

Introducing Ferraris Tolenoid C[®]

March 2020



Ferraris Challenge



Ever since the commercialization of electricity, there have been an untapped byproduct in form of electromagnetic field generated by flowing currents in power lines. By harnessing the forgotten and unused electromagnetic energy through electromagnetic energy recycling, Ferraris has opened a new pathway for electric power generation and energy recycling technology for the mankind. Ferraris was founded in a strive to harness the power from a magnetic field produced by power lines and transform it into a reliable and countable power source.

Dr. KOO, who is the founder of Ferraris wishes the investors to set their focus and priority environmental social governance with key focus on providing clean energy produced by Ferraris' products through the magnetic energy over the corporate management of Ferraris. The prime directive of Ferraris is to provide clean energy with no environmental pollution around the world to improve and restore environment for the benefit of current and future generations to come.

We have named Ferraris Inc. in memory of Galileo Ferraris.



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I. Introducing Ferraris Tolenoid C[®] Technology

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1. Ferraris Tolenoid C[®] Technology

A Ferraris technology which harnesses induced electrical energy from the magnetic energy variation produced from the power line regardless of the power line voltage. The world's first technology that only Ferraris has – Linear power scalability(<u>https://youtu.be/Y3IR5djt5hg</u>), input/output power Variation controllability(<u>https://youtu.be/z3OLe21eFGU</u>) and Single digit mass production loss ratio.

Ferraris Tolenoid C[®] is designed, developed and manufactured mainly for the electrical power generator.





The uses of Magnetic Harvesting products



Incoming power lines from the sources.(such as power generation, solar/wind farm, substation, distribution substation and transformer)

Electric devices such as sensors, monitoring systems, aircraft warning light, CCTV, public light, public WIFI, drone charging station, monitoring robots, EV charging station, lighting fixtures and e nergy storage system etc.

Key Obstacles of Producing ready-made Magnetic Harvesting products

Key obstacles regarding the Magnetic input source Harvesting •The current of power line is not products constant, but varies in wide range, furthermore it cannot be controlled by harvesting device. •The amplitude of current of power line may be lower than the minimum one set by regulation in many cases. •The product must be easy and simple to Install or de-installation without power off a power line. Furthermore there should be no Key obstacles regarding the safety hazard issue. mass production •Exiting magnetic core is made mainly for sensor application, not for the power application.

The production process and quality control procedures such as winding, cutting, polishing, primary test, coiling, and final tests can be automated to minimize product loss and human dependency, which enable product to be mass producible.

Key obstacles regarding the output source

• Power source should be scalable for the variable output source.

- The power usage of the electric devices for system integration by the solution provider varies by case by case, which means there is no standard output requirement, but should be adaptable in the field.
- In most cases, power supply based on magnetic harvesting method is designed by custom method, not modular design method.

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Ferraris Manufactures ready-made Magnetic Harvesting products





2. Ferraris Tolenoid C[®] Technology - Linear power scalability







4. Ferraris Tolenoid C[®] Technology - Output Load variation / traceability

5. Ferraris Tolenoid C[®] Technology - Performance Evaluation

In the 15 ~ 60A primary current line, Ferraris Tolenoid C[®] produced higher output power (Watt) of 49.73% ~ 107.06% than other companies' core products.



II. Introducing Ferraris Tolenoid C[®]

1. Ferraris Tolenoid C[®] products

• For further information of the products, refer to chapter V. Spec sheets.



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2. Four kind of Ferraris Tolenoid C[®]

• Ferraris Tolenoid C[®] can be installed wherever power lines are regardless of its voltage such as high-voltage distribution lines, underground lines.

Tolenoid C [®]		for Home IoT	for IoT / Smart grid (underground/distribution line)			
			Ser		0	
	line thickness (inches) ^(^1)	Under 0.90	Under 1.30	Under 2.48	Under 5.90	
Power line	line current (A)	~ 15	10 ~ 650	10 ~ 650	10 ~ 650	
specifications	line voltage	~380 V	~ 30 kV		154 kV	
	line diameter (inches)	~ 0.90	~ 1.30	~ 2.48	~ 5.90	
Environmental	operating temp.(°F)	-13 ~ 158	- 40 ~ 185	- 40 ~ 185	- 40 ~ 185	
specifications	ingress protection (dust/water proof)	IP65	IP67/68	IP67/68	IP67/68	
Dimensions	size (inches)	4.37×3.15×3.23	5.12×3.94×4.33	6.69×3.94×5.90	11.30×7.87×4.02	
Dimensions	weight (lb)	2.20	4.70	7.05	5.29	

1 : The line diameter is determined by the line voltage.

3. Similar products





4. China MINRONG



7. China Xiamen







5. China HYLITON



8. Korea KEPCO KDN



3. Austria ZELISKO



6. China EChun



9. Korea Hyundai Heavy Industry



III. Comparing Ferraris Tolenoid C[®] and its Technology

- 1. Ferraris Tolenoid C[®] is designed, developed and manufactured mainly for the Electrical power generation.
- 2. Linear power scalability Ferraris Tolenoid C[®] can produce upto desired output level by simply adding Tolenoid C[®] module step by step if incoming power line has more than enough power from the desired one.
- 3. Input controllability Ferraris SMPS can control the maximum wattage Tolenoid C[®] power generation through its logics system so that the Tolenoid C[®] produce input power does not exceed maximum desired wattage. (Maximum wattage can be set by the user) #2 and 3 Full-motion video demo <u>https://youtu.be/Y3IR5djt5hg</u>
- 4. Output load variation/traceability Under load variation situations, Ferraris SMPS will produce stable output power the user demands. Any further surplus output power caused by load variation control is managed by Ferraris SMPS's control logics system of the production system. Full-motion video demo <u>https://youtu.be/z3OLe21eFGU</u>
- 5. Even under the simultaneous variation in primary line and load, Ferraris SMPS supplies stable output power.
- 6. Ferraris Tolenoid C[®] is easy and simple to Install or uninstall without switching off a power line and thus minimizes any safety hazard issue.
- 7. Innovative method of magnetic energy harvesting and large-scale system over kilowatt to megawatt level is easily implementable. (Ferraris ERR System)
- 8. Ferraris is the first to have adopted an operational production system to mass produce its products. By utilizing innovative automated production process and quality control, Ferraris has reduced **loss ratio to a single digit**.

IV. Ferraris Patents and Research efforts

1. Ferraris Patents

		Korea			USA	CANADA	JAPAN	EUROPE	CHINA
Patentee	Patent	Application Number & Filing date	Registration Number & date	PCT Application & Filing date	Registration Number & date				
JA-IL Koo	Systems, Methods and Devices for Induction-Based Power Harvesting in Battery-Powered Vehicles			PCT/US2017/037668 12/21/2017	[UH20:I22SA] 16/220.692	1060P-AAA-CAP1	1060P-AAA-JPP1	EP17814088.5	1060P-AAA-CNP1
Ferrarispower	Wiring method and apparatus of magnetic field energy harvesting considering voltage drop of power cable	10-2018-0167391 12/21/2018							
Ferrarispower	Networked partial discharge detection system using power supply of magnetic induction type	10-2018-0087268 7/26/2018							
Ferrarispower	Separable current transformer	10-2015-0160586 11/16/2015	10-1586785 1/13/2016	PCT/KR2016/011392 10/12/2016					
Ferrarispower	Method for manufacturing split electromagnetic inductive apparatus for power supply	01-2014-0044862 4/15/2014	10-1505873 3/19/2015	PCT/KR2015/003279 4/2/2015	SN. 15/304.373	2945940 9/26/2017	SN 2016-563043	EP157793336.5	SN201580023179.5 2/22/2017
Ferrarispower	Unit current transformer device and magnetic induction power supplying device for linearly controlling output power by using the same	10-2014-0025317 3/4/2014	10-1459336 11/3/2014	PCT/KR2014/011120 11/19/2014	US 9,793,818 B2 10/17/2017	2941529 7/10/2018	6104457 3/10/2017	14882783.5 2/19/2018	ZL 2014 8 0007684.6 11/14/2017
Ferrarispower	Current transformer	10-2013-0053188 5/10/2013	10-1323607 10/24/2013						
Ferrarispower	Security camera system using of electromagnetic inductive power supply	10-2013-0036946 4/4/2013	10-1320339 10/15/2013	PCT/KR2014/002932 4/4/2014	US 9,824,282 B2 11/21/2017		6161785 6/23/2017		ZL 2014 8 0019561.4 3/18/2019
Ferrarispower	Current transformer system with sensor CT and generator CT separately arranged in paralled in electric power line, and integrated system for controlling same in wireless communications network	10-2013-0018739 2/21/2013	10-1317220 10/4/2013	PCT/KR2014/001374 2/20/2014	US 10,192,678 B2 1/29/2019		6204505 9/8/2017	In progress	
Ferrarispower	Electromagnetic Inductive Power Supply Apparatus	10-2013-0005968 1/18/2013	10-1444371 9/18/2014	PCT/KR2014/000517 1/17/2014	US 9,673,694 B2 6/6/2017	2934854 8/21/2018	6129347 4/21/2017	2947751 4/11/2018	ZL 2014 8 0005251.7 2/6/2018
Ferrarispower	Zig System for Polishing of Magnetic Core and the Method for the same	10-2012-0080730 7/24/2012	10-1252011 4/2/2013	PCT/KR2013/006632 7/24/2013					
Ferrarispower	Zig System for Cutting of Magnetic Core and the Method for the same	10-2012-0080724 7/24/2012	10-1255180 4/10/2013	PCT/KR2013/006631 7/24/2013					

• US Patent –US 9,673,694 B2

(12) Uni Koo	ited States Patent	(10) Patent No.: US 9,673,694 B2 (45) Date of Patent: Jun. 6, 201
(54) ELEC POW	CTROMAGNETIC INDUCTION TYPE ER SUPPLY DEVICE	(58) Field of Classification Search CPC
(71) Applic	cant: TERA ENERGY SYSTEM SOLUTION CO. LTD., Ilwascong-si, Gyconggi-do (KR)	See application file for complete search history. (56) References Cited
(72) Invent	tor: Ja-II Koo, Scongnam-si (KR)	U.S. PATENT DOCUMENTS
(73) Assign	nee: FERRARISPOWER CO., LTD, Gyeonggi-do (KR)	3.443,194 A * 5/1969 Cielo
(*) Notice	e: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 90 days	(Continued)
(21) Anni	No. 14761 029	IP H06-70491 A 3/1994
(a) Appl.		JP 2001-112104 A 4/2001 (Continued)
(22) PCTF	Filed: Jan. 17, 2014	Primary Examiner — Timothy J Dole
(86) PCT N § 371 (2) De	(c)(1), (c)(1, tul 17, 2015	Assistant Examiner — Yusef Ahmed (74) Attorney: Agent, or Firm Masuvalley & Partners
(a) Do		(57) ABSTRACT
(87) PCLE PCLE	Pub. No.: WO2014/112827 Pub. Date: Jul. 24, 2014	Disclosed is an electromagnetic induction type power supply device, which generates electric power through an electro
(65) US 20	Prior Publication Data 015/0357907 Δ1 Dec. 10, 2015	flowing through a transmission line, can adjust an output thereof by detecting and feeding back the output, enables
(30)	Foreign Application Priority Data	removed as necessary. The electromagnetic induction typ power supply device includes a transformer module include
Jan. 18, 2	2013 (KR) 10-2013-0005968	ing a plurality of transformers for outputting electric power by inducing, in an electromagnetic induction method, see
(51) Int. C H02M H01F	71. 1 1/32 (2007.01) 7 38/28 (2006.01)	ondary current from primary current flowing through transmission line; a power source module including a plu rality of power converting units for converting the electric recurse output from the plurality of transformers to direct
(52) U.S. C	(Continued) Cl. H02M 1/32 (2013.01): H01F 38/28	current power and outputting the converted power; and power summing unit for summing the direct current power
((2013.01); H02J 5/005 (2013.01): H02J 50/10 (2015.02):	summed power to a load.
	(Continued)	5 Claims, 2 Drawing Sheets
	0 30 20 0.0021 21 0.0021 21 0.0021 21 0.0021 22 0.0021 23 0.0021 24 0.0021 25 0.0021 26 0.0021 27 0.0021 18 0.0021 26 0.0021 27 0.0021 10 0.0021 26 0.0021 10 0.0021 27 0.0021 10 0.0021 27 0.0021 10 0.0021 28 0.0021 10 0.0021 20 0.0021 21 0.0021 22 0.0021 23 0.0021 24 0.0021 25 0.0021 26 0.0021 27 0.0021	

51) Int. CL. 20020003713 A1* 1/2002 Nakwaga,	1) Int. Cl. 10235 566 (2006.01) 2002003713 A1* 1/2002 Nakwaga		US 9,0	13,094 B2		
1) Inc. C. P. 2000,000,713 AF 10202 Sakawaga 100M 12003 10201 300,000,70 14 S2000 Sacata 1020 1300,70 10201 301,000,70 14 S2000 Faska 1020 130,70 30,70 4,412,640 A * 10198 1000,77,73 14 52000 Paska 6000,12 201,000,753 14 62012 Cuada 1011,72,24 4,412,640 A * 1098 Forman 1001,77,73 14 7001 201,200,753 14 62012 Cuada 1011,77,24 4,412,645 A * 31989 Pateree 1000,77,235 301,700,422 201,200,7354 14 1201,000,701,41 3201,500,700,41 112013	1) Int. L. L. 2006.01) 2002.0007/3 AP 1/202 Sakawaga R0M 1200 10234 7009 (2016.01) 2002.0012/37 AP 1/202 Takhorma 10231333 10234 7009 (2016.01) 2002.0012/37 AP 1/202 Takhorma 10231333 10234 5009 (2016.01) 2002.0012/37 AP 1/202 Takhorma 10231333 10234 5009 (2016.01) 2007.0051712 AP 52007 Taaka 52019 2012 U.S. C. 10234 500 Taaka 10231333 1/2012	(51) Int (3)		2002/00/2012	1,2022	N-house Hour Hour
IIOM 5.00 (2006.01) 2002001237 II-1020 Iakhama 10220333 IIOJ 5000 (2016.01) 20020075872 AI 62020 Sim 102333 SiX 9095 SiX 9005 SiX 9005 <th>IID3M Sci0 (2006.01) 20020012257 AI* 12002 Iakahama 10220333 IID3M 7078 (2006.01) 20020073872 AI* 62002 Kim 1033230 JUL SCI (2013.01); IID2M 7076 2007003121 AI* 52007 Kocken 2312 OF CPC </th> <th>1102M 7/06</th> <th>(2006.01)</th> <th>2002/00/3/13 AT</th> <th>1/2002</th> <th>363/72</th>	IID3M Sci0 (2006.01) 20020012257 AI* 12002 Iakahama 10220333 IID3M 7078 (2006.01) 20020073872 AI* 62002 Kim 1033230 JUL SCI (2013.01); IID2M 7076 2007003121 AI* 52007 Kocken 2312 OF CPC	1102M 7/06	(2006.01)	2002/00/3/13 AT	1/2002	363/72
IDD 3 Prof. (20101) 2002007872 A1* 62002 Kin 11021 3/28 IDD 3 For (2010) 2007003712 A1* 32007 Koeken B33/267 S2 U.S. CI. (201301): III2M 706 2007003712 A1* 32007 Koeken B33/267 S2 U.S. CI. III2M 142M 706 2015011 2007003712 A1* 32007 Koeken B33/267 S0 References Cited 20150163 200700329 A1* 62007 Tanaka H03/376 4,125601 A* 51979 Zeit H03K 708 300703712 A1* 82090 Pak McCoord 3007 3017 4,125601 A* 51979 Zeit H03K 708 300713723 A1* 70013 Saxby 307103 4,125601 A* 41988 Komaan 100717353 301207000308 A1* 112013 V1 10913 503 5,12114 A* 61992 Cahell 1003/3336 2014078791 A1* 32014 Goodanai 10017 103 5,91106 A* 111990 Kokea 10013 350 201507000 A1* 30210 M0713 307104 6,05276 B2* G2006 Cuahel 1003/3356 10013830 20150703826 A 42012	IDD3 300 (201301) 2002009872 All 62002 Kin 102M 202 (201301) (201301) 2007003172 All 62002 Kin B32367 (201301) (201301) 102M 726 201301 2007003172 All 62007 Kin B32367 (201301) (201301) 102M 726 2017003172 All 62007 Faaka 101191 (201301) 102M 726 2017003172 All 62007 Faaka 101191 531267 (201301) 102M 726 1001000056 All 420110000056 All 4201100 5012104 (20140525 All 42011 102M 1028 5012104 5012104 5012104 5012104 50121404 5012104 50121404 5012104077 112011 501210407 1101073132 20140007031 112011 501210407 1101127334 50121404 5012140 5012140 5012140 5012140 5012140 5012140 5012140 50121407 50121100 50121100	1102M 5/40	(2006.01)	2002/0012257 A1*	1/2002	Takahama H02M 3/337 363/95
100.21 Str.70 (2016.01) 20070031712 A1* 32007 Kesken 112.00 52) U.S. C1. 102.01 S40 (2013.01); 102.01 706 20070133239 A1* 62007 Taaka 2012103 56) References Cited 2013.01 12.01 70 A1* 82000 Fak 2020103025 A1* 42011 Low 201210395 508 4.412.661 A* 5/1979 Zeit H018 7308 307302 201210080056 A1* 42011 Low 100215 508 4.412.661 A* 5/1979 Zeit H018 7308 307302 3073025 A1* 52012 Caddra 1012.100 4.412.661 A* 5/1979 Zeit H018 7308 307302 3073025 A1* 52012 Caddra 1012.100 4.412.663 A* 5/1979 Zeit H018 7308 20150087037 A1* 72013 Skathy 10012.100 20150080308 A1* 112015 Ya 2012.00187637 A1* 72013 Skathy 10012.300770 A1* 82008 Normal 10012.2008 N1* 112015 Ya 20150078030 A1* 32016 Gardssani 1002.0077104 5.3011 B0 A* 11/1999 Konsen 32013778 32015 Gardssani 1002.0077104 20150078030 A1* 112015 Ya 2015078030 A1* 112015 Ya 2015077104 5.3011 B0 A* 11/1999 Konsen 3201377 32018 Gardssani 102017703 1077104 2015078030 A1* 112015 Ya 2015078030 A1* 112015 Ya 2015078030 A1* 112015 Ya </td <td>III03 59/10 (2016.01) 20070031712 Alt * 32007 Keeken 20191301 (2) U.S. Ci. III02M 5404 (2013.01); III02M 706 (2013.01) 20070133239 Alt * 62007 Taaka 36246 (2013.01); II22 JW 708 (2013.01) 2007013722 Alt * 82009 Pak 626463 36364 (103.01); II22 JW 708 (2013.01) 20070137239 Alt * 62007 Taaka 36364 (113.010) References Cited 2018 (2016.07) Alt * 82009 Pak 626463 (4.61937 At * 41985 Komana 1000 17535 307.104 30210080268 Alt * 112013 Yu 10913.365 (4.61937 At * 41985 Komana 1000 17355 3037104 2013.0100208 Alt * 112013 Yu 10913.765 (3.5114) At * 61992 Cathell 1023.3376 3037104 2014.078751 112013 Yu 10917.763 (3.5214) At * 2000 Beckenan 1021.7025 3021.14 112015 Yanguchi 1021.702 (3.52641) At * 2000 Beckenan 1021.7025 7021.14 7021.702 7021.703<td>H025 5/00 H02M 7/08</td><td>(2006.01)</td><td>2002/0079872 AI*</td><td>6/2002</td><td>Kim 1102M 3/28</td></td>	III03 59/10 (2016.01) 20070031712 Alt * 32007 Keeken 20191301 (2) U.S. Ci. III02M 5404 (2013.01); III02M 706 (2013.01) 20070133239 Alt * 62007 Taaka 36246 (2013.01); II22 JW 708 (2013.01) 2007013722 Alt * 82009 Pak 626463 36364 (103.01); II22 JW 708 (2013.01) 20070137239 Alt * 62007 Taaka 36364 (113.010) References Cited 2018 (2016.07) Alt * 82009 Pak 626463 (4.61937 At * 41985 Komana 1000 17535 307.104 30210080268 Alt * 112013 Yu 10913.365 (4.61937 At * 41985 Komana 1000 17355 3037104 2013.0100208 Alt * 112013 Yu 10913.765 (3.5114) At * 61992 Cathell 1023.3376 3037104 2014.078751 112013 Yu 10917.763 (3.5214) At * 2000 Beckenan 1021.7025 3021.14 112015 Yanguchi 1021.702 (3.52641) At * 2000 Beckenan 1021.7025 7021.14 7021.702 7021.703 <td>H025 5/00 H02M 7/08</td> <td>(2006.01)</td> <td>2002/0079872 AI*</td> <td>6/2002</td> <td>Kim 1102M 3/28</td>	H025 5/00 H02M 7/08	(2006.01)	2002/0079872 AI*	6/2002	Kim 1102M 3/28
J. DS. CL. IB201 540 (2013.0); IB201 706 (2013	20 CK. C. 1023f 549 (2013 01): 1024f 708 (2013 0): (2013 01): 1024f 708 (2013 0): 005 2007013229 A1* 62007 Taaka — B00A 333 200920177 A1* 200920177 A1* 62009 Pak 2007013229 A1* 62007 Taaka — B00A 333 201008055 A1* 62012 Code 10347120 201008055 A1* 42011 Low 10347120 201008055 A1* 42011 Low 1012733 2011008055 A1* 62012 Code 1012733 2011008055 A1* 62012 Code 1001 2733 20140078791 A1* 2010 God208 A1* 12013 Yu 10081 356 201407 7531 A1* 2014 Gardaanai 10074 108 2012 100 2015 Gardaanai 10074 108 2012 100 2015 Gardaanai 10074 108 20140078791 A1* 2015 Gardaanai 10074 108 20140078791 A1* 2016 Gardaanai 10074 108 20140078791 A1* 2015 Gardaanai 10074 108 20140078791 A1* 2016 Gardaanai 10074 108 20140078791 A1* 2015 Gardaanai 10074 108 20140078791 A1* 2015 Gardaanai 10074 108 2012 12 2015 Gardaanai 10074 108 20140078791 A1* 2015 Gardaanai 100	11023 50/10	(2016.01)	2007/0051712 A1*	3/2007	Kooken B23K 9/095
(2013.03): <i>H02M '208</i> (2013.01) 5000 50 References Cited 361.12 1.52.661 S (1979 7cii * 1979 7cii * 1989 7cii * 1000 302.12 4.45.965 Å * 71954 Falten 302.02 2011098056 Å1* 42011 Low 1021.1201 4.45.965 Å * 71954 Falten 302.02 2012.018757 Å1* 7010 Saxby 363.12 4.45.965 Å * 71954 Falten 1021.326 2012.018757 Å1* 7010 Saxby 363.12 5.121.314 Å * 61992 Cathell 1021.3156 2014.078791 Å1* 32014 Gardssaai 1020.1763 5.911.07 Å * 11999 Kooken 728.17 353.17 2015.0780.19 Å1* 32014 Gardssaai 1020.1740 5.911.07 Å * 11999 Kooken 1001.3350 2014.078791 Å1* 32014 Gardssaai 360.217.60 6.755.77 B.27 & 6.290 Dischman 1011.3870 2015.0780.19 Å1* 320.15 Myanchi = 1602.1760 367.164 7.388.761 B.1* 62098 Wang 10101.3370 2015.070639 Å1* 320.21 Mag 367.164 7.388.761 B.1* 62098 Wang 10101.3370 2014.070439Å Å1* 32007 367.164 7.388.761 B.1* 62098 Wang 10101.3370 383.117 1201.4707.034.84 Å1 32007 9.33581 B.2* 52016 Cauche 1011.3873 383.117 361.1707.01489Å Å1 32007	(2013.01); III23J 708 (2013.01) 5016 6) References Cited 20990201707 A1* 82009 Park 50069 Call 4,452,661 A* 51097 7cit 10017 7537 2011008058 A1* 42011 Low 100112205 4,461,957 A* 71984 Fabra 10018727 2012016057 A1* 72013 Sarby 501210 4,461,957 A* 71984 Fabra 10018727 2013018677 A1* 72013 Sarby 501107 741* 82009 Park 100112277 4,814,065 A* 31989 Pearsen 10018720 20130186707 A1* 72013 Sarby 20140078791 A1* 32014 Gardsami 100177538 5,212,144 A* (1992 Called III 10224 33376 303177 50211 G1* 12015 Yamagachi 100177538 6,735,776 132* 6/2000 Precisiona 10217075 303177 50210 Called S011 A1* 112015 Yamagachi 10017839 7,388,761 134* 6/2008 Wang 10021303766 JP 2026407753 A1 * 3200 With 1001 3830 307104 7,388,761 134* 6/2008 Wang 10021303766 JP 2026104189 A + 52029 307104 8010012207 A1* 8/2001 Nomaa 1002133376 JP 2026104189 A + 52029 307104 901012207 A1* 8/2001 Nomaa 303177 KK 1020207043494 A1 32207 30207 901012207 A1* 8/2001 Nomaa 303177 * cited by examiner <td>(52) U.S. CI. CPC</td> <td></td> <td>2007/0133239 A1*</td> <td>6/2007</td> <td>219/130.1 Tanaka</td>	(52) U.S. CI. CPC		2007/0133239 A1*	6/2007	219/130.1 Tanaka
56) References Cited 103/12 U.S. PATLEYT DOCUMENTS 2010/00/26 AI * 4/2011 2010/26 AI *	 Bergenerse Cited U.S. PATINET DOCUMENTS 4.152.661 A * 51999 7eix BORT 708 4.61.93 A * 71984 Fulter 1003 10370 4.739.461 A * 41985 Konatan 1003 13570 4.739.461 A * 41985 Konatan 1003 13570 5.121.144 A * 61992 Cabell 1004 1303 6.759.76 132 * 62004 Packines 1001 1370 7.308.761 B * 62004 Packines 1001 1370 7.308.761 B * 62004 Packines 1001 1370 1001 1370 1001 1009 Koskan 1001 1000 Koskan		(2013.01); 1102M 7/08 (2013.01)	2000:0201505 +1#	8:3000	363/65
U.S. PATENT DOCUMENTS 4.4126161 A * 5/1979 Zeis HOLK 708 4.461987 A * 7/1946 Falton 102/15/03 4.461987 A * 7/1946 Falton 102/15/03 4.739.461 A * 4/1988 Komain 102/15/33 4.739.461 A * 4/1988 Komain 102/15/33 5.121.314 A * 6/1992 Cahell 1102/15/37 5.91.160 A * 111999 Kooken 2021/2025 6.025.412 A 22020 Breckman 2021/2025 7.388.761 B1 * 6/2028 Warg 1101/13716 6.755.778 B2 * 6/2004 Pedision 1101/13716 9.353.877 R2 * 5/2016 Cuadra 1010/13716 9.353.877 R2 * 5/2016 Cuadra 1010/13716 9.353.877 R2 * 5/2016 Cuadra 1010/13716 9.353.877 R2 * 5/2016 Cuadra 1010/13716 8.2011 Normana 102/15/177 9.353.877 R2 * 5/2016 Normana 102/17/177 9.353.877 R2 * 5/2016 Normana 102/17/177 9.353.87	U.S. PATENT DOCUMENTS 4.152.661 A * 51079 Zeit	(56)	References Cited	2009/0201707 /41-	8 2009	363/126
4.152.661 A * 5/1979 7eit HOK 708 4.461.957 A * 7/1984 Fabra 1003/17.55 3.0770 4.79.461 A * 4/1985 Koman 1023/37 4.79.461 A * 4/1985 Koman 1023/37 4.79.461 A * 4/1985 Koman 1023/37 4.81.4985 A * 3/1989 Patersen 1023/37 5.121.134 A * (2012) Cuda 1010/37/391 A1 * 32014 Gardasati 11020/37/387 5.091.169 A * 11/1999 Kosken 1233/07 6.625.475 A2 * 62002 Chelle 11020/37/317 5.091.169 A * 11/1999 Kosken 1233/07 6.625.475 A2 * 62002 Patersen 1011/37/387 30100 6.625.471 A * 22000 Bockman 1011/37/387 30100 6.625.471 A * 22000 Bockman 1011/37/387 30100 6.755.76 B2 * 62004 Pathies 10101/37/387 30100 6.755.76 B2 * 62004 Pathies 10101/37/387 303177 4.79.2001 Norman 10101/37/387 303177 4.79.2001 Norman 1022/37/37 4.70.20714594 A1 3/2007 * cited by examiner	4.152.661 A * \$1979 7eit 4.461.987 A * 71984 Fabre 100.2757 4.739.461 A * 41988 Komanu 100.2757 4.739.461 A * 41988 Komanu 100.2757 4.739.461 A * 41988 Komanu 100.2757 5.31989 Patersen 100.2757 5.321.143 A * 2.2000 Reckman 100.2757 5.391.169 A * 111999 Kooken 122017 FS 6.628.413 A * 2.2000 Reckman 100.1757 5.391.169 A * 111999 Kooken 100.1757 5.391.169 A * 11199 Kooken 100.1757 5.391.160 A * 11199 Kooken 100.1757 7.500 A * 11190 A * 2000 Kooken 100.1757 7.500 A * 100 A * 100.1757 7.500 A * 100	U.S.	PATENT DOCUMENTS	2011/0080056 A1*	4/2011	Low
Add.1987 71984 Futon 330/32 2013/010/617 A1* 72013 Sodely 6018/2160 4,461.987 4 71984 Futon 100/7163 318/750 2013/000/208 A1* 11/2013 Yu 1040 356 4,759,461 A 4/1988 Komana 100/7164 318/750 2013/000/208 A1* 11/2013 Yu 1040 356 4,314.966 A 310/80 2014/0078711 A1* 32014 Garcular 100/7163 307/104 2015 Solution 100/7163 2015 Solution 307/104 2014 Solution 307/104 2014/078	4,61.037 A 71984 Fulton 100/17/525 4,759,461 A 41984 7567 2013.0306208 A1* 112013 Yu 104013/525 4,759,461 A 41985 Komana 100/17/525 2013.0306208 A1* 112013 Yu 104013/525 4,8144.05 A 31989 Pearsen 100/17/104 2014.0078791 A1* 32014 Goradami 100/17/104 5,121.134 A 6 1992 Cathell 10220.33737 2015.007809 A1* 12015 Yanagachi 100/17/104 5,991.109 K 101999 Kooka 10217.05 307/104 2015.007809 A1* 12015 Yanagachi 100/17/104 307/104 6,755.76 13.2* C3000 Bockama 100/17/103 2015.007805 A 4/2012 2015.00785 A 7.0066 307/104 307/104 307/104 307/104 307/104 307/104 307/104 307/104 307/104 307/104 307/104	4 152 661 A #	\$1070 Zaie H03F 7/08	2012/0140525 AI*	6/2012	Cuadra 11011 27/324
4.402.06 A 4.1988 Kenamin 100.10.25 3341127 4.759.461 A 4.1988 Kenamin 100.11.356 201.13030228 A1* 11.2013 Ya 11.0013 Ya 3.814.965 A 3.1986 100.11.3156 201.40078791 A1* 3.2014 Gareadsani 11002.15.03 5.121.314 A 6.1982 Cashell 1100.01 Y176 2015.007.8019 A1* 3.2014 Gareadsani 1102.11.60 5.921.108 A 111999 Kenken B.221.9105 36317 5.021.112 3.021.02 3.015 3015.007.8019 A1* 3.2015 Maynechi 1102.11.102 6.022.413 A 2.20200 Brochmann 2.20201 Brochmann 307.114 6.023.413 A 2.20200 Brochmann 2.201.117.92 P 202.633358 A 2.4012 7.388.761 B1* 6.2028 Warg 102.113874 P 202.637358 A 2.5029 202.933838 A 2.5029 9.335.871 R2* 5.2001 Norman 100.113714 YK 10.200.04639 A 3.52007 9.01012207 A1* 8.2001 Norman 100.01.3714 YK 10.200.04594 A 3.52007 9.335.871 R2* 5.2001 Norman	4,10244 A 1029 1008 1002410.55 334112 4,739,461 A 41958 600843738 2013030208 A1* 112013 Yu 10031356 4,814056 A 31989 Petersen 10031356 2014097591 A1* 3204 Garodsanai 1003155 5,121,314 A 6 (192) Cashell 10231127 2015(037609) A1* 32015 Myanchi 10231 (103) 55337 5,91,169 A 111999 Rookan D210176 2015(037609) A1* 32015 Myanchi 10201 (103) 55337 6,028,413 A 22000 Brockanan 10207 015 2015(037601) A1* 11/2015 Nanagachi H2211710 6,028,413 A 22000 Brockanan 10017075 D2 Potersen 10017076 5,755.76 324* 6204 Potersen 10017076 Potersen 10217108 7,538.76 124* 6209 Potersen 10017076 Potersen 201207 9,330,871 12* 5206 1007878 7/2006 Potersen 3/2007 9,330,871 12* 52061 Nomana	4461.097	330/202	2013/0187637 A1*	7/2013	Saxby
4,479,461 A * 41938; Komana (2001) 4,314,965 A * 31939 Deteren (2001) 5,312134 A * (2192 Cablel III02M 3317 5,391,169 A * 111999 Kooken (2001) 6,6225,415 A * 22000 Biocleman (2001) 6,75576 B2* 6,2004 Pleklines (2001) 7,388,767 B2* 6,2004 Pleklines (2001) 7,388,777 B2* 6,2004 Pleklines (2001) 7,388,777 B2* 6,2004 Pleklines (2001) 7,388,778 B2* 6,2004 Pleklines (2001) 7,387,778 Pleklines (2001) 7,387,778 Pleklines (2001) 7,397,778 Pleklines (2	4,279,461 A * 41938 Komana (MOM 328) 307.104 4,814,065 A * 31989 Patersen (NOM 370,104) 2014/0078791 A1* 32014 Garadasani (MOM 72837) 5,321,114 A * 11999 Kooken (2012) 1002 A3376 5,391,169 A * 111999 Kooken (2012) 2015/078019 A1* 32015 Myanchi (MOM 72837) 6,028,413 A * 2,2000 Breckmann (2017) 2019 17 85 6,028,413 A * 2,2000 Breckmann (2017) 2019 17 85 6,756,761 82* 6/304 Petkinsen (1001) 3530 307.104 7,388,761 81* 6/2004 Petkinsen (1001) 35376 JP 2026-107158 A 7.2009 9,30,837 12* 5/2016 Cuade (1001) 78374 303.17 90,10012207 A1* 8/2001 Norman (1001,4007) 303.17 9,30,837 12* 5/2016 Cuade (1001,41874) WO 2000 14394 A1 3.2007 9,30,837 12* 5/2016 Norman (102,407354) * cited by esaminer	4,461.987 A *	102M 7/525 318/729	2013/0300208 AI*	11/2013	324/127 Yu
4,814.065 A * 31080 Peteron 100X/33350 5,121.314 A * 6/1992 Cathell 10223/3375 5,991.160 A * 111099 Koken 2017 00 6,756.776 132 * 6/2004 Petkinsen 1001/3780 7,988.761 11* 6/2008 Wang 1002/37856 7,988.761 11* 6/2008 Wang 1002/37876 7,988.761 11* 6/2008 Wang 1002/37876 7,987.761 11* 6/2008 Wang 1002/37876 7,987.771 11* 7,2006 1002/3777 7,0006 1002/277 11* 3/2007 1002/377 7,0006 1000/2007 11* 3/2007 1000/2007 11* 1000/2007 1000/2	4.84465 A * 31989 Peteren	4,739,461 A *	4/1988 Komatsu	2014/2017/201	2001	307/104
5,121,314 A * 61992 Cahell IIIOMY5776 2015 007309 A1* 32015 Myanchi IIOMY5776 5,091,108 A * 111999 Kooken 2021 703 2015 0036031 A1* 112015 Yanagachi H021 7160 6,023,413 A * 22000 Brockman 2021 703 2015 0036031 A1* 112015 Yanagachi H021 7160 6,023,413 A * 22000 Brockman 2011 700 2015 0036031 A1* 112015 Yanagachi H021 7160 6,025,413 A * 22000 Brockman 2011 700 2011 700 FOREIGN PATTENT DOCUMENTS 6,755,76 B * 62004 Pediasen 1011 1370 JP 2021-03358 A 4.002 9,353,837 B * 6 52001 00233376 JP 2021-03358 A 4.002 9,353,837 B * 2001 Nomana 1001 13814 W0 2007 045894 A1 3.2007 901 0012207 A1* 8 2001 Nomana 1001 13814 W0 2007 045894 A1 3.2007	5,121,314 A * 6/1992 Calledl 10231 (21)7 33317 32015 Myanchi 110211 (20) 32015 Myanchi 11021 (20) 32015 11011 (20) 32015 11011 (20) 32016 11011 (20) 32015 11011 (20) 32016 11011 (20	4,814,965 A *	3/1989 Petersen	2014/00/8/91 AI*	3:2014	363/37
 5.991.169 A * 11/1999 Keoken201/1706 201017025 6.052.413 A * 2/2000 Buschmann1021/7025 6.756.776 B2* 6/2004 Perkinsen1011/153/30 7.9387.61 B1* 6/2004 Perkinsen10101/33/30 9.305.81 B2* 5/2016 Cuade10101/33/30 9.201/012207 A1* 8/2001 Nomana102/M3/3054 * cited by examiner 	5.991,169 A * 111999 Kooken2017170 2017176 6.028.41 A * 2.2000 Breckmann1017.05 6.755.776 B2* 6.2004 Petkinen101138/30 7.388.761 B2* 6.2004 Wag102X.33376 9.330.837 B2* 5.2016 Cuada102X.33376 9.001.02207 A1* 8.2001 Norman102M.375817 8.83107 * cited by examiner * cited by examiner	5,121.314 A *	6/1992 Cathell H02M 3/3376	2015/0078039 A1*	3/2015	Miyauchi H02M 1/08 363/21.12
6,228.413 A * 2/2006 Breckmans100.70.15 6,756.776 B2* 6/2004 Pekkinea1011 38.20 7,388.761 B1* 6/2008 Wang1011 38.20 7,388.761 B1* 6/2008 Wang1020 32.576 9,230.871 B2* 5/2016 Cualma101 33.576 2001.0012207 A1* 5/2001 Nomara1021 33.589 2001.0012207 A1* 5/2001 Nomara1021 33.589 3.63/17 * clied by examiner	6,028,413 A * 2/2000 Brockmann101171 PS FOREIGIN PATTINI DOCUMENTS 6,755,776 132* 6,2004 Pedkinee101113870 J2 / P 2006-107758 A 7/2006 7,358,761 J31* 6,2008 Wang1020 J3315 0 / P 2012-078356 A 4 2013 3,030,817 J32* 5,2016 Cuede1010 J3354 W 0 2007.034894 A1 5/2007 3,030,817 J32* 5/2016 Cuede1010 J3354 W 0 2007.034894 A1 5/2007 3,031/17 * clied by examiner * clied by examiner	5,991,169 A *	363/17 11/1999 Kooken B23K 9/1056	2015/0326031 AT*	11/2015	Yamaguchi H02J 17/00
6,756,776 B2* 6/2004 Perkinsea	6,756,776 B2 6'2004 Petkinsen 100113830 JP 0206040758 7,7066 7,388,761 B4 6'2008 Wang 1001138376 JP 0206/0758 A 42012 7,388,761 B4 6'2008 Wang 1001138376 JP 0202/073858 A 42012 9,330,837 B2 5'2016 Cudera 1001138374 WO 2007/004690 A 5'2000 9,330,837 B2 5'2016 Cudera 1001138374 WO 2007/014894 A1 3/2007 9,010012207 A1* 8/2001 Nomma H00X MO 3/3/17 * cited by examiner	6,028,413 A *	2/2000 Brockmann			307-104
7,388.761 B1* 6/2008 Wang	1201126 JP 2066-107788 A 7/2066 9,30837182* 5/2016 Cunda 1002M.3357 FR 10-2079-406449 A 4/2012 9,30837182* 5/2016 Cunda 1002M.3357 KR 10-2079-406449 A 5/2009 9010012207 A1* 8/2001 Nomaa H02M.33287 WO 20070-406449 A 3/2007 9010012207 A1* 8/2001 Nomaa H02M.33287 * cited by examiner *	6,756,776 132*	320/108 6/2004 Perkinson	FOREIG	IN PATE	INT DOCUMENTS
353.03 BC 55206 Cundr 100173414 WO 2007045894 \$52007 2001/0012207 A1* \$5201 Nomana 1002/1373589 * cited by examiner 363/17 * cited by examiner * cited by examiner *	30317 KR 10-2009-064-693 Å 52009 303047 KR 10-2009-064-693 Å 52009 2001-0012207 Å1* \$2001 1007 Fill WO 2007 2001-0012207 Å1* \$2001 Nomara 1007 # cited by examiner	7 388 761 181 *	6/2008 Wang 102M 3/33576	JP 2006-197 IP 2012-075	7758 A	7/2006
20010012257 At \$ 52001 Nomara	20010012207 A1* \$2000 NomaaH02M 30359 W0 200704394 A1 32007 3031/7 * cited by examiner	0.330.937 13.8	363/17 1/2016 Conde	KR 10-2009-0040	6439 A	5/2009
363/17 * cited by examiner	363/17 * cited by examiner	2001/0012207 A1*	8/2001 Nomura	WO 2007/034	4894 A1	3/2007

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2. Ferraris Research efforts

Paper title	Academic conference / Journal	Co-auther
Magnetic energy harvesting from traction return current in railway system	Korea Metropolitan Railway Association (2018 Autumn Conference)	Jay(JA-IL) Koo, Bumjin Park, Chan Joon Park, Ok-Hyoun Jung, Seungyoung Ahn
Analytic Computation of Power Line Voltage Drop Produced by Magnetic Energy Harvesting Device	INTERMAG 2018 (Academic conference)	Jay(JA-IL) Koo, Kibeom Kim, Bumjin Park, Jedok Kim, Seungyoung Ahn
A 1.14 kW Magnetic Energy Harvesting Near Power Line by Considering Saturation Effect	EVS31 & EVTeC 2018 (Academic conference)	Jay(JA-IL) Koo, Bumjin Park, Dongwook Kim, Jaehyoung Park, Yujun Shin, Seung young Ahn, Okhyun Jeong
Design of Toroidal Core for Magnetic Energy Harvester near Power Line Considering Saturation	Joint IEEE & APEMC 2018 (Academic conference)	Jay(JA-IL) Koo, Bumjin Park, Dongwook Kim, Jaehyoung Park, Yujun Shin, Seung young Ahn
Design of magnetic energy harvesting core using saturation effect	Electronic Society of Korea (2018 Summer Conference)	Jay(JA-IL) Koo, Bumjin Park, Dong Wook Kim, Jae Hyung Park, Yujun Shin, Chan J oon Park, Ok-Hyoun Jung, Seungyoung A hn
Application of magnetic field energy harvesting near power line for maintenance sensors in railway system	Korea Metropolitan Railway Association (2018 Spring Conference)	Jay(JA-IL) Koo, Bumjin Park, Yujun Shin, Jaehyoung Park, Jong-Kew Won, Ki Hyun g Kim, Seungyoung Ahn
Optimization Design of Toroidal Core for Magnetic Energy Harvesting Near Power Line by Considering Saturation Effect	AIP Advances 8 (2018 Journal)	Jay(JA-IL) Koo, Bumjin Park, Dongwook Kim, Jaehyoung Park, Kibeom Kim, Hyun Ho Park, Seungyoung Ahn
Design methodology of toroidal core for magnetic energy harvesting based on magnetic field dependence of permeability near power line	MMM 2017 (Academic conference)	Jay(JA-IL) Koo, Bunjin Park, Dongwook Kim, Jaehyoung Park, Hyunho Park, Seun gyoung Ahn
Study on the CT-based wide range current detection system combined with contactless power	Korea Institute of Lighting & Electrical Equipment(2016 Spring Conference)	Jay(JA-IL) Koo, Jong-Kew Won, Dong-Kw an Seo, Jin-Ouk Kim, Hwa-Young Kim, Ok-Hyoun Jung

Joint IEEE & APEMC 2018 Design of Toroidal Core for Magnetic Energy Harvester near Power Line Considering Saturation



V. Spec sheets of Ferraris Tolenoid C[®] products

Tolenoid C[®] (Contactless power supply)



Under 1.30 inches



Line thickness Under 2.48 inches



Split form factor

Tolenoid C® (1.30 / 2.48 inches)

- Tolenoid C[®] convert magnetic energy around power line into electric power form for various electric devices.
- Tolenoid C[®] can be installed into power lines regardless of its voltage such as high voltage distribution lines, underground lines as a form factor of splitable one which make them possible easy install Tolenoid C[®].
- Tolenoid C[®] can save electric device installation cost and time compare to conventional way which requires transformer and complex wiring process for 110 or 220Vac power line.
- Maximize efficiency of induction electricity generation by effective Core design and manufacturing process from Ferraris technology.
- Secure electric power energy generation from 10 ~ 650 Ampere power line.
- Water proof case design. (IP65 ~ IP68)
- Electric power generation capacity depends on the current of the primary power line and this can be controlled Ferraris designed SMPS type.

Specifications	Under 1.30 "	Under 2.48 "	
Primary power line current (A)	10 ~ 650 A		
Primary power line voltage (V)	~ 30	D kV	
Primary power line wire thickness (inches)	~ 1.30	~ 2.48	
Output current type	AC output		
Working temperature (°F)	- 40 ~ 185		
Waterproof (IP)	IP 65 ~ 68 (KS C IEC 60529)		
Size (W*D*H inches)	5.12 * 3.94* 4.33	6.69 * 3.94 * 5.90	
Weight (Ib)	4.70 7.05		
Case material PC GF 20			

SMPS (Switching mode power supply)

Input : connector to multi-adapter



Output : connector to system



SMPS (12V 20W / 60W)

- SMPS block is a semiconductor based circuit board which convert AC input from Tolenoid C[®] into to a DC output for the user requirement or multi-adapter for multiple Tolenoid C[®].
- Ferraris SMPS block is basically composed of two component. Incoming AC signal is converting into DC signal by regulator sub-block and this DC signal is smooth by advanced SMPS block for stable DC output.
- · Ferraris SMPS block has the following features.
 - 1) Preventing overvoltage, overcurrent, overload feature
 - 2) Line regulation less than 1%
 - 3) Control maximum output controllability
 - 4) Incoming input controllability
- Available IP65 to IP68 case design available.
- Scalable power output capacity is possible depending on customer need.

Specifications	12V/20W	24V/60W	
Input	Output of Tolenoid C [®]		
Output	DC 12V/20W	DC 24V/60W	
Working temperature (°F)	- 40 ~ 185		
Waterproof (IP)	IP 65 ~ 68 (KS C IEC 60529)		
Size (W*D*H inches)	3.54 * 5.51 * 2.36		
Weight (Ib)	1.87		
Case material	Case material PC GF 20		

Multi-adapter





Multi-adapter

- Multi-adapter is a sub-block tool that allows multiple Tolenoid C[®] to be connected and operated.
- This one make system allow output power scalability, such as increasing power from 10 to 40Watt and also reducing the required minimum current of power line for Tolenoid C[®] power generation.
- The multi-adapter has four Tolenoid C[®] connectors and one for each SMPS and Separator.
- For the future usage, Tolenoid C[®] connectors can be added more, such as up to eight.
- Deliver generated power from these multiple Tolenoid C[®] to SMPS block.
- Separator is for safe installing and disassembling Tolenoid C[®] to SMPS block. This is mandatory one for safety.
- You can switch on and off each Tolenoid C[®] by pressing switch even if you connect them up to multiple Tolenoid C[®].

Tolenoid C [®]	Up to 4ea
Separator	For installation/de-installation
SMPS	SMPS connections based on desired voltage and output
Working temperature (°F)	- 40 ~ 185
Waterproof (IP)	IP 65 ~ 68 (KS C IEC 60529)
Size (W*D*H inches)	7.09 * 3.94 * 1.77
Weight (lb)	2.09
Case material	PC GF 20

Separator



Separator

- The Separator is tool for safe installation or de-installation of Tolenoid C[®] at active power line without shutting down power line.
- The Separator make it possible of demagnetization of Tolenoid C[®] occurred when the Tolenoid C[®] is installed in the magnetic field around the active power line.
- Install or de-installation using physical force or other equipment without the Separator causes a safety problems such as finger jammed in between and there is a risk of injury by cutting surface of the core.
- With Separator on, you can install or de-install Tolenoid C[®] at active power line without physical force or other big tools.
- Be sure to sue the designated Separator for Tolenoid C[®] check product serial numbers.



Specifications				
Working temperature (°F)	- 40 ~ 185			
Waterproof (IP)	IP 40 (KS C IEC 60529)			
Size (W*D*H inches)	1.93 * 2.60 * 1.50			
Weight (Ib)	0.29			
Case material	Plastic			

 Multi-adapter connection terminal • Cable and Connector - Obtain UL & CUL Certification, Waterproof test pass - IP 68



Cable

Internal wiring of electrical electronic equipment

Cable Connector

- #1 Connector connected to cable
- male & female pin (screw type, solder)

Output Connector







#1

	Max4.0	-
<u></u>	MM	- 10
NA.	MM H	62
15	48	

- #2 Tolenoid C[®], Multi-adapter output connector, panel mount & female pin (lock bayonet type, solder)
- #3 SMPS output Connector, rear panel mount & male (screw type, solder)

Input Connector

• #4 Multi-Adapter, SMPS input connector, panel mount & male pin (screw type, solder)

Interface Cables				
Rated	(UL) 221°F 300V			
Insulation vessel	UL 1007, UL 1061 Type			
Flammability	VW-1, FT-1 Satisfied			
Application specification	UL Subject 758, 1581 CSA C22.2 No. 210			
Cable C	Connector			
Panel thickness (inches)	0.138 ~ 0.268 inches			
Environmental protection	IP 67 or 68 (IEC 60529)			
Mechanical life	500 Mating cycles			
Operating temperature (°F)	- 49 ~ 221			
Voltage rating	110 V			
Rated current (104 °F)	5 A			
Output	Connector			
Panel thickness (inches)	Max 0.196 inches			
Environmental protection	IP 67 or 68 (IEC 60529)			
Mechanical life	500 Mating cycles			
Operating temperature (°F)	- 49 ~ 221			
Voltage rating	30 ~ 300 V			
Rated current (104 °F)	2 ~ 10 A			
Input C	Connector			
Panel thickness (inches)	Max 0.157 inches			
Environmental protection	IP 67 or 68 (IEC 60529)			
Mechanical life	500 Mating cycles			
Operating temperature (°F)	221			
Voltage rating	30 ~ 300 V			
Rated current (104 °F)	2 ~ 10 A			

(FERRARIS INC.



Electric energy is Electromagnetic energy, Our approach to a new paradigm of efficient electric power generation and recycling !

If there are any questions, please feel free to contact us as below,

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