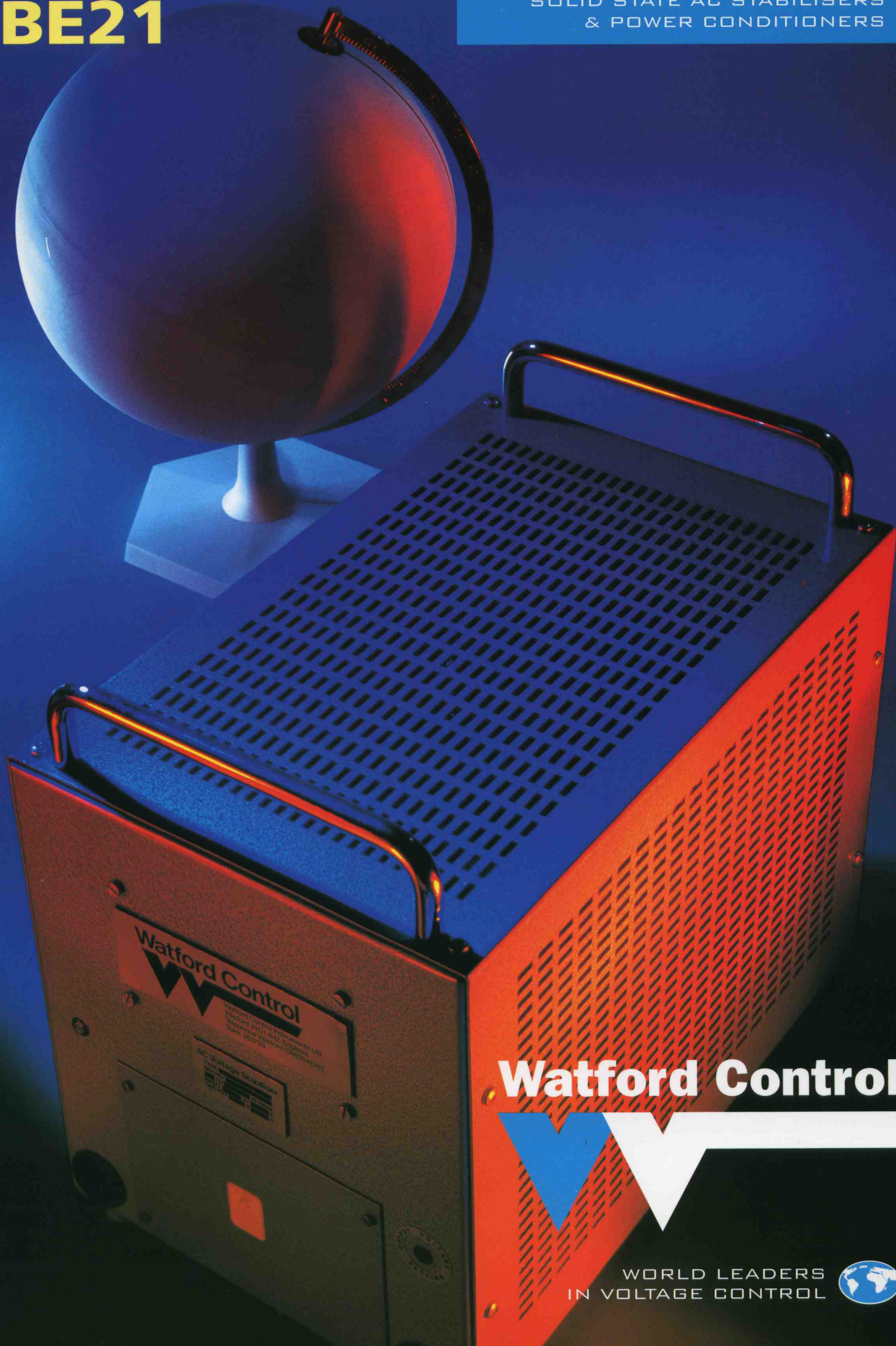


BE21

SOLID STATE AC STABILISERS
& POWER CONDITIONERS



Watford Control



WORLD LEADERS
IN VOLTAGE CONTROL





+ All mains powered equipment requires a supply which is maintained within certain limits. Thus a low supply voltage will cause malfunction, whilst a high supply voltage can cause damage. Micro-processor based systems require not only a stable voltage but a supply free of transient spikes and electrical noise.

As world leaders in voltage control for over 40 years Watford Control offer unique design, manufacturing and advisory capability. We have associated companies and agents throughout the world, covering every requirement from low cost transient suppression to total power conditioning.

All Watford Control products are designed and manufactured within our extensive Corby plant. There are hundreds of thousands of Watford Control units in service, in some of the toughest environments on earth.



The Power to Control

The BE21 range of solid state AC voltage stabilisers and power conditioners are the latest in the series of solid state stabilisers designed and manufactured by Watford Control. Based on the unique low distortion inductive power control concept, providing the reliability of solid state control without the use of power semiconductors in the supply line which can be damaged by voltage or current surges, as is the case with solid state tap changers.

Behind the BE21 series lies the vast experience gained since 1952 when Watford Control first manufactured the original range of AC voltage stabilisers. The twin transductor design was first introduced and patented in 1964. The original patented design was significantly improved in 1971 by the addition of a low distortion transductor assembly. For the first time electronic voltage stabilisers could give high accuracy and reliability in service, with impressively low harmonic distortion achieved without costly filtering. This latest

range offers not only improved performance but a price reduction of up to 30% per KVA compared to the previous BEN and BEW ranges. With three phase assemblies now rated up to 360KVA, this is without question the widest solid state choice available.

PRINCIPLE OF OPERATION

A twin transductor assembly forms a potential divider across two taps of an auto-transformer, one side of which is connected to the incoming mains supply, the other to the load. A solid state amplifier monitors the output voltage across the load against a highly stable reference voltage. Any error voltage is amplified and directly coupled to the control windings of the transductors, thus altering the voltage across the load and reducing the error to zero.

The transductors are not susceptible to damage from short circuits or voltage surges and the amplifier operates at low voltage and current levels.

KEY FEATURES

Reliability and economy of inductive power control, no moving parts or semi-conductors in the main power handling circuits.

Transverse mode transient noise suppression.

Common mode transient noise suppression (optional).

Low internal impedance, capable of sustaining high surge currents.

Accuracy of $\pm 0.5\%$ or $\pm 5.0\%$ as specified.

Stability maintained over the full range of input voltage variations, frequency variations and from zero to full load at any lagging power factor.

Fast response.

High efficiency.

Single and three phase assemblies from 300VA to over 360 KVA.



STABILISED OUTPUT VOLTAGE

Can be preset to any value within these ranges:

- H MODELS** 200 to 254 V output single phase.
 345 to 440V output three phase.
- L MODELS** 100 to 127V output single phase.
 170 to 220V output three phase.

Other voltages to order.

OUTPUT VOLTAGE ACCURACY

±0.5% as standard or ±5.0% for extended input voltage range. Accuracy maintained over the full range of input voltage variations from zero to full load, any power factor irrespective of frequency variations and ambient temperature variations up to +45 deg C. Three phase stabilisers will, in addition to the above, maintain the output accuracy of each phase to neutral, even if the input voltage and load are unbalanced. Line to line voltages are fully stabilised when the load is balanced. With an unbalanced load of up to 10% the output voltage will be within 2% (5% for extended input voltage swing).

INPUT VOLTAGE RANGE

The input voltage range is shown as a percentage of the pre-set output voltage. Each model can be supplied in one of eight performance modes shown below.

The 'R' number (total input voltage range) has to be specified when ordering but both tap 'A' and 'B' are provided on standard units and can be selected at the time of installation and easily altered if required.

Performance Mode	Tap	Input Voltage Range	Output Accuracy
R20/0.5	A	-15% to +5%	± 0.5%
R20/0.5	B	-10% to +10%	± 0.5%
R20/5.0	A	-20% to +10%	± 5.0%
R20/5.0	B	-15% to +15%	± 5.0%
R30/0.5	A	-20% to +10%	± 0.5%
R30/0.5	B	-15% to +15%	± 0.5%
R30/5.0	A	-25% to +15%	± 5.0%
R30/5.0	B	-20% to +20%	± 5.0%

SUPPLY FREQUENCY

50 or 60 Hz ± 2%

POWER FACTOR

Any PF lagging to 0.95 leading.

Above 65% of full load there is a slight shift in the input voltage range as the power factor deviates from 1.0. This shift does not exceed +3% for R20 models and +5% for R30 models. The output voltage accuracy remains unaffected.

WAVEFORM DISTORTION

Less Than 2.5% THD.

CORRECTION TIME

Correction times vary according to model size, typically 3 cycles (0.06 secs) for smaller models and 15 cycles (0.3 secs) for the larger ones.

EFFICIENCY

Better than 94% at full load with up to 96% for larger models.

SURGE RATING

Ten times the rated current up to 2 seconds. Five times up to 30 seconds. Twice up to 300 seconds.

ENVIRONMENT

The quoted current ratings apply to ambient temperatures up to +45 degrees C. Derate by 2% for each additional degree C up to 70 degrees C. Temperature stability better than 0.03% per degree C. Maximum altitude 1000m. Derate by 2.5% for each additional 500m. BE stabilisers are suitable for indoor tropical use. For outdoor and other hostile environments please contact our sales office.

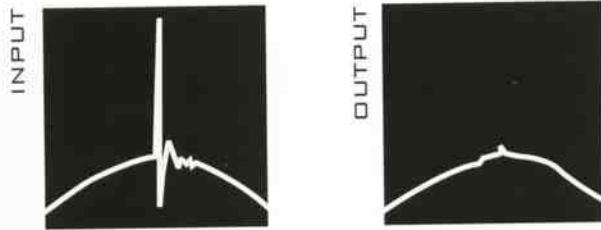


AUDIBLE NOISE LEVEL

Less than 40dB at 1m distance.

TRANSVERSE MODE (SYMMETRICAL) INTERFERENCE SUPPRESSION

Fitted as standard, this will suppress any spikes, transients or noise between line and neutral and line to line to a harmless ripple.



INPUT PULSE

Rise time: 0.25 micro secs.

Duration: 5 micro secs.

dV/dT: 7Kv/micro sec.

ATTENUATION

80 to 1(-38dB)

Absolute limit of 2% above the peak of the stabilised voltage. Rising to -105dB @ 100KHz.

The oscillograms show the Transverse Mode attenuation of a spike/pulse on the incoming supply. It is important that a Power Conditioner can provide spike/pulse attenuation as well as noise attenuation. Quoting dB figures without defining the disturbance is meaningless and intended to mislead.

COMMON MODE (ASYMMETRICAL) INTERFERENCE SUPPRESSION

This option (PC-BE21 models) will eliminate any potential difference, spikes or noise between earth and neutral or earth and line. A screened double wound isolation transformer is connected to the output of the stabiliser, enabling the secondary neutral to be earthed and at that point the common mode interference is ZERO. A floating secondary is not desirable nor safe.

OPTIONAL LIGHTING ARRESTORS

Can be provided if requested to protect the stabiliser/power conditioner and load from the harmful effects of induced lightning strikes to the incoming supply distribution network.

REMOTE SENSING

Separate terminals provide for monitoring the output voltage nearer to the load point, to compensate for any voltage drop in long cable runs.



CONSTRUCTION

The larger BE stabilisers are enclosed in robust steel floor standing cubicles with door access for easy installation and servicing. Lifting eye-bolts are provided to assist handling during transportation.

The smaller single phase models are suitable for floor or bench mounting. Enclosures to IP20 BS5490/IEC529. Other enclosures to order.

ELECTRO MAGNETIC COMPATIBILITY

Complies to BS6527, BS6667 pt 3. IEEE 587 Cat A and EC 801 pt 3 & 4, and will comply with other standards when available.

THREE PHASE MODELS

BE three phase stabilisers are normally supplied for "star" connection and require an incoming neutral. If no neutral is available a static balancer will be fitted to the stabiliser. If the load also requires a neutral a larger balancer can be provided. Full accuracy of each phase will be maintained line to neutral under all conditions of unbalance.



Our quality management system has been assessed and approved to ISO9002 and all our products are manufactured to the relevant British Standards and their international equivalents.



All our AC Voltage Stabilisers and Power Conditioners can be fitted with optional accessories to suit any requirement that may arise. Listed below are some of the standard extras which we can fit. Other special requirements will be incorporated to order.

VOLTMETER

Including phase selector switch on three phase models.

AMMETER

Including phase selector switch on three phase models.

COMMON MODE SUPPRESSION

Common mode noise and spike attenuation.

INDUCED LIGHTNING ARRESTORS

Additional suppression to protect the stabiliser and load from the harmful effect of induced lightning strikes.

ELECTRONIC OVER/UNDER VOLTAGE RELAY

Monitors the output voltage and is actuated if the voltage deviates below or above a pre-set level.

LOW FREQUENCY/HIGH VOLTAGE RELAY

Monitors the output and is actuated if the voltage deviates above or the frequency deviates below a pre-set level.

ELECTRONIC HIGH VOLTAGE TRIP

Operates in conjunction with an output circuit breaker and will trip if the output voltage deviates above a pre-set level for a pre-set time (fitted as standard on BE2104 models and above).

PHASE ROTATION/FAILURE RELAY

Monitors the incoming supply to ensure correct phase rotation and that all three phases are present.

INPUT CIRCUIT BREAKER

OUTPUT CIRCUIT BREAKER

BY-PASS SWITCH

Either supplied as a separate item (the recommended method) or incorporated in the stabiliser enclosure. Operation of the switch will transfer the load directly to the incoming supply and isolates the stabiliser.

STATIC BALANCING TRANSFORMER

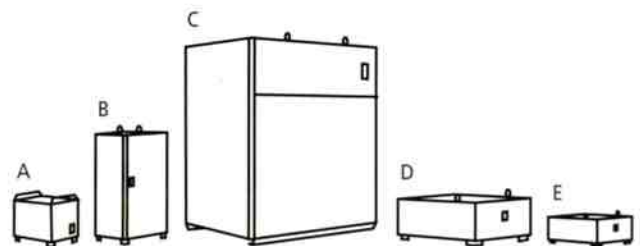
Can be fitted where there is no incoming neutral, allowing the stabiliser to be operated on a three phase three wire system. If the load also requires a four wire system a larger static balancer will be required and this must be specified.

DISTRIBUTION PANEL

For multiple MCB protected outputs, panel mounted within the stabiliser enclosure.

DIMENSIONS

SINGLE PHASE		Dimensions in cm, weight in kg				
Model	Enc	Height	Width	Depth	Weight	
BE360	E	140	121	279	11	
BE600	E	160	140	316	14	
BE1200	E	190	140	316	24	
BE2101	A	335	285	475	45	
BE2102	A	335	285	475	60	
BE2103	A	335	285	475	70	
BE2104	A	415	310	645	120	
BE2105	A	415	310	645	135	
BE2106	D	440	370	815	190	
BE2107	D	580	410	1070	340	
BE2108	D	580	410	1070	460	
BE2109	D	1000	750	1200	575	
BE2110	D	1000	750	1200	950	
BE2111	D	1000	750	1200	1200	



THREE PHASE		Dimensions in cm, weight in kg				
Model	Enc	Height	Width	Depth	Weight	
BE2101	B	860	285	580	140	
BE2102	B	1160	335	615	200	
BE2103	B	1160	335	615	245	
BE2104	B	1275	385	800	410	
BE2105	B	1275	385	800	450	
BE2106	C	1510	770	860	650	
BE2107	C	1510	770	860	1080	
BE2108	C	1660	865	1075	1450	
BE2109	C	2100	1000	1200	1800	
BE2110	C	2100	1000	1200	2950	
BE2111	C	2100	1000	1200	3700	



R20 MODELS (NARROW SWING)

SINGLE PHASE ('H' MODELS)

Model No.	KVA @ 240v	KVA @ 230v	KVA @ 220v	Max Current
BE2101-H-R20	2.64	2.53	2.42	11
BE2102-H-R20	3.84	3.68	3.52	16
BE2103-H-R20	5.76	5.52	5.28	24
BE2104-H-R20	8.40	8.05	7.70	35
BE2105-H-R20	12.00	11.50	11.00	50
BE2106-H-R20	16.80	16.10	15.40	70
BE2107-H-R20	24.00	23.00	22.00	100
BE2108-H-R20	38.40	36.80	35.20	160
BE2109-H-R20	60.00	57.50	55.55	250
BE2110-H-R20	90.00	86.25	82.50	375
BE2111-H-R20	120.00	115.00	110.00	500

THREE PHASE ('H' MODELS)

Model No.	KVA @ 415v	KVA @ 400v	KVA @ 380v	Max Current
BE2101-H-3P-R20	7.92	7.59	7.26	11
BE2102-H-3P-R20	11.52	11.04	10.65	16
BE2103-H-3P-R20	17.28	16.56	15.84	24
BE2104-H-3P-R20	25.20	24.15	23.10	35
BE2105-H-3P-R20	36.00	34.50	33.00	50
BE2106-H-3P-R20	50.40	48.30	46.20	70
BE2107-H-3P-R20	72.00	69.00	66.00	100
BE2108-H-3P-R20	115.20	110.40	105.60	160
BE2109-H-3P-R20	180.00	172.50	168.50	250
BE2110-H-3P-R20	270.00	258.75	247.50	375
BE2111-H-3P-R20	360.00	345.00	330.00	500

SINGLE PHASE ('L' MODELS)

Model No.	KVA @ 120v	KVA @ 115v	KVA @ 110v	Max Current
BE2101-L-R20	2.64	2.53	2.42	22
BE2102-L-R20	3.84	3.68	3.52	32
BE2103-L-R20	5.76	5.52	5.28	48
BE2104-L-R20	8.40	8.05	7.70	70
BE2105-L-R20	12.00	11.50	11.00	100
BE2106-L-R20	16.80	16.10	15.40	140
BE2107-L-R20	24.00	23.00	22.00	200
BE2108-L-R20	38.40	36.80	35.20	320
BE2109-L-R20	60.00	57.50	55.55	500
BE2110-L-R20	90.00	86.25	82.50	750
BE2111-L-R20	120.00	115.00	110.00	1000

THREE PHASE ('L' MODELS)

Model No.	KVA @ 208v	KVA @ 200v	KVA @ 190v	Max Current
BE2101-L-3P-R20	7.92	7.59	7.26	22
BE2102-L-3P-R20	11.52	11.04	10.65	32
BE2103-L-3P-R20	17.28	16.56	15.84	48
BE2104-L-3P-R20	25.20	24.15	23.10	70
BE2105-L-3P-R20	36.00	34.50	33.00	100
BE2106-L-3P-R20	50.40	48.30	46.20	140
BE2107-L-3P-R20	72.00	69.00	66.00	200
BE2108-L-3P-R20	115.20	110.40	105.60	320
BE2109-L-3P-R20	180.00	172.50	168.50	500
BE2110-L-3P-R20	270.00	258.75	247.50	750
BE2111-L-3P-R20	360.00	345.00	330.00	1000

SINGLE PHASE ('LOW COST' MODELS)

Model No.	KVA @ 240v	KVA @ 230v	KVA @ 220v	Max Current
BE360-H-R20	0.36	0.34	0.33	1.5
BE600-H-R20	0.60	0.57	0.55	2.5
BE1200-H-R20	1.20	1.15	1.10	5.0

Model No.	KVA @ 240v	KVA @ 230v	KVA @ 220v	Max Current
BE360-L-R20	0.36	11.50	0.33	3.0
BE600-L-R20	0.60	16.10	0.55	5.0
BE1200-L-R20	1.20	23.00	1.10	10.0

R30 MODELS (WIDE SWING)

SINGLE PHASE ('H' MODELS)

Model No.	KVA @ 240v	KVA @ 230v	KVA @ 220v	Max Current
BE2101-H-R30	1.44	1.38	1.32	6
BE2102-H-R30	2.64	2.53	2.42	11
BE2103-H-R30	3.36	3.22	3.08	14
BE2104-H-R30	5.04	4.83	4.62	21
BE2105-H-R30	7.20	6.90	6.60	30
BE2106-H-R30	10.00	9.66	9.24	42
BE2107-H-R30	14.40	13.80	12.20	60
BE2108-H-R30	23.04	22.08	21.12	96
BE2109-H-R30	36.00	34.50	33.00	150
BE2110-H-R30	54.00	51.57	49.50	225
BE2111-H-R30	72.00	69.00	66.00	300

THREE PHASE ('H' MODELS)

Model No.	KVA @ 415v	KVA @ 400v	KVA @ 380v	Max Current
BE2101-H-3P-R30	4.32	4.14	3.96	6
BE2102-H-3P-R30	7.92	7.59	7.26	11
BE2103-H-3P-R30	10.08	9.66	9.24	14
BE2104-H-3P-R30	15.12	14.49	13.86	21
BE2105-H-3P-R30	21.60	20.70	19.80	30
BE2106-H-3P-R30	30.24	28.98	27.72	42
BE2107-H-3P-R30	43.20	41.40	39.60	60
BE2108-H-3P-R30	69.12	66.24	63.36	96
BE2109-H-3P-R30	108.00	103.50	99.50	150
BE2110-H-3P-R30	162.00	154.71	148.50	225
BE2111-H-3P-R30	216.00	207.00	198.00	300

SINGLE PHASE ('L' MODELS)

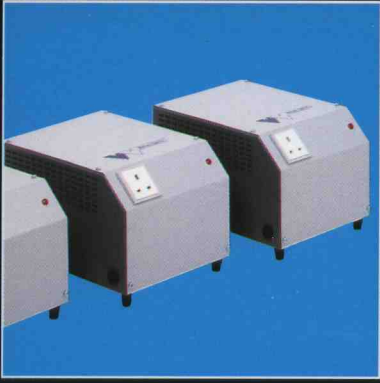
Model No.	KVA @ 120v	KVA @ 115v	KVA @ 110v	Max Current
BE2101-L-R30	1.44	1.38	1.32	12
BE2102-L-R30	2.64	2.53	2.42	22
BE2103-L-R30	3.36	3.22	3.08	28
BE2104-L-R30	5.04	4.83	4.62	42
BE2105-L-R30	7.20	6.90	6.60	60
BE2106-L-R30	10.00	9.66	9.24	84
BE2107-L-R30	14.40	13.80	12.20	120
BE2108-L-R30	23.04	22.08	21.12	192
BE2109-L-R30	36.00	34.50	33.00	300
BE2110-L-R30	54.00	51.57	49.50	450
BE2111-L-R30	72.00	69.00	66.00	600

THREE PHASE ('L' MODELS)

Model No.	KVA @ 208v	KVA @ 200v	KVA @ 190v	Max Current
BE2101-L-3P-R30	4.32	4.14	3.96	12
BE2102-L-3P-R30	7.92	7.59	7.26	22
BE2103-L-3P-R30	10.08	9.66	9.24	28
BE2104-L-3P-R30	15.12	14.49	13.86	42
BE2105-L-3P-R30	21.60	20.70	19.80	60
BE2106-L-3P-R30	30.24	28.98	27.72	84
BE2107-L-3P-R30	43.20	41.40	39.60	120
BE2108-L-3P-R30	69.12	66.24	63.36	192
BE2109-L-3P-R30	108.00	103.50	99.50	300
BE2110-L-3P-R30	162.00	154.71	148.50	450
BE2111-L-3P-R30	216.00	207.00	198.00	600



the power to control



**DUOMODE FERRO-RESONANT
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CONDITIONERS**
0.3 to 50KVA single and three phase.



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0.3 to 360KVA single and three phase models
give voltage stabilisation, spike attenuation
and transverse mode transient suppression
as standard.



**AC ELECTRONIC SERVO
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giving voltage stabilisation, plus transverse
and common mode transient attenuation.



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models assure common/transverse
mode transient attenuation
with an isolated supply.



**ROTAVOLT® VARIABLE
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Single and three phase assemblies giving
precise, continuous, linear AC voltage
regulation - up to 60KVA rating. Enclosed and
motorised options - all unit dimensionally
interchangeable with other makes.



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STABILISERS & POWER
CONDITIONERS**
For outdoor use on power
distribution networks.

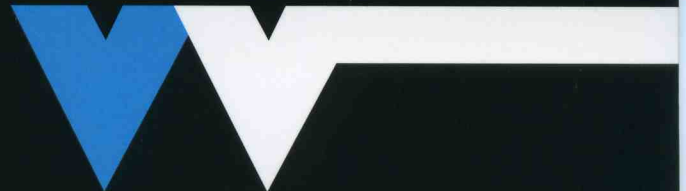
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Watford Control



All of the Watford Control ranges are covered
by brochures giving full specification.
Ask for the copies you require.

