitors only
H02M 5/10	...	using transformers
H02M 5/12	....	for conversion of voltage or current amplitude only
H02M 5/14	....	for conversion between circuits of different phase number
H02M 5/16	....	for conversion of frequency
H02M 5/18	....	for conversion of waveform
H02M 5/20	...	using discharge tubes without control electrode or semiconductor devices without control electrode
H02M 5/22	...	using discharge tubes with control electrode or semiconductor devices with control electrode
H02M 5/225	....	{comprising two stages of AC-AC conversion, e.g. having a high frequency intermediate link }
H02M 5/25	....	using devices of a thyatron or thyristor type requiring extinguishing means ( <a href="#">H02M 5/225</a> }, <a href="#">H02M 5/27</a> take precedence)

H02M 5/253	.....	using discharge tubes only
H02M 5/257	.....	using semiconductor devices only
H02M 5/2573	.....	{with control circuit }
H02M 5/2576	.....	{with digital control }
H02M 5/27	.....	for conversion of frequency
H02M 5/271	.....	{from a three phase input voltage }
H02M 5/272	.....	{for variable speed constant frequency systems }
H02M 5/273	.....	{with digital control }
H02M 5/275	....	using devices of a triode or transistor type requiring continuous application of a control signal ( { <a href="#">H02M 5/225</a> }, <a href="#">H02M 5/297</a> take precedence)
H02M 5/29	.....	using discharge tubes only
H02M 5/293	.....	using semiconductor devices only
H02M 5/297	.....	for conversion of frequency
H02M 5/32	..	by dynamic converters
H02M 5/34	...	using mechanical contact-making and -breaking parts
H02M 5/36	....	wherein the parts are rotating and collectors co-operate with brushes or rollers
H02M 5/38	..	by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
H02M 5/40	.	with intermediate conversion into dc
H02M 5/42	..	by static converters
H02M 5/44	...	using discharge tubes or semiconductor devices to convert the intermediate dc into ac
H02M 5/443	....	using devices of a thyatron or thyristor type requiring extinguishing means
H02M 5/447	.....	using discharge tubes only
H02M 5/45	.....	using semiconductor devices only
H02M 5/4505	.....	{having a rectifier with controlled elements }
H02M 5/451	.....	with automatic control of output voltage or frequency
H02M 5/452	.....	with automatic control of output waveform
H02M 5/453	....	using devices of a triode or transistor type requiring continuous application of a control signal
H02M 5/456	.....	using discharge tubes only
H02M 5/458	.....	using semiconductor devices only
H02M 5/4585	.....	{having a rectifier with controlled elements }
H02M 5/46	..	by dynamic converters
H02M 5/48	..	by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
<b>H02M 7/00</b>		<b>Conversion of ac power input into dc power output; Conversion of dc power input into ac power output</b>
H02M 7/003	.	{Constructional details, e.g. physical layout, assembly, wiring, busbar connections }
H02M 7/006	.	{using discharge tubes }

H02M 7/02	.	Conversion of ac power input into dc power output without possibility of reversal
H02M 7/04	..	by static converters
H02M 7/043	...	{using transformers or inductors only }
H02M 7/046	...	{using discharge tubes }
H02M 7/06	...	using discharge tubes without control electrode or semiconductor devices without control electrode
H02M 7/062	....	{Avoiding or suppressing excessive transient voltages or currents }
H02M 7/064	....	{with several outputs }
H02M 7/066	....	{particular circuits having a special characteristic }
H02M 7/068	....	{mounted on a transformer }
H02M 7/08	....	arranged for operation in parallel
H02M 7/10	....	arranged for operation in series, e.g. for multiplication of voltage
H02M 7/103	.....	{Containing passive elements (capacitively coupled) which are ordered in cascade on one source }
H02M 7/106	.....	{With physical arrangement details }
H02M 7/12	...	using discharge tubes with control electrode or semiconductor devices with control electrode
H02M 7/125	....	{Avoiding or suppressing excessive transient voltages or currents }
H02M 7/145	....	using devices of a thyatron or thyristor type requiring extinguishing means
H02M 7/15	.....	using discharge tubes only
H02M 7/151	.....	{with automatic control (H02M 7/153 takes precedence) }
H02M 7/153	.....	{arranged for operation in parallel }
H02M 7/155	.....	using semiconductor devices only
H02M 7/1552	.....	{in a biphasic or polyphase arrangement (voltage multipliers H02M 7/19) }
H02M 7/1555	.....	{with control circuit }
H02M 7/1557	.....	{with automatic control of the output voltage or current }
H02M 7/162	.....	in a bridge configuration
H02M 7/1623	.....	{with control circuit }
H02M 7/1626	.....	{with automatic control of the output voltage or current }
H02M 7/17	.....	arranged for operation in parallel
H02M 7/19	.....	arranged for operation in series, e.g. for voltage multiplication
H02M 7/21	...	using devices of a triode or transistor type requiring continuous application of a control signal
H02M 7/213	.....	using discharge tubes only
H02M 7/217	.....	using semiconductor devices only
H02M 7/2173	.....	{in a biphasic or polyphase circuit arrangement (H02M 7/2176 takes precedence; voltage multipliers H02M 7/25) }
H02M 7/2176	.....	{comprising a passive stage to generate a rectified sinusoidal voltage and a controlled switching element in series between such stage and the output }
H02M 7/219	.....	in a bridge configuration
H02M 7/23	.....	arranged for operation in parallel { (H02M 7/2176 takes precedence) }
H02M 7/25	.....	arranged for operation in series, e.g. for multiplication of voltage

H02M 7/26	...	using open-spark devices, e.g. Marx rectifier
H02M 7/28	...	using electrolytic rectifiers
H02M 7/30	..	by dynamic converters
H02M 7/32	...	using mechanical contact-making and -breaking parts
H02M 7/34	....	wherein the parts are rotating and collectors co-operate with brushes or rollers
H02M 7/36	....	with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general <a href="#">H01H 51/34</a> )
H02M 7/38	...	using one or more sparking electrodes rotating over counterelectrodes
H02M 7/40	..	by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
H02M 7/42	.	Conversion of dc power input into ac power output without possibility of reversal
H02M 7/44	..	by static converters
H02M 7/445	...	{using discharge tubes }
H02M 7/46	...	using discharge tubes without control electrode or semiconductor devices without control electrode
H02M 7/48	...	using discharge tubes with control electrode or semiconductor devices with control electrode
H02M 7/4807	....	{having a high frequency intermediate AC stage }
H02M 7/4826	....	{operating from a resonant DC source, i.e. the DC input voltage varies periodically, e.g. resonant DC-link inverters }
H02M 7/483	....	Converters with outputs that each can have more than two voltages levels
H02M 7/487	.....	Neutral point clamped inverters
H02M 7/49	.....	Combination of the output voltage waveforms of a plurality of converters
H02M 7/493	....	the static converters being arranged for operation in parallel
H02M 7/497	....	sinusoidal output voltages being obtained by combination of several voltages being out of phase
H02M 7/501	....	sinusoidal output voltages being obtained by the combination of several pulse-voltages having different amplitude and width
H02M 7/505	....	using devices of a thyatron or thyristor type requiring extinguishing means { ( <a href="#">H02M 7/4807</a> , <a href="#">H02M 7/483</a> , <a href="#">H02M 7/493</a> and <a href="#">H02M 7/4826</a> take precedence) }
H02M 7/51	.....	using discharge tubes only
H02M 7/515	.....	using semiconductor devices only
H02M 7/5152	.....	{with separate extinguishing means }
H02M 7/5155	.....	{wherein each commutation element has its own extinguishing means }
H02M 7/5157	.....	{wherein the extinguishing of every commutation element will be obtained by means of a commutation inductance, by starting another main commutation element in series with the first }
H02M 7/516	.....	Self-oscillating arrangements
H02M 7/517	.....	with special starting equipment
H02M 7/519	.....	in a push-pull configuration ( <a href="#">H02M 7/517</a> takes precedence)
H02M 7/521	.....	in a bridge configuration
H02M 7/523	.....	with LC-resonance circuit in the main circuit

<a href="#">H02M 7/5233</a>	.....	{the commutation elements being in a push-pull arrangement }
<a href="#">H02M 7/5236</a>	.....	{in a series push-pull arrangement }
<a href="#">H02M 7/525</a>	.....	with automatic control of output waveform or frequency ( <a href="#">H02M 7/517</a> to <a href="#">H02M 7/523</a> take precedence)
<a href="#">H02M 7/527</a>	.....	by pulse width modulation
<a href="#">H02M 7/529</a>	.....	using digital control
<a href="#">H02M 7/53</a>	....	using devices of a triode or transistor type requiring continuous application of a control signal { ( <a href="#">H02M 7/4807</a> , <a href="#">H02M 7/493</a> and <a href="#">H02M 7/4826</a> take precedence) }
<a href="#">H02M 7/533</a>	.....	using discharge tubes only
<a href="#">H02M 7/537</a>	.....	using semiconductor devices only, e.g. single switched pulse inverters
<a href="#">H02M 7/5375</a>	.....	with special starting equipment

**WARNING**Incomplete, see also [H02M 1/36](#)

<a href="#">H02M 7/538</a>	.....	in a push-pull configuration ( <a href="#">H02M 7/5375</a> takes precedence; {with oscillating arrangements <a href="#">H02M 7/53832</a> , <a href="#">H02M 7/53846</a> })
<a href="#">H02M 7/53803</a>	.....	{with automatic control of output voltage or current }
<a href="#">H02M 7/53806</a>	.....	{in a push-pull configuration of the parallel type }
<a href="#">H02M 7/5381</a>	.....	Parallel type
<a href="#">H02M 7/5383</a>	.....	in a self-oscillating arrangement ( <a href="#">H02M 7/538</a> takes precedence)
<a href="#">H02M 7/53832</a>	.....	{in a push-pull arrangement }
<a href="#">H02M 7/53835</a>	.....	{of the parallel type }
<a href="#">H02M 7/53838</a>	.....	using a single commutation path
<a href="#">H02M 7/53846</a>	.....	Control circuits { WARNING Group <a href="#">H02M 7/53846</a> and subgroups is not complete, see provisionally also <a href="#">H02M 7/5383</a> and subgroups }
<a href="#">H02M 7/538463</a>	.....	{ for thyristor type converters }
<a href="#">H02M 7/538466</a>	.....	{ for transistor type converters }
<a href="#">H02M 7/53854</a>	.....	using thyristor type converters
<a href="#">H02M 7/53862</a>	.....	using transistor type converters
<a href="#">H02M 7/5387</a>	.....	in a bridge configuration
<a href="#">H02M 7/53871</a>	.....	{with automatic control of output voltage or current }
<a href="#">H02M 7/53873</a>	.....	{with digital control }
<a href="#">H02M 7/53875</a>	.....	{with analogue control of three-phase output }
<a href="#">H02M 7/5388</a>	.....	with asymmetrical configuration of switches { WARNING Group <a href="#">H02M 7/5388</a> is not complete, see provisionally also <a href="#">H02M 7/5387</a> and subgroups }
<a href="#">H02M 7/539</a>	.....	with automatic control of output wave form or frequency ( <a href="#">H02M 7/5375</a> to <a href="#">H02M 7/5387</a> take precedence)
<a href="#">H02M 7/5395</a>	.....	by pulse-width modulation
<a href="#">H02M 7/54</a>	..	by dynamic converters
<a href="#">H02M 7/56</a>	...	using mechanical parts to select progressively, or to vary continuously, the input potential
<a href="#">H02M 7/58</a>	...	using mechanical contact-making and -breaking parts to interrupt a single

- potential
- H02M 7/60 . . . . wherein the parts are rotating and collectors co-operate with brushes or rollers
  - H02M 7/62 . . . . with electromagnetically-operated vibrating contacts, e.g. chopper  
(self-interrupters in general [H01H 51/34](#))
  - H02M 7/64 . . by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
  - H02M 7/66 . with possibility of reversal
  - H02M 7/68 . . by static converters
  - H02M 7/70 . . . using discharge tubes without control electrode or semiconductor devices without control electrode
  - H02M 7/72 . . . using discharge tubes with control electrode or semiconductor devices with control electrode
  - H02M 7/75 . . . . using devices of a thyatron or thyristor type requiring extinguishing means  
([H02M 7/77](#) takes precedence)
  - H02M 7/753 . . . . . using discharge tubes only
  - H02M 7/757 . . . . . using semiconductor devices only
  - H02M 7/7575 . . . . . {for high voltage direct transmission link }
  - H02M 7/758 . . . . . with automatic control of output waveform or frequency
  - H02M 7/77 . . . . . arranged for operation in parallel
  - H02M 7/79 . . . . using devices of a triode or transistor type requiring continuous application of a control signal ([H02M 7/81](#) takes precedence)
  - H02M 7/793 . . . . . using discharge tubes only
  - H02M 7/797 . . . . . using semiconductor devices only
  - H02M 7/81 . . . . . arranged for operation in parallel
  - H02M 7/82 . . . using open-spark devices, e.g. Marx rectifier
  - H02M 7/84 . . . using electrolytic rectifiers
  - H02M 7/86 . . by dynamic converters
  - H02M 7/88 . . . using mechanical parts to select progressively or to vary continuously the input potential
  - H02M 7/90 . . . using mechanical contact-making and -breaking parts to interrupt a single potential
  - H02M 7/92 . . . . wherein the parts are rotating and collectors co-operate with brushes or rollers
  - H02M 7/94 . . . . wherein the parts are operated by rotating cams or cam-like devices
  - H02M 7/95 . . . . with electromagnetically-operated vibrating contacts, e.g. chopper  
(self-interrupters in general [H01H 51/34](#))
  - H02M 7/96 . . . . with moving liquid contacts
  - H02M 7/98 . . by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters

## **H02M 11/00 Power conversion systems not covered by the preceding groups**

### **Guidance heading:**

## **H02M 2001/00 Details of apparatus for conversion**

- H02M 2001/0003 . Details of control, feedback and regulation circuits
- H02M 2001/0006 . . Arrangements for supplying an adequate voltage to the control circuit of a converter
- H02M 2001/0009 . . Devices and circuits for detecting current in a converter
- H02M 2001/0012 . . Control circuits using digital or numerical techniques ([in dc/dc converters H02M 3/157](#), [H02M 3/33515](#); [in dc-ac converters H02M 7/53873](#))
- H02M 2001/0016 . . Control circuits providing compensation of output voltage deviations using feedforward of disturbance parameter
- H02M 2001/0019 . . . the disturbance parameter being load current fluctuations
- H02M 2001/0022 . . . the disturbance parameter being input voltage fluctuations
- H02M 2001/0025 . . Arrangements for modifying reference value, feedback value or error value in the control loop of a converter
- H02M 2001/0029 . . Circuits or arrangements for limiting the slope ("[slew rate](#)") of switching signals
- H02M 2001/0032 . . Control circuits allowing low power mode operation, e.g. "standby"
- H02M 2001/0035 . . . by burst mode control
- H02M 2001/0038 . . Circuits or arrangements for suppressing, e.g. by masking incorrect turn-on or turn-off signals, e.g. due to current spikes in current mode control
- H02M 2001/0041 . . Control circuits in which a clock signal is selectively enabled or disabled
- H02M 2001/0045 . Converters combining the concepts of switch-mode regulation and linear regulation, e.g. linear preregulator to switching converter, linear and switching converter in parallel, same converter or same transistor operating either in linear or switching mode
- H02M 2001/0048 . Circuits or arrangements for reducing losses ([using snubbers H02M 1/34](#))
- H02M 2001/0051 . . Diode reverse recovery losses
- H02M 2001/0054 . . Transistor switching losses ([periodically suspending operation of switching converter in low power mode H02M 2001/0035](#))
- H02M 2001/0058 . . . by employing soft switching techniques, i.e. commutation of transistor when voltage applied to it is zero and/or when current flowing through it is zero ([in resonant inverters H02M 2007/4815](#); [in inverters operating from a resonant dc source H02M 7/4826](#); [using an auxiliary actively switched resonant commutation circuit connected to an intermediate dc voltage or between two push-pull branches of an inverter bridge H02M 2007/4811](#))
- H02M 2001/0064 . Magnetic structures combining different functions, e.g. storage, filtering, transformation
- H02M 2001/0067 . Converter structures employing plural converter units, other than for parallel operation of the units on a single load
- H02M 2001/007 . . Plural converter units in cascade ([push-pull dc/dc converters with preregulator H02M 3/3374](#); [dc-ac converters following a dc-dc stage which includes a high frequency transformer H02M 7/4807](#), [dc-ac converters following a dc-dc conversion stage which generates a periodically varying voltage H02M 7/4826](#))
- H02M 2001/0074 . . Plural converter units whose inputs are connected in series
- H02M 2001/0077 . . Plural converter units whose outputs are connected in series
- H02M 2001/008 . . Plural converter units for generating at least two independent, non-parallel outputs, e.g. systems with plural point of load switching regulators
- H02M 2001/0083 . Converters characterized by their input or output configuration

- H02M 2001/0087 . . adapted for receiving as input a current source
- H02M 2001/009 . . having more than one output with independent control (for dc-dc converter with intermediate ac [H02M 3/33561](#))
- H02M 2001/0093 . . wherein the output is created by adding a regulated voltage to or subtracting it from an unregulated input
- H02M 2001/0096 . Means for increasing hold-up time, i.e. the duration of time that a converter's output will remain within regulated limits following a loss of input power
- H02M 2001/12 . Arrangements for reducing harmonics from ac input or output
- H02M 2001/123 . . Suppression of common mode voltage or current
- H02M 2001/32 . Means for protecting converters other than automatic disconnection (emergency protective circuit arrangements specially adapted for converters with automatic disconnection [H02H 7/10](#))

### **WARNING**

Group [H02M 1/32](#) and its subgroup are not complete, see provisionally also [H02M 1/32](#), [H02M 3/00](#) and subgroups, [H02M 7/00](#) and subgroups

- H02M 2001/322 . . Means for rapidly discharging a capacitor of the converter, in order to protect electrical components or prevent electrical shock
- H02M 2001/325 . . with means for allowing continuous operation despite a fault, i.e. fault tolerant converters
- H02M 2001/327 . . against abnormal temperatures
- H02M 2001/34 . . Snubber circuits
  - H02M 2001/342 . . . Active non-dissipative snubbers
  - H02M 2001/344 . . . Active dissipative snubbers
  - H02M 2001/346 . . . Passive non-dissipative snubbers
  - H02M 2001/348 . . . Passive dissipative snubbers
- H02M 2001/38 . Means for preventing simultaneous conduction of switches

### **WARNING**

Group [H02M 1/38](#) is not complete, see provisionally also [H02M 1/00P2](#), [H02M 3/337](#) and subgroups, [H02M 7/538](#) and subgroups

- H02M 2001/385 . . with means for correcting output voltage deviations introduced by the dead time
- H02M 2001/42 . Circuits or arrangements for compensating for or adjusting power factor in converters or inverters

### **WARNING**

Group [H02M 1/42](#) is not complete, see provisionally also [H02M 1/32](#) and subgroups

- H02M 2001/4208 . . { Arrangements for improving power factor of AC input }

<a href="#">H02M 2001/4275</a>	...	by adding an auxiliary output voltage in series to the input
<a href="#">H02M 2001/4283</a>	...	by adding a controlled rectifier in parallel to a first rectifier feeding a smoothing capacitor
<a href="#">H02M 2001/4291</a>	...	by using a Buck converter to switch the input current
<b>H02M 2003/00</b>		<b>Conversion of dc power input into dc power output { (converters specially adapted for use in combination with a battery <a href="#">H02J 7/0065</a>) }</b>
H02M 2003/02	.	without intermediate conversion into ac
H02M 2003/04	..	by static converters
H02M 2003/06	...	using resistors or capacitors, e.g. potential divider
H02M 2003/07	....	using capacitors charged and discharged alternately by semiconductor devices with control electrode, { e.g. <a href="#">charge pumps (for substrate bias voltage generators G05F 3/205; for static stores G11C 5/145, G11C 16/06; charge pumping structures for internal polarisation H01L 27/0222)</a> }
<a href="#">H02M 2003/071</a>	.....	adapted to generate a negative voltage output from a positive voltage source
<a href="#">H02M 2003/072</a>	.....	adapted to generate an output voltage whose value is lower than the input voltage
H02M 2003/073	.....	{ <a href="#">Charge pumps of the SCHENKEL type</a> }
<a href="#">H02M 2003/075</a>	.....	including a plurality of stages and two sets of clock signals, one set for the odd and one set for the even numbered stages
<a href="#">H02M 2003/076</a>	.....	the clock signals being boosted to a value which is higher than input voltage value
<a href="#">H02M 2003/077</a>	.....	with parallel connected charge pump stages
<a href="#">H02M 2003/078</a>	.....	with means for reducing the back bias effect, i.e. the effect which causes the threshold voltage of transistors to increase as more stages are added to the converter
H02M 2003/10	...	using discharge tubes with control electrode or semiconductor devices with control electrode ( <a href="#">H02M 3/07 takes precedence</a> )
H02M 2003/145	....	using devices of a triode or transistor type requiring continuous application of a control signal
H02M 2003/155	.....	using semiconductor devices only
<a href="#">H02M 2003/1552</a>	.....	Boost converters exploiting the leakage inductance of a transformer or of an alternator as boost inductor
<a href="#">H02M 2003/1555</a>	.....	for the generation of a regulated current to a load whose impedance is substantially inductive
<a href="#">H02M 2003/1557</a>	.....	Single ended primary inductor converters [SEPIC]
H02M 2003/156	.....	with automatic control of output voltage or current, e.g. switching regulators
<a href="#">H02M 2003/1566</a>	.....	with means for compensating against rapid load changes, e.g. with auxiliary current source, with dual mode control, with inductance variation
H02M 2003/158	.....	including plural semiconductor devices as final control devices for a single load
H02M 2003/1584	.....	{ <a href="#">with a plurality of power processing stages connected in parallel</a> }
<a href="#">H02M 2003/1586</a>	.....	switched with a phase shift, i.e. interleaved

<b>H02M 2005/00</b>	<b>Conversion of ac power input into ac power output, e.g. for change of voltage, for change of frequency, for change of number of phases</b>
H02M 2005/02	. without intermediate conversion into dc
H02M 2005/04	.. by static converters ( <a href="#">controlling transformers, reactors or choke coils, e.g. by tap changing H02P 13/00</a> )
H02M 2005/22	... using discharge tubes with control electrode or semiconductor devices with control electrode
H02M 2005/275	.... using devices of a triode or transistor type requiring continuous application of a control signal ( <a href="#">H02M 5/225</a> }, <a href="#">H02M 5/297</a> take precedence)
H02M 2005/293	..... using semiconductor devices only
<a href="#">H02M 2005/2932</a>	..... with automatic control of output voltage, current or power
<a href="#">H02M 2005/2935</a>	..... using reverse phase control, i.e. turn-on of switch in series with load at zero crossing of input voltage, turn-off before next zero crossing
<a href="#">H02M 2005/2937</a>	..... using whole cycle control, i.e. switching an integer number of whole (half) cycles of the ac input voltage
<b>H02M 2007/00</b>	<b>Conversion of ac power input into dc power output; Conversion of dc power input into ac power output</b>
H02M 2007/02	. Conversion of ac power input into dc power output without possibility of reversal
H02M 2007/04	.. by static converters
H02M 2007/12	... using discharge tubes with control electrode or semiconductor devices with control electrode
H02M 2007/21	.... using devices of a triode or transistor type requiring continuous application of a control signal
H02M 2007/217	..... using semiconductor devices only
H02M 2007/219	..... in a bridge configuration
<a href="#">H02M 2007/2195</a>	..... the switches being synchronously commutated at the same frequency of the AC input voltage
H02M 2007/42	. Conversion of dc power input into ac power output without possibility of reversal
H02M 2007/44	.. by static converters
H02M 2007/48	... using discharge tubes with control electrode or semiconductor devices with control electrode
<a href="#">H02M 2007/4803</a>	.... with means for reducing dc component from AC output voltage
<a href="#">H02M 2007/4811</a>	.... having an auxiliary actively switched resonant commutation circuit connected to an intermediate dc voltage or between two push-pull branches
<a href="#">H02M 2007/4815</a>	.... Resonant converters ( <a href="#">H02M 2007/4811</a> and <a href="#">H02M 7/4826</a> take precedence)
<a href="#">H02M 2007/4818</a>	..... with means for adaptation of resonance frequency, e.g. by modification of capacitance or inductance of resonance circuit
<a href="#">H02M 2007/4822</a>	.... arranged for operation in parallel
H02M 2007/483	.... Converters with outputs that each can have more than two voltages levels
<a href="#">H02M 2007/4835</a>	..... comprising a plurality of cells, each including a switchable capacitor, the capacitors having a nominal charge voltage which corresponds to a given fraction of the input voltage, the capacitors being selectively connected in

		series to determine the instantaneous output voltage
H02M 2007/53	....	using devices of a triode or transistor type requiring continuous application of a control signal { ( <a href="#">H02M 7/4807</a> , <a href="#">H02M 7/493</a> and <a href="#">H02M 7/4826</a> take precedence) }
H02M 2007/537	.....	using semiconductor devices only, e.g. single switched pulse inverters
H02M 2007/5387	.....	in a bridge configuration
H02M 2007/53871	.....	{with automatic control of output voltage or current }
H02M 2007/53875	.....	{with analogue control of three-phase output }
<a href="#">H02M 2007/53876</a>	.....	based on synthetising a desired voltage vector via the selection of appropriate fundamental voltage vectors, and corresponding dwelling times
<a href="#">H02M 2007/53878</a>	.....	by time shifting switching signals of one diagonal pair of the bridge with respect to the other diagonal pair