ERG-5000
Installation manual

ECO

Industrial

Energy Recycle

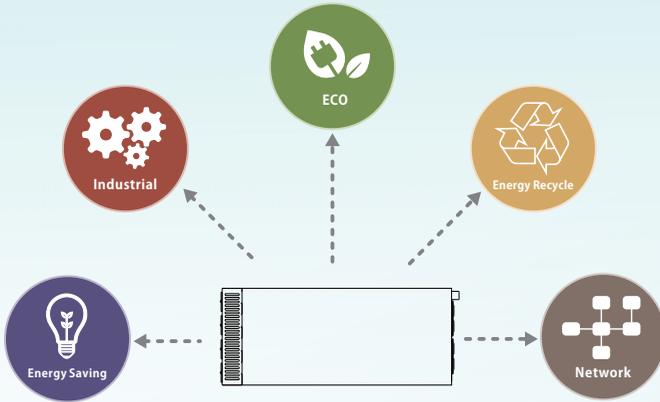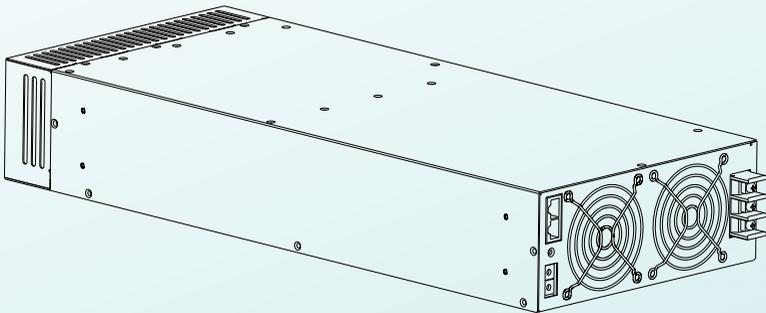Energy Saving

Network

4 Channels 5KW Energy Recycling Grid Type Power Inverter

ERG-5000 series is a grid-tied energy recycling power inverter that supports 5KW rated and maximum up to 6KW input, It can achieve high efficiency up to 91%. CC and CV modes selectable and 4 input channels design that can be used independently or connected in series or parallel offer flexible combinations for various applications. Moreover, the ERG-5000 series also provide remote control and monitoring functions by using CMU2A or the CANBus protocol for data analysis and remote monitor. ERG-5000 supports 10~60VDC input voltage & ERG-5000H supports 60~420VDC input voltage.
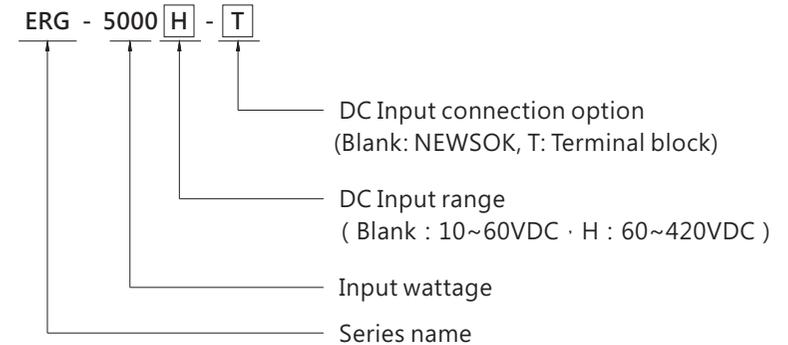
Contents

1.Safety Guidelines

- ■ Risk of electrical shock and energy hazard, all failure should be examined by a qualified technician. Please do not remove the case from the inverter by yourself.
- ■ Please do not install the inverter in places with high moisture, high ambient temperature or under direct sunlight.
- ■ Fans and ventilation holes must be kept free from any obstructions. At least 15 cm clearance must be kept when the adjacent device is a heat source.
- ■ Please do not stack any object on the unit.
- ■ The safety protection level of this unit is class I. The "Frame Ground" (⏚) of the unit must be well connected to PE (Protective Earth).

2.Introduction

2.1 Model Encoding

ERG - 5000 H - T

DC Input connection option
(Blank: NEWSOK, T: Terminal block)

DC Input range
(Blank : 10~60VDC · H : 60~420VDC)

Input wattage

Series name

2.2 Features

- ● Wide input voltage range 10~60VDC / 60~420VDC by models
- ● High efficiency up to 91%
- ● Modular design for flexible configuration
- ● Flexible CC/CV operation modes
- ● Remote control and monitoring by CANBus protocol via CMU2A control console
- ● Maximum 64 units of ERG-5000 series that can be connected on the same bus
- ● Protections: Over voltage / Under voltage / Over temperature /Over power / Grid fault / Communication error
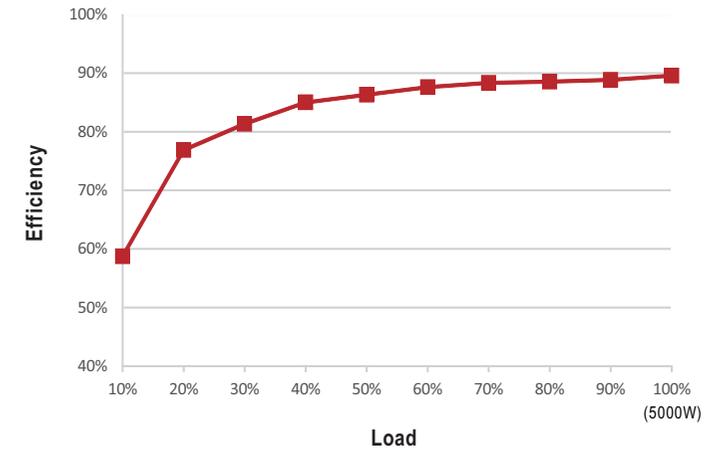
2.3 Specification

MODEL		ERG-5000	ERG-5000H
DC INPUT	**RATED INPUT POWER (Typ.)**	5000W (1250W*4CH)	5000W (1250W*4CH)
	MAX. INPUT POWER (Typ.)(Note.2)	6000W (1500W*4CH)	6000W (1500W*4CH)
	INPUT VOLTAGE RANGE	10 ~ 60VDC	60 ~ 420VDC
	RATED INPUT CURRENT (Typ.)	105A*4CH	21A*4CH
	MAX. INPUT CURRENT (Typ.)	125A*4CH	25A*4CH
AC OUTPUT	**RATED OUTPUT POWER (Typ.)**	2600 ~ 4320VA (For input 10 ~ 12VDC) 4320 ~ 4400VA (For input 12 ~ 60VDC)	4500 ~ 4600VA (For input 60 ~ 420VDC)
	AC VOLTAGE RANGE	180 ~ 264±5VAC, single phase	
	AC GRID FREQUENCY	47 ~ 63Hz	
	MAX. OUTPUT CURRENT (Typ.)	24A/230VAC	
	POWER FACTOR (AT RATED POWER)	>0.97	
	THD(AT RATED POWER) (Typ.)	<5%	
	EFFICIENCY (Typ.)	88%@48VDC input/5000W	91%@380VDC input/5000W
	ENERGY RECYCLING RATIO (Typ.)	80%@48VDC input/5000W (power supply efficiency≧90.5%)	88%@380VDC input/5000W (power supply efficiency≧96.5%)
		Please refer to energy recycling ratio for more detail	
PROTECTION	**OVER TEMPERATURE**	Shuts down AC output voltage, reset after fault condition removed	
	DC INPUT OVER VOLTAGE	Shuts down AC output voltage, reset after fault condition removed	
	DC INPUT UNDER VOLTAGE	Shuts down AC output voltage, reset after fault condition removed	
	GRID FAULT (Note.3)	Shuts down AC output voltage, reset after fault condition removed	
	COMMUNICATION ERROR	Shuts down AC output voltage after communication is failed for 4s. Reset after communication is re-built	
	OVER POWER	Constant power limiting at MAX input power	
FUNCTION	**COMMUNICATION INTERFACE**	CANBus, Baud Rate 250k bps (Maximum 64 units ERG-5000 series)	
	CC/CV MODE SELECT (Note.4)	CONSTANT CURRENT (CC) : 0.5~125A(±1%) / per. channel	CONSTANT CURRENT (CC) : 0.1~25A(±1%) / per. channel
		CONSTANT VOLTAGE (CV) : 10~60VDC (±1%)	CONSTANT VOLTAGE (CV) : 60~420VDC (±1%)
	PARALLEL	Please refer to function manual and user manual for more detail	
ENVIRONMENT	**WORKING TEMP.**	-20 ~ +60℃	
	WORKING HUMIDITY	20% ~ 90% RH non-condensing	
	STORAGE TEMP.,HUMIDITY	-40 ~ +85℃, 10 ~ 95% RH	
	VIBRATION	10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes	
SAFETY & EMC (Note 6)	**SAFETY STANDARDS**	BS EN/EN62368-1 approved	
	WITHSTAND VOLTAGE	I/P-O/P:4KVDC I/P-FG:2.5KVDC O/P-FG:2.5KVDC	I/P-O/P:2.5KVDC I/P-FG:2.5KVDC O/P-FG:2.5KVDC
		I/P: DC input, O/P: AC output (Communiction port JK1 excluded)	
	EMC EMISSION Note.5	Compliance to BS EN/EN55032 (CISPR32) Class A	
	EMC IMMUNITY Note.5	Compliance to BS EN/EN55035, BS EN/EN61000-4-2,3,4,5,6 light industry level, criteria A	
OTHERS	**MTBF**	ERG-5000: 148.8K hrs min. Telcordia SR-332 (Bellcore) ; 15K hrs min. MIL-HDBK-217F (25℃) ERG-5000H: 172K hrs min. Telcordia SR-332 (Bellcore) ; 19.5K hrs min. MIL-HDBK-217F (25℃)	
	COOLING	Internal fan cooling	
	DIMENSION	ERG-5000: 504*211*83.5mm(L*W*H) ERG-5000-T: 460*211*83.5mm(L*W*H)	
	PACKING	ERG-5000: 12Kg; 1pcs/12Kg/0.86CUFT ERG-5000-T: Kg; 1pcs/ Kg/ CUFT	
NOTE		1.All parameters NOT specially mentioned are measured at 230VAC output,48VDC input (ERG-5000),380VDC input(ERG-5000H), rated input power and 25℃ of ambient temporature. 2.It achieves max input power up to 6000W, auto derating to rated power by ambient temperature increasing , OTP occurs when the internal temperature exceeds the limit. 3.Grid Fault:Includes AC output over voltage protection and under voltage protection. 4.Tolerances are calculated based on MAX input current and MAX input voltage. Tolerances may increase during high and low ambient temperature operation. 5.Guidance of additional filter, please refer to user manual for more detail. 6.The power supply is considered a component which will be installed into a final equipment. All the EMC tests are been executed by mounting the unit on a 900mm*1300mm metal plate with 2mm of thickness. The final equipment must be re-confirmed that it still meets EMC directives. For guidance on how to perform these EMC tests, please refer to "EMI testing of component power supplies." (as available on https://www.meanwell.com//Upload/PDF/EMI_statement_en.pdf) ※ Product Liability Disclaimer：For detailed information, please refer to https://www.meanwell.com/serviceDisclaimer.aspx	

2.4 Efficiency versus Load

※ ERG-5000

Efficiency measured at 48VDC input and 25℃ of ambient temperature

※ ERG-5000H

Efficiency measured at 380VDC input and 25℃ of ambient temperature
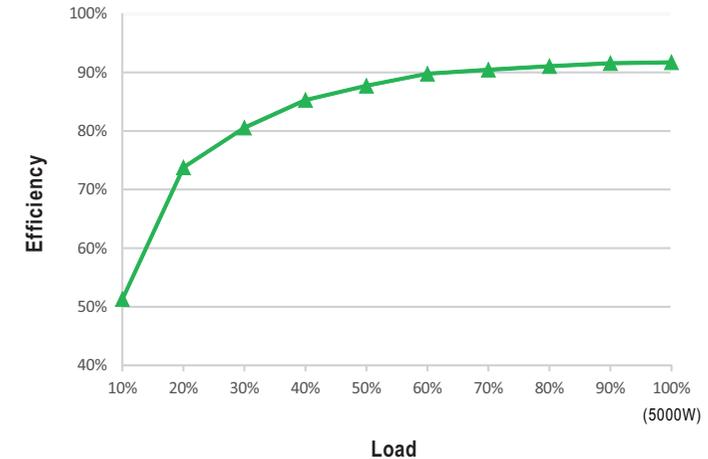
※ Energy recycling ratio = Efficiency 1 (power supply) x Efficiency 2 (ERG-5000 series)

2.5 Static Characteristics

※ERG-5000

(5000W) 100

Input Power (%)

80

60

40

10 12　20　25　30　35　40　45　50　55　60

Input voltage (VDC)

※ERG-5000H

(5000W) 100

Input Power (%)

80

60

40

60　95　130　165　195　225　255　285　320　355　420

Input voltage (VDC)
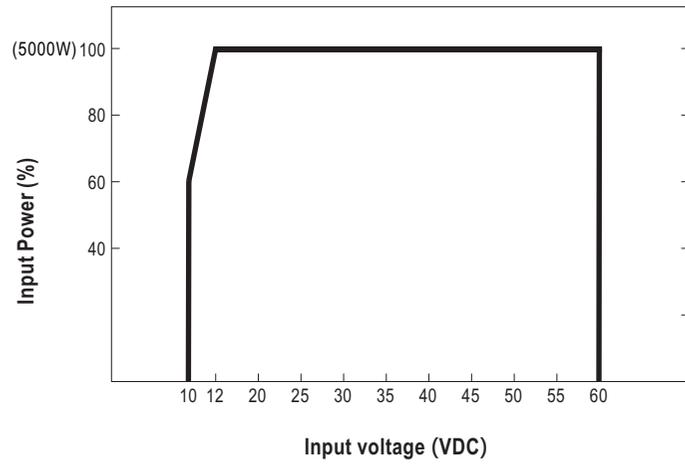
2.6 Mechanical specification

Unit:mm

3.Installation & Wiring

3.1 Precautions

- Please make sure the system chassis has sufficient strength to carry the unit.
- In order to ensure the lifespan of the unit, you should refrain from operating the unit in environment of high dust or moisture.
- The energy recycling inverter is designed with built-in DC fans, please make sure the ventilation is not blocked. There should be no barriers within 15cm of the ventilating.

3.2 Installation Procedures

1. Choose the right and suitable cable size for connection between the DC input of the ERG-5000 and the output of the power supplies that are desired to be burn-in. Please refer to "3.3 DC Cable Size Selection".
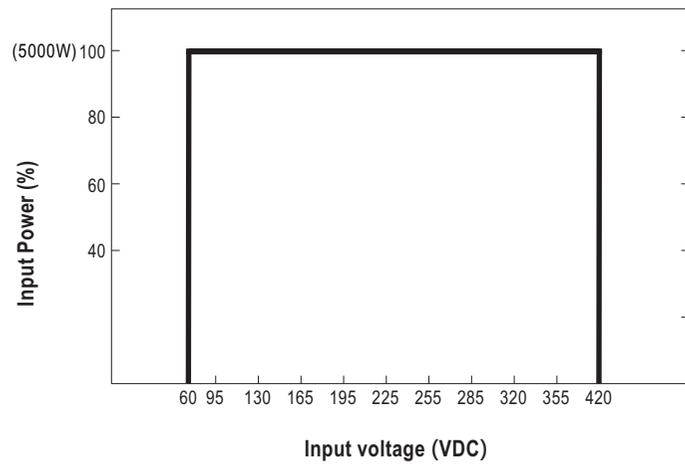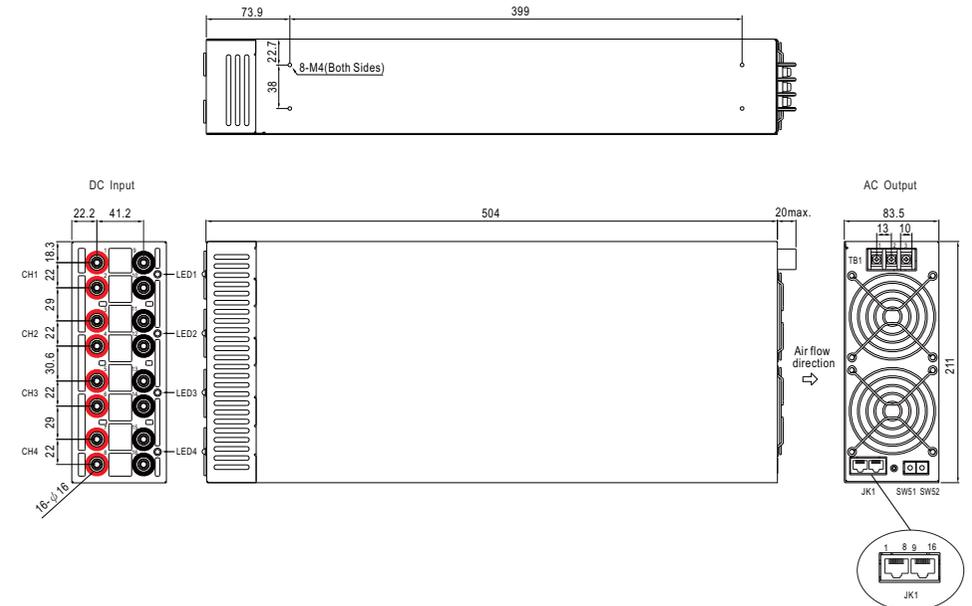2. Connect the DC positive polarity of the supply to the positive of the DC input and connect the DC negative polarity of the supply to the negative of the DC input. Make sure there is no reverse polarity or short-circuit on the connection. There are up to 3 different connections available, please refer to 3.2.1.
3. Connect the inverter to the AC grid, FG to the earth, AC/N to the neutral and AC/L to the live.

NOTE: The inverter is single-phase AC input/output. Please pay attention to the wiring when connecting the unit to a three-phase system.
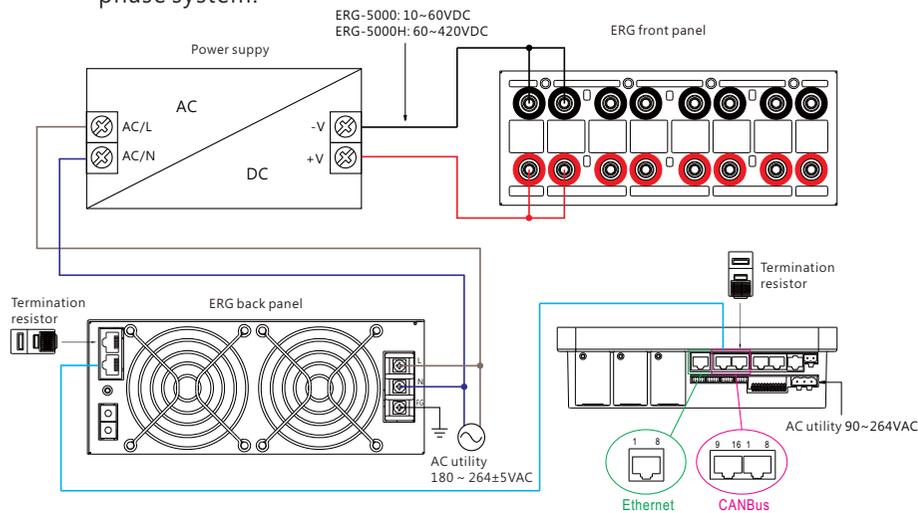
NOTE: After connecting the communication cable, install termination resistors to the remaining sockets of both the ERG-5000 series and CMU2A to prevent signal reflections.

3.2.1 Front Panel Connection Diagram

(1) Parallel application
- Single ERG: 4 channels in parallel
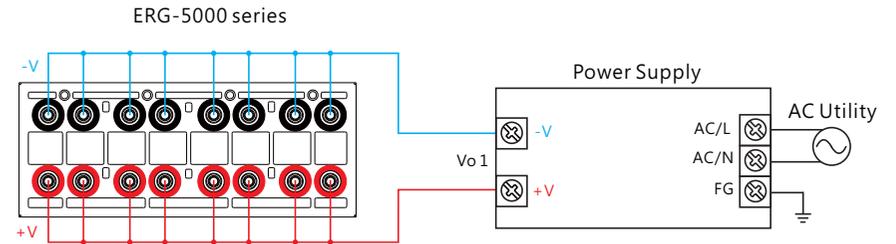
- Single ERG: 2 sets of 2 channels in parallel
  Each set can take up to 1250W*2 independently

● Multi ERG in parallel

ERG-5000 series

Power Supply

-V

Vo 1

-V

+V

AC/L
AC/N
FG

AC Utility

-V

+V

Max. 64 units

-V

+V

(2) Series Application

● Single ERG: 4 channels in series
When 4 channels are connected in series, it is recommended that the maximum voltage does not exceed 75% of the rated voltage. Taking ERG-5000H as an example, 420 * 4 * 75% = 1260V.

ERG-5000 series

-V

Vo 2

-V

+V

Power Supply 2

AC/L
AC/N
FG

AC Utility

+V

● Single ERG: 2 sets of 2 channels in series

ERG-5000 series

-V

Vo 1

-V

+V

Power Supply 1

AC/L
AC/N
FG

AC Utility

+V

● Multi ERG in series & parallel connection

ERG-5000 series

Power Supply

-V

Vo 1

-V

+V

AC/L
AC/N
FG

AC Utility

+V

Max. 64 units

-V

+V

ERG-5000 series

Power Supply

-V

Vo 1

-V

+V

AC/L
AC/N
FG

AC Utility

+V

Max. 64 units

-V

+V
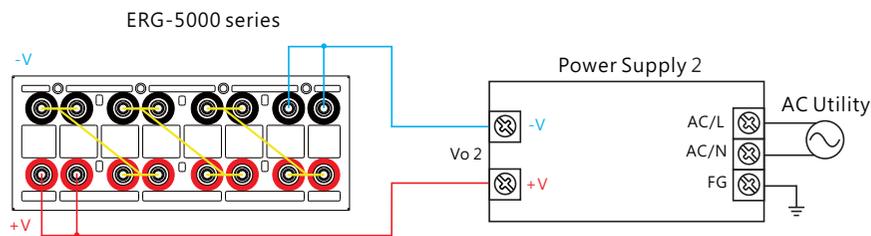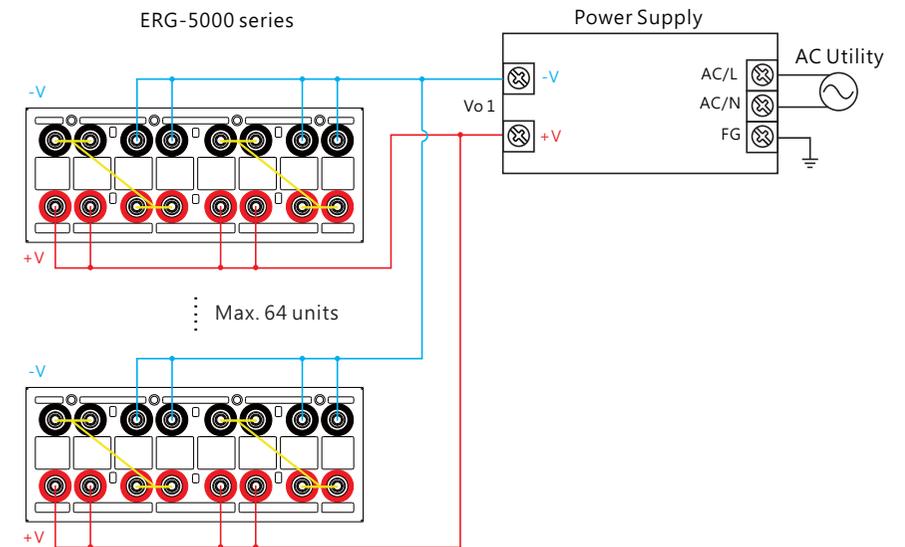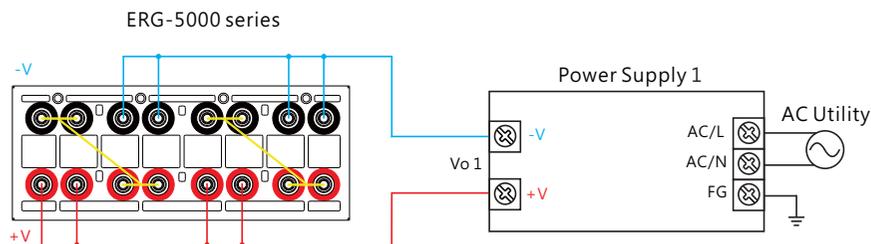
(3)4 channels used independently

Power Supply 4
ERG-5000 series
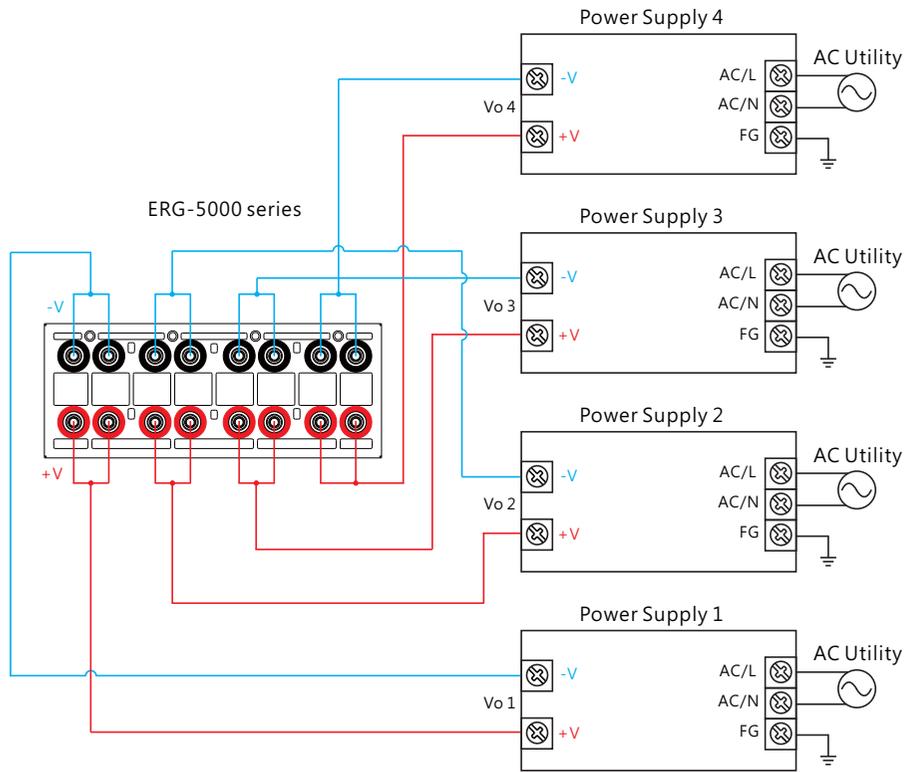
3.3 DC Cable Size Selection

Wire connections should be as short as possible and less than 1 meter is highly recommended. Make sure that suitable wires are chosen based on safety requirement and rating of current. Small cross section will result in lower efficiency, less output power and the wires may also become overheated and cause danger. For selection, please refer to table 3-1.

Table 3-1 Wire recommendations apart from official cables

AWG	Cross-section Are (mm^2)	DC current (A)
18	0.75	6A
16	1	6-10A
14	1.5	10-16A
12	2.5	16-25A
10	4	25-32A
8	6	32-40A
6	10	40-63A
4	16	63-80A
2	25	80-100A
1	35	100-125A
---	50	190A

4.User Interface

4.1 Panel Description

Ⓐ **Ventilation holes for fans:**

The inverter requires suitable ventilation to work properly. Please make sure there is sufficient ventilation and the lifespan of the inverter can preserved.

Ⓑ **Communication port**

CANBus communication port is used to set burn-in modes and monitor parameters and operation status. Please refer to 4.3 for detail.

Ⓒ **Rotary switches:**

For device addressing. Please refer to 4.4 for detail.

Ⓓ **AC terminals**

Suggested torque setting is 8Kgf-cm.

Ⓔ **DC terminals**

PRO-TEN 5.7mm NEWSOK PCB mount assembly or equivalent.
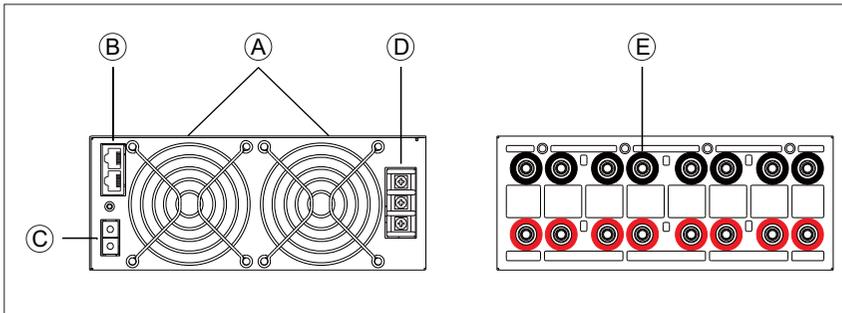
4.2 LED Indicator

LED		Description
LED OFF	●	No AC utility connected
Steady Green	🟢	Normal operating
Flashing Green	🔆	Abnormal status (OTP, Grid Fault)
Steady Orange	🟠	Standby mode
Flashing Orange	🔆	Internal communication error
Steady Red	🔴	Input UVP
Flashing Red	🔆	Input OVP

4.3 Pin Assignment of JK1
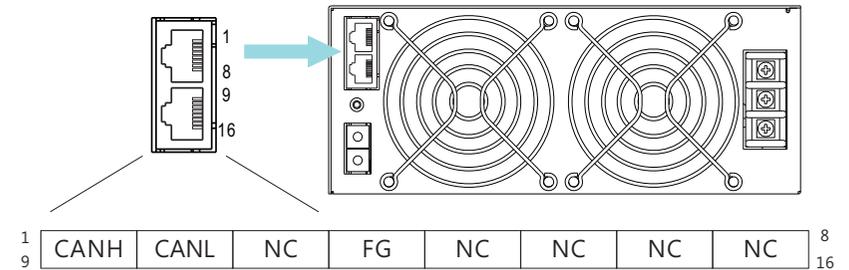
Pin No.	Function	Description
1,9	CANH	Data line used in CANBus interface
2,10	CANL	Data line used in CANBus interface
3,11	NC	Retain for future use
4,12	FG	Reference ground for CANBus interface
5,6,7,8,13, 14,15,16	NC	Not use

4.4 CANBus ID Assignment

Each ERG-5000 unit should have their unique and own device address to communicate over the CANBus. SW51 and SW52 allow users to designate an address for the inverter units (with maximum of 64 addresses). Please refer to below for detailed settings.

Model No.	Switch position	
	SW51	SW52
0	0	0
1	0	1
2	0	2
3	0	3
4	0	4
5	0	5
6	0	6
7	0	7
8	0	8
9	0	9
10	1	0
11	1	1
12	1	2
13	1	3
14	1	4
15	1	5
16	1	6
17	1	7
18	1	8
19	1	9
20	2	0
21	2	1
22	2	2
23	2	3
24	2	4
25	2	5
26	2	6
27	2	7
28	2	8
29	2	9
30	3	0
31	3	1

Model No.	Switch position	
	SW51	SW52
32	3	2
33	3	3
34	3	4
35	3	5
36	3	6
37	3	7
38	3	8
39	3	9
40	4	0
41	4	1
42	4	2
43	4	3
44	4	4
45	4	5
46	4	6
47	4	7
48	4	8
49	4	9
50	5	0
51	5	1
52	5	2
53	5	3
54	5	4
55	5	5
56	5	6
57	5	7
58	5	8
59	5	9
60	6	0
61	6	1
62	6	2
63	6	3

5.Operation

5.1 Overview of Energy Recycling

Traditional burn-in process in power supply manufacturing usually utilizes resistive or electronic loads as the burn-in equipment to examine products before being placed in service. The main drawback is that AC energy required during the burn-in period will be transformed into heat and lost. Take a power supply with 3,000W rating as an example, if it requires a burn-in time for 8 hours a day at the production line, meaning that one single unit of this product will be consuming 6000kWh annually (3,000W x 8hours x 250 working days).

The innovation design of the ERG-5000 is that it recycles DC energy from the burn-in process and then transforms that into AC energy and feeds back to the AC grid. It can reduce burn-in energy up to 78%, compared to the traditional equipment. In other words, it can recycle 4680kWh in burn-in process for a 3,000W power supply annually.

AC output voltage range of the ERG-5000 series is 200 - 240V/47 - 63Hz and its DC input voltage range covers DC: 10 - 420V, which is suitable for applications with different voltage requirement, such as equipment for battery discharge test and burn-in equipment for power supplies.
In order to meet a variety of applications, there are CC and CV operation modes selectable and 4 DC input channels, each channel can carry up to 1,500W (1250W rated), which is 6,000W (5000W rated) in total for a inverter.

INPUT

ERG

OUTPUT

ERM#0
DD   DD
ERM#1
DD   DD
ERM#2
DD   DD
ERM#3
DD   DD

DD
+
DA

4 CH INPUT
10 - 420V$_{DC}$

Each CH
1250W(rated)
/1500W(max)

CC   CV

CH1
CH2
CH3
CH4

AC200 - 264V
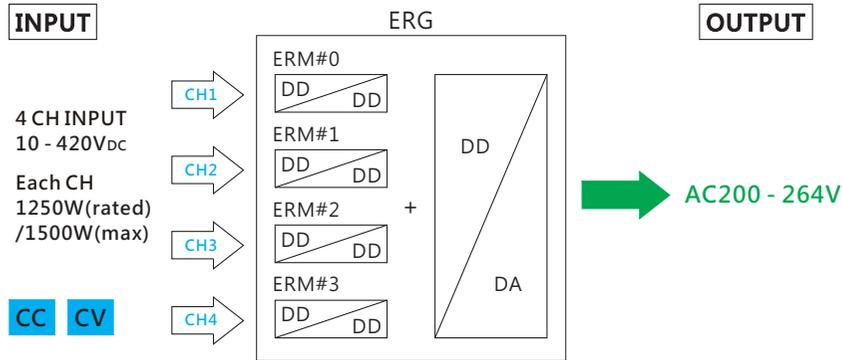
5.2 DC constant current mode

DC constant current mode is suitable for burn-in process of general power supplies and it's range is as below:

C.C. mode	Adjustable range
ERG-5000	0.5~125A(±1%)/per channel
ERG-5000H	0.1~25A(±1%)/per channel

5.3 DC constant voltage mode

DC constant current mode is suitable for burn-in process of power supplies with constant current output (e.g. chargers or LED drivers) and it's range is as below:

C.V. mode	Adjustable range
ERG-5000	10~60V(±1%)
ERG-5000H	60~420V(±1%)

5.4 Burn-in Process

Please utilize CANBus interface or CMU2A to set a burn-in process when using the ERG-5000. CMU2A, the smart controller, is developed by MeanWell, users can edit a burn-in process through the touch panel and monitor burn-in parameters via the Ethernet. Users also can edit burn-in process by built in CANBus communication interface of the ERG-5000.

5.5 CANBus Protocol

CANBus communication interface provides control and monitoring functions. It is a necessary function for starging a burn-in process. Users can read and write the parameters through the bus, which includes CC/CV mode selection, ON/OFF, temperature and status reading etc.

5.5.1 CANBus Specification

- Physical layer specification
  This protocol follows CAN ISO-11898 with Baud rate of 250Kbps.
- Date Frame
  This protocol utilizes Extended CAN 29-bit identifier frame format or CAN 2.0B.

Bit length   1   32   6   0-8 bytes   16   2   7

Start bit   Control bits   Data field   CRC bits   Acknowledge   End

Arbitration field which contains:

– 29-bit identifier + SRR bit + IDE bit + RTR bit for extended frame format
Where: RTR = Remote Transmission Request
       SRR = Substitute Remote Request
       IDE = Identifier Extension
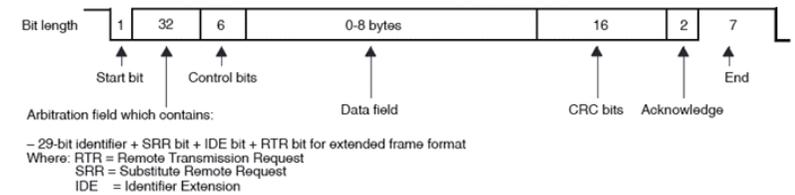
- Communication Timing
  Min. request period (Controller to ERG-5000): 100mSec ±2 mSec。
  Max. response time (ERG-5000 to Controller): 10mSec ±1 mSec。

Request period
(Controller to PSU/CHG)

PSU CAN-RX
(form Controller)

RX data   RX data

PSU CAN-TX

Response time
(PSU/CHG to Controller)

Packet Margin time
(Controller to PSU/CHG)

TX data
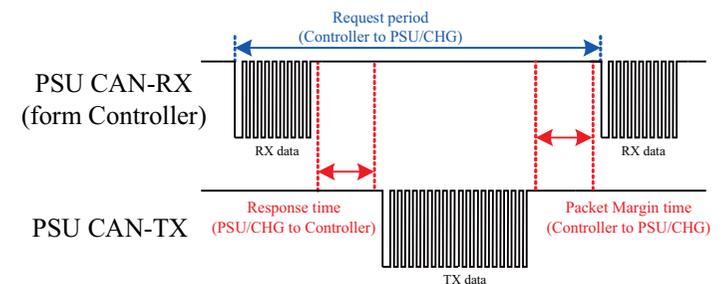
5.5.2 Message ID

Message ID definition:

Description	Message ID
ERG-5000 to controller Message ID	0x00000400
Controller to ERG-5000 Message ID	0x000003XX
Controller broadcasts to ERG-5000 Message ID	0x000003FF

Note : XX means the address of ERG-5000 (which can be assigned by SW51 and SW52, ranged from 0x00 ~ 0x3F)

5.5.3 Data Field

5.5.3.1 Parameter Definition

Name	Description	Range
ID	ERG's ID that can be assigned by SW51 and SW52, ranged from 0x00 ~ 0x3F)	0x00-3F
Function	Write/Set	0x01
	Read (able to read data continuously)	0x02
Setting Address	The address that is desired to be controlled or set	0x0000~0x00FF
Starting Address	The starting address of data receiving	0x0100~0xFFFF
Stopping Address	The stopping address of data receiving	0x0100~0xFFFF
Quantity	Quantity of the data receiving	0x00~0xFF
Number of the Packet	Notifying which number of the packet it is	0x01~0xFF
Total number of the sending packets	Notifying total number of the packets (ending packet is not included, DLC=0)	0x02~0xFF
Data	Data that is desired to be sent or received	6 bytes

5.5.3.2 Transmission Form

- Controller to ERG-5000:

  The principle of data sending is as the followings. First send Byte0 and then byte 1, until to byte7. To ensure correctness of data transmission, the length of Data Length Code or DLC must be confirmed.

  Therefore, the correct length of DLC must be filled in when transmitting.

  Data Setting：(Function = 0x01 for parameter writing/setting)
  DLC = Function (1) + Setting Address (2) + Data (2 - 5) = 5 - 8 bytes

Byte 0	Byte 1-2	Byte 3-7
Function	Setting Address	5 bytes Data

Data Reading：(Function = 0x02 for parameter reading)
DLC = Function (1) + Quantity (1) + Starting_Address (2) = 4 bytes

Byte 0	Byte 1	Byte 2-3	Byte 4-7
Function	Quantity	Starting Address	N/A

- ERG-5000 to Controller:

  The principle of data responding is as the followings.

  The first packet the ERG returned: (Defining total data length)
  DLC = ERG's ID (1) + Function (1) + Number of the packet (1) + Total number of the sending packets (1) + Starting Address (2) + Stopping Address(2)=8 bytes

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4-5	Byte 6-7
ERG's ID	Function	Number of the packet	Total number of the sending packets	Starting Address	Stopping Address

The second and the following packets：(Data response)
DLC = 2+ quantity of the Data bytes

Byte 0	Byte 1	Byte 2-7
ERG's ID	Number of the packet	6 bytes Data

End of packet:
After responding the final data packet, the ERG will send a packet without any data (DLC = 0) as the end of the packet.

5.5.4 Data Address Definition
5.5.4.1 Data Type Definition

The data types of the protocol is defined as the table below:

Data Type	Description	Bytes	Range
U4	unsigned long integer	4	0~4294967295
S4	signed long integer	4	-2147483648~2147483647
U2	unsigned integer	2	0~65535
S2	signed integer	2	-32768 ~ 32767
U1	unsigned char	1	0 ~255
S1	signed char	1	-128~127
IQ6	signed integer (NOTE)	2	-512~511.984375
IQ8	signed integer (NOTE)	2	-128~127.996093750
IQ22	signed long	4	-512~511.999 999 762
IQ24	signed long	4	-128~127.999 999 940

NOTE:

In the program operation, the IQ format is declared as signed long. Before IQ math conversion, the received data is necessary to be converted into signed long type as the communication transmission length is limited to 2 bytes.

The form of representation of IQ math is IQ#, # represents $2^{\#}$

EX: IQ6 = initial value x 2^{6}

Take voltage data with IQ6 as an example, if 0x0F00 is received.

The actual voltage value will be 0x0F00 → $3840/(2^{6})$ =60V.

5.5.4.2 Parameter control/setting: (FUNCTION: 0x01、0x02)
Valid data ranges: (0x0000 ~ 0x0035)

Register address	Byte bytes	Command name	Description	Range	Data type	Unit
0x0000	2	Operation	ON/OFF control	All ON: 0xFFAA All OFF: 0xFF55	U2	
0x0001	2	C_Faults	Clear fault flags	0x0000 is used to clear the flags	U2	
0x0002	2	I_CC	Set constant current value for a burn-in process	ERM-350: 0~30 ERM-350H: 0~3.6 ERM-1250: 0.5~125 ERM-1250H: 0.1~25	IQ8	A
0x0003	2	P_CP	Set constant power value for a burn-in process	ERM-350(H): 0~360	IQ6	W
0x0024	2	V_CV	Set constant voltage value for a burn-in process	ERM-350H: 60~380 ERM-1250: 10~60 ERM-1250H: 60~420	IQ6	V
0x0035	2	ERMH_Ctrl	Channels in parallel or not and CC/CV mode settings	High Byte: 0x00: Each Independent; 0x01: 2 Channels in parallel separately as TWO groups; 0x02: 4 Channels in parallel as ONE group; 0x03: 2 Channels in series separately as TWO groups; 0x04: 4 Channels in series as ONE group. Low Byte: 0x00: CC mode; 0x01: CV mode	U2	NOTE

NOTE:

1.The high byte of ERMH_Ctrl is used to set numbers of the channels (CH1-CH4) in parallel, series, or used independently and the low byte is used to determine CC or CV mode.

If it is operated in CC mode, the channels (CH1-CH4) can be set at series connection or independent use. If it is in CV mode, the channels (CH1-CH4) can be set at parallel connection or independent use. For instance, it is necessary to set high byte of ERMH_Ctrl at 0x01 to carry a 2000W load in CV mode.

2.The application limitations of CC/CV mode and series/parallel connection between channels are shown in the following table.

ERG Input	Load mode	Series/parallel control mode	Application limitations
Series connection (Suitable for applications of high voltage input)	CC	0x03: 2 sets of 2 channels in series 0x04: 1 set of 4-channel in series connection	• This mode can be used for single channel used independently, 2 channels in series and 4 channels in series. • Only support series connection for channels in a single ERG. multi-ERG units in series is not allowed. • A maximum number of 64 ERG units can be connected in parallel. • When connecting 4 channels in series, it is recommended not to exceed 75% of the rated voltage. Taking ERG-5000H as an example, 420 * 4 * 75% = 1260V.
	CV	0x00: Independent	• This mode can be used for single channel used independently, 2 channels in series, 3 channels in series and 4 channels in series. • Only support series connection for channels in a single ERG. multi-ERG units in series is not allowed. • When connecting 4 channels in series, it is recommended not to exceed 75% of the rated voltage. Taking ERG-5000H as an example, 420 * 4 * 75% = 1260V.
Parallel Connection (Suitable for applications of high input power)	CC	0x00: Independent	• This mode can be used for single channel used independently, 2 channels in parallel, 3 channels in parallel and 4 channels in parallel • A maximum number of 64 ERG units can be connected in parallel.
	CV	0x01: 2 sets of 2-channel in parallel 0x02: 1 set of 4-channel in parallel connection	• This mode can be used for single channel used independently, 2 channels in parallel and 4 channels in parallel . • Only support parallel connection for channels in a single ERG. multi-ERG units in parallel is not allowed.

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5.5.4.3 Status Data Reading (Only supports FUNCTION: 0x02)

(1)Status data address registers · Valid data ranges :
(0x0200~0x0223)

Register address	Data bytes	Command Name	Description	Range	Data type	Unit
0x0200	2	OTP1	Temperature 1		U2	℃ NOTE 3
0x0201	2	OTP2	Temperature 2		U2	℃ NOTE 3
0x0206	2	R_status	Operation status flag	Refer to 5.5.5.1	U2	
0x0207	2	R_fault	Fault flags	Refer to 5.5.5.3	U2	
0x0208	2	R_ERM status	Operation status flags of the channels	Refer to 5.5.5.2	U2	
0x020A	2	R_ERM fault	Fault flags of the channels	Refer to 5.5.5.5	U2	NOTE 1
0x020B	2	R_ERM Com._n	Model names of the channels	Refer to 5.5.5.4	U2	
0x020F	2	#0Vin	Input voltage of CH1 (ERM#0)	ERM-1250:0~70 ERM-1250H: 0~500	IQ6	V
0x0210	2	#0Iin	Input voltage of CH1 (ERM#0)	ERM-1250: 0~150 ERM-1250H: 0~25	IQ8	A
0x0211	2	#1Vin	Input current of CH2 (ERM#1)	ERM-1250: 0~70 ERM-1250H: 0~500	IQ6	V
0x0212	2	#1Iin	Input current of CH2 (ERM#1)	ERM-1250: 0~150 ERM-1250H: 0~25	IQ8	A
0x0213	2	#2Vin	Input voltage of CH3 (ERM#2)	ERM-1250: 0~70 ERM-1250H: 0~500	IQ6	V
0x0214	2	#2Iin	Input current of CH3 (ERM#2)	ERM-1250: 0~150 ERM-1250H: 0~25	IQ8	A
0x0215	2	#3Vin	Input voltage of CH4 (ERM#3)	ERM-1250: 0~70 ERM-1250H: 0~500	IQ6	V
0x0216	2	#3Iin	Input voltage of CH4 (ERM#3)	ERM-1250: 0~150 ERM-1250H: 0~25	IQ8	A
0x0220	2	Revision	Firmware version	0~999	U2	NOTE 2
0x0221	2	Model	Model name	〝ER〞	ASCII	NOTE 2
0x0222	2	Model	Model name	〝G〞/〝GH〞	ASCII	NOTE 2
0x0223	2	Model	Model name	〝5K〞	ASCII	NOTE 2

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NOTE 1 :
Fault signals are integrated into R_ERM fault, meaning that the register will synchronize current status of the channels when any channel falls. Please refer to 5.5.5.5 for detailed information.
NOTE 2 :
(1)0~999 represents R00.0~R99.9 in firmware version.
(2)ERG5K represents ERG-5000 and ERG5KH is ERG-5000H in Model.
NOTE 3 :
(1)The read values are from the temperatures of HS1 and HS3 heat sinks on the main board. For example: the read value is 0x0016→22, meaning 22°C.

5.5.5 Flag Definition

5.5.5.1 Operation Status Flag (0x0206)

Types of the operation status for the ERG series are listed in the table below. Offline: Bus disconnection or power off; Run: Unit in operation mode; Fault: Unit in abnormal condition; Standby: Unit in standby mode. E.g.: 0x0001 represents the ERG unit is in operation mode.

Bit	Meaning	Bit	Meaning
0	0 : Offline、1 : Run	8	-
1	2 : Fault、3 : Standby	9	-
2	-	10	-
3	-	11	-
4	-	12	-
5	-	13	-
6	-	14	-
7	-	15	-

5.5.5.2 Operation status flags of the channels (0x0208)

Types of the operation status for the channels (the ERMs) are listed in the table below. Offline: Bus disconnection or power off; Run: Unit in operation mode; Fault: Unit in abnormal condition; Standby: unit in standby mode. E.g.: 0x 55000000 represents ERM# 0-3 are in operation mode.

Bit	Meaning	Bit	Meaning
0	ERM#0 0 : Offline、1 : Run、 2 : Fault、3 : Standby	16	ERM#8 0 : Offline、1 : Run、 2 : Fault、3 : Standby
1		17	
2	ERM#1 0 : Offline、1 : Run、 2 : Fault、3 : Standby	18	ERM#9 0 : Offline、1 : Run、 2 : Fault、3 : Standby
3		19	
4	ERM#2 0 : Offline、1 : Run、 2 : Fault、3 : Standby	20	ERM#10 0 : Offline、1 : Run、 2 : Fault、3 : Standby
5		21	
6	ERM#3 0 : Offline、1 : Run、 2 : Fault、3 : Standby	22	ERM#11 0 : Offline、1 : Run、 2 : Fault、3 : Standby
7		23	
8	ERM#4 0 : Offline、1 : Run、 2 : Fault、3 : Standby	24	ERM#12 0 : Offline、1 : Run、 2 : Fault、3 : Standby
9		25	
10	ERM#5 0 : Offline、1 : Run、 2 : Fault、3 : Standby	26	ERM#13 0 : Offline、1 : Run、 2 : Fault、3 : Standby
11		27	
12	ERM#6 0 : Offline、1 : Run、 2 : Fault、3 : Standby	28	ERM#14 0 : Offline、1 : Run、 2 : Fault、3 : Standby
13		29	
14	ERM#7 0 : Offline、1 : Run、 2 : Fault、3 : Standby	30	ERM#15 0 : Offline、1 : Run、 2 : Fault、3 : Standby
15		31	

NOTE : There are only ERM#0 - ERM#3 available in the ERG-5000(H). The reset of ERM#4~ERM#16 are preserved for future use.

5.5.5.3 Fault flags (0x0207)

Types of the Fault flags are listed in the table below. If there is a certain error that occurs, the corresponding bit will be high. If there is no any error, all of the bits will stay low.

E.g.: 0x100 represents ERG AC Fault, meaning that abnormal AC input.

Bit	Meaning	Bit	Meaning
0	-	8	ERG AC Fault
1	-	9	ERG COMM.Error
2	-	10	ERG CBC OT
3	-	11	-
4	-	12	-
5	-	13	-
6	-	14	-
7	-	15	-

Bit 8 ERG AC Fault: ERG AC abnormal protection
Bit 9 ERG COMM.Error: ERG communication error/disconnection
        protection.
Bit 10 ERG CBC OT: ERG hardware cycle by cycle over-current protection
        (it will be not triggered in normal use).

5.5.5.4 Model names of the channels (0x020B)

The command responses models' names of the channels installed in the ERG unit.
R_ERM Com._0 : ERM #0~#3
R_ERM Com._1 : ERM #4 ~#7
R_ERM Com._2 : ERM #8~#11
R_ERM Com._3 : ERM #12~#15
E.g.: 0x4444 means that model names for the ERM#0-3 are ERM1250(H)

Bit	Meaning	Bit	Meaning
0-3	(ERM# 0/4/8/12) 0 :Offline 1：ERM100、 3：ERM350 2：ERM-350H、4：ERM1250(H)	8-11	(ERM# 2/6/10/14) 0：Offline 1：ERM100、 3：ERM350 2：ERM-350H、4：ERM1250(H)
4-7	(ERM# 1/5/9/13) 0：Offline 1：ERM100、 3：ERM350 2：ERM-350H、4：ERM1250(H)	12-15	(ERM# 3/7/11/15) 0：Offline 1：ERM100、 3：ERM350 2：ERM-350H、4：ERM1250(H)

NOTE：There are only ERM#0 - ERM#3 available in the ERG-5000(H).
        The reset of ERM#4~ERM#16 are preserved for future use.

5.5.5.5 Fault Flags of The Channels(0x020A)

Types of the fault flags of the channels are listed in the table below. If there is a certain error that occurs, the corresponding bit will be high. If there is no any error, all of the bits will stay low. E.g.: ox01 represents OVP(BOOST), meaning that the ERM channel is in OVP condition.

Bit	Meaning	Bit	Meaning
0	OVP(BOOST)	8	-
1	-	9	-
2	OVP(Input voltage)	10	-
3	UVP(Input voltage)	11	-
4	OVP(Output voltage)	12	-
5	-	13	-
6	OTP Fault	14	-
7	OVP(Input voltage >10%)	15	-

Bit 0 OVP(BOOST): The ERM channel in over-voltage protection
Bit 2 OVP(Input voltage): Input of the ERM channel too high.
                The protection will be triggered when ERM VIN > 63V for the low voltage input version;The protection will be triggered when ERM VIN > 435V for the high voltage input version .
Bit 3 UVP(Input voltage): UVP(Input voltage): Voltage of the device under test fluctuating under 10%.The protection will be triggered when ERM VIN is fluctuating and lower than 10% of the input voltage of the device under test in a burn-in process.

Bit 4 OVP(Output voltage): Internal bus voltage of the ERM channel too
high. The protection will be triggered when
ERM VOUT>406V.
Bit 6 OTP Fault: Internal temperature of the channel too high.
BIT 7 OVP(Input voltage >10%): During the burn-in, ERM VIN floats over
10%.The protection will be triggered
when ERM VIN is fluctuating and higher
than 10% of the input voltage of the
device under test in a burn-in process.
NOTE: UVP(Input voltage) and OVP(Input voltage >10%) will only start
sensing after 25 secs of burn-in to prevent incorrect protection
caused by transient state during startup.

5.5.6 Communication Examples
5.5.6.1 Example for setting
Before starting a burn-in process, settings on "ERMH_Ctrl" and
"Operation" commands are required. The steps below use an
example of the ERG unit at CV 40V and 4 channels independently.
Please be aware that voltage value setting has to be at maximum
value in CC mode and current setting at maximum value in CV
mode in order to gain best performance.

① Set at 40V
ID: 0x000003FF (Controller broadcasts to ERG-5000 Message ID)
DLC: 5 bytes (Function (1) + Setting Address (2) + Data(2))
Function: 0x01 (Write/Set)
Setting Address: 0x0024 (V_CV)
Data: 40 x 64 (IQ6 =2^6) = 3840 → 0x0F00

Request:

CAN ID	DLC (Data Length)	Command code		
		Function (bytes 0)	Setting Address (bytes 1 - 2)	Data (bytes 3 - 4)
0x000003FF	0x05	0x01	0x0024	0x0F00

② Set burn-in current at 125A
ID: 0x000003FF
DLC: 5 bytes (Function (1) + Setting Address (2) + Data(2))
Function: 0x01 (Write/Set)
Setting Address: 0x0002 (I_CC)
Data: 125 x 256 (IQ8 =2^8) = 32000 → 0x7D00

Request:

CAN ID	DLC (data length)	Command code
0x000003FF	0x05	0x01 0002 7D00

③ Set at CV mode and channels (CH1 – CH4) used independently
parallel or series configuration setting
ID: 0x000003FF
DLC: 5 bytes (unction (1) + Setting Address (2) + Data(2))
Function: 0x01 (Write/set)
Setting Address: 0x0035 (ERMH_Ctrl)
Data: 0x0001 (Each Independent ; CV mode)

High Byte	Low Byte
0x00: Each Independent 0x01: 2 Channels in parallel separately as TWO groups 0x02: 4 Channels in parallel as ONE group 0x03: 2 Channels in series separately as TWO groups 0x04: 4 Channels in series as ONE group	0x00: CC mode 0x01: CV mode

Request:

CAN ID	DLC (data length)	Command code
0x000003FF	0x05	0x01 0035 0001

④ Turn the ERG on and start a burn-in process
ID: 0x000003FF
DLC: 5 bytes (Unction (1) + Setting Address (2) + Data(2))
Function: 0x01 (Write/Set)
Setting Address: 0x0000 (Operation)
Data: 0xFFAA (All on)

Request:

CAN ID	DLC (Data Length)	Command code
0x000003FF	0x05	0x01 0000 FFAA

5.5.6.2 Example for reading

Read input voltage and current of the CH4 from the ERG-5000 with ID 63(0x3F).

Request:

CAN ID	DLC (data length)	Command code
0x0000033F	0x04	0x02 02 0215

ID: 0x0000033F

DLC: 0x04

Function: 0x02 (Read)

Quantity: 0x02 (Two bytes)

Starting Address: 0x0215 (#3Vin)

Response:

First package → ID: 0x00000400, DLC: 0x08, Data: 0x3F 02 01 02 02 15 02 16

Second package → ID: 0x00000400, DLC: 0x06, Data: 0x3F 02 04 F9 02 01

Third package → End of package, ID: 0x00000400, DLC: 0x00

First package :

3F	02	01	02	0215	0216
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4-5	Byte 5-6
ERG's ID	Function	Number of the Packet	Total Number of the Sending packets	Starting Address	Stopping Address

ERG(3F) responses to the request of FUNCTION(02) and returns the first package(01). The total number of the sending package (02), data from 0x0215(#3Vin) to 0x0216(#3Iin).

Second package :

3F	02	04F9 0201
Byte 0	Byte 1	Byte 2-6
ERG's ID	Number of the Packet	Data

ERG(3F) responses to the request of FUNCTION(02) and returns the second package(02). Data is 0x04F9 and 0x0201.Representing that

1. #data of 3Vin(0x0215) is 0x04F9 → $1273/(2^6)$ = 19.89V

2. #data of 3Iin(0x0201) is 0x0201 → $513/(2^8)$ = 2A

End of package:

The end of the packet with zero DLC

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5.5.6.3 Analysis of Returned Data

Three packages are returned from a ERG-5000.

First package → ID: 0x00 00 04 00, DLC: 8, Data: 0x00 02 01 02 00 00 00 01

Second package → ID: 0x00 00 04 00, DLC: 6, Data: 0x00 02 FF 55 00 00

Third package → End of package, ID: 0x00 00 04 00, DLC: 0

First package :

00	02	01	02	00 00	00 01
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4-5	Byte 6-7
ERG's ID	Function	Number of the Packet	Total Number of Packets	Starting Address	Stopping Address

ERG(00) responses to the request of FUNCTION(02) and returns the first package(01). The total number of the sending package (02), data from 0x0000 (Operation) to 0x0001 (C_Faults).

Second package :

00	02	FF 55 00 00
Byte 0	Byte 1	Byte 2-5
ERG's ID	Number of the Packet	Data

ERG(00) responses to the request of Function(02) and returns the second package(02). Data is 0xFF55 and 0x0000. Representing that

1. #data of Operation(0x000) is 0xFF55 → ERG(00) is OFF

2. #data of C_Faults(0x0001) is 0x0000

Register address	Data bytes	Command Name	Description	Range
0x0000	2	Operation	ON/OFF control	All ON: 0xFFAA All OFF: 0xFF55
0x0001	2	C_ Faults	Clear fault flags	0x0000 is used to clear the flags

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5.6 Value range and tolerance

(1)Display parameters

Command Name	Model	Display parameters	Tolerance
Input voltage of channels (#Vin - 0x020F, 0x0211, 0x0213, 0x0215)	ERG-5000H	0~500V	±1.5V
	ERG-5000	0~70V	±0.6V
Input current of channels (#Iin - 0x0210, 0x0212, 0x0214, 0x0216)	ERG-5000H	0~25A	±0.2A
	ERG-5000	0~150A	±0.9A

(2)Control parameters

Command Name	Model	Adjustable range	Tolerance
CC mode (I_CC - 0x0002)	ERG-5000H	0.1~25A	±0.25A
	ERG-5000	0.5~125A	±1.25A
CV mode (V_CV - 0x0024)	ERG-5000H	60~420V	±4.2V
	ERG-5000	10~60V	±0.6V

6. Selection of EMI Filters

■ Schematic
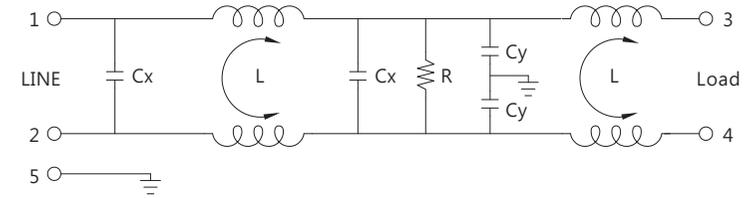
■ Minimum insertion loss (In dB at 50Ω system): Filter model 30DPGS5C or equivalent

FREQ. MHz	0.01	0.05	0.10	0.15	0.50	1.0	5.0	10	30
COM. MODE dB	2	5	8	10	30	35	55	45	30
DIF. MODE dB	4	15	18	18	45	50	40	40	40

■ Minimum resistance: Core model CF-130SN or equivalent

FREQ. MHz	10	20	30	50	60	80	90	100	120
Z(Ω)	80	125	160	190	200	210	220	225	235

■ Suggested configuration

Metal plate: 1300mm*900mm* 2mm

Connecting Cables:

No.	Cable	Length	Core	Note
A	Power Cable	0.5m		
B	Power Cable	1.4m		
C	DC Power Cable (+,-)	3.5m	2pcs*4ch	
D	Power Cable (L)	0.25m	1pcs	
E	Power Cable (N)	0.25m		
F	Power Cable (PE)	0.25m		
G	Power Cable	0.7m		
H	Power Cable connector	0.1m		
I	Power Cable	1.4m		
J1	RJ45 Cable	4.0m	1pcs	3 turns
J2		1.2m		
K	Power Cable	1.0m		

Example of configuration:

No.	Unit	Model No.	FCC ID	Trade Name	Power Code
1	Filter	30DPGS5C	N/A	DELTA	1.8m
2	DC Source	SHP-10K-380	N/A	MEAN WELL	N/A
3	CMU2	N/A	N/A	MEAN WELL	N/A
4	Filter	FN3288-20-33-R5	N/A	SCHAFFNER	1.8m
5	Breaker	N/A	N/A	N/A	N/A
6	Surge Protection Device	SPD-20-240P	N/A	MEAN WELL	N/A
7	Core	CF-130SN	N/A	N/A	N/A

7.Suggested configuration

7.1 AC Fail Protection

When AC voltage or frequency is out of range, ERG-5000 will enter protection mode and stop output. Repower on to restore after AC abnormal condition is resolved.

7.2 Over Temperature Protection

Built-in thermal detection circuit, once the internal temperature exceeds a threshold value, the supply will shut down automatically. Please switch off the inverter, remove all possible causes and then leave the supply cooling down to a normal working temperature (approximate 10 minutes – 1 hour) before repower on again.

7.3 Communication Error

If there is no command sending for 4 seconds, the ERG-5000 will enter communication timeout and stop output.
It is suggested reading values back from every ERG units on the bus at certain intervals to prevent communication timeout.

7.4 Input DC Protection

Input over voltage: The inverter will restore automatically when input is back to a normal range.
Input under voltage: The inverter will restore automatically when input is back to a normal range.

7.5 Over Load Protection

Over load is limited at 6000W(1500W* 4CH).
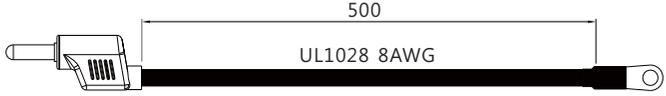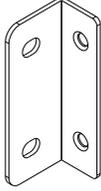
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8. Warranty

This product provide 5 years warranty under normal usage. Do not replace parts or any form of modification to the product in order to keep the warranty effectively.

※ **MEAN WELL posses the right to adjust the content of this manual. Please refer to the latest version of our manual on our website**. **https://www.meanwell.com**

MEAN WELL WEB

A.**Appendix**

The list for accessories in the package

	Item	Quantity
①	Red wire for +V connector (for ERG-5000 series only) 500 UL1028 8AWG	8
②	Black wire for -V connector (for ERG-5000 series only) 500 UL1028 8AWG	8
③	Mount bracket	2
④	Termination resistor	1
⑤	Screw M4 L=8	4