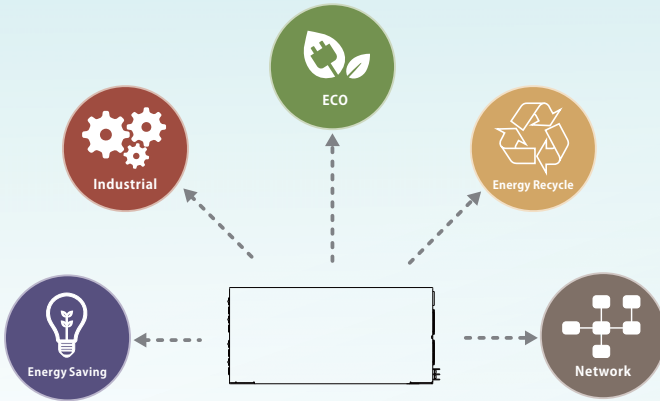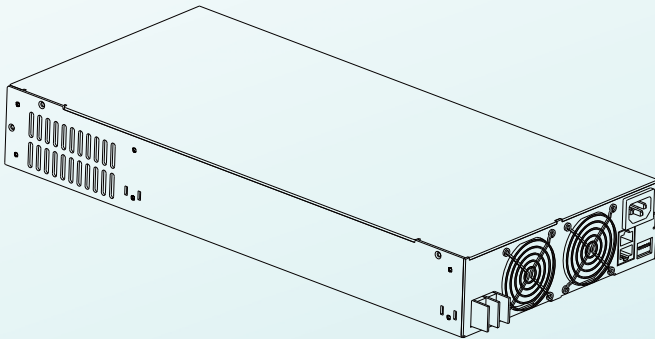# ERS-1400
Installation manual

ECO

Industrial

Energy Recycle

Energy Saving

Network

4 Channels 1400W Energy Recycling DC Power Supply

ERS-1400 series is an DC energy recycling power unit that supports 1400W rated input, it can achieve high efficiency up to 91%. CC and CV/CP 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 system also provides remote control and monitoring functions by using CMU2A or the CANBus protocol for data analysis and remote monitor. ERS-1400 supports 10~60VDC input voltage & ERS-1400H supports 60~380VDC 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 supply is class I. The "Frame Ground" (⏚) of the unit must be well connected to PE (Protective Earth).

2.Introduction

2.1 Model Encoding

ERS - 1400 H

DC Input range
(Blank : 10~60VDC · H : 60~380VDC)

Input wattage

Series name
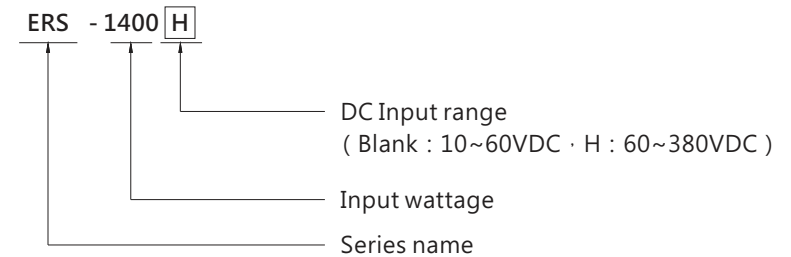
2.2 Features

- Wide input voltage range 10~60VDC / 60~380VDC by models
- High efficiency up to 91%
- Modular design for flexible configuration
- Flexible CC/CV/CP operation modes
- Remote control and monitoring by CANBus protocol via CMU2A control console
- Maximum 64 units ERS-1400 series that can be connected on the same bus
- Protections: Over voltage / Under voltage / Over temperature / Communication error

2.3 Specification

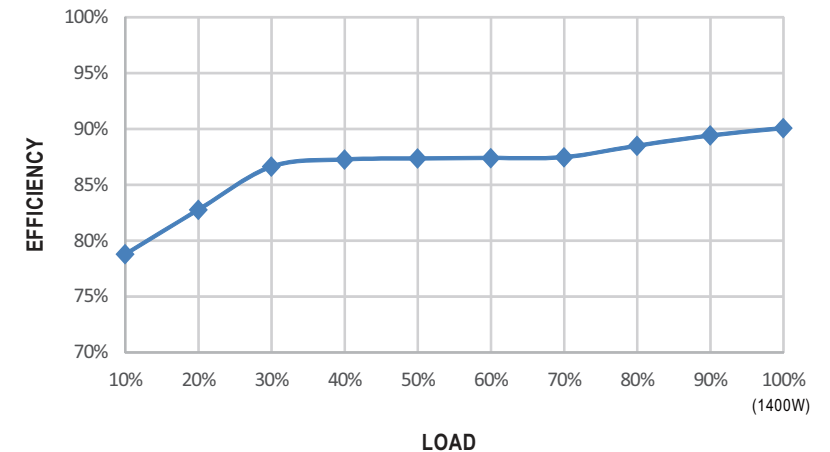| MODEL		ERS-1400	ERS-1400H
DC INPUT	**RATED INPUT POWER (Typ.)**	1200 ~ 1440W (for input 10 ~ 12VDC) 1440W (for input 12 ~ 60VDC)	864 ~ 1440W (for input 60 ~ 100VDC) 1440W (for input 100 ~ 380VDC)
	INPUT VOLTAGE RANGE	10 ~ 60VDC	60 ~ 380VDC
	RATED INPUT CURRENT (Typ.)	30A*4CH	3.6A*4CH
	EFFICIENCY (Typ.)	91% @ 48V input	90% @ 380V input
DC OUTPUT	**VOLTAGE**	320VDC	
	VOLTAGE TOLERANCE	±2%	
	RIPPLE & NOISE (max.)	4V	
	OUTPUT CURRENT (max.)	6.3A	
	ENERGY RECYCLING RATIO (Typ.)	85%@48VDC input/1440W (power supply efficiency≧95%) Please refer to energy recycling ratio for more detail	85%@380VDC input/1440W (power supply efficiency≧96%)
AC INPUT	**VOLTAGE RANGE**	180 ~ 264VAC	
	FREQUENCY RANGE	47 ~ 63Hz	
	POWER FACTOR	0.97/230VAC	
	INRUSH CURRENT (Typ.)	50A /230VAC	
PROTECTION	**OVER TEMPERATURE**	Shuts down DC output voltage, reset after fault condition removed	
	DC INPUT OVER VOLTAGE	Shuts down DC output voltage, reset after fault condition removed	
	DC INPUT UNDER VOLTAGE	Shuts down DC 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 ERS-1400 series)	
	CC/CV/CP MODE SELECT (Note.2)	CONSTANT CURRENT (CC) : 0.5~30A(±1%) / per. channel	CONSTANT CURRENT (CC) : 0.5~3.6A(±1%) / per. channel
		-----	CONSTANT VOLTAGE (CV) : 60~380VDC (±10V)
		CONSTANT POWER (CP) : 5~360W (±5%) / per. channel	-----
	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	
SAFETY & EMC (Note. 4)	**SAFETY STANDARDS**	BS EN/EN62368-1 approved	
	EMC EMISSION Note.3	Compliance to BS EN/EN55032 (CISPR32)	
	EMC IMMUNITY Note.3	Compliance to BS EN/EN61000-4-2,3,4,5,6,8,11 light industry level, criteria A	
OTHERS	**MTBF**	ERS-1400:　260.3K hrs min.　Telcordia SR-332 (Bellcore) ; 29.4K hrs min.　MIL-HDBK-217F (25℃) ERS-1400H: 264.2K hrs min.　Telcordia SR-332 (Bellcore) ; 27.7K hrs min.　MIL-HDBK-217F (25℃)	
	COOLING	Internal fan cooling	
	DIMENSION	450*213*63.5mm(L*W*H)	
	PACKING	5.76Kg; 2pcs/12.5Kg/1.68CUFT	
NOTE		1.All parameters NOT specially mentioned are measured at 320VDC output,48VDC input (ERS-1400),380VDC input(ERS-1400H), rated input power and 25℃ of ambient temperature. 2.Tolerances are calculated based on MAX input current and MAX input voltage. Tolerances may increase during high and low ambient temperature operation. 3.Guidance of additional filter, please refer to user manual for more detail. 4.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 http://www.meanwell.com) ※ Product Liability Disclaimer：For detailed information, please refer to https://www.meanwell.com/serviceDisclaimer.aspx	

2.4 Efficiency versus Load

※ ERS-1400
Efficiency measured at 48VDC input and 25℃ of ambient temperature
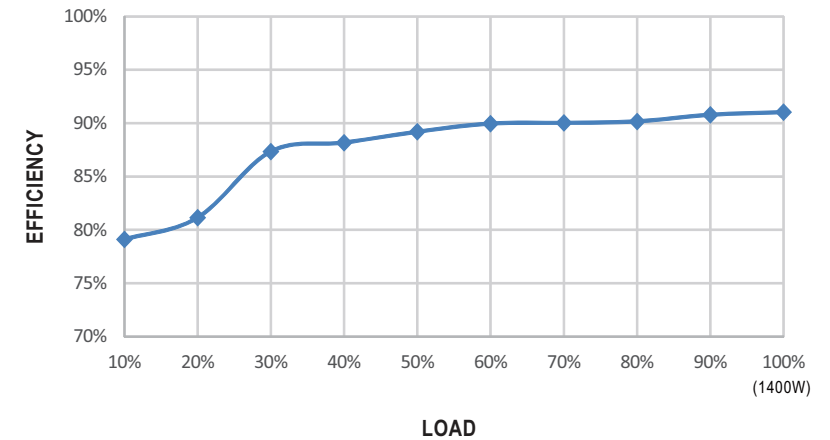
※ ERS-1400H
Efficiency measured at 380VDC input and 25℃ of ambient temperature

※ Energy Recycling Ratio Calculation
Energy recycling ratio = Efficiency 1 (power supply) x Efficiency 2 (ERS-1400 series)

2.5 Static Characteristics

※ERS-1400

INPUT POWER (%) vs **INPUT VOLTAGE (VDC)**

(1440W) 100
83.3
60
40

10 12 20 25 30 35 40 45 50 55 60

INPUT VOLTAGE (VDC)

※ERS-1400H

INPUT POWER (%) vs **INPUT VOLTAGE (VDC)**

(1440W) 100
80
60
40

60 80 100 130 160 190 220 250 280 310 380

INPUT VOLTAGE (VDC)
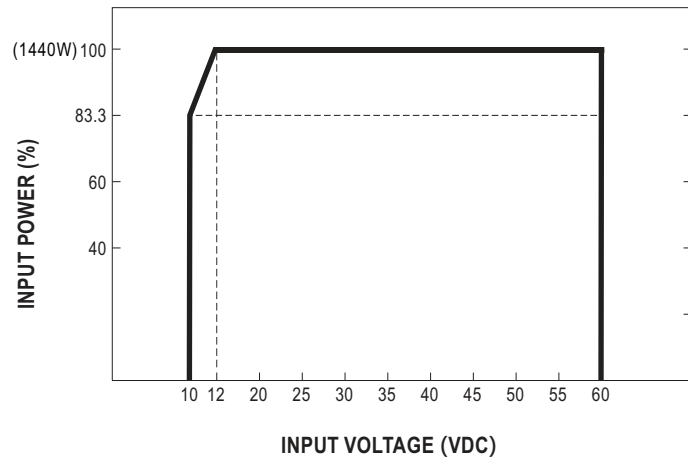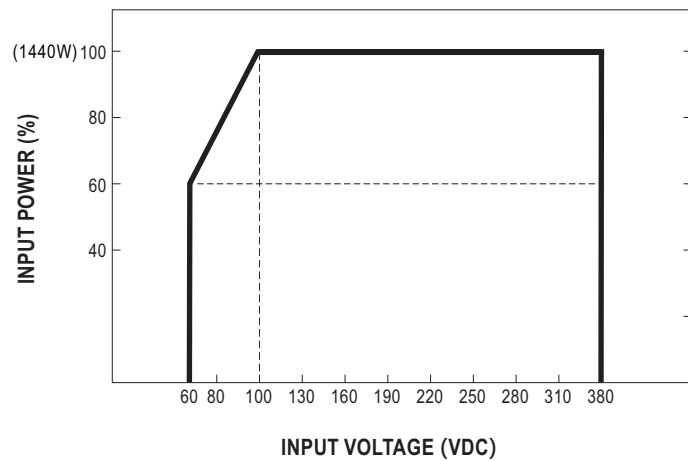
2.6 Mechanical specification

Unit:mm

439.5
310
15
40 11.75
38 12.5

Communication port
1 9
8 16

12-M4 L=6(Both Sides)

DC INPUT
16 22.6
30.8
CH1 20
CH2 20
34.25
CH3 20
CH4 20
16-φ12
SW1

450

AC INPUT
63.5
AC INPUT

Air flow direction

213

DC OUTPUT 320Vdc

15max.
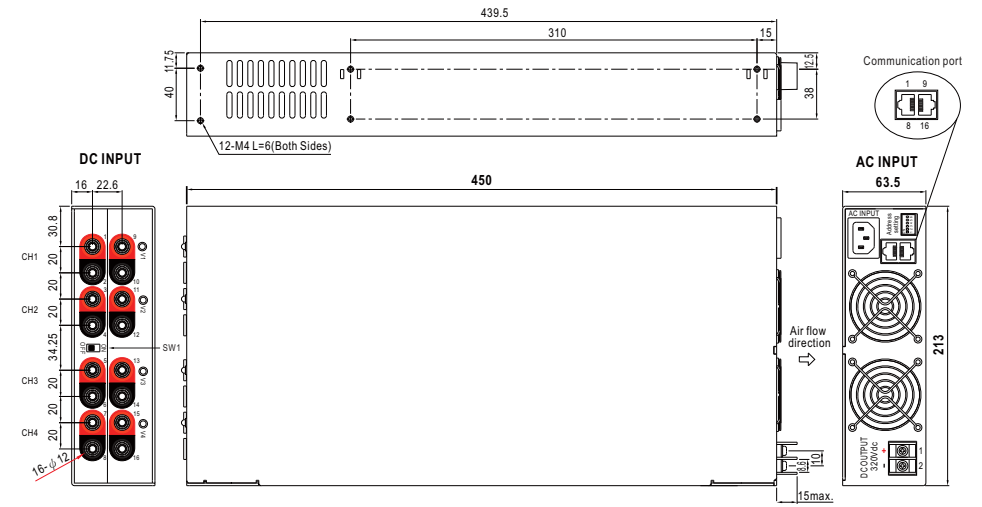
3.Installation & Wiring

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 ERS-1400 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.

3.Connect the supply to the AC grid, FG to the earth, AC/N to the neutral and AC/L to the live.

NOTE: The supply is single-phase AC input. Please pay attention to the wiring when connecting the supply to a three phase system.
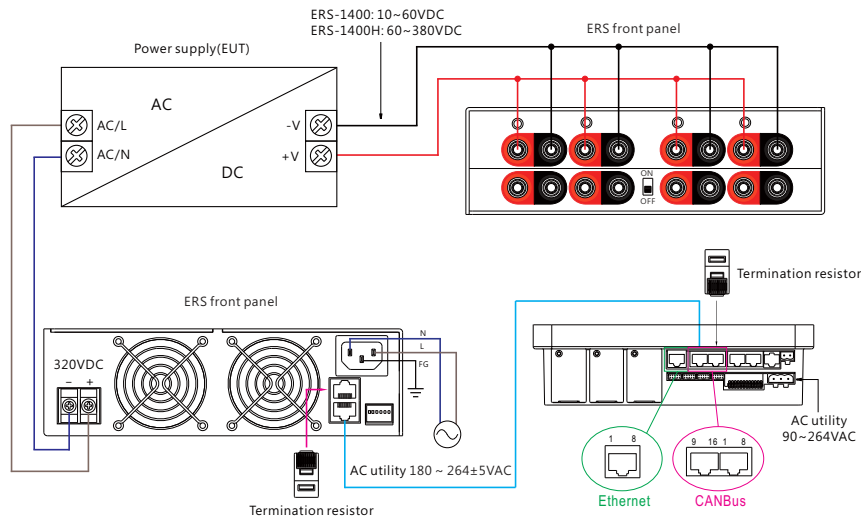
NOTE: After connecting the communication cable, install termination resistors to the remaining sockets of both the ERS-1400 series and CMU2A to prevent signal reflections.

3.3 DC Cable Size Selction

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 causedanger. 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

(A) **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.

(B) **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.

(C) **DIP switches:**

For device addressing. Please refer to 4.4 for detail.

(D) **AC terminals**

(E) **DC output terminals**

Suggested torque setting is 8Kgf-cm.

(F) **DC input terminals**

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

Rotary switches → DIP switches
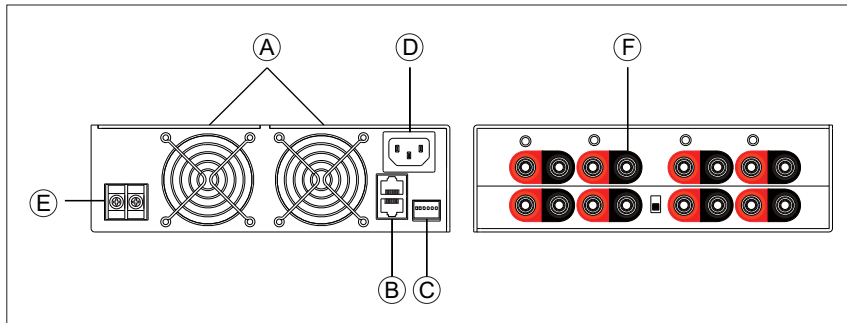
4.2 LED Indicator

LED		Description
LED OFF	●	No AC utility connected
Steady Green	●	Normal operating
Flashing Green	☀	Abnormal status (OTP, Grid Fault)

4.3 Pin Assignment of communication port

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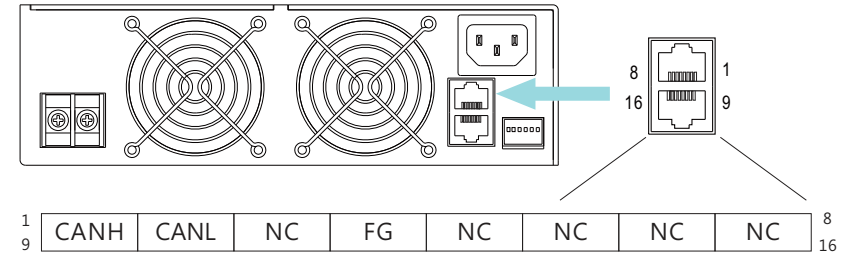
Pin No.	Function	Description
1,9	CANH	Data line used in CANBus interface
2,10	CANL	Data line used in CANBus interface
3,11	NC	Retain for future use
4,12	FG	Reference ground for CANBus interface
5,6,7,8,13, 14,15,16	NC	Not use

4.4 CANBus ID Assignment

Each ERS-1400 unit should have their unique and own device address to communicate over the CANBus. Address setting allow users to designate an address for the supply units (with maximum of 64 addresses). Please refer to below for the detailed setup advice.

ON
1 2 3 4 5 6

Module No.	DIP switch position					
	1	2	3	4	5	6
0	OFF	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	OFF	ON	ON
4	OFF	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	OFF	ON	OFF	ON
6	OFF	OFF	OFF	ON	ON	OFF
7	OFF	OFF	OFF	ON	ON	ON
8	OFF	OFF	ON	OFF	OFF	OFF
9	OFF	OFF	ON	OFF	OFF	ON
10	OFF	OFF	ON	OFF	ON	OFF
11	OFF	OFF	ON	OFF	ON	ON
12	OFF	OFF	ON	ON	OFF	OFF
13	OFF	OFF	ON	ON	OFF	ON
14	OFF	OFF	ON	ON	ON	OFF
15	OFF	OFF	ON	ON	ON	ON
16	OFF	ON	OFF	OFF	OFF	OFF
17	OFF	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON	OFF
19	OFF	ON	OFF	OFF	ON	ON
20	OFF	ON	OFF	ON	OFF	OFF
21	OFF	ON	OFF	ON	OFF	ON
22	OFF	ON	OFF	ON	ON	OFF
23	OFF	ON	OFF	ON	ON	ON
24	OFF	ON	ON	OFF	OFF	OFF
25	OFF	ON	ON	OFF	OFF	ON
26	OFF	ON	ON	OFF	ON	OFF
27	OFF	ON	ON	OFF	ON	ON
28	OFF	ON	ON	ON	OFF	OFF
29	OFF	ON	ON	ON	OFF	ON
30	OFF	ON	ON	ON	ON	OFF
31	OFF	ON	ON	ON	ON	ON

| Module No.	DIP switch position					
	1	2	3	4	5	6
32	ON	OFF	OFF	OFF	OFF	OFF
33	ON	OFF	OFF	OFF	OFF	ON
34	ON	OFF	OFF	OFF	ON	OFF
35	ON	OFF	OFF	OFF	ON	ON
36	ON	OFF	OFF	ON	OFF	OFF
37	ON	OFF	OFF	ON	OFF	ON
38	ON	OFF	OFF	ON	ON	OFF
39	ON	OFF	OFF	ON	ON	ON
40	ON	OFF	ON	OFF	OFF	OFF
41	ON	OFF	ON	OFF	OFF	ON
42	ON	OFF	ON	OFF	ON	OFF
43	ON	OFF	ON	OFF	ON	ON
44	ON	OFF	ON	ON	OFF	OFF
45	ON	OFF	ON	ON	OFF	ON
46	ON	OFF	ON	ON	ON	OFF
47	ON	OFF	ON	ON	ON	ON
48	ON	ON	OFF	OFF	OFF	OFF
49	ON	ON	OFF	OFF	OFF	ON
50	ON	ON	OFF	OFF	ON	OFF
51	ON	ON	OFF	OFF	ON	ON
52	ON	ON	OFF	ON	OFF	OFF
53	ON	ON	OFF	ON	OFF	ON
54	ON	ON	OFF	ON	ON	OFF
55	ON	ON	OFF	ON	ON	ON
56	ON	ON	ON	OFF	OFF	OFF
57	ON	ON	ON	OFF	OFF	ON
58	ON	ON	ON	OFF	ON	OFF
59	ON	ON	ON	OFF	ON	ON
60	ON	ON	ON	ON	OFF	OFF
61	ON	ON	ON	ON	OFF	ON
62	ON	ON	ON	ON	ON	OFF
63	ON	ON	ON	ON	ON	ON

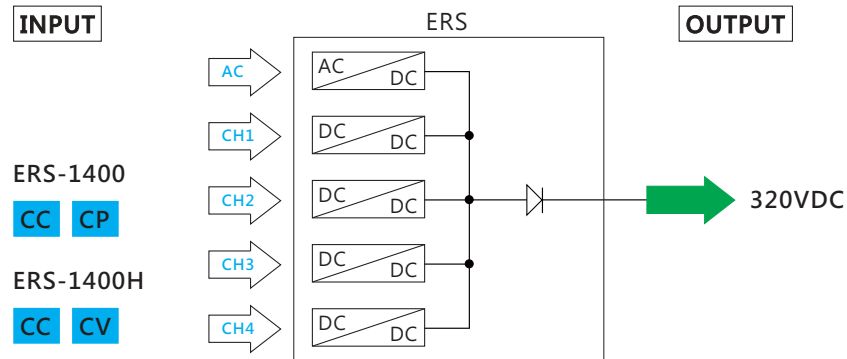# 5.Operation

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 ERS-1400 is that it recycles DC energy from the burn-in process and then boosts the recycled energy into 320VDC and feeds back to the power supplies again. It can reduce burn-in energy up to 70%, compared to the traditional equipment. In other words, it can recycle 4200kWh in burn-in process for a 3,000W power supply annually.
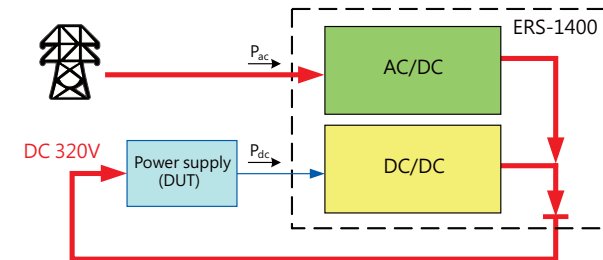
Input voltage range of the ERS-1400 series covers DC: 10 – 380V; although its DC output is fixed at 320VDC it is still suitable for DC/DC converters or its output can be changed to AC output by co-operation with inverters. In order to meet a variety of applications, there are CC, CV and CP operation modes selectable and 4 DC input channels, each channel can carry up to 360W, which is 1440W in total.

5.2 DC Constant Current Mode

DC constant current mode is suitable for burn-in process of general power supplies. Range is as below:

C.C. mode	Adjustable range
ERS-1400	0.5~30A
ERS-1400H	0.5~3.6A

5.3 DC Constant Voltage Mode

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

C.C. mode	Adjustable range
ERS-1400H	60~380V

5.4 DC Constant Power Mode

DC constant power mode is suitable for burn-in process for general power supplies. Range is as below:

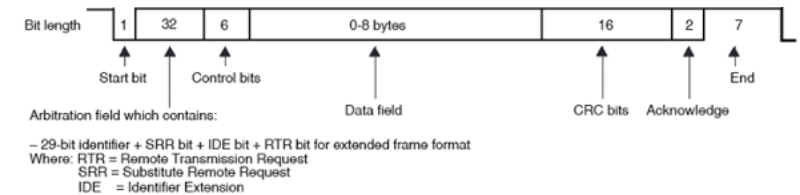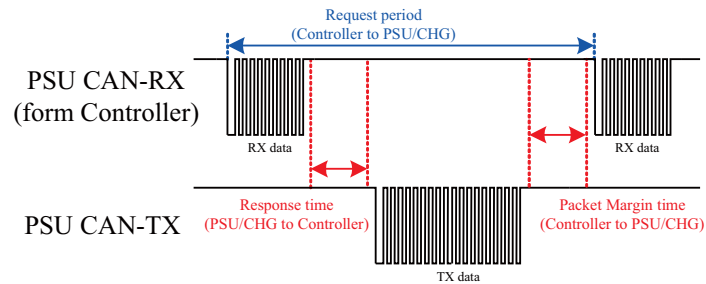| C.C. mode	C.C. mode
ERS-1400	5~360W

5.5 Burn-in Process

Please utilize CANBus interface or CMU2A to set a burn-in process when using the ERS-1400. CMU2A, the smart controller, is developed by MeanWell, users can edit a burn-in process through the touch panel or monitor burn-in parameters via the Ethernet. Users also can edit burn-in process by built in CANBus communication interface of the ERS-1400.

5.6 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.

5.6.1 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

● Communication Timing

Min. request period (Controller to ERS-1400): 100mSec ±2 mSec。

Max. response time (ERS-1400 to Controller): 10mSec ±1 mSec。

Request period
(Controller to PSU/CHG)

PSU CAN-RX
(form Controller)

RX data   RX data

Response time   Packet Margin time
(PSU/CHG to Controller)   (Controller to PSU/CHG)

PSU CAN-TX

TX data

5.6.2 Message ID

Message ID definition:

Description	Message ID
ERS-1400 to controller Message ID	0x000004XX
Controller to ERS-1400 Message ID	0x000003XX
Controller broadcasts to ERS-1400 Message ID	0x000003FF

Note : XX means the address of ERS-1400 (which can be assigned by SW51 and SW52, ranged from 0x00 ~ 0x3F)

5.6.3 Data filed
5.6.3.1 Parameter Definition

Name	Description	Range
ID	ERS's ID that can be assigned by SW51 and SW301, 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

5.6.3.2 Transmission Form

● Controller to ERS-1400:
The principle of data sending is as the followings. First send Byte 0 and then byte 1, until to byte 7. 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

● ERS-1400 to Controller:
   The principle of data responding is as the followings.

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

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4-5	Byte 6-7
ERS'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
ERS's ID	Number of the packet	6 bytes Data

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

5.6.4 Data Address Definition
5.6.4.1 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 $\rightarrow$ 3840/(2^6) =60V.

5.6.4.2 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	ERS-1400: 0~30 ERS-1400H: 0~3.6	IQ8	A
0x0003	2	P_CP	Set constant power value for a burn-in process	ERS-1400: 0~360	IQ6	W
0x0024	2	V_CV	Set constant voltage value for a burn-in process	ERS-1400H: 60~380	IQ6	V
0x0035	2	ERMH_Ctrl	Channels in parallel or not and CC/CV/CP mode settings	**High Byte** 0x00: Each Independent 0x01: 2 Channels in parallel separately as TWO groups 0x02: 4 Channels in parallel as ONE group **Low Byte** 0x00: CC mode 0x01: CV mode 0x02: CP mode	U2	NOTE

NOTE:
The high byte of ERMH_Ctrl is used to set numbers of the channels (CH1 - CH4) connected in parallel and the low byte is used to determine CC or CV mode.
If it is operated in CC mode, the channels (CH1 - CH4) are not necessary to be connected in parallel. However, if it is in CV mode, it is required to determine how many channels to carry the same load. For instance, it is necessary to set high byte of ERMH_Ctrl at 0x01 to carry a 600W load in CV mode.

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

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

Register address	Byte bytes	Command Name	Description	Range	Data type	Unit
0x0200	2	OTP1	Temperature 1		U2	℃ NOTE 3
0x0201	2	OTP2	Temperature 2		U2	℃ NOTE 3
0x0202	2	V_Buck	DC output voltage of the ERS	0~350	U2	1V
0x0203	2	V_Boost	Internal DC voltage of the ERS	0~475	U2	1V
0x0206	2	R_status	Operation status flag	Refer to 5.6.5.1	U2	
0x0207	2	R_fault	Fault flags	Refer to 5.6.5.3	U2	
0x0208	2	R_ERM status	Operation status flags of the channels	Refer to 5.6.5.2	U2	
0x020A	2	R_ERM fault	Fault flags of the Channels	Refer to 5.6.5.5	U2	NOTE 1
0x020B	2	R_ERM Com._n	Model names of the Channels from CH1 –CH4	Refer to 5.6.5.4	U2	
0x020C	2	R_ERM Com._n	Model names of the Channels from CH5 –CH8	Refer to 5.6.5.4	U2	
0x0220	2	Revision	Firmware version	0~999	U2	NOTE 2
0x0221	2	Model	Model name	`ER`	ASCII	NOTE 2
0x0222	2	Model	Model name	`S` / `SH`	ASCII	NOTE 2
0x0223	2	Model	Model name	`14`	ASCII	NOTE 2

NOTE 1：
Fault signals are integrated into R_ERM fault, meaning the register will synchronize the current status when any channel falls. Please refer to 5.6.5.5 for detailed information.
NOTE 2：
(1)0~999 represents R00.0~R99.9 in Revision.
(2)ERS14 represents ERS-1400 and ERS14H is ERS-1400H in Model.
NOTE 3：
(1)The read values are the temperatures of HS1 and HS3 heat sinks on the main board. For example: the read value is 0x0016→22, meaning 22°C.

5.6.5 Flag Definition

5.6.5.1 Operation Status Flag (0x0206)

Types of the operation status for the ERS 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 ERS 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	-

5.6.5.2 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	CH#0 0 : Offline、1 : Run、	16	CH#8 0 : Offline、1 : Run、
1	2 : Fault、3 : Standby	17	2 : Fault、3 : Standby
2	CH#1 0 : Offline、1 : Run、	18	CH#9 0 : Offline、1 : Run、
3	2 : Fault、3 : Standby	19	2 : Fault、3 : Standby
4	CH#2 0 : Offline、1 : Run、	20	CH#10 0 : Offline、1 : Run、
5	2 : Fault、3 : Standby	21	2 : Fault、3 : Standby
6	CH#3 0 : Offline、1 : Run、	22	CH#11 0 : Offline、1 : Run、
7	2 : Fault、3 : Standby	23	2 : Fault、3 : Standby

Bit	Meaning	Bit	Meaning
8	CH#4 0 : Offline、1 : Run、	24	CH#12 0 : Offline、1 : Run、
9	2 : Fault、3 : Standby	25	2 : Fault、3 : Standby
10	CH#5 0 : Offline、1 : Run、	26	CH#13 0 : Offline、1 : Run、
11	2 : Fault、3 : Standby	27	2 : Fault、3 : Standby
12	CH#6 0 : Offline、1 : Run、	28	CH#14 0 : Offline、1 : Run、
13	2 : Fault、3 : Standby	29	2 : Fault、3 : Standby
14	CH#7 0 : Offline、1 : Run、	30	CH#15 0 : Offline、1 : Run、
15	2 : Fault、3 : Standby	31	2 : Fault、3 : Standby

NOTE : There are only ERM#0 - ERM#3 available in the ERS-1400(H). The reset of ERM#4~ERM#16 are preserved for future use.

5.6.5.3 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.

Bit	Meaning	Bit	Meaning
0	ERS OVP	8	-
1	ERS AC Input OVP	9	-
2	ERS DC Output UVP	10	-
3	-	11	-
4	ERS OTP	12	-
5	-	13	-
6	-	14	-
7	-	15	-

Bit 0 : Overvoltage occurred inside the ERS.
Bit 1 : ERS AC input overvoltage.
Bit 2 : ERS DC output has over-low voltage.
Bit 4 : ERS internal over-temperature protection.

5.6.5.4 Model names of the channels (0x020B)

The command responses models' names of the channels installed in the ERG unit.

R_ERM Com._0 : CH #0~#3
R_ERM Com._1 : CH #4 ~#7
R_ERM Com._2 : CH #8~#11
R_ERM Com._3 : CH #12~#15

E.g.: 0x3333 means that model names for the ERM#0-3 are ERS-1400.

Bit	Meaning	Bit	Meaning
0-3	(CH# 0/4/8/12) 0 :Offline 2 : ERS-1400H 3 : ERS-1400 4 : ERG-5K(H)	8-11	(CH# 2/6/10/14) 0 : Offline 2 : ERS-1400H 3 : ERS-1400 4 : ERG-5K(H)
4-7	(CH# 1/5/9/13) 0 : Offline 2 : ERS-1400H 3 : ERS-1400 4 : ERG-5K(H)	12-15	(CH# 3/7/11/15) 0 : Offline 2 : ERS-1400H 3 : ERS-1400 4 : ERG-5K(H)

NOTE : There are only ERM#0 - ERM#3 available in the ERS-1400.
The reset of ERM#4~ERM#16 are preserved for future use.

5.6.5.5 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	8	-
1	-	9	-
2	OVP(Input voltage)	10	-
3	UVP(Input voltage < 10%)	11	-
4	OVP(Output voltage)	12	-
5	-	13	-
6	OTP Fault	14	-
7	OVP(Input voltage >10%)	15	-

Bit 0 OVP: The ERM channel in over-voltage protection.
Bit 2 OVP(Input voltage): Input of the ERM channel too high.
Bit 3 UVP(Input voltage): Voltage of the device under.
Bit 4 OVP(Output voltage): Internal bus voltage of the ERM channel too high.
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.

5.6.6 Communication Examples

5.6.6.1 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 ERS unit at CV 300V 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 300V

ID: 0x000003FF (Controller broadcasts to ERS-1400 Message ID)
DLC: 05 (Function (1) + Setting Address (2) + Data(2))
Function: 0x01 (Write/Set)
Setting Address: 0x0024 (V_CV)
Data: 300 x 64 (IQ6 =2^6) = 19200 → 0x4B00

Request:

CAN ID	DLC (data length)	Command code		
		Function (bytes 0)	Setting Address (bytes 1 - 2)	Data (bytes 3 - 4)
0x000003FF	0x05	0x01	0x0024	0x4B00

② Set burn-in current at 30A
　ID: 0x000003FF
　DLC: 05 (Function (1) + Setting Address (2) + Data(2))
　Function: 0x01 (Write/Set)
　Setting Address: 0x0002 (I_CC)
　Data: 30 x 256 (IQ8 =2^8) = 7680 → 0x1E00

Request:

CAN ID	DLC (data length)	Command code
0x000003FF	0x05	0x01 0002 1E00

③ Set at CV mode and channels (CH1 – CH4) independently
　ID: 0x000003FF
　DLC: 05 (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	0x00: CC mode 0x01: CV mode

Request:

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

④ Turn the ERS 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

5.6.6.2 Example for reading
　Read input voltage and current of the CH4 from the ERS-1400 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
ERS's ID	Function	Number of the Packet	Total Number of the Sending packets	Starting Address	Stopping Address

ERS(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
ERS's ID	Number of the Packet	Data

ERS(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

5.5.6.3 Analysis of Returned Data

Three packages are returned from a ERS-1400.

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
ERS's ID	Function	Number of the Packet	Total Number of Packets	Starting Address	Stopping Address

ERS(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
ERS's ID	Number of the Packet	Data

ERS(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 → ERS(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

5.7 Value range and tolerance

(1)Display parameters

Command Name	Model	Display parameters	Tolerance
Input voltage of channels	ERS-1400H	0~400V	±10V
	ERS-1400	0~70V	±1V
Input current of channels	ERS-1400H	0~3.6A	±0.1A
	ERS-1400	0~30A	±1A

(2)Control parameters

Command Name	Model	Adjustable range	Tolerance
Cc mode (I_CC - 0x0002)	ERS-1400H	0.5~3.6A	±0.1A
	ERS-1400	0.5~30A	±1A
Cv mode (V_CV - 0x0024)	ERS-1400H	60~380V	±10V
CP mode (V_CP - 0x0003)	ERS-1400	5~360W	±10W

6.Suggested configuration

6.1 Communication Error

If there is no command sending for 4 seconds, the ERS-1400 will enter communication timeout and stop output.

It is suggested reading values back from every ERS units on the bus at certain intervals to prevent communication timeout.

6.2 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.
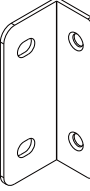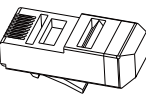
7. Warranty
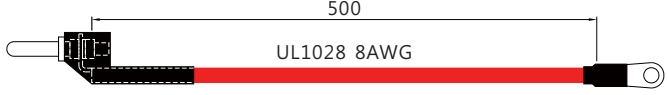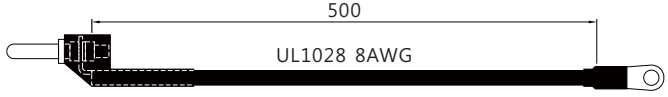
This product provide 5 years warranty under normal usage. Do not replace parts or any form of modification to the product in order to keep the warranty effectively.

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A.Appendix

The list for accessories in the package

	Item	Quantity
①	Red wire for +V connector 500 UL1028 8AWG	4
②	Black wire for -V connector 500 UL1028 8AWG	4
③	Bracket	2
④	Termination resistor	1
⑤	Screw M4 L=8	4