



Let The Power Shine

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POWER QUALITY SOLUTIONS

TRANSFORMERS & REACTORS

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ABOUT ELEKTRA

Founded with the purpose of transformer production in 1982, Elektra Elektronik have been proposing transformer, reactor, and energy quality solutions across the world with a top notch quality perception.

Maintaining both production and design with its own human resources and facilities, our Company have been recognized as one of the pioneer R&D companies with its unique experience and expertise in the Turkish Electronic Industry.

Providing solutions throughout Turkey and across the world, our Company inaugurated office in China. Elektra have been recognized as a major exporter company with a portfolio of more than 50 countries. Today, Elektra's solutions are being used in industrial, railway, medical, automation, military, naval and such related systems in 5 continents.





QUALITY

Both our products and production line are subject to internal and independent external audits. Thus ever increasing security and quality requirements are being satisfied and our products perform in accordance to up to date worldwide standards. Our goal is to keep providing our products to the world market with the sustainable quality and safety principles.

In order to scale up our performance in this measure, we push our efforts to add new certificates to our existing ones. Our system certificates ISO 9001, ISO 14001, OHSAS with the cooperation with TUV-Nord and TSE.





CONTROL TRANSFORMERS

Control transformers are widely used in industrial applications such as electrical panels or PLC power supplies.

Input and output voltages may vary up to 1000V and they possibly include voltage taps or shield windings. Power ratings of these transformers go up to 10kVA. The electrical connection is done via terminal blocks and special mounting for DIN rails is available on request

MAIN FEATURES

- Highly permeable iron core
- High quality copper or aluminium windings
- Class 1 transformer
- Excellent voltage regulation
- High short time power
- Vacuum impregnated varnish to ensure silent and moisture-immune operation
- CE sign and compatibility with EN 60076, EN 61558 and suitable subclauses
- Manufactured under ISO 9001 quality management system



INDUSTRIAL APPLICATIONS

Elektra's control transformers are used in various countries and industries across the world. To mention a few:

- Lighting,
- Electric Automation,
- Steel,
- Machinery,
- Robotics,
- Ship Construction,
- Elevator,
- Lifting Industry



CONTROL TRANSFORMERS

MODEL NO	Power(VA)	Primary Input (V)	Secondary Input (V)	Efficiency (%)	UK (%)	Weight (kg)
ETC 0025 230/24	25	230	24	81	13	1
ETC 0040 230/24	40	230	24	82,14	9,59	1,3
ETC 0050 230/24	50	230	24	81	9,33	1,5
ETC 0075 230/24	75	230	24	85,27	7,48	1,7
ETC 0100 230/24	100	230	24	85,13	7,44	1,9
ETC 0160 230/24	160	230	24	85,14	7,36	2,4
ETC 0200 230/24	200	230	24	85,8	7,63	3
ETC 0250 230/24	250	230	24	87,7	6,14	3,4
ETC 0320 230/24	320	230	24	88,6	5,85	4,5
ETC 0400 230/24	400	230	24	89,85	4,93	5,3
ETC 0500 230/24	500	230	24	90,43	4,28	6,7
ETC 0630 230/24	630	230	24	90,48	4,54	7,9
ETC 0800 230/24	800	230	24	91,99	3,41	10,3
ETC 1000 230/24	1000	230	24	92,48	3,26	14,4
ETC 1300 230/24	1300	230	24	92,57	2,48	21
ETC 1600 230/24	1600	230	24	93,25	2,4	24,2
ETC 2000 230/24	2000	230	24	93,84	2,29	26,8
ETC 2500 230/24	2500	230	24	94,85	1,98	28,5
ETC 0025 400/230	25	400	230	78,74	10,7	1
ETC 0040 400/230	40	400	230	79,72	9,66	1,3
ETC 0050 400/230	50	400	230	81,62	8,89	1,5
ETC 0075 400/230	75	400	230	84,9	7,79	1,7
ETC 0100 400/230	100	400	230	84,22	8,03	1,9
ETC 0160 400/230	160	400	230	84,05	8,11	2,4
ETC 0200 400/230	200	400	230	86,25	7,2	3
ETC 0250 400/230	250	400	230	87,92	5,8	3,4
ETC 0320 400/230	320	400	230	87,89	5,42	4,5
ETC 0400 400/230	400	400	230	89,02	5,46	5,3
ETC 0500 400/230	500	400	230	90,18	4,67	6,7
ETC 0630 400/230	630	400	230	90,65	4,43	7,9
ETC 0800 400/230	800	400	230	91,79	3,61	10,3
ETC 1000 400/230	1000	400	230	92,37	3,11	14,4
ETC 1300 400/230	1300	400	230	92,47	2,96	21,5
ETC 1600 400/230	1600	400	230	93,48	2,61	24,2
ETC 2000 400/230	2000	400	230	94,16	2,23	26,8
ETC 2500 400/230	2500	400	230	94,26	2,42	28,5

Products with customized dimensions, power ratings and connection types can be produced
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ISOLATION TRANSFORMERS

Isolation Transformers are designed to be used on one or three phase systems where galvanic isolation and voltage step-up or step-down required.

Input and output voltages may vary up to 5000V and they possibly include voltage taps or shield windings. Power ratings of these transformers go up to 1600kVA.

The electrical connection is done via terminal blocks or bars. Any vectoral connection type is available on request.

MAIN FEATURES

- Highly permeable iron core
- High quality copper or aluminium windings
- Class 1 transformer
- Excellent Insulation
- Low losses, high efficiency
- Vacuum impregnated varnish to ensure silent and moisture-immune operation
- CE sign and compatibility with EN 60076, EN 61558 and suitable subclauses
- Manufactured under ISO 9001 quality management system



INDUSTRIAL APPLICATIONS

Elektra's isolation transformers are used in various countries and industries accross the world. To mention a few:

- Lighting,
- Electric Automation,
- Steel,
- Machinery,
- Robotics,
- Ship Construction,
- Elevator,
- Lifting Industry

MONO PHASE ISOLATION TRANSFORMERS

Data stated in the table below are for Aluminium windings with 50 Hz 230V/230V IP00 parameters.
It may vary depending on the variations of these parameters.

Model No	Power (kVA)	No Load Current (%)	No Load Loss (W)	Load Loss (W)	Regulation (%)	Short Circuit Voltage - UK (%)	Efficiency (%)	Weight (kg)
ET2U 4001	4	4,5	51	261	6,48	4,61	92,74	28
ET2U 5001	5	4,2	58	273	5,5	4,01	93,7	32
ET2U 6301	6,3	4,2	72	315	5,01	3,78	94,2	37
ET2U 1002	10	3,7	91	428	4,35	3,49	94,96	50
ET2U 1602	16	3,4	134	602	3,9	3,47	95,55	72
ET2U 2002	20	3	168	708	3,67	3,1	95,72	100
ET2U 2502	25	3,6	192	919	3,83	3,2	95,65	110
ET2U 3152	31,5	5	231	1055	3,46	3,1	96,05	120
ET2U 5002	50	3,9	322	1363	2,81	2,8	96,7	170

THREE PHASE ISOLATION TRANSFORMERS

Data stated in the table below are for Aluminium windings with 50Hz 400V / 400V DyN11 IP00 parameters.
It may vary depending on the variations of these parameters.

Model No	Power (kVA)	No Load Current (%)	No Load Loss (W)	Load Loss (W)	Regulation (%)	Short Circuit Voltage - UK (%)	Efficiency (%)	Weight (kg)
ET3U 4001	4	6,1	65	325	7,98	5,46	91,15	37
ET3U 5001	5	5,5	76	346	6,93	4,8	92,12	42
ET3U 6301	6,3	4,2	79	395	6,22	4,5	93	47
ET3U 8001	8	4,2	101	450	5,6	4	93,53	60
ET3U 1002	10	4,1	116	534	5,3	3,93	93,9	64
ET3U 1602	16	3,7	168	685	4,3	3,39	94,88	100
ET3U 2002	20	3,5	203	771	3,86	3,08	95,33	120
ET3U 2502	25	3,8	265	955	3,94	3,19	95,3	150
ET3U 3152	31,5	3,3	293	1104	3,63	2,99	95,68	165
ET3U 4002	40	3,2	324	1430	3,6	3,18	95,7	180
ET3U 5002	50	2,7	388	1446	2,98	2,73	96,4	220
ET3U 6302	63	2,5	462	1685	2,83	2,65	96,59	275
ET3U 8002	80	2,5	568	1947	2,47	2,55	96,96	325
ET3U 1003	100	2,2	667	2132	2,2	2,51	97,25	395
ET3U 1253	125	2,2	807	2215	1,86	2,3	97,58	420
ET3U 1603	160	1,8	882	3004	1,9	2,65	97,63	540
ET3U 2003	200	1,68	1013	3650	1,7	2,95	97,68	630
ET3U 2503	250	1,8	1386	3705	1,48	2,26	98,02	820
ET3U 3003	300	1,74	1514	3778	1,3	2,35	98,2	915
ET3U 4003	400	1,6	1718	7465	1,97	4,44	98,2	1150
ET3U 5003	500	0,56	1227	9229	2,03	4,8	97,86	1250
ET3U 6303	630	2	1687	12080	1,34	3,57	98,4	1500

Products with customized dimensions, power ratings and connection types can be produced
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AUTO TRANSFORMERS

Auto transformers are used to change the level of voltage without providing galvanic isolation. They are an economical alternative to isolating transformers.

Input and output voltages may vary up to 3000V and they possibly include voltage taps or shielding windings. Power ratings of these transformers go up to 1600kVA. The electrical connection is done via terminal blocks or bars. Any vectoral connection type is available on request

MAIN FEATURES

- Highly permeable iron core
- High quality copper or aluminium windings
- Class 1 transformer
- Excellent Insulation
- Low losses, high efficiency
- Vacuum impregnated varnish to ensure silent and moisture-immune operation
- CE sign and compatibility with EN 60076, EN 61558-2-13 and suitable subclauses
- Manufactured under ISO 9001 quality management system



INDUSTRIAL APPLICATIONS

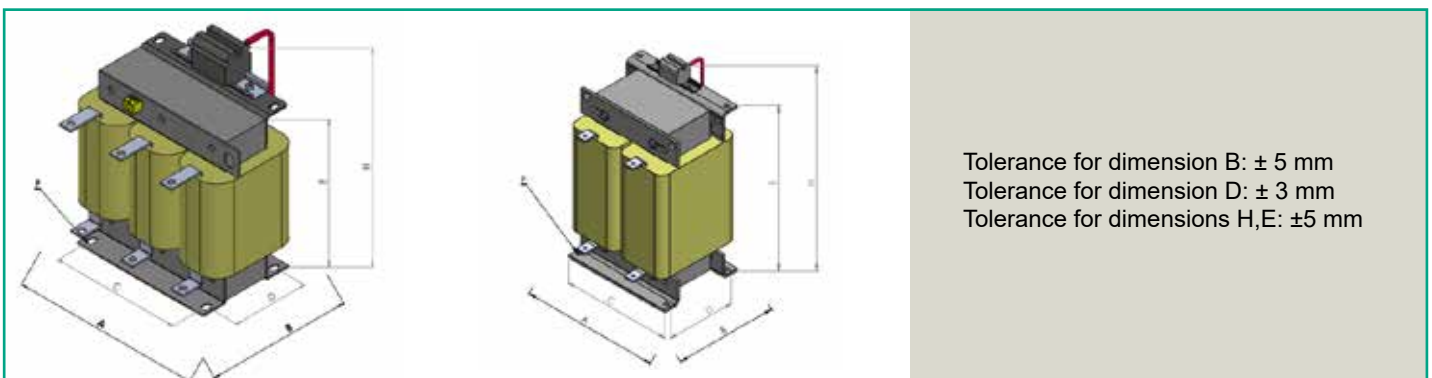
- Motor Starting,
- Voltage Regulation,
- Energy saving circuits

MONO PHASE AUTO TRANSFORMERS

Model No	Power (kVA)	Voltage(V)	Weight (kg)	Dimension (mm)				Connections (mm)		
				A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	F (mm)
ETA2U 8001	8	400 / 230	28	240	175	140	365	130		15x10
ETA2U 1002	10	400 / 230	32	240	181	140	365	135		15x10
ETA2U 1602	16	400 / 230	45	280	205	170	405	163		16x22
ETA2U 2002	20	400 / 230	50	280	211	170	405	171		16x22
ETA2U 5002	50	400 / 230	110	360	256	255	515	205		16x22
ETA2U 8002	80	400 / 230	150	400	220	280	570	180		16x22
ETA2U 1003	100	400 / 230	170	400	245	280	570	205		16x22
ETA2U 2003	200	400 / 230	290	500	315	395	670	275		16x22
ETA2U 2503	250	400 / 230	330	500	340	395	670	300		16x22
ETA2U 3203	320	400 / 230	450	650	285	500		245	760	16x22
ETA2U 4003	400	400 / 230	660	650	315	500		275	760	16x22

THREE PHASE AUTO TRANSFORMERS

ETA3U 8001	8	400 / 230	28	250	185	224	121		300	10x15
ETA3U 1002	10	400 / 230	35	250	195	224	131		300	10x15
ETA3U 1602	16	400 / 230	44	360	205	265	133		350	10x15
ETA3U 2002	20	400 / 230	55	360	220	265	149		350	10x15
ETA3U 5002	50	400 / 230	96	420	275	315	203		405	15x21
ETA3U 8002	80	400 / 230	125	480	285	395	213		455	15x21
ETA3U 1003	100	400 / 230	180	480	335	395	263		455	15x21



Products with customized dimensions, power ratings and connection types can be produced

MEDICAL TRANSFORMERS

Medical transformers used for isolating systems in purpose of maintaining human safety and protecting sensitive medical equipments in hospitals and medical clinics. Therefore these transformers are designed and built to meet the specifications for these places. The IEC 61558-2-15 standard describes the additional specifications.

Medical transformers can be produced according to the customers voltage requests. Different voltage ratings for different regions are applicable.



MAIN FEATURES



- Much lower inrush current ($< 12 \cdot I_n$)
- Much better voltage regulation ($< 3\%$)
- Much lower no-load current ($< 3\%$)
- Near-zero leakage current
- A specific center tap to provide means to watch isolation level
- Mounted PTC to monitor the temperature levels of the transformers
- Varnished under vacuum to obtain silent duty with high moisture resistance
- Manufactured under ISO 9001 quality management system

MONO PHASE MEDICAL TRANSFORMERS

Model No	Power (kVA)	Input-Output-Voltage (V)	Uk (%)	No Load Current (%)	Inrush Current	No Load Loss (W)	Load Loss (W)	Weight (kg)
ETM 0322	3,2	230-230	3,73	2,2	12*In>Ipeak	29,98	145,3	40
ETM 0322	3,2	400-230	3,76	2,19	12*In>Ipeak	29,98	146,2	40
ETM 0402	4	230-230	3,48	2,2	12*In>Ipeak	32,76	173,3	42
ETM 0402	4	400-230	3,51	2,2	12*In>Ipeak	32,89	176,5	42
ETM 0502	5	230-230	3,55	2,3	12*In>Ipeak	36	234	47
ETM 0502	5	400-230	3,57	2,3	12*In>Ipeak	36,02	236	47
ETM 0632	6,3	230-230	2,98	2,4	12*In>Ipeak	46,8	250,2	49
ETM 0632	6,3	400-230	3	2,41	12*In>Ipeak	46,8	252,6	49
ETM 0802	8	230-230	2,77	2,2	12*In>Ipeak	56,51	271,9	57
ETM 0802	8	400-230	2,86	2,2	12*In>Ipeak	59,39	282,7	57
ETM 1002	10	230-230	2,61	2,44	12*In>Ipeak	70,56	330,1	62
ETM 1002	10	400-230	2,65	2,4	12*In>Ipeak	70,6	332,2	62

THREE PHASE MEDICAL TRANSFORMERS

ETM3 0322	3,2	3x400-3x400	2,93	2,9	12*In>Ipeak	65,6	90,7	71
ETM3 0632	6,3	3x400-3x400	2,9	2,9	12*In>Ipeak	126,8	220,6	76
ETM3 0802	8	3x400-3x400	2,56	2,9	12*In>Ipeak	159,1	241,2	90
ETM3 1002	10	3x400-3x400	2,58	2,9	12*In>Ipeak	200	310,7	110

Products with customized dimensions, power ratings and connection types can be produced
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MOTOR STARTER TRANSFORMERS

Motor starter transformers, are used to limit in-rush current at the time of motor starting . Main output voltage tap is 70% rated in comparison with nominal voltage. Thus half of rated torque can not be applied on the motor axis. As a result of these circumstances, motor starting current is drop down to nominal current . Protection devices will not trigger

After motor starts and reaches nominal operation , output voltage point is transferred to input voltage point and motor, switched into the nominal operation mode. Thus transformer is being deactivated for the purpose of cooling down until the next starting moment.

Transformers can be designed in a smaller size than normal thanks to the principle of this duty cycle operation mode. Elektra Motor starter transformers designed for 10 starts per hour with a maximum at 3 consecutive starts.



MAIN FEATURES

- Nominal Operation Voltage: Up to 6600V
- Output Voltage: 0-%70 % other taps at different voltage rating optionally
- Starting time: 6 seconds
- Thermal Protection: 132°C
- Working Principle: 10 starts per hour with a maximum at 3 consecutive starts
- Special design can be made according to different duty cycles
- Standart: EN 61558-2-13, IEC 60076

TECHNICAL SPECIFICATIONS

- Highly permeable iron core
- High quality copper or aliminum windings
- Low losses high efficiency
- Vacuum impregnated varnish to ensure silent and moisture-immune operation
- Complies with the EN 61558-2-13 , CE Sign
- Manufactured under ISO 9001 quality management system

400V THREE PHASE %70 TAP MOTOR STARTER TRANSFORMERS

Model No	Motor Power (kW)	Motor Power (Hp)	Uk (%)	No Load Current (%)	On Load Current (A)	No Load Losses (W)	On Load Losses(W)	Ağırlık (kg)
ET3MY-400/3201	3,2	4,3	8,78	5,1	6,6	5,3	156,9	5,5
ET3MY-400/7501	7,5	10,1	5,96	4,4	15,5	11,8	227,1	12,4
ET3MY-400/9201	9,2	12,3	5,76	4	19	13,36	273	13,8
ET3MY-400/1102	11	14,8	5,59	3,4	22,7	16,28	308,7	14,9
ET3MY-400/1252	12,5	16,8	5,86	3,1	25,8	16,01	373,2	15,3
ET3MY-400/1502	15	20,1	3,2	3,2	31	20,1	373,3	18,3
ET3MY-400/1852	18,5	24,8	4,74	2,7	37,2	19,84	433	18,9
ET3MY-400/2202	22	29,5	4,58	2,6	45,4	23,75	513,8	19,7
ET3MY-400/3002	30	40,3	4,39	2	61,9	28	675,5	26
ET3MY-400/3702	37	49,7	4,15	2,1	76,3	30,56	626,4	28
ET3MY-400/4502	45	60,4	3,99	1,8	92,8	41,64	917,8	39
ET3MY-400/5502	55	73,8	3,57	1,8	113,4	49,68	1007	46
ET3MY-400/7502	75	100,7	3,48	1,4	155	60,28	1315	54
ET3MY-400/9202	92	123,5	3,09	1,3	190	70,54	1442	62,9
ET3MY-400/1103	110	147,7	3,2	7,2	214	56,2	1628	67
ET3MY-400/1203	120	161,1	3,39	8,6	233	64,59	2016	73
ET3MY-400/1323	132	177,2	3,08	2,6	256	86,9	2025	74
ET3MY-400/1473	147	197,3	2,93	2,6	286	92,96	2129	97
ET3MY-400/1603	160	214,8	2,78	1,9	343	101,8	2360	127

Products with customized dimensions, power ratings and connection types can be produced



HARMONIC FILTER REACTORS

Detuned Harmonic Filter Reactors, are used in series with capacitor banks in power factor correction units. By using these types of detuned reactors it is possible to avoid following negative effects on system.

- Overcurrent during switching on the capacitor banks
- Overload of capacitor banks because of the harmonic resonance.
- Short lifetime on capacitors
- Overheating of the utility transmission cables.
- Overheating of the distribution transformer.
- Unintended triggering of the protective devices.
- Distortion of utility voltage waveform and problems on voltage sensitive devices
- Interferences on data transmission systems
- Unexplainable faults in electronic boards



Choosing the correct detuned filter reactor and capacitor value on detuned power factor correction systems is very important. To obtain optimum performance from a detuned power factor correction system following criteria must be controlled and met during the pairing of the reactors and capacitors.

CHOOSING CORRECT HARMONIC FILTER REACTOR

- The resonance frequency must be chosen according to harmonic analysis of the system
- The voltage across the terminals of the capacitor will increase because of the inductive reaction of the reactor. The rated voltage of the capacitors must be chosen according to the resonance frequency.
- In detuned power factor correction systems, presence of higher voltage rated capacitors and reactors causes a difference between rated capacitor power and obtained reactive power. The obtained power must be calculated in order to avoid low compensation.
- The reactors will generate extensive heat due to heavy harmonic load. The cabinets must be designed to disperse this heat.
- All Elektra harmonic filter reactors have CE sign, produced according to 61558-2-20 standards, and tested in accredited laboratory

Harmonics	$U_3 = 0,5\%UR$
	$U_5 = 6,0\%UR$
	$U_7 = 5,0\%UR$
	$U_{11} = 3,5\%UR$
	$U_{13} = 3,0\%UR$
Effective Current	$I_{rms} = \sqrt{I_1^2 + I_3^2 \dots I_{13}^2}$

HARMONIC FILTER REACTORS P=%7 189Hz 400V/50Hz/LINEARITY>1.73xlrms

Model No	Power (kVAr)	Inductance (mH)	I ₁ (A)	I _{rms} (A)	Losses (W)	Weight (kg)
ERH 7/400/2.5K	2,5	15,3	3,6	3,8	42,86	2,4
ERH 7/400/6.25K	6,25	6,13	9	9,51	70,12	4,7
ERH 7/400/10K	10	3,84	14,4	15,21	56,02	8
ERH 7/400/12.5K	12,5	3,07	18,1	19,11	80,02	9,3
ERH 7/400/20K	20	1,92	29	30,63	101,95	12,8
ERH 7/400/25K	25	1,53	36,1	38,12	125,21	13,4
ERH 7/400/40K	40	0,95	57,7	60,94	172,7	18,1
ERH 7/400/50K	50	0,76	72,2	76,26	221,8	21
ERH 7/400/75K	75	0,51	108	114,1	289,2	27,6
ERH 7/400/100K	100	0,38	145	153	353,8	42,4

HARMONIC FILTER REACTORS P=%5.67 210Hz 400V/50Hz/ LINEARITY>2.08xlrms

ERH 5.67/400/2.5K	2,5	12,25	3,6	4,179	61,37	2,7
ERH 5.67/400/6.25K	6,25	4,9	9	10,48	88,24	7,2
ERH 5.67/400/10K	10	3,06	16,79	16,79	95,05	7,4
ERH 5.67/400/12.5K	12,5	2,33	19	22,09	114,18	8,1
ERH 5.67/400/20K	20	1,53	28,9	33,62	119,9	13,7
ERH 5.67/400/25K	25	1,22	36,1	42,01	146,5	15,6
ERH 5.67/400/40K	40	0,76	57,7	67,15	213,1	19,9
ERH 5.67/400/50K	50	0,58	75,9	88,34	238,2	31,5
ERH 5.67/400/75K	75	0,41	108	125,7	320,6	51,2
ERH 5.67/400/100K	100	0,31	144	167,6	431	52,2

HARMONIC FILTER REACTORS P=%14 134Hz 400V/50Hz/LINEARITY>1.37xlrms

ERH 14/400/2.5K	2,5	33,2	3,6	3,63	55,96	3,9
ERH 14/400/6.25K	6,25	13,3	9	9,06	70,56	8,9
ERH 14/400/10K	10	8,3	14,4	14,49	94,75	10,2
ERH 14/400/12.5K	12,5	6,63	18	18,11	118,2	12,6
ERH 14/400/20K	20	4,15	28,9	29,08	168,74	16,1
ERH 14/400/25K	25	3,32	36,1	36,32	144,5	19,2
ERH 14/400/40K	40	2,07	57,7	58,06	192,1	33,8
ERH 14/400/50K	50	1,66	72,2	72,65	283	42,5
ERH 14/400/75K	75	1,11	109	109,6	334	55,5
ERH 14/400/100K	100	0,83	144	144,9	425,3	67,9

Products with customized dimensions, power ratings and connection types can be produced
 MECHANICAL DATA R-1 PAGE 48

SHUNT REACTORS

Shunt reactors are mainly used in places with long power transmission and distribution lines. Especially for supplying telecommunication stations in urban areas like radio, GSM and TV transmitters with electricity, long overland cables must be used. These cables have a capacitive characteristic at longer distances. This capacitive characteristic causes the system to become overcompensated. This results in penalties in electricity bills because of high capacitive demand.

Furthermore this capacitive characteristic causes the line voltage to increase and may damage sensitive equipment connected to it. This problem can also be observed in industrial zones, wide campuses, solar farms etc.

The solution for this problem is loading the system inductively with shunt reactors. These reactors can be used single or three phased. They will utilize necessary inductive load for the system to stop overcompensation.



MAIN FEATURES

- One of three phase, highly permeable iron core,
- High quality copper or aluminium windings,
- Thermal fuse protection against overheating in all phases,
- Low losses, high efficiency,
- Vacuum impregnated varnish to ensure silent and moisture-immune operation,
- CE sign and compatibility with EN 61558-2-20 and suitable subclauses,
- Manufactured under ISO 9001 quality management system

COMMON APPLICATIONS

- Telecommunications stations in urban areas like radio, GSM and TV transmitters.
- Places with large areas like industrial zones, wide campuses, solar farms.
- Inductive load systems.

MONO PHASE SHUNT REACTORS

Model No	Number of Phase	Voltage (V)	Power (kVAr)	Inductance (mH)	Current (A)	Weight (kg)
ERS1-230/0.1	1	230	0,1	1523	0,46	1,5
ERS1-230/0.25	1	230	0,25	672	1,1	1,95
ERS1-230/0.5	1	230	0,5	338	2,17	2,95
ERS1-230/1	1	230	1	168	4,35	5,4
ERS1-230/1.5	1	230	1,5	103	6,82	8,9
ERS1-230/2.5	1	230	2,5	67	10,9	12,11
ERS1-230/3	1	230	3	56	13	17
ERS1-230/3.5	1	230	3,5	48	15,2	25,2
ERS1-230/5	1	230	5	33,7	21,7	21
ERS1-230/7.5	1	230	7,5	22,5	32,6	26,2
ERS1-230/10	1	230	10	16,8	43,5	29

THREE PHASE SHUNT REACTORS

ERS3-400/1	3	400	1	505	1,45	6,6
ERS3-400/1.5	3	400	1,5	336	2,2	9
ERS3-400/2	3	400	2	252	2,9	11,4
ERS3-400/2.5	3	400	2,5	203	3,6	11,65
ERS3-400/3	3	400	3	170	4,35	17,4
ERS3-400/5	3	400	5	102	7,2	21,5
ERS3-400/7.5	3	400	7,5	67,5	10,9	29
ERS3-400/10	3	400	10	51	14,5	37,7
ERS3-400/12.5	3	400	12,5	40	18	51,6
ERS3-400/15	3	400	15	33,6	22	52,2
ERS3-400/20	3	400	20	25,5	29	78,5
ERS3-400/25	3	400	25	20,4	36,3	92
ERS3-400/30	3	400	30	16,6	43,5	115
ERS3-400/40	3	400	40	12,75	58	124
ERS3-400/50	3	400	50	10,2	72,5	181

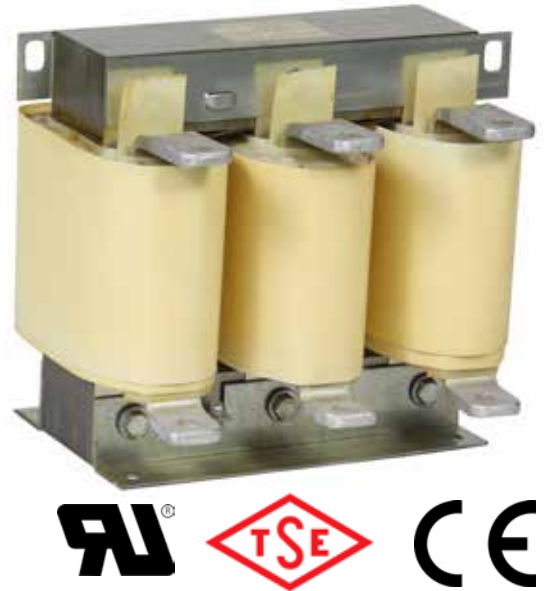
Products with customized dimensions, power ratings and connection types can be produced
MECHANICAL DATA R-2 PAGE 49



LINE REACTORS

Line reactors are used installed between motor drives and utility. They prevent notches on voltage and dampen the harmonic content of the current drawn by the motor drive. Additionally they increase the operation life of motor driver. The Line reactors are connected in series to the system, thus affecting the system directly. They help lowering the short circuit current of the system, allowing for more economical circuit breaker solutions.

Operation voltage is up to 1000V. Maximum design current for these reactors are 2000A. The connections are terminal block, bar or cable connection depending on current value. Our line reactors have CE sign and are compatible with European standards.



MAIN FEATURES

- Highly permeable iron core,
- High quality copper or aluminium windings,
- High linearity,
- Low losses, high efficiency,
- Design capability with short-circuit voltage %2 and %4,
- Vacuum impregnated varnish to ensure silent and moisture-immune operation,
- CE sign and compatibility with EN 61558-2-20 and suitable subclauses,
- Manufactured under ISO 9001 quality management system

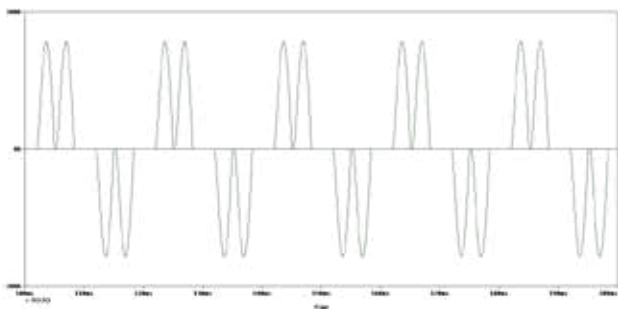


Figure 1 - Before Line Reactor

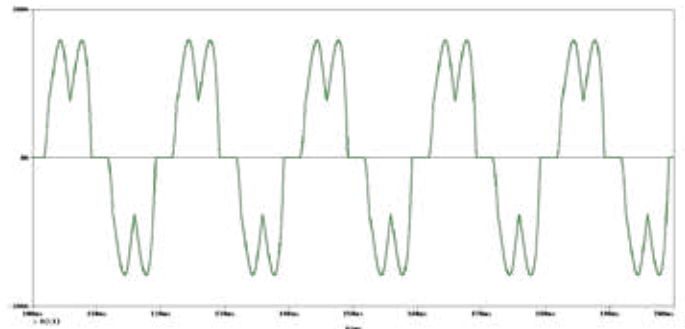


Figure 2 - After Line Reactor

LINE REACTORS = %4

Model No	Current (A)	Motor Power (kW)	Inductance (mH)	Loss (W)	Weight (kg)
ERL3 400/10/5	10	5	2,93	47	2,1
ERL3 400/16/7.5	16	7,5	1,83	74	3
ERL3 400/24/11	24	11	1,17	77	4,7
ERL3 400/30/15	30	15	0,98	79	4,9
ERL3 400/37/18.5	37	18,5	0,81	82	6,4
ERL3 400/50/22	50	22	0,59	105	9
ERL3 400/75/37	75	37	0,385	172	11
ERL3 400/90/45	90	45	0,32	180	11
ERL3 400/110/55	110	55	0,27	188	18
ERL3 400/150/75	150	75	0,18	216	20
ERL3 400/180/90	180	90	0,163	224	31
ERL3 400/250/110	250	110	0,118	291	40
ERL3 400/300/132	300	132	0,098	325	38
ERL3 400/350/160	350	160	0,084	388	40
ERL3 400/400/200	400	200	0,074	382	48
ERL3 400/500/250	500	250	0,059	441	60
ERL3 400/700/315	700	315	0,042	482	75
ERL3 400/800/400	800	400	0,037	594	114
ERL3 400/1000/500	1000	500	0,029	729	120
ERL3 400/1200/600	1200	600	0,024	704	156

LINE REACTORS = %2

ERL3 400/10/5-2	10	5	1,47	41,4	1,353
ERL3 400/16/7.5-2	16	7,5	0,92	51,9	1,375
ERL3 400/24/11-2	25	11	0,59	73,8	2,596
ERL3 400/30/15-2	30	15	0,49	76,2	2,64
ERL3 400/37/18.5-2	37	18,5	0,367	76,8	4,158
ERL3 400/50/22-2	50	22	0,294	81	4,422
ERL3 400/75/37-2	75	37	0,21	93,3	5,94
ERL3 400/90/45-2	90	45	0,15	116,46	10,175
ERL3 400/110/55-2	110	55	0,13	120,6	12,65
ERL3 400/150/75-2	150	75	0,09	145,2	16,555
ERL3 400/180/90-2	180	90	0,082	158,4	22,495
ERL3 400/250/110-2	250	110	0,059	185,4	25,52
ERL3 400/300/132-2	300	132	0,05	223,5	25,85
ERL3 400/350/160-2	350	160	0,045	249,09	31,79
ERL3 400/400/200-2	400	200	0,035	220,2	37,62
ERL3 400/500/250-2	500	250	0,029	292,53	36,19
ERL3 400/700/315-2	700	315	0,02	327	52,03
ERL3 400/800/400-2	800	400	0,0186	365,7	52,47
ERL3 400/1000/500-2	1000	500	0,015	456,3	59,73
ERL3 400/1200/600-2	1200	600	0,012	549	65,56

Products with customized dimensions, power ratings and connection types can be produced



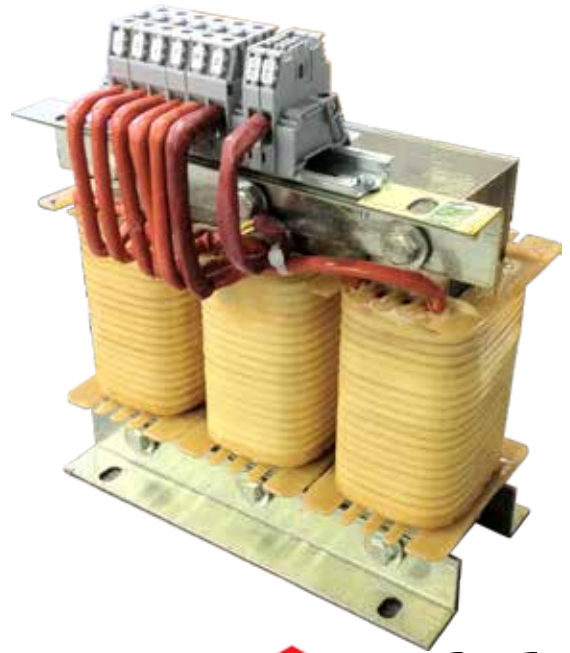
MOTOR REACTORS

Motor reactors are used between variable speed drives and the motor. They are used to dampen the harmonic content of the voltage generated by the motor drive.

Operating voltage is up to 1000V. Maximum design current for these reactors are 2000A. The connections are terminal block, bar or cable connection depending on current value

Elektra motor reactors are compatible with international standards and CE signed. Also the reactors are produced under ISO9001 quality management system.

Motor reactors are classified according to their switching frequencies. They are mainly designed for a switching frequency band of 4kHz – 12kHz. For switching frequencies over 12kHz, custom design motor reactors are used.



MAIN FEATURES

- Highly permeable iron core,
- High quality copper or aluminium windings,
- High linearity,
- Design capability for different clock frequencies,
- Low losses, high efficiency,
- Vacuum impregnated varnish to ensure silent and moisture-immune operation,
- CE sign and compatibility with EN 61558-2-20 and suitable subclauses,
- Manufactured under ISO 9001 quality management system

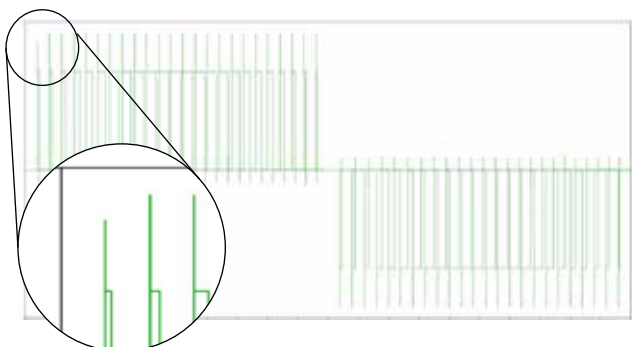


Figure 1 - Before Motor Reactor

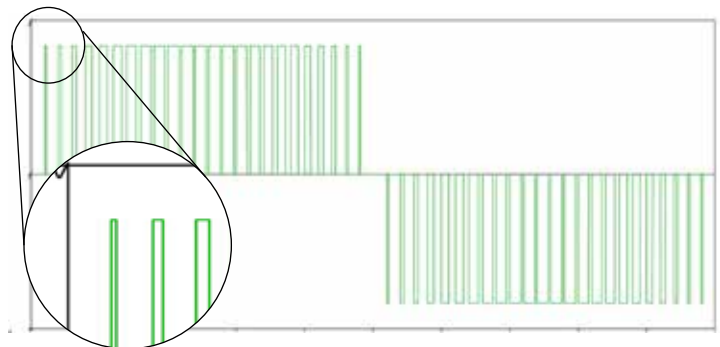


Figure 2 - After Motor Reactor

MOTOR REACTORS 4 kHz

Model No	Current (A)	Motor Power (kW)	Inductance (mH)	Loss (W)	Weight (kg)
ERM 400/8/4	8	4	1,75	32,4	1,3959
ERM 400/10/5	10	5	1,44	38,4	1,4091
ERM 400/12/5.5	12	5,5	1,15	44,1	1,4421
ERM 400/16/7.5	16	7,5	0,92	50,4	1,518
ERM 400/20/10	20	10	0,74	51,3	1,5411
ERM 400/24/11	24	11	0,59	56,49	2,8171
ERM 400/30/15	30	15	0,45	58,8	2,893
ERM 400/37/18.5	37	18,5	0,48	68,1	4,3461
ERM 400/50/22	50	22	0,3	95,4	4,895
ERM 400/60/30	60	30	0,24	81,9	6,38
ERM 400/75/37	75	37	0,2	90,03	7,7561
ERM 400/90/45	90	45	0,16	100,5	9,1311
ERM 400/110/55	110	55	0,13	141,9	10,9439
ERM 400/120/60	120	60	0,12	142,2	11
ERM 400/150/75	150	75	0,09	189	13,42
ERM 400/180/90	180	90	0,08	190,2	16,7211
ERM 400/200/100	200	100	0,075	197,4	18,92
ERM 400/250/110	250	110	0,05	212,4	19,3589
ERM 400/300/132	300	132	0,046	256,2	29,227
ERM 400/350/160	350	160	0,042	267	29,4811
ERM 400/400/200	400	200	0,037	286,2	33,4411
ERM 400/500/250	500	250	0,029	421,8	42,0211
ERM 400/600/300	600	300	0,023	431,7	54,0661
ERM 400/700/315	700	315	0,021	434,7	54,34
ERM 400/800/400	800	400	0,018	442,8	54,67
ERM 400/900/450	900	450	0,016	450,3	56,32
ERM 400/1000/500	1000	500	0,014	477,9	56,98
ERM 400/1200/600	1200	600	0,011	675	73,04

Products with customized dimensions, power ratings and connection types can be produced
 MECHANICAL DATA R-4 PAGE 51



DISCHARGE UNITS

In a volatile reactive power environment, discharge reactors reduced discharge time and increase the life-time of the capacitors in a power factor correction system.

MAIN FEATURES

- Reduces discharge time of capacitors for fast changing reactive power demands
- Low Loss
- Compact Design
- Up to 100 kVAR discharging
- Up to 690V operation voltage
- Din Rail mountable shockproof casin
- CE sign and manufactured under ISO 9001 quality management system



Discharge Time	230V	up to 25 kVAr < 10 s
		up to 50 kVAr < 20 s
		up to 100 kVAr < 40 s
	400-525V	up to 25 kVAr < 5 s
		up to 50 kVAr < 10 s
		up to 100 kVAr < 20 s
	525-690V	up to 25 kVAr < 3 s
		up to 50 kVAr < 6 s
		up to 100 kVAr < 12 s
	690-800V	up to 25 kVAr < 2,5 s
		up to 50 kVAr < 5 s
		up to 100 kVAr < 10 s

LV CAPACITORS

Between 1.0 kVAr and 30 kVAr power rating
230V / 400V / 440V / 525V voltage options

Elektra LV Capacitors(ECP Serie) are designed for LV applications like power factor correction systems, motor compensation, and filtered power factor correction systems.

ELECTRICAL AND MECHANICAL FEATURES

- Up to 30 kVAr per capacitor for three-phase applications
- 135.000 hours service life design
- High inrush current (Up to $200 \times I_R$)
- Output range 1.0 30 kVAr
- Voltage range 230V ... 525 VAC
- Reduced mounting costs, easy installation and connection
- Low weight and compact volume
- Maintenance-free
- Faston terminals for 1.0 kVAr to 2.5 kVAr
- Screw terminals over 2.5 kVAr

MAIN FEATURES

- Special design in cylindrical extruded aluminum can
- Metalized polypropylene film with stacked windings
- Resin impregnation
- Three phase, internally Delta connected
- External discharge resistor
- Self-Healing
- Overpressure disconnecter
- Environment friendly; PCB free





FEATURES AND TECHNICAL DETAILS OF CAPACITORS

Inrush Current	I_s	up to $200 \times I_R$
Frequency	f	50 Hz
Capacitance tolerance	%	-5% / +10%
Over current	I_{max}	up to $1,3 \times I_R$ ye kadar(including total effects of harmonics, overvoltages and capacitance)
Losses (Dielectric - Total)	W/kVAr	< 0.2 W/kVAr < 0.45 W/kVAr (without discharge resistor)
Over voltage	V_{max}	$V_R + 10\%$ (up to 8 h daily) / $V_R + 15\%$ (up to 30 min daily) $V_R + 20\%$ (up to 5 min daily) / $V_R + 30\%$ (up to 1 min daily)
Test Voltage, terminal / terminal	V	$2,15 \times V_R$ AC, 2 sec.
Test Voltage, terminal / body	V	3000 V AC, 10 sec
Design Life	hour	up to 135.000 h
Number of switching operations		max 5000 switchings per year according to IEC 60831-1+2
Ambient Temperature	°C	max. temperature 55 °C min. temperature -25 °C
Cooling		natural or forced
Humidity	%	Max 95%
Altitude	m	max. 2000m above sea level
Standard		IEC 60831-1+2
Discharge Resistor		75V in 3 min

MONO PHASE CAPACITORS (230V, 50 Hz, delta connection)

Model No	Voltage	Power (kVAr)	Current(A)	Capacitance(Dimensions (d x h)	Weight (kg)
ECP1 230/0,25	230	0,25	1,9	1 x 15	65 x 100	0,4
ECP1 230/0,50	230	0,50	2,2	1 x 30	65 x 100	0,4
ECP1 230/1,0	230	1,0	4,4	1 x 60	65 x 112	0,4
ECP1 230/1,5	230	1,5	6,5	1 x 90	70 x 112	0,7
ECP1 230/2,5	230	2,5	10,9	1 x 150	70 x 112	0,7
ECP1 230/5,0	230	5,0	21,7	1 x 301	75 x 247	0,9

THREE PHASE CAPACITORS (400V, 50 Hz, delta connection)

ECP3-400 / 1,0	400	1	1,4	3 x 6,6	65 x 95	0,4
ECP3-400 / 1,5	400	1,5	2,2	3 x 9,9	65 x 110	0,4
ECP3-400 / 2,5	400	2,5	3,6	3 x 16,6	65 x 172	0,7
ECP3-400 / 5,0	400	5	7,2	3 x 33,3	65 x 172	0,7
ECP3-400 / 7,5	400	7,5	10,8	3 x 50	65 x 210	0,9
ECP3-400 / 10,0	400	10,0	14,4	3 x 66,7	70 x 210	0,9
ECP3-400 / 12,5	400	12,5	18,0	3 x 83,3	70 x 247	1
ECP3-400 / 15,0	400	15,0	21,7	3 x 100	75 x 247	1,6
ECP3-400 / 20,0	400	20	28,1	3 x 133,3	85 x 247	1,8
ECP3-400 / 25,0	400	25	36,1	3 x 166,7	100 x 247	2
ECP3-400 / 30,0	400	30	43,2	3 x 200	100 x 285	2,2

THREE PHASE CAPACITORS(440V, 50 Hz, delta connection)

ECP3-440 / 1,0	440	1	1,3	3 x 5,5	65 x 95	0,4
ECP3-440 / 1,5	440	1,5	2,0	3 x 8,3	65 x 110	0,4
ECP3-440 / 2,5	440	2,5	3,3	3 x 13,7	65 x 172	0,7
ECP3-440 / 5,0	440	5	6,6	3 x 27,5	65 x 172	0,7
ECP3-440 / 7,5	440	7,5	9,9	3 x 41,2	65 x 210	0,9
ECP3-440 / 10,0	440	10,0	13,1	3 x 55	70 x 210	0,9
ECP3-440 / 12,5	440	12,5	16,4	3 x 69	70 x 247	1
ECP3-440 / 15,0	440	15,0	19,7	3 x 82	75 x 247	1,6
ECP3-440 / 20,0	440	20	26,3	3 x 109,7	85 x 247	1,8
ECP3-440 / 25,0	440	25	32,8	3 x 137,1	100 x 247	2
ECP3-440 / 30,0	440	30	39,4	3 x 164	100 x 285	2,2

THREE PHASE CAPACITORS (525V, 50 Hz, delta connection)

ECP3-525 / 20,0	525	20	22	3 x 77,1	85 x 247	1,8
ECP3-525 / 25,0	525	25	27,5	3 x 96,3	100 x 247	2
ECP3-525 / 30,0	525	30	33	3 x 116	100 x 247	2,2
ECP3-525 / 40,0	525	40	44	3 x 154,1	100 x 285	2,2



THYRISTOR-CONTROLLED REACTOR

GAMMA series thyristor-controlled reactor (TCR) converter modules dynamically adjust equivalent reactance of shunt reactors up to 30kVAr and support dynamic power factor control (PFC) applications where extremely fast reactive power compensation is necessary. Converter modules consist of three single-phase phase-controlled bidirectional thyristor units and can control each phase independently. Through phase control, the net RMS voltage across each shunt reactor can be varied continuously. This way, the net reactive power flow can be controlled and desired reactive power rating may be achieved instantaneously. GAMMA converter modules are internally protected against overheating.



GAMMA modules can operate with both NPN and PNP open collector triggering circuits. They can be controlled easily with PLCs and PFC relays. The modules monitor reactor voltages, line voltages and internal temperatures and provides LEDs on the front panel for diagnostics. They are also equipped with external thermostat connection terminals to protect the shunt reactors from overheating. GAMMA modules protect the shunt reactors from overheating, overvoltage and transients, hence enabling long-lasting dynamic power factor control.

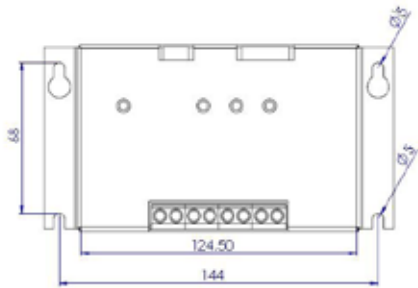
TECHNICAL FEATURES

Nominal Ratings	Unit	GAMMA-3005	GAMMA-3010	GAMMA-3020	GAMMA-3030
Nominal Voltage	V	230	230	230	230
Nominal Power	kVAr	(5) 3 x 1.5	(10) 3 x 3.5	(20) 3 x 7	(30) 3 x 10
Nominal Current	A	7	16	30	45
Nominal Frequency	Hz	50/60	50/60	50/60	50/60
Trigger Signal	-	12V/40mA	12V/40mA	12V/40mA	12V/40mA
IP Class	-	20	20	20	20
Dimensions					
(W x D x H)	mm	130x85x105	130x125x105	130x145x155	130x145x156
Weight	kg	1.2	1.7	2.8	2.9
Ambient Temperature	°C	-20~45	-20~40	-20~45	-20~45

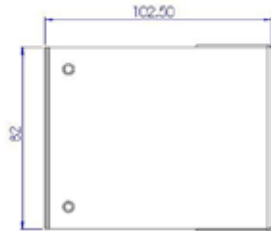
Technical specifications presented here are provided for 40°C ambient temperature and 80°C heat sink temperature, unless otherwise specified. Exceeding these guaranteed ratings will significantly reduce module life expectancy.



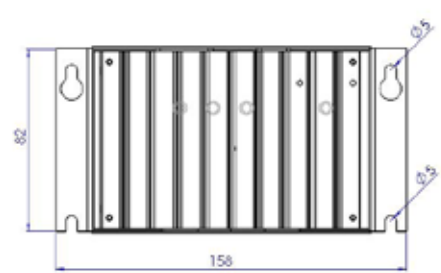
THYRISTOR-CONTROLLED REACTOR TECHNICAL DRAWINGS



(a)

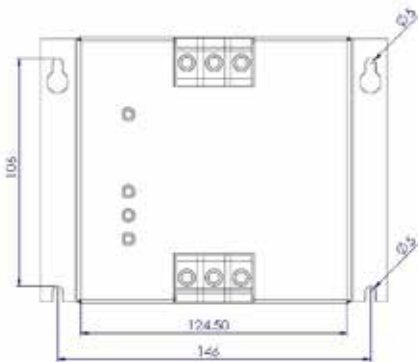


(b)

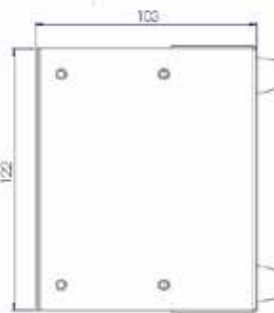


(c)

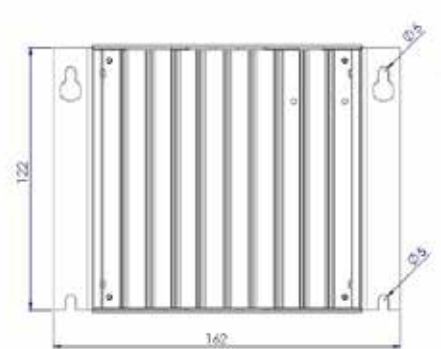
GAMMA-3005 Module



(a)

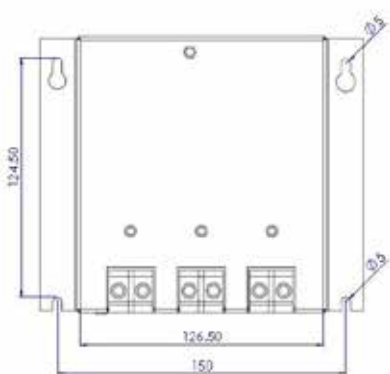


(b)

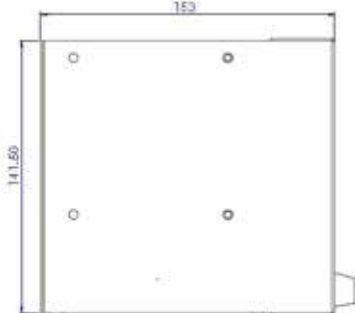


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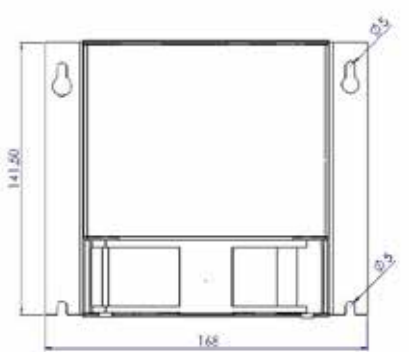
GAMMA-3010 Module



(a)



(b)



(c)

GAMMA-3020 and GAMMA-3030 Modules



THYRISTOR MODULES

ALPHA series thyristor modules are designed to switch capacitive loads up to 80 kVAr in power factor correction (PFC) applications. The modules can switch capacitive loads within 10ms of receiving a triggering signal. The microprocessor-based architecture and its algorithm switches at the voltage zero crossing, thereby avoiding capacitor abrasion.



MAIN FEATURES of ALPHA SERIES THYRISTOR MODULES:

- Up to 480V, star-or delta-connected symmetrical or asymmetrical loads
- Easy triggering from PFC relays or PLCs
- Longer life expectancy
- Fast switching performance – typically below 10ms
- Guaranteed transient free capacitor switching
- Monitors voltage, status and temperature
- Records detected faults, provides a dry contact output and displays faults on front panel
- Can operate with or without a detuned filter reactor.
- Provides external thermostat connection which can be used to protect detuned filter reactors
- Maintenance free
- Quiet operation

TECHNICAL FEATURES

Nominal Rating	Unit	ALPHA-012	ALPHA-025	ALPHA-050	ALPHA-080
Nominal Voltage	V	400	400	400	400
Maximum Operating Current	A	20	40	80	120
Number of Semiconductor Modules	-	2	2	2	2
Auxiliary Supply Voltage	V	-	-	220	220
Triggering Voltage	V	24	24	24	24
Fan Power Rating	VA	-	-	32	32
Fan Activation Temperature	°C	-	-	50	50
Absolute Maximum Values					
i2t (10 ms)	A2s	720	4000	18050	18050
Heatsink Temperature	°C	90 ± 5	90 ± 5	90 ± 5	90 ± 5
Ambient Temperature at Full Load	°C	60	40	45	45
Ambient Temperature at 75% Load	°C	70	60	65	65
Storage Temperature	°C	-40~100	-40~100	-40~100	-40~100
Relative Humidity	%	5~95	5~95	5~95	5~95
Cabling and Mounting					
Power Cable Cross Section	mm ²	16	16	35	35
Auxiliary Supply Cable Cross Section	mm ²	1.5	1.5	1.5	1.5
Trigger Cable Cross Section	mm ²	1.5	1.5	1.5	1.5
Dry Contact Cable Cross Section	mm ²	1.5	1.5	1.5	1.5
External Thermostat Cable Cross Section	mm ²	1.5	1.5	1.5	1.5
Dimensions(WxHxD)	mm	114x150x118	114x150x118	161x232x198	161x232x198
IP Class	-	20	20	20	20
Weight	kg	2.2	2.2	5.9	5.9
Operation					
Triggering delay	-	< 10 ms	< 10 ms	< 10 ms	< 10 ms
Maximum Capacitor Rating	kVAr	12.5	25	50	80
Power Loss	W	40	75	155	280
Overheating Protection	°C	90 ± 5	90 ± 5	90 ± 5	90 ± 5
Recommended Fuse Type and Rating	A	35 (NH)	63 (NH)	125 (NH)	200 (NH)

Technical specifications presented here are provided for 40°C ambient temperature and 70°C heat sink temperature, unless otherwise specified. Exceeding these guaranteed ratings will significantly reduce module life expectancy



SINE FILTERS

Sinus filters are used to filter out the high frequency components of the PWM generated voltage waveform at the output of motor drives. They are especially useful for applications where data cables are installed close to power cables of a drive. By filtering out high frequency components, they prevent electromagnetic interference from causing unwanted signals to occur in the system. Moreover, a sinusoidal shaped voltage at the terminals will increase lifetime expectancy of motors. Additionally, motor drives with a sinus filter can be used to supply different types of loads than motors.

By installing a sinus filter to a system, ringing effects due to long cable lengths will also be prevented. Sinus filters can be used for a variety of applications, not limited to motor drives only.



MAIN FEATURES

- Nominal Operation Voltage : Up to 1000V
- Switching Frequency : $4\text{kHz} < f_s < 12\text{kHz}$. Other switching frequencies available upon request
- Thermal Protection : 132°C
- Operation Mode: Continuous
- Standard: EN 61558-2-20, IEC 60076-6

TECHNICAL SPECIFICATIONS

- Highly permeable iron core
- High quality copper or aluminium windings
- Low losses, high efficiency
- Vacuum impregnated varnish to ensure silent and moisture-immune operation
- CE sign and compatibility with IEC 60076-6, EN 61558-2-20
- Manufactured under ISO 9001 quality management system

SINE FILTERS

Model No	Current (A)	Motor Power (kW)	Inductance (mH)	Capacitance (uF)	Total Loss (W)	Weight (kg)
ESF3 400/8/4	8	4	12,7	2	85,38	4,455
ESF3 400/10/5	10	5	10,3	2	109,5	5,06
ESF3 400/12/5.5	12	5,5	8,4	3	114,6	5,324
ESF3 400/16/7.5	16	7,5	6,33	3	121,8	8,063
ESF3 400/20/10	20	10	5,1	5	168,6	10,989
ESF3 400/24/11	24	11	4,2	5	200,88	11,286
ESF3 400/30/15	30	15	3,37	8	180,3	14,575
ESF3 400/37/18.5	37	18,5	2,75	8	209,1	17,325
ESF3 400/48/22	48	22	2,17	10	264	21,065
ESF3 400/60/30	60	30	1,7	10	327,9	23,76
ESF3 400/75/37	75	37	1,36	18	308,1	33,88
ESF3 400/90/45	90	45	1,13	18	348	40,81
ESF3 400/110/55	110	55	0,89	25	426	43,78
ESF3 400/120/60	120	60	0,86	25	447	44,11
ESF3 400/150/75	150	75	0,68	35	534	56,65
ESF3 400/180/90	180	90	0,56	35	570	69,19
ESF3 400/200/100	200	100	0,507	50	648	69,52
ESF3 400/250/110	250	110	0,41	50	723	94,49
ESF3 400/300/132	300	132	0,34	75	1002	120
ESF3 400/350/160	350	160	0,296	75	1029	120,01
ESF3 400/400/200	400	200	0,253	100	1068	124,3
ESF3 400/500/250	500	250	0,206	100	1149	166,65
ESF3 400/600/300	600	300	0,17	125	1365	257,95
ESF3 400/700/315	700	315	0,146	125	1344	272,8
ESF3 400/800/400	800	400	0,127	180	1461	238,7
ESF3 400/900/450	900	450	0,113	200	1521	331,1
ESF3 400/1000/500	1000	500	0,103	200	1632	431,2
ESF3 400/1200/600	1200	600	0,085	250	1950	502,7

Products with customized dimensions, power ratings and connection types can be produced
MECHANICAL DATA H-1 PAGE 52

POWER QUALITY AND HARMONICS

The increase in use of modern power electronic systems (motor drives, UPS, IT systems etc.) caused the distortions on energy supply system to increase. These distortions, also called harmonics, cause faults and losses on many industrial applications.

Harmonics are sinusoidal waveshape ripples on voltage and current, which happen at whole number multipliers of base frequency (i.e. 50 Hz or 60 Hz). These ripples cause many different problems on industrial systems, such as;

- Overheating of capacitors. This overheat results in deteriorating of dielectric substance, which results in shorter life times on capacitors.
- Overheating of transformers, busbars and cables. Increased heat causes faults on these components, especially transformers
- Triggering of protective devices with no reason. This results in excessive loss of labor and work at unexpected times.
- Noisy operation on electromagnetic devices (i.e. motors, coils and transformers). This results in physical resonance and mechanical faults in some cases
- Excessive electro magnetic interference (EMI). This can cause sever problems on data lines, PLC's and othe sensitive electrical equipment.



PASSIVE HARMONIC FILTER

Elektra Passive Harmonic Filters are designed to protect your system against harmful effects of harmonics. This unit is installed at the input of harmonic generating load (i.e Motor drive, inverter, UPS etc.) and eliminates harmonics at the source.

MAIN FEATURES

Elektra Passive Harmonic Filters are available in two forms: wall type and panel type. For the current values under 110A Wall type units are used. For higher current values panel type is preferred. General Features can be listed as follows.

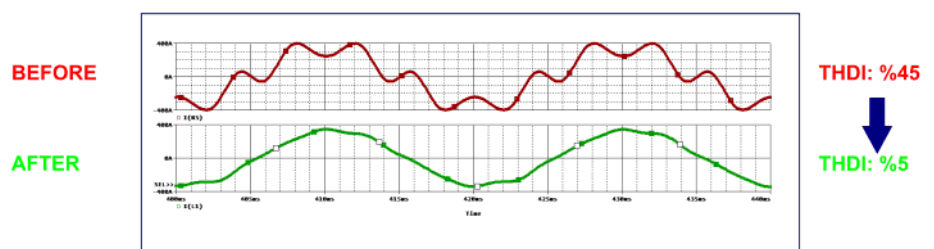
- Designed and manufactured in Turkey,
- Available as Panel Mounted and Wall type,
- Provides constant capacitive power,
- High performance and reliable,
- Complies with the standarts EN 61000-2-2, EN 61558-2-20, EN 60831-1, CE signed
- Dampens the harmonics up to 90%
- Minimized resonance risk design
- Built-in overcurrent protection
- Automatically turns off in overload conditions
- Automatically regulates the panel/cabinet temperature.



INDUSTRIAL APPLICATIONS

- Textile, Printing, Food Industry etc. and for the large constant loads
- Companies supplied by high power UPS devices,
- Large cement and similar chemical mixers
- Factory automation devices
- Water treatment plants
- Fan ve pump applications
- HVAC facilities
- DC fast charger devices

PERFORMANCE



PASSIVE HARMONIC FILTERS

Model No	Voltage (V)	Current (A)	Motor Power (kW)	Frequency (Hz)	THDI (%)	Loss (W)	Weight (kg)	Dimensions (mm)
EPF3 400/8/4	400	8	4	50	%5>	125	23	207x430x218
EPF3 400/10/5	400	10	5	50	%5>	157	31	327x612x292
EPF3 400/12/5.5	400	12	5,5	50	%5>	157	31	327x612x292
EPF3 400/16/7.5	400	16	7,5	50	%5>	225	34	327x612x292
EPF3 400/20/10	400	20	10	50	%5>	230	38	327x612x292
EPF3 400/24/11	400	24	11	50	%5>	236	49	327x612x292
EPF3 400/30/15	400	30	15	50	%5>	262	56	327x612x292
EPF3 400/37/18.5	400	37	18,5	50	%5>	340	60	327x612x292
EPF3 400/50/22	400	50	22	50	%5>	371	74	327x612x292
EPF3 400/60/30	400	60	30	50	%5>	379	98	327x612x292
EPF3 400/75/37	400	75	37	50	%5>	497	110	514x826x314
EPF3 400/90/45	400	90	45	50	%5>	574	120	514x826x314
EPF3 400/110/55	400	110	55	50	%5>	600	126	514x826x314
EPF3 400/120/60	400	120	60	50	%5>	726	128	700x800x1800
EPF3 400/150/75	400	150	75	50	%5>	779	130	700x800x1800
EPF3 400/180/90	400	180	90	50	%5>	1111	145	700x800x1800
EPF3 400/200/100	400	200	100	50	%5>	1186	162	700x800x1800
EPF3 400/250/110	400	250	110	50	%5>	1259	185	700x800x1800
EPF3 400/300/132	400	300	132	50	%5>	1436	230	600x1000x2300
EPF3 400/350/160	400	350	160	50	%5>	1822	495	600x1000x2300
EPF3 400/400/200	400	400	200	50	%5>	1986	550	600x1000x2300

Table above is valid for 400V 50 Hz parameters. Mains outfitting these parameters should be applied with tailor made filters. Passive filters with higher current values can be manufactured upon request.



ACTIVE HARMONIC FILTER

ELEKTRA Active Harmonic Filters help to remove harmonic distortion from the power network and avoid problems arising due to low power quality. Variable frequency drives, UPS systems, computers and energy saving light systems cause harmonic distortion levels beyond acceptable limits. High harmonic distortion reduces equipment lifetime and causes productivity loss. Unbalanced loads such as computers cause excessive neutral currents and 3rd harmonic currents to flow on the neutral wire. This results in unacceptable voltage levels between neutral and earth, and may lead to equipment malfunction and physical danger



ELEKTRA Active harmonic filters provide a complete solution for facilities with dynamic variations in the load harmonic distortion, load imbalances and single phase loads with high level of current harmonics on the neutral wire. ELEKTRA Active harmonic filters are connected in parallel with the load or facility. They measure and analyze the harmonic content of the load or line currents and inject a compensating current into the grid to cancel the harmonics. As a result, the harmonics on the line currents are eliminated and the neutral wire is off-loaded as illustrated in Figure 1. ELEKTRA active harmonic filters guarantee less than 5% current total harmonic distortion (THD-i) even in facilities with highly dynamic and harmonic loads. Active harmonic filters also help dynamic power factor correction with %100 inductive and capacitive support. System reacts to load changes withing 25µs.

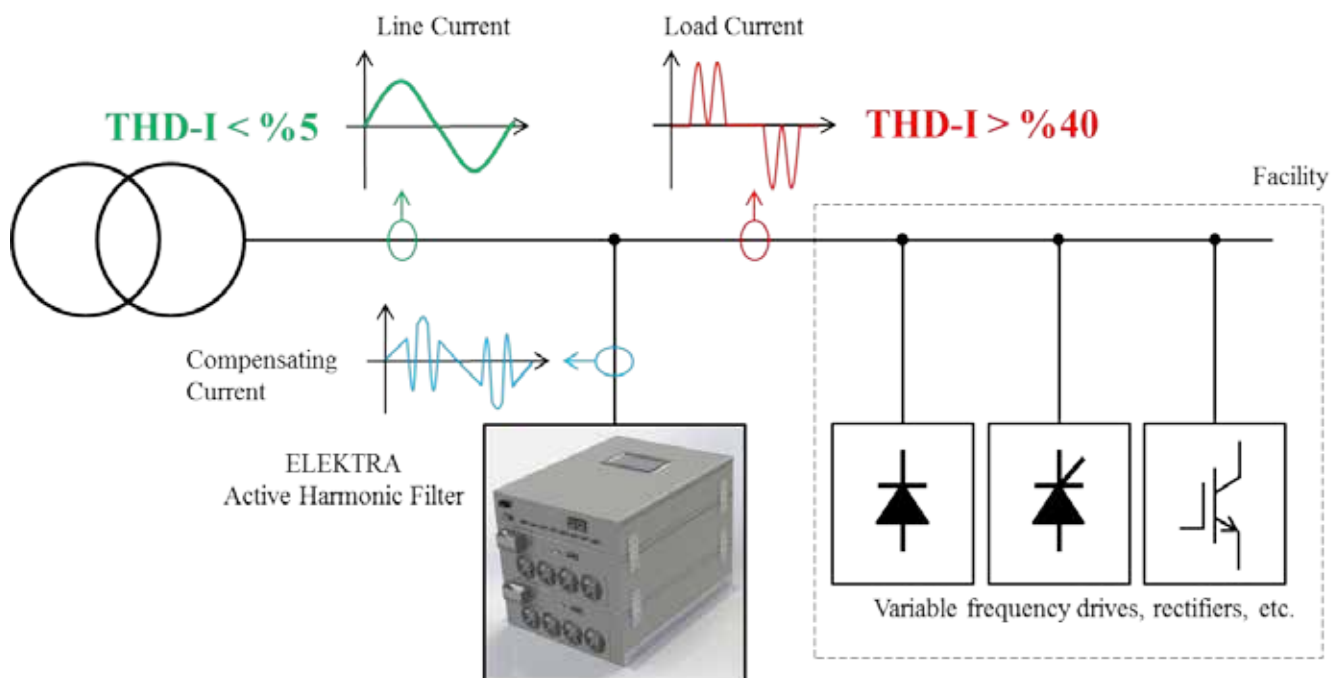


Figure1 : Illustration of active harmonic filter operation

MAIN FEATURES

ELEKTRA active harmonic filters are available in two different forms: wall-mount and floor-mount. Wall-mount configuration is recommended for filters with 70A or less current rating. For current ratings above 70A, floor-mount panel is the recommended solution. Wall-mount products are comprised of up to two power module and a single display/communication module as shown in Figures 2 and 3, respectively. Floor-mount configuration is highly modular with holding up to seven hotswap-supported power modules within one cabinet and supporting unlimited number of parallel units.

- ELEKTRA active harmonic filters are made in Turkey.
- Its modular structure enables scaling up easily.
- No limitation on the maximum number of parallel units.
- Hotswap supported on floor-mount rack type configuration.
- Modules available for floor-mount and wall-mount application
- Filtering capability up to 51st harmonic
- Selective harmonic filtering up to 51st harmonic with each harmonic individually selectable.
- Ultra-fast reactive power support for power factor correction.
- Balances unbalanced loads
- Eliminates neutral currents.
- High performance dynamic filtering
- Reliable operation
- User-friendly touch screen user interface
- Easy setup and commissioning
- Immune to grid interferences, overvoltages and faults.

APPLICATION AREAS

ELEKTRA active harmonic filters are successfully applied to facilities with high harmonic distortion, dynamic load variations, load imbalances and high neutral currents and harmonic currents on neutral wires. They are ideal for applications where neutral conductors have to be off-loaded and problems related to high neutral to earth voltages have to be addressed

- Any facility with sensitivity to grid conditions
- Plastic industry – injection, extrusion and molding
- Office buildings and shopping malls (especially 3rd harmonics and overloaded neutral conductor)
- Industrial production machines
- Induction furnaces
- UPS systems
- Data Centers
- Photovoltaic systems and wind turbines





Figure 2: Power Module



Figure 3: Control and communication unit

TECHNICAL SPECIFICATIONS

Technical specifications for ELEKTRA active farmonic filters are summarized below

Grid Conneciton	3P3W : 3P4W						
Current Rating (A)	35	70	105	140	175	210	245
Neutral Current Rating (A)	105	210	315	420	525	630	735
Line Voltage	3P3W: 200V ~ 480V (±%10) 3P4W: 200V ~ 415V (±%10)						
Inverter Topology	IGBT three-level NPC inverter						
Frequency	50/60Hz ± 3 Hz						
Switching Frequency	20 kHz						
Reaction Time	25 µs						
Harmonic Filtering Capability	Individually selectable up to 51st harmonic						
Power Factor Correction Capability	0 ~ 100% Inductive 0 ~ 100% Capacitive						
Mechanical Dimensions (W x D x H)	449x623x161 mm						
Current Transformer	Line side or Load side. Class 1 or better Primary: 100A ~ 2500A Secondary: 1A ~ 5A						
Typical Losses	< %4						
Mounting Type	Wall	Wall	Floor	Floor	Floor	Floor	Floor
Ambient Temperature	-10 ~ +40 °C						
IP Class	IP20						
Relative Humidity	% 95						
Noise	< 56 dB						

TECHNICAL DRAWINGS

Technical drawings for a single 35A modular power module is shown in Figure 4. Technical drawings for the control/communication unit is given in Figure 5.

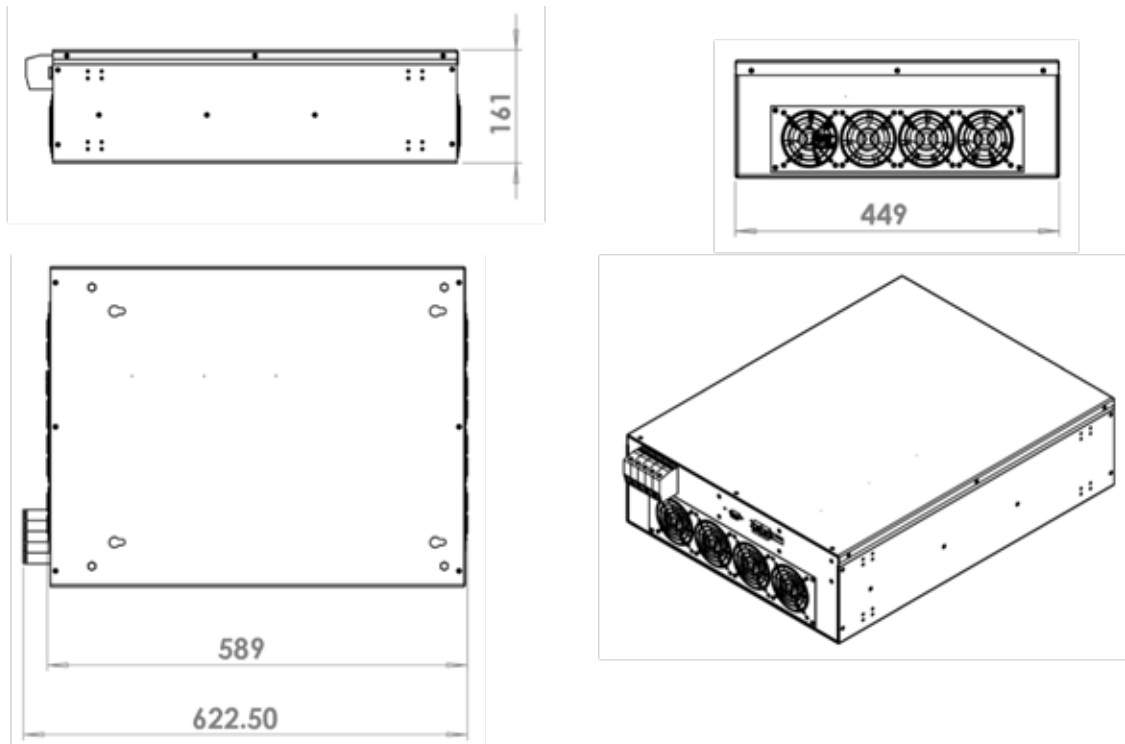


Figure 4: Technical drawings for 35A power module

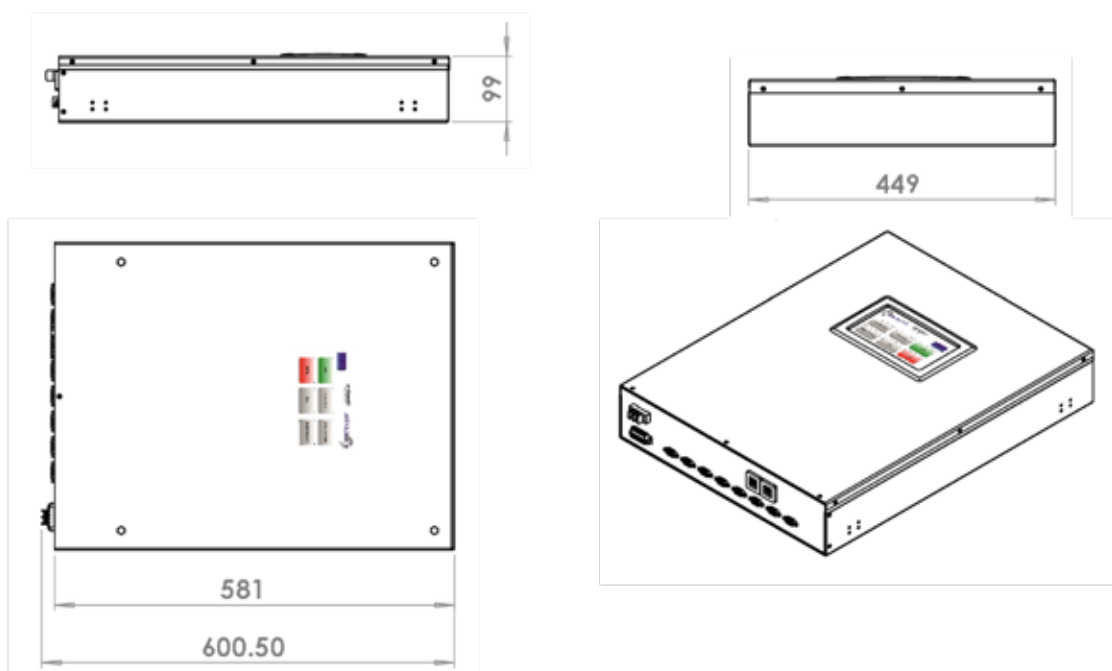


Figure 5: Technical drawings for the control/communication unit



MV IRON CORE HARMONIC FILTER REACTORS

These units are iron cored detuned filter reactors to be used at medium voltage power factor correction applications up to 12kV.

Detuned filters are power factor correction units with anti-resonance reactors connected in series with capacitor steps. The low impedance at 50 Hz and high impedance at common harmonic frequencies allows them to effectively protect the capacitor banks against the harmful effects of harmonics, while retaining the reactive power compensation function.

Iron core medium voltage detuned reactors are mainly used at applications where space is limited. In some cases they may present a more economical solution than an air cored counterpart. These units are designed for indoor use only.



MAIN FEATURES

- Highly permeable iron core,
- High quality copper or aluminium windings,
- High linearity,
- Low losses, high efficiency,
- Vacuum impregnated varnish to ensure silent and moisture-immune operation,
- CE sign and compatibility with EN 60076-11 and suitable subclauses,
- Manufactured under ISO 9001 quality management system

TYPE TEST REPORTED ITEM

12kV, %7, 135A, 13.8 mH, 2500 kVAr iron core reactor is type test reported by accredited laboratory

MV AIR CORE HARMONIC FILTER REACTORS

These units are iron cored detuned filter reactors to be used at medium voltage power factor correction applications up to 34.5kV.

Air core reactors have similar electrical characteristics as iron core reactors, but they lack an iron core. These reactors make up for the lack of magnetic material by having more turns in windings, thus resulting in larger dimensions. Since it is very hard to actually saturate air, these type reactors have excellent linearity, maintaining same amount of inductance value, regardless of current.

Air core reactors can be used independently, or they can be mounted on top of each other.

MAIN FEATURES

- High quality copper or aluminium windings,
- High linearity,
- Low losses, high efficiency,
- Vacuum impregnated varnish to ensure silent and moisture-immune operation,
- CE sign and compatibility with EN 60076-11 and suitable subclauses,
- Manufactured under ISO 9001 quality management system





MV CAPACITORS

These units are special capacitors designed to be used for power factor correction systems at medium voltage levels (up to 34.5 kV). The dielectric material is low loss polypropylene film. An adequate amount of capacitor elements, chosen according to power and voltage level, are connected in series and parallel. The unit is impregnated with an environmentally harmless impregnation substance. This way, in an unlikely event of failure, the leaking material will not be harmful.

Single phase and three phase units are available at given voltage levels below.



Voltage Levels (kV)	Mono Phase	3, 3.3, 6.3, 6.6, 7.2, 10.5
	Three Phase	6.3, 10.5, 15.8, 20, 31.5, 33, 34.5
Over Voltage	8 hours/day	1.1 Un
	30 minutes/day	1.15 Un
	5 minutes/200 times	1.2 Un
	1 minute/200 times	1.25 Un
Temperature Category		-25 / 50 °C
Ambient Temperature		40 °C
Bushings	152 mm	60 kV BIL
	185 mm	75 kV BIL
	225 mm	95 kV BIL
	152 mm	125 kV BIL
	185 mm	150 kV BIL
	225 mm	170 kV BIL

CURRENT LIMITING REACTORS

Current limiting reactors for medium voltage applications up to 34.5kV are used to dampen the transient current spikes that happen during the turn on of various electrical components and machines. Most common example is the power factor correction capacitors. During the initial charging of these capacitors a very large current spike occurs.

These reactors, when connected in series with a capacitor bank, prevent this spike, thus preventing protection devices from kicking in and shutting the system down. Furthermore the additional impedance provided by these units can be used to reduce the short circuit current of the system, allowing for circuit breakers with lower short circuit capacity to be used.

Air core reactors can be used independently, or they can be mounted on top of each other.



MAIN FEATURES

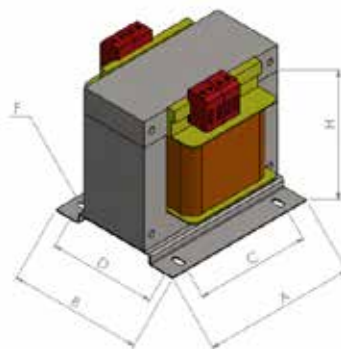
- Aluminium windings,
- High linearity,
- Low losses, high efficiency,
- UV protected epoxy varnish for outdoor duty,
- CE sign and compatibility with EN 60076-11 and suitable subclauses,
- Manufactured under ISO 9001 quality management system



CONTROL TRANSFORMERS

T-1

Model No	A (mm)	B (mm)	C (mm)	D (mm)	H (mm)	F (mm)
ETC 0025 230/24	66	79	50	65	80	6X9
ETC 0040 230/24	66	79	50	65	80	6X9
ETC 0050 230/24	84	77	64	64	85	6X9
ETC 0075 230/24	84	77	64	64	85	6X9
ETC 0100 230/24	84	77	64	64	85	6X9
ETC 0160 230/24	96	90	84	74	95	6X9
ETC 0200 230/24	96	90	84	74	95	6X9
ETC 0250 230/24	96	103	84	86	95	6X9
ETC 0320 230/24	120	122	90	103	115	6X9
ETC 0400 230/24	120	122	90	103	115	6X9
ETC 0500 230/24	120	122	90	103	115	6X9
ETC 0630 230/24	150	114	122	90	125	7X13
ETC 0800 230/24	150	130	122	105	125	7X13
ETC 1000 230/24	150	153	122	130	125	7X13
ETC 1300 230/24	192	143	130	117	175	7X13
ETC 1600 230/24	192	155	130	129	175	7X13
ETC 2000 230/24	192	177	130	151	175	7X13
ETC 2500 230/24	192	198	130	172	175	7X13
ETC 0025 400/230	66	79	50	65	80	6X9
ETC 0040 400/230	66	79	50	65	80	6X9
ETC 0050 400/230	84	77	64	64	85	6X9
ETC 0075 400/230	84	77	64	64	85	6X9
ETC 0100 400/230	84	77	64	64	85	6X9
ETC 0160 400/230	96	90	84	74	95	6X9
ETC 0200 400/230	96	90	84	74	95	6X9
ETC 0250 400/230	96	103	84	86	95	6X9
ETC 0320 400/230	120	122	90	103	115	6X9
ETC 0400 400/230	120	122	90	103	115	6X9
ETC 0500 400/230	120	122	90	103	115	6X9
ETC 0630 400/230	150	114	122	90	125	7X13
ETC 0800 400/230	150	130	122	105	125	7X13
ETC 1000 400/230	150	153	122	130	125	7X13
ETC 1300 400/230	192	143	130	117	175	7X13
ETC 1600 400/230	192	155	130	129	175	7X13
ETC 2000 400/230	192	177	130	151	175	7X13
ETC 2500 400/230	192	193	130	167	175	7X13



Tolerance for dimension B: ± 5 mm
 Tolerance for dimension D: ± 3 mm
 Tolerance for dimensions H,E: ± 5 mm

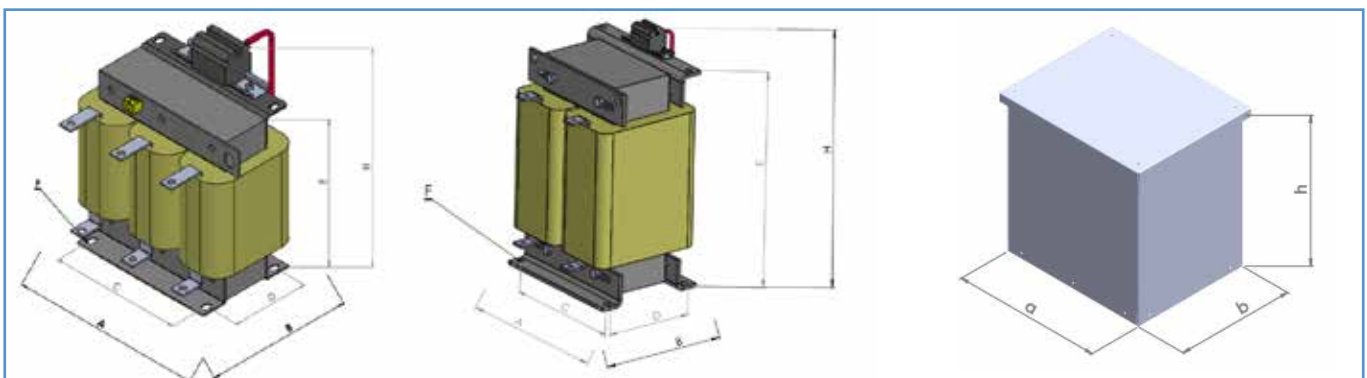
MONO PHASE ISOLATION TRANSFORMERS

T-2

Model No	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	F (mm)	IP23 Kutu Boyutları		
								(a)	(b)	(h)
ET2U 4001	250	205	220	133		350	10x15	500	450	600
ET2U 5001	250	205	220	133		350	10x15	500	450	600
ET2U 6301	250	220	220	149		350	10x15	500	450	600
ET2U 1002	280	240	175	171		415	10x22	550	500	600
ET2U 1602	320	275	205	203		465	10x15	600	550	650
ET2U 2002	320	305	205	233	405		10x15	600	500	650
ET2U 2502	360	285	235	216	455		10x15	650	600	700
ET2U 3152	360	300	235	233	455		10x15	650	600	700
ET2U 5002	400	325	280	253	510		10x15	650	600	750

THREE PHASE ISOLATION TRANSFORMERS

ET3U 4001	250	190	224	128		300	10x15	500	400	450
ET3U 5001	250	205	224	144		300	10x15	500	400	450
ET3U 6301	360	205	265	133		350	10x15	600	500	550
ET3U 8001	360	220	265	149		350	10x15	600	500	550
ET3U 1002	420	225	315	156		405	15x21	650	550	650
ET3U 1602	480	245	395	176		455	15x21	700	650	700
ET3U 2002	480	265	395	193		455	15x21	700	650	700
ET3U 2502	480	290	395	218		455	15x21	700	650	700
ET3U 3152	480	305	395	233		455	15x21	750	650	750
ET3U 4002	540	285	400	213		505	15x21	750	650	750
ET3U 5002	540	315	400	243	460		15x21	750	650	750
ET3U 6302	600	325	470	253	510		15x21	850	700	850
ET3U 8002	600	350	470	278	510		15x21	1000	750	1000
ET3U 1003	720	325	600	253	610		15x21	1000	750	1000
ET3U 1253	720	355	600	283	610		15x21	1000	750	1000
ET3U 1603	720	375	600	303	610		15x21	1000	750	1000
ET3U 2003	900	325	780	253	760		15x21	1350	1000	1200
ET3U 2503	900	375	780	303	760		15x21	1350	1000	1200
ET3U 3003	900	395	780	323	760		15x21	1350	1000	1200
ET3U 4003	900	445	780	373	760		15x21	1350	1000	1200
ET3U 5003	900	445	780	373	760		15x21	1350	1000	1200
ET3U 6303	900	525	780	453	760		15x21	1350	1000	1200



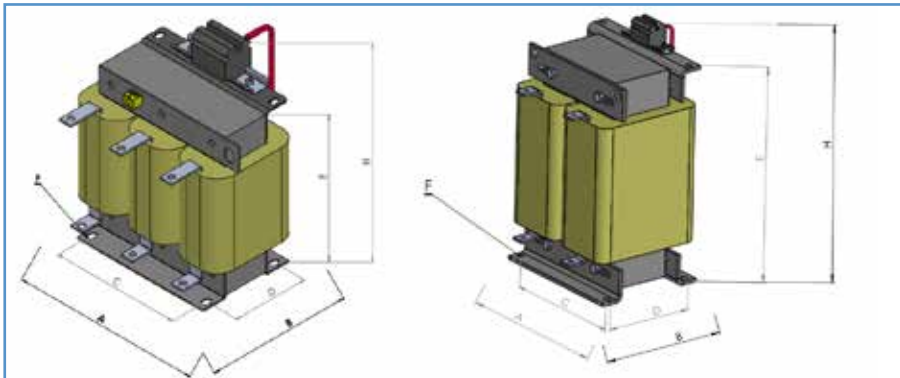
MONO PHASE MEDICAL TRANSFORMERS

T-3

Model No	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	F (mm)
ETM 0322	250	200	220	126		365	10x15
ETM 0322	250	200	220	126		365	10x15
ETM 0402	250	200	220	126		365	10x15
ETM 0402	250	200	220	126		365	10x15
ETM 0502	250	200	220	126		365	10x15
ETM 0502	250	200	220	126		365	10x15
ETM 0632	250	215	220	141		365	10x15
ETM 0632	250	215	220	141		365	10x15
ETM 0802	280	225	175	156		415	10x22
ETM 0802	280	225	175	156		415	10x22
ETM 1002	280	225	175	156		415	10x22
ETM 1002	280	225	175	156		415	10x22

THREE PHASE MEDICAL TRANSFORMERS

ETM3 0322	420	225	315	156		415	15x21
ETM3 0632	420	240	315	171		415	15x21
ETM3 0802	420	255	315	186		415	15x21
ETM3 1002	480	265	395	193		465	15x21



Tolerance for dimension B: ± 5 mm
 Tolerance for dimension D: ± 3 mm
 Tolerance for dimensions H,E: ± 5 mm

ERH P=%7 189Hz 400V/50Hz/LINEARITY1.73xIrms R-1

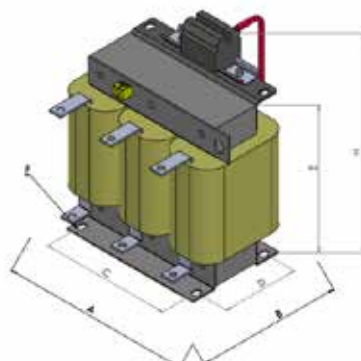
Model No	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	F (mm)
ERH 7/400/2.5K	120	105	90	52		120	5X10
ERH 7/400/6.25K	150	105	110	55		160	5X10
ERH 7/400/10K	180	140	135	88	155		5X10
ERH 7/400/12.5K	180	150	135	97	155		5X10
ERH 7/400/20K	250	135	185	80	205		10X15
ERH 7/400/25K	250	135	185	80	205		10X15
ERH 7/400/40K	250	155	185	100	205		10X15
ERH 7/400/50K	270	170	200	106	250		10X15
ERH 7/400/75K	300	175	224	110	255		10X15
ERH 7/400/100K	350	195	265	126	305		10X15

ERH P=%5.67 210Hz 400V/50Hz/LINEARITY>2.08xIrms

ERH 5.67/400/2.5K	120	115	90	62		120	5X10
ERH 5.67/400/6.25K	180	120	135	68		170	5X10
ERH 5.67/400/10K	180	130	135	78	155		5X10
ERH 5.67/400/12.5K	180	140	135	88	155		5X10
ERH 5.67/400/20K	250	135	185	80	205		10X15
ERH 5.67/400/25K	250	145	185	90	205		10X15
ERH 5.67/400/40K	250	135	185	81	205		10X15
ERH 5.67/400/50K	270	195	200	121	250		10X15
ERH 5.67/400/75K	350	195	265	126	305		10X15
ERH 5.67/400/100K	350	195	265	126	305		10X15

ERH P=%14 134Hz 400V/50Hz/LINEARITY>1.37xIrms

ERH 14/400/2.5K	120	115	90	62		120	5X10
ERH 14/400/6.25K	180	130	135	78		170	5X10
ERH 14/400/10K	180	150	135	97	155		5X10
ERH 14/400/12.5K	250	134	185	80	205		10X15
ERH 14/400/20K	250	145	185	90	205		10X15
ERH 14/400/25K	250	135	185	81	205		10X15
ERH 14/400/40K	300	180	224	115	255		10X15
ERH 14/400/50K	300	185	224	120	255		10X15
ERH 14/400/75K	350	195	265	126	305		10X15
ERH 14/400/100K	350	225	265	156	305		10X15



Tolerance for dimension B: ± 5 mm
 Tolerance for dimension D: ± 3 mm
 Tolerance for dimensions H,E: ± 5 mm

MONO PHASE SHUNT REACTORS

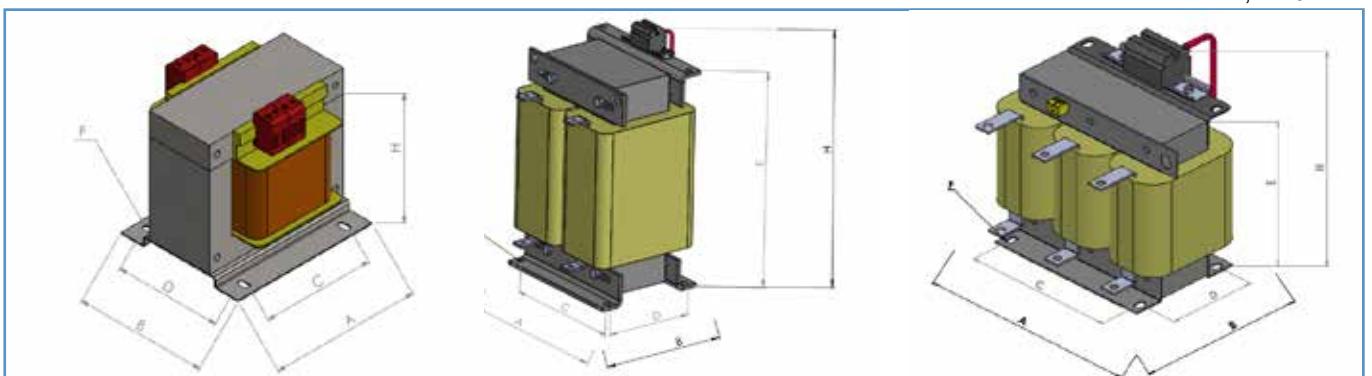
R-2

Model No	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	F (mm)
ERS1-230/0.1	84	77	64	64		85	6X9
ERS1-230/0.25	84	77	64	64		85	6X9
ERS1-230/0.5	96	103	84	86		95	6X9
ERS1-230/1	120	122	90	103		115	6X9
ERS1-230/1.5	150	153	122	126		125	7X13
ERS1-230/2.5	192	157	130	145		145	6X12
ERS1-230/3	192	157	130	145		145	6X12
ERS1-230/3.5	192	185	130	173		175	6X12
ERS1-230/5	200	195	170	102	305		10X15
ERS1-230/7.5	200	225	170	134	305		10X15
ERS1-230/10	250	170	200	130	355		10X15

THREE PHASE SHUNT REACTORS

ERS3-400/1	180	140	135	88		200	5X10
ERS3-400/1.5	180	150	135	97		200	5X10
ERS3-400/2	240	135	185	80		250	10X15
ERS3-400/2.5	240	145	185	90		250	10X15
ERS3-400/3	240	155	185	100		250	10X15
ERS3-400/5	250	170	224	102		300	10X15
ERS3-400/7.5	250	195	224	130		300	10X15
ERS3-400/10	300	195	265	126		350	10X15
ERS3-400/12.5	350	210	265	138	305		10X15
ERS3-400/15	350	210	265	141	305		10X15
ERS3-400/20	420	240	315	171	355		15X21
ERS3-400/25	420	250	315	178	355		15X21
ERS3-400/30	420	255	315	186	355		15X21
ERS3-400/40	480	265	356	193	410		15X21
ERS3-400/50	540	275	400	206	460		15X21

Tolerance for dimension B: ± 5 mm
 Tolerance for dimension D: ± 3 mm
 Tolerance for dimensions H,E: ± 5 mm



LINE REACTORS UK= %4

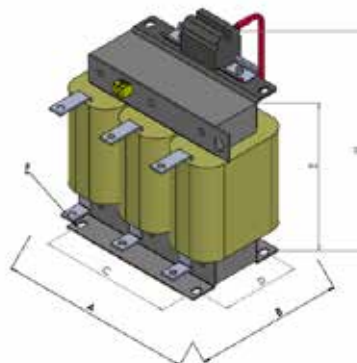
R-3

Model No	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	F (mm)
ERL3 400/10/5	120	85	90	63		125	5X10
ERL3 400/16/7.5	150	80	110	60		150	5X10
ERL3 400/24/11	180	91	135	71		175	5X10
ERL3 400/30/15	180	91	135	71		175	5X10
ERL3 400/37/18.5	180	101	135	81		175	5X10
ERL3 400/50/22	180	120	135	100		175	5X10
ERL3 400/75/37	240	108	185	83	205		5x10
ERL3 400/90/45	240	108	185	83	205		5X10
ERL3 400/110/55	240	133	185	108	205		5X10
ERL3 400/150/75	264	142	200	110	243		10X15
ERL3 400/180/90	300	162	224	140	225		10X15
ERL3 400/250/110	360	170	265	130	305		10X15
ERL3 400/300/132	360	170	265	130	305		10X15
ERL3 400/350/160	360	170	265	130	305		10X15
ERL3 400/400/200	360	185	265	145	305		10X15
ERL3 400/500/250	360	200	265	160	305		10X15
ERL3 400/700/315	420	205	315	165	425		15X21
ERL3 400/800/400	420	252	315	212	425		15X21
ERL3 400/1000/500	420	252	315	212	425		15X21
ERL3 400/1200/600	480	278	356	238	445		15X21

LINE REACTORS UK= %2

ERL3 400/10/5-2	120	75	90	53		125	5x10
ERL3 400/16/7.5-2	120	75	90	53		125	5x10
ERL3 400/24/11-2	150	80	110	60		150	5x10
ERL3 400/30/15-2	150	80	110	60		150	5x10
ERL3 400/37/18.5-2	150	95	110	75		150	5x10
ERL3 400/50/22-2	180	91	135	71		175	5x10
ERL3 400/75/37-2	180	101	135	81		175	5x10
ERL3 400/90/45-2	240	108	185	83		225	5x10
ERL3 400/110/55-2	240	118	185	93		225	5x10
ERL3 400/150/75-2	240	168	185	108	205		5x10
ERL3 400/180/90-2	264	196	200	125	225		10x15
ERL3 400/250/110-2	300	197	224	120	255		10x15
ERL3 400/300/132-2	300	197	224	120	255		10x15
ERL3 400/350/160-2	300	212	224	135	255		10x15
ERL3 400/400/200-2	300	228	224	151	255		10x15
ERL3 400/500/250-2	360	225	265	130	305		10x15
ERL3 400/700/315-2	360	255	265	160	305		10x15
ERL3 400/800/400-2	360	255	265	160	305		10x15
ERL3 400/1000/500-2	360	255	265	160	355		10x15
ERL3 400/1200/600-2	420	270	315	165	425		15x21

MOTOR REACTORS 4 kHz							R-4
Model No	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	F (mm)
ERM 400/8/4	120	75	90	53		155	5X10
ERM 400/10/5	120	75	90	53		155	5X10
ERM 400/12/5.5	120	75	90	53		155	5X10
ERM 400/16/7.5	120	75	90	53		155	5X10
ERM 400/20/10	120	85	90	63		155	5X10
ERM 400/24/11	150	80	110	60		180	5X10
ERM 400/30/15	150	80	110	60		180	5X10
ERM 400/37/18.5	150	95	110	75		180	5X10
ERM 400/50/22	180	91	135	71		205	5X10
ERM 400/60/30	180	101	135	81		205	5X10
ERM 400/75/37	180	161	135	91	155		5X10
ERM 400/90/45	180	170	135	100	155		5X10
ERM 400/110/55	240	158	185	83	205		10X15
ERM 400/120/60	240	158	185	83	205		10X15
ERM 400/150/75	240	168	185	93	205		10X15
ERM 400/180/90	240	178	185	103	205		10X15
ERM 400/200/100	264	192	200	110	243		10X15
ERM 400/250/110	264	192	200	110	243		10X15
ERM 400/300/132	300	202	224	120	255		10X15
ERM 400/350/160	300	202	224	120	255		10X15
ERM 400/400/200	300	214	224	132	255		10X15
ERM 400/500/250	360	220	265	130	305		10X15
ERM 400/600/300	360	270	265	160	305		10X15
ERM 400/700/315	360	270	265	160	305		10X15
ERM 400/800/400	360	270	265	160	305		10X15
ERM 400/900/450	360	270	265	160	305		10x15
ERM 400/1000/500	360	270	265	160	395		10X15
ERM 400/1200/600	420	275	315	165	425		15X21



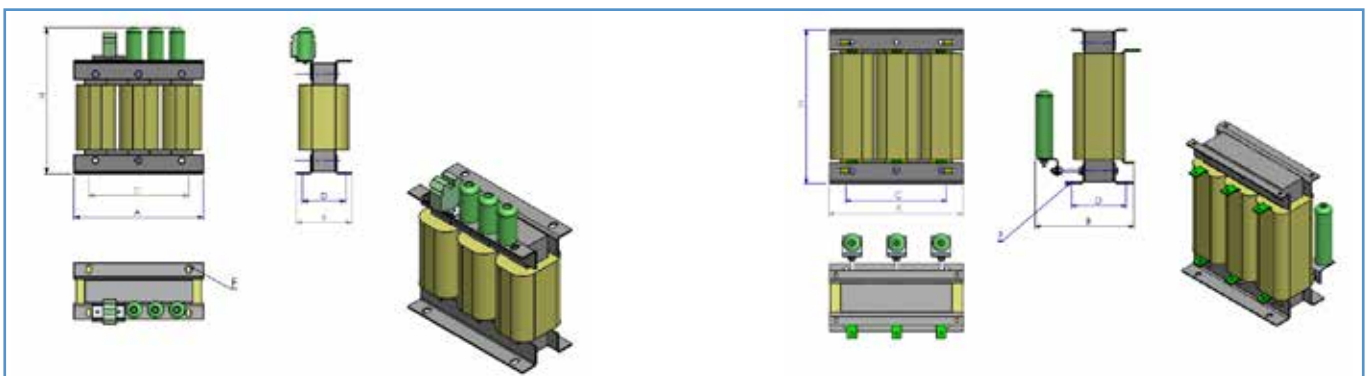
Tolerance for dimension B: ± 5 mm
 Tolerance for dimension D: ± 3 mm
 Tolerance for dimensions H,E: ± 5 mm

SINE FILTERS

H-1

Model No	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
ESF3 400/8/4	150	95	110	75	180	5x10
ESF3 400/10/5	180	91	135	71	205	5X10
ESF3 400/12/5.5	180	91	135	71	205	5X10
ESF3 400/16/7.5	180	91	135	71	205	5X10
ESF3 400/20/10	240	108	185	83	255	10X15
ESF3 400/24/11	240	108	185	83	255	10X15
ESF3 400/30/15	240	118	185	93	255	10X15
ESF3 400/37/18.5	240	128	185	103	255	10X15
ESF3 400/48/22	264	142	200	110	293	10X15
ESF3 400/60/30	300	189	224	157	305	10X15
ESF3 400/75/37	300	264	224	182	255	10X15
ESF3 400/90/45	300	279	224	197	255	10X15
ESF3 400/110/55	360	270	265	180	305	10X15
ESF3 400/120/60	360	270	265	180	305	10X15
ESF3 400/150/75	360	285	265	195	355	10X15
ESF3 400/180/90	360	300	265	210	355	10X15
ESF3 400/200/100	420	305	315	215	375	15X21
ESF3 400/250/110	420	335	315	245	375	15X21
ESF3 400/300/132	540	331	356	241	485	15X21
ESF3 400/350/160	540	331	356	241	485	15X21
ESF3 400/400/200	540	331	356	241	485	15X21
ESF3 400/500/250	540	358	356	268	485	15X21
ESF3 400/600/300	600	418	400	308	525	15X21
ESF3 400/700/315	600	418	400	308	525	15X21
ESF3 400/800/400	600	378	470	268	635	15X21
ESF3 400/900/450	600	428	470	318	635	15X21
ESF3 400/1000/500	600	478	470	368	635	15X21
ESF3 400/1200/600	720	452	600	352	685	15X21

Tolerance for dimension B: ± 5 mm
Tolerance for dimension D: ± 3 mm
Tolerance for dimensions H,E: ± 5 mm





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