LS ULTRACAPACITOR MODULE

User Manual

Part No. : LSUM 129R6C 0062F EA (**1 Master + 6Slaves**)
Version 1.0 _ Oct / 2013

LS Ultracapacitor Module

User Manual

CONTENT

Overview

The LSUM 129R6C 0062F EA Ultracapacitor Modules have high energy and low ESR to meet energy storage and power delivery requirements.

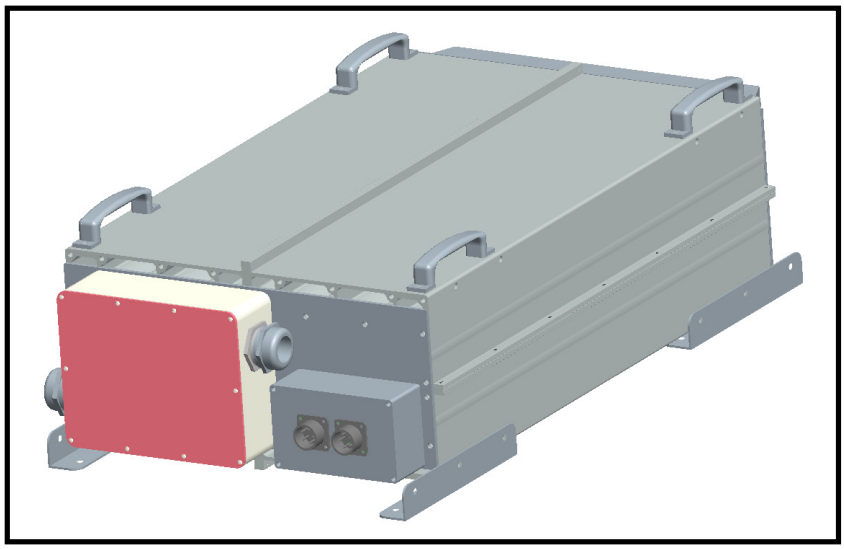
The cells used in the modules have 2.7 V maximum voltage rating and are connected in series to get higher operating voltage of modules. To meet the long cycle life requirements, the cells operate under 2.7V. In addition, all the cells are balanced by balancing circuit connected parallel to each cell.

Item		Value	Comments
Rated Capacitance	F	62.5	3000F unit 48 series
Rated Voltage	V	129.6	2.7V/cell
ESR(DC)	mΩ	13 (Max.)	
Ambient Temp.	℃	-40 ~ 65	Storage @ -40 ~ 70
Ambient Humidity	%	0 ~ 95	Storage @ 0 ~ 100
Weight	kg	53±2	
Dimension-W	mm	405±2	
Dimension-D	mm	720±2	
Dimension-H	mm	207±2	

Description

Identification of features

▪ Product Image

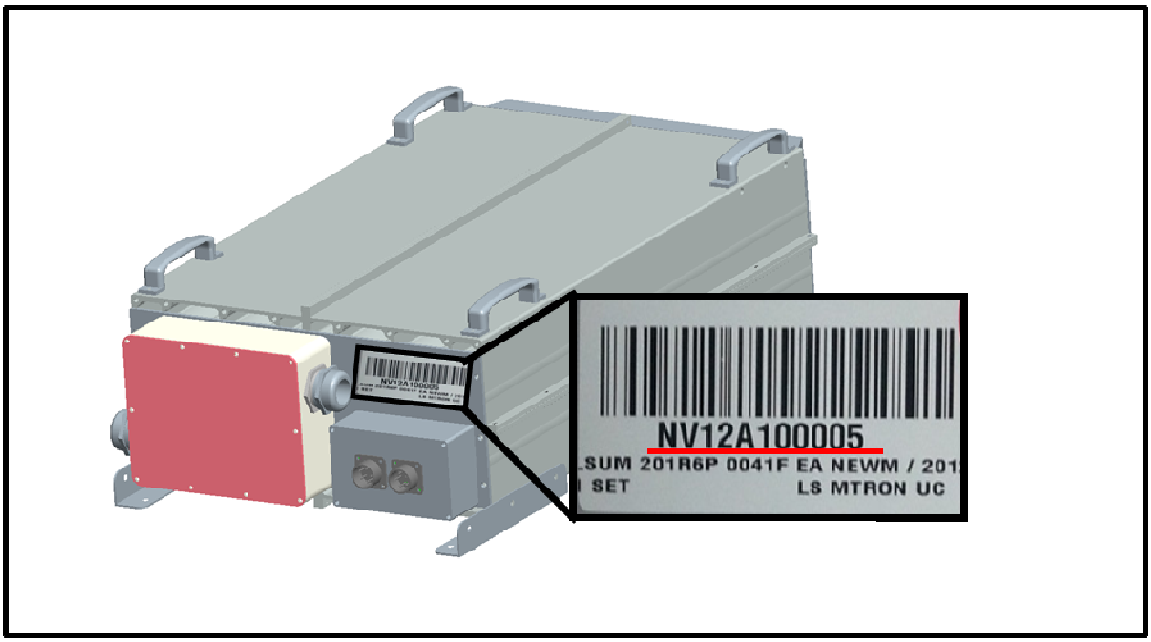


<Fig. 1> Product Image

Installation

▪ Master – Slave Module

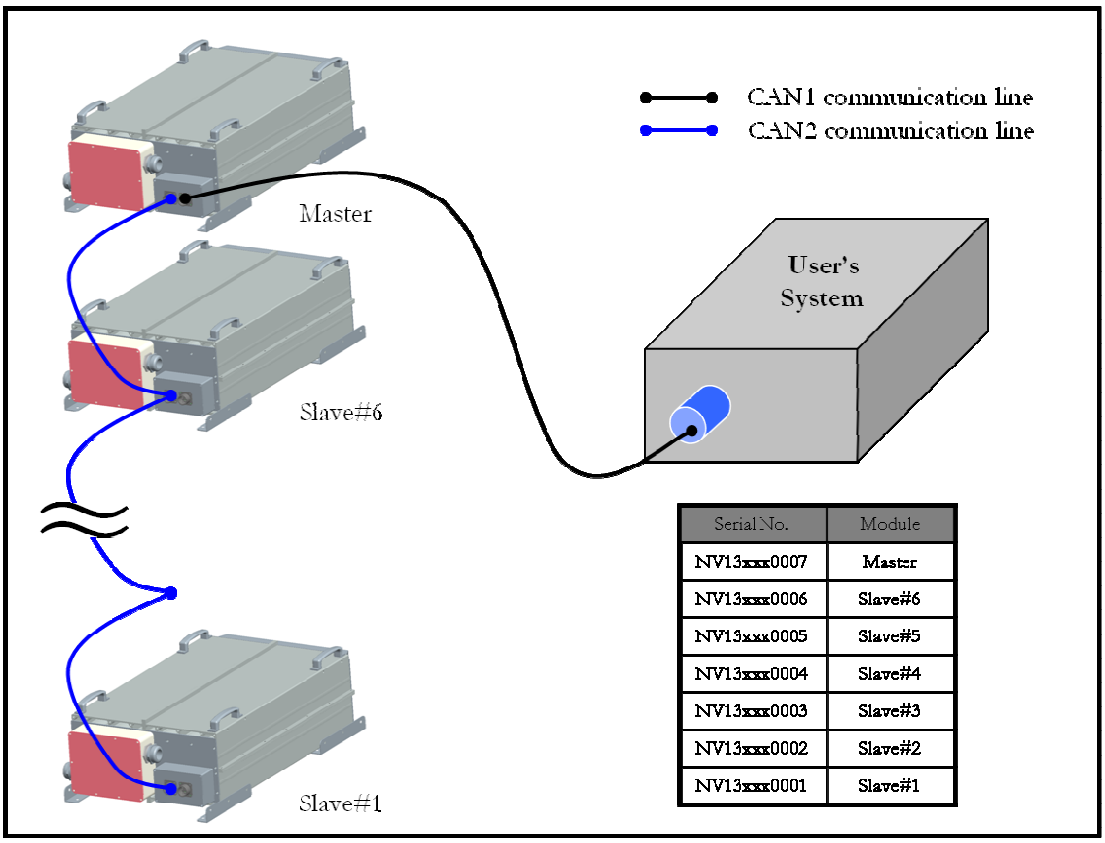
- This module system is comprised of 7 sets of sub-module, 129.6V / 62.5F, **which are one master module and six slave modules.** Basically, the number and composition of cells and components inside the modules are same but it is distinguished in Master and Slave for CAN communication. The serial number shows Master and Slave modules. The serial numbers can be identified at the location, as <Fig. 2>.



<Fig. 2> Location of SERIAL NO.

▪ Module to module connection

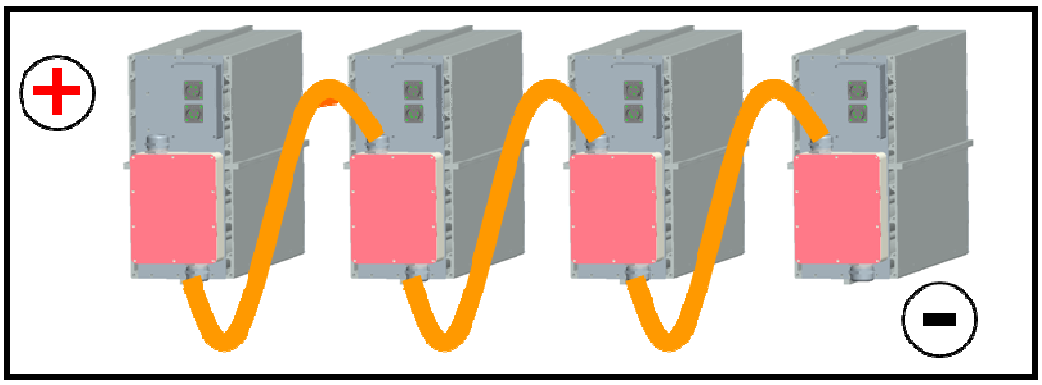
- <Fig. 3> specifies how Master and Slave module are interconnected. Detailed circuit diagram is referred to the Chapter UC monitoring system - CAN communication.



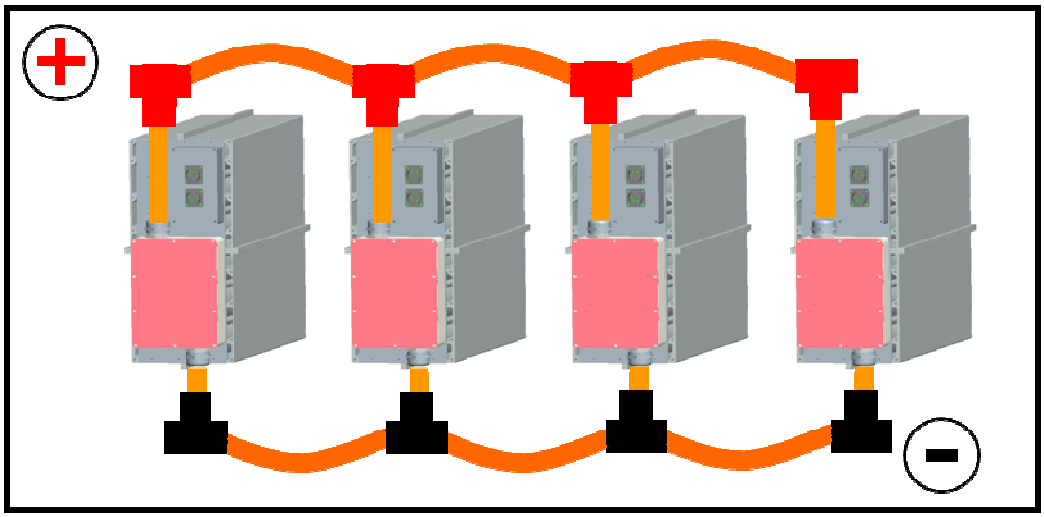
Serial No.	Module
NV13xxx0007	Master
NV13xxx0006	Slave#6
NV13xxx0005	Slave#5
NV13xxx0004	Slave#4
NV13xxx0003	Slave#3
NV13xxx0002	Slave#2
NV13xxx0001	Slave#1

<Fig. 3> CAN communication line

- There are series and parallel connection for High power



<Fig. 4> Series Connection of Modules

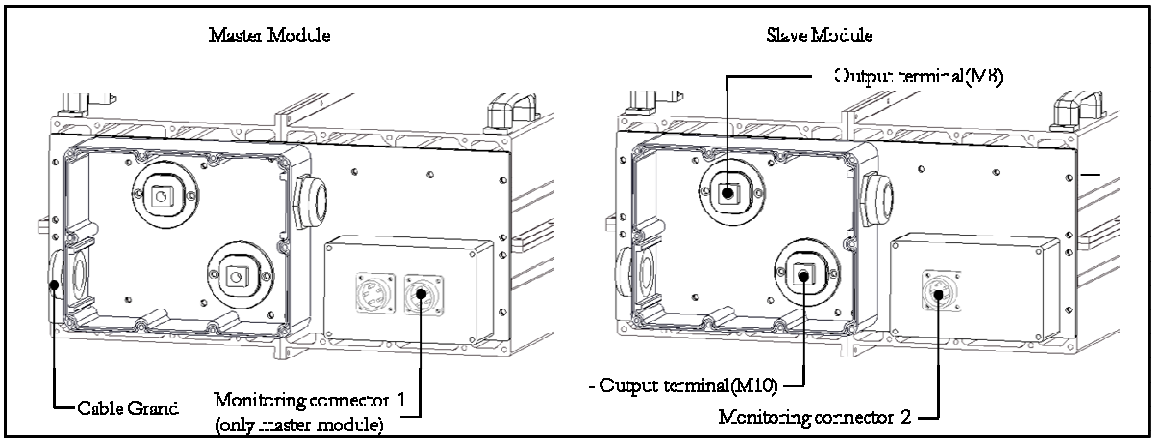


<Fig. 5> Parallel Connection of Modules

▪Output terminal connection

- The output terminals are located inside the Junction Box which is in the front part of the module. They are designed to connect directly to a ring lugs. The positive and negative terminals have each hole for the screw. The threaded size is M8.(negative terminal is M10) Wave washers are required to ensure long term, reliable connections. When implementing torque to the terminals, it is suggested to apply the maximum torque for the M8(negative terminal is M10) bolt and screw hole. Because the modules have a very low ESR, total ESR will be affected by a ring lug torque. Therefore, it needs more attention to assemble the modules.

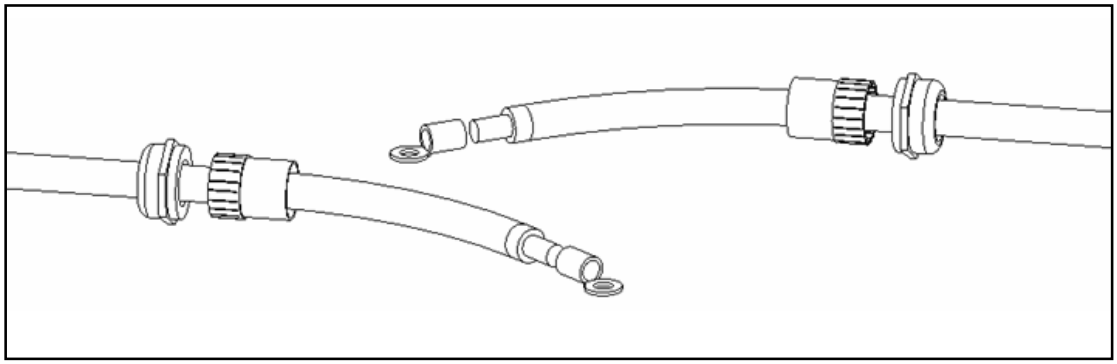
1) Open the Junction Box located in the front of the module.



<Fig. 6> Internal Junction Box

2) Disassemble male Cable-grand off female Cable-grand attached to the side of Junction Box.

Connect cable prepared into male Cable-grand, and then clamp Ring lug at the end of cable.

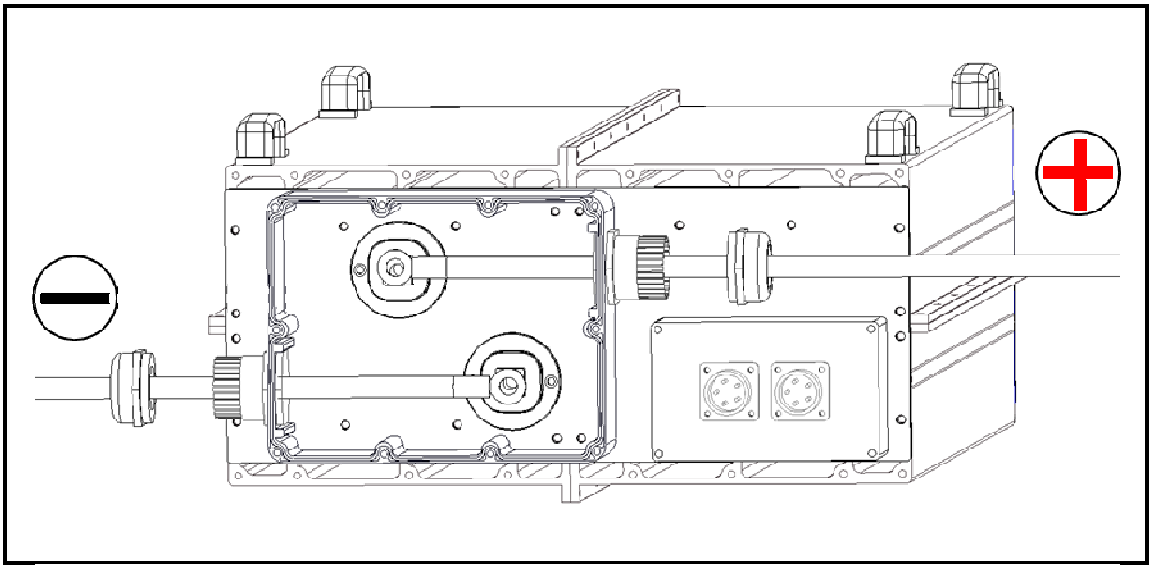


< Fig. 7 > Clamping Ring lug

3) Push the Ring lug clamped with cable into the Female Cable-grand on the side of Junction -

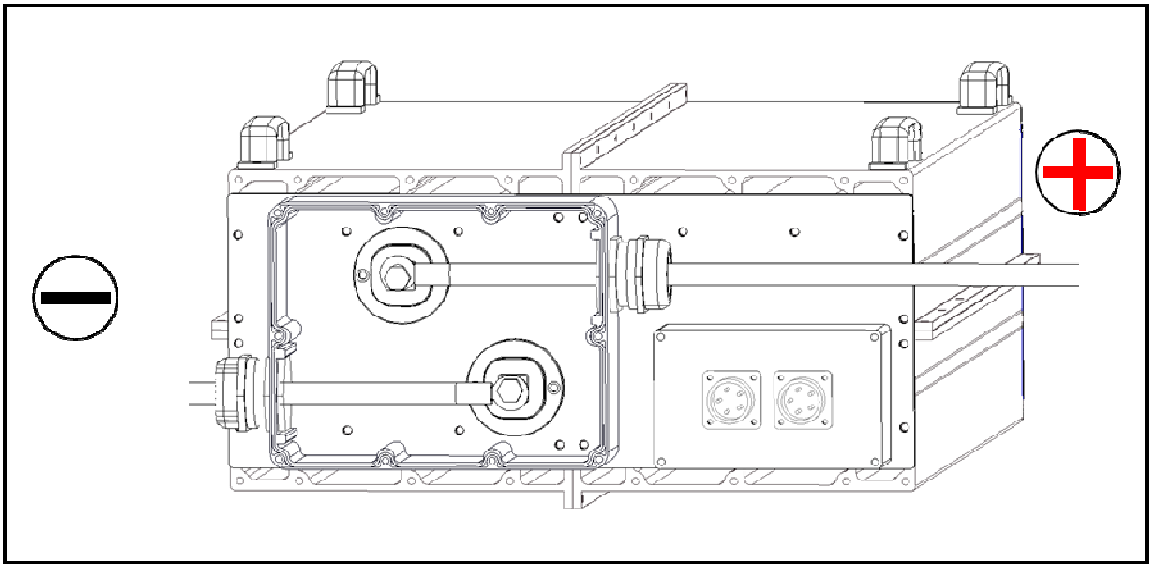
Box. Fix Ring lug with washer and M8 bolt into + terminal(M10 bolt into – terminal).

(Attention to Polarity)



< Fig. 8 > Fixing Cable

4) After fixing cables into + / - output terminals, tighten Cable-grand on the side of Junction-Box. (place extra attention because it is related with water proof)



<Fig. 9> Tightening Cable-grand

Monitoring system

▪ Monitoring connectors

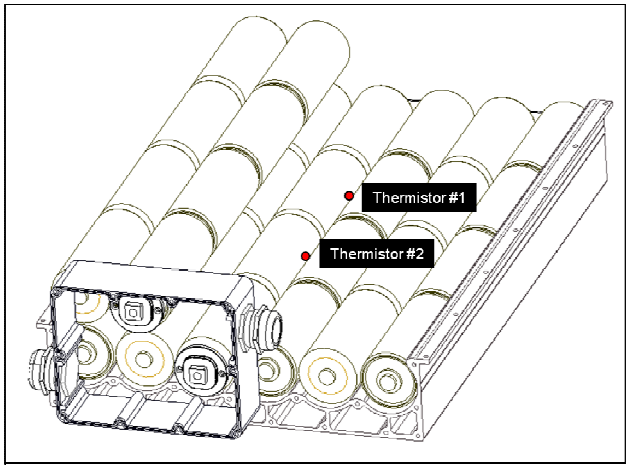
- The output of connector is tabulated below.

	LS UC Module Side		Customer System Side		Pin Out
	Image	Part's No. (pin)	Image	Part's No. (pin)	
Monitoring Connector 1 (only master module)		KD3102A 16s-1P (7-pin)		KD3106A 16s-1S (7-pin)	A - +24 B - GND C - CAN1_GND D - CAN1_h E - CAN1_l F - G -
Monitoring Connector 2		KD3102A 16s-8P (5-pin)		KD3106A 16s-8S (5-pin)	A - +24 B - GND C - CAN2_GND D - CAN2_h E - CAN2_l

* Connector images are used just for reference only. 7/5 pin type is actually used.

▪ Temperature Monitoring

- The NTC thermistors are used for module temperature monitoring. The temperature output is also available via CAN communication. <Fig. 10> shows the location of thermistors.



<Fig. 10> Location of the NTC thermistors

▪ CAN communication

- CAN Protocol

1) Baud rate : 125, 250, 500kbps (The default baud rate is 250kbps)

2) CAN identifier : 29-bit extended CAN identifier

LS UC Master Module Default ID - Receive : 0x18EF0100

LS UC Master Module Default ID - Send : 0x18FF4601

2-1) 24V DC power comes on and for initial 5sec, ID / Baud rate can be on changing mode.

2-2) Message table for ID / Baud rate changing mode

Message	Sender	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	L
Enter ID/Baud rate Changing Mode	PC	0x80	0xff	0xff	0xff	0xff	0xff	0xff	0xff	8
Changing UC Master Module ID-Receive	PC	0x81	*ID_LL	ID_LH	ID_HL	ID_HH	0xff	0xff	0xff	8
Changing Baud rate	PC	0x82	0:125kbit/s 1:250kbit/s 2:500kbit/s	0xff	0xff	0xff	0xff	0xff	0xff	8
Read ID-Receive / Baud rate	PC	0x83	0xff	0xff	0xff	0xff	0xff	0xff	0xff	8
Return message	Master Module	0x83	Baud rate	ID_LL	ID_LH	ID_HL	ID_HH	0xff	0xff	8
Exit ID/Baud rate Changing Mode	PC	0x84	0xff	0xff	0xff	0xff	0xff	0xff	0xff	8
Changing UC Master Module ID-Send	PC	0x85	ID_LL	ID_LH	ID_HL	ID_HH	0xff	0xff	0xff	8
Read ID-Send	PC	0x86	0xff	0xff	0xff	0xff	0xff	0xff	0xff	8
Return message	Master Module	0x86	ID_LL	ID_LH	ID_HL	ID_HH	0xff	0xff	0xff	8

* ex) If the UC Master Module ID is set to 0x12345678
ID_LL = 0x78
ID_LH = 0x56
ID_HL = 0x34
ID_HH = 0x12

3) User's System(or PC) → Master Module

3) PC ⇒ Master Module

Description	Messages	DB 1	DB 2	DB 3	DB 4	DB 5	DB 6	DB 7	DB 8	Data length
		command	data							
Parameter	Set Cyclic Transmission Interval	0x02	0-off 1-Voltage 2-Temp. 1,2 3-Voltage &Temp.1,2	Interval(ms)_L	Interval(ms)_H	0xff	0xff	0xff	0xff	8
	Set Time Between Messages	0x03	Time(ms)_L	Time(ms)_H	0xff	0xff	0xff	0xff	0xff	8
Ask Voltage & Temperature Data		0x11	***Module Number	0 : ¼ Voltage 1 : Half Voltage 2 : ¾ Voltage 3 : Full Voltage 4 : Temp.1 5 : Temp.2	0xff	0xff	0xff	0xff	0xff	8
Condition Check	Version	0x21	0xff	0xff	0xff	0xff	0xff	0xff	0xff	8

' Default condition (PC ⇒ Master Module)
Master module send massage of voltage & temperature automatically to User's system through CAN line in every 100ms once you turn 24VDC onto the module. Fan is off.

'' <ex 1>. If customer wants to receive voltage data only in every 500ms(=01f4_hex),
User's system should give command massage to master module as below;
ID 0x18EF0100 0x02 0x01 0xf4 0x01 0xff 0xff 0xff 0xff

<ex 2>. If customer wants to receive temperature data only in every 5.6sec(=15e0_hex),
User's system should give command massage to master module as below;
ID 0x18EF0100 0x02 0x02 0xe4 0x15 0xff 0xff 0xff 0xff

<ex 3>. If customer does not want to receive data cyclically,
User's system should give command massage to master module as below;
ID 0x18EF0100 0x02 0x00 0x00 0x00 0xff 0xff 0xff 0xff

''' Module Number is dependant on the composition of master and slave modules and tabulated below.

	1 Master Module + 3 Slave Modules	1 Master Module + 4 Slave Modules	1 Master Module + 5 Slave Modules	1 Master Module + 6 Slave Modules
Module Number	0 : Slave #1 1 : Slave #2 2 : Slave #3 3 : Master	0 : Slave #1 1 : Slave #2 2 : Slave #3 3 : Slave #4 4 : Master	0 : Slave #1 1 : Slave #2 2 : Slave #3 3 : Slave #4 4 : Slave #5 5 : Master	0 : Slave #1 1 : Slave #2 2 : Slave #3 3 : Slave #4 4 : Slave #5 5 : Slave #6 6 : Master

4) User's System(or PC) ← Master Module

<table>
<tr><th rowspan="2">Description</th><th rowspan="2">Messages</th><th>DB 1</th><th>DB 2</th><th>DB 3</th><th>DB 4</th><th>DB 5</th><th>DB 6</th><th>DB 7</th><th>DB 8</th><th rowspan="2">Data length</th></tr>
<tr><th>command</th><th colspan="7">data</th></tr>
<tr><td>Parameter</td><td>Cyclic Transmission Interval Acknowledge</td><td>0x02</td><td>0xff</td><td>0xff</td><td>0xff</td><td>0xff</td><td>0xff</td><td>0xff</td><td>0xff</td><td>8</td></tr>
<tr><td colspan="2" rowspan="2">Voltage & Temperature Acknowledge
Fan Status Return</td><td rowspan="2">0x11</td><td rowspan="2">Module Number</td><td rowspan="2">***
0 : ¼ Voltage
1 : Half Voltage
2 : ¾ Voltage
3 : Full Voltage
4 : Temp.1
5 : Temp.2</td><td>DATA_L</td><td>DATA_H</td><td rowspan="2">*SOC</td><td rowspan="2">**Fan Status Return
0:off
1:on</td><td rowspan="2">0xff</td><td rowspan="2">8</td></tr>
<tr><td colspan="2">*** Value = DATA / 100</td></tr>
<tr><td>Condition Check</td><td>Version Acknowledge</td><td>0x21</td><td>Main Version</td><td>Sub Version</td><td>0xff</td><td>0xff</td><td>0xff</td><td>0xff</td><td>0xff</td><td>8</td></tr>
</table>

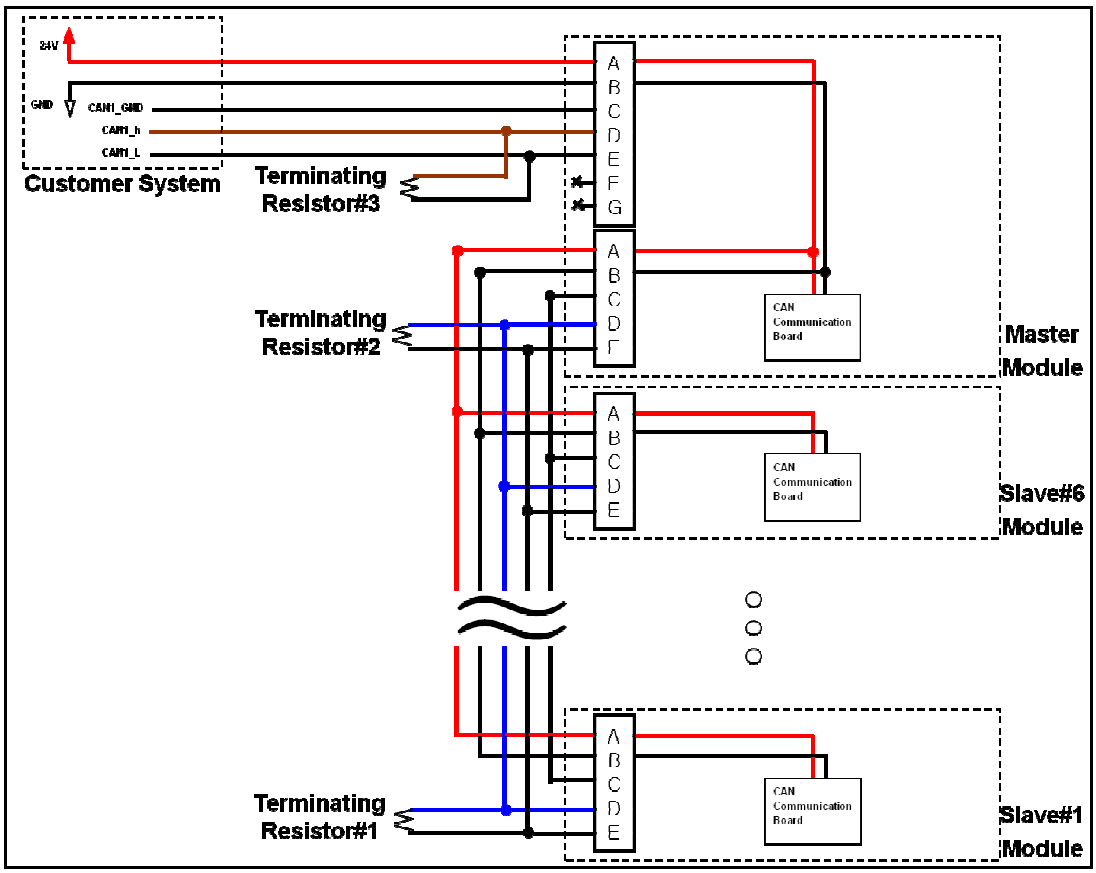
' SOC : State of Charge
'' Fan Status Return : You can check "Fan on" order at "Fan Control Acknowledge".
If the "Fan Control Acknowledge" is on and "Fan status Return" is off, it means Fan Control Error. (Please inform LS Mtron.)
''' If less quantity of slave modules than set up quantity in Master module are connected (or in cable unplugged situation),
Voltage data = 0xff ff, Temperature data = 0xff ff, SOC = 0x00.

5) Messages

	Offset	Min	Max	Units
Voltage	0	0.12	499.87	Volts
Temperature	0	0.00	120.00	℃

- Circuit Diagram & Terminating Resistor

<Fig. 11> shows the schematic of LS UC Module



<Fig. 11> Circuit Diagram

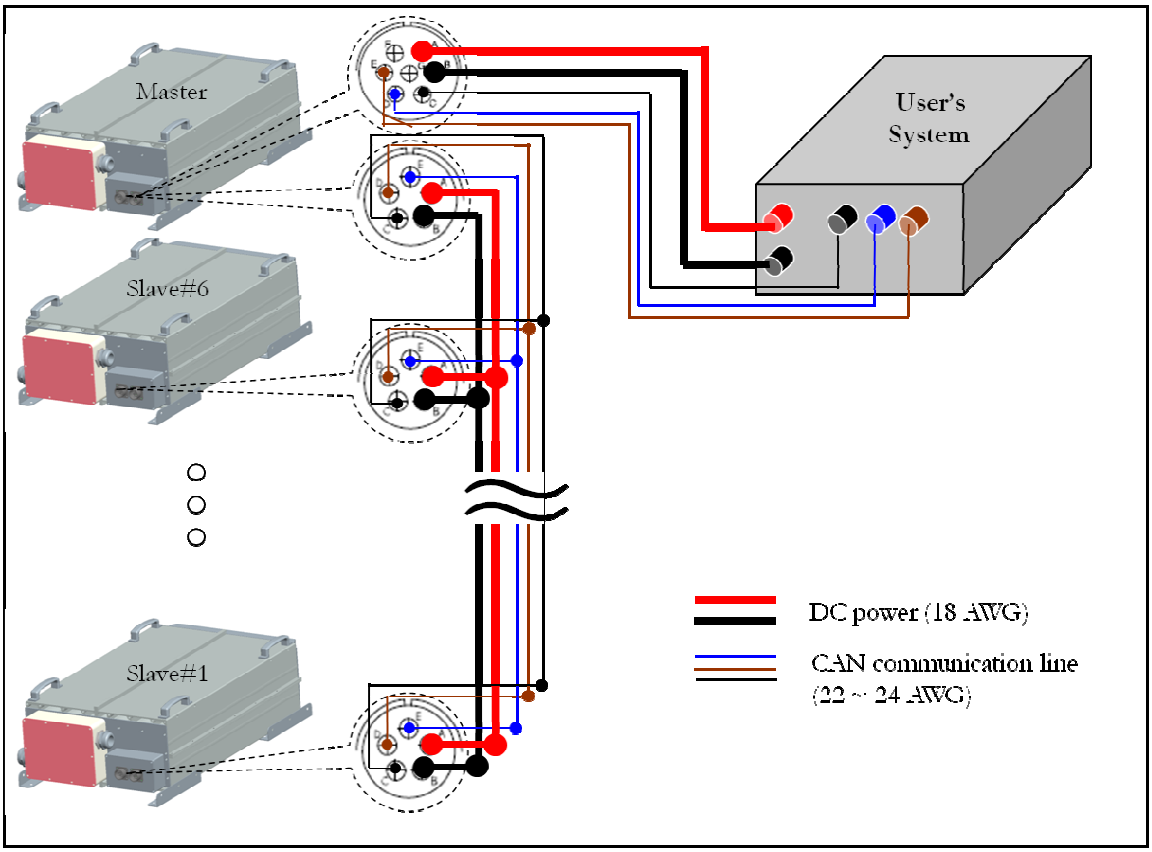
Terminating Resistor is not installed when customer receive modules. Connect Terminating Resistor to CAN2 network from outside after connecting modules. (120Ω in parallel will be suitable) Two Terminating Resistors below #1, #2 need to be connected from outside after you arrange modules as <fig.11> (If master module is located at the physical end of CAN1 network, the follwing#3 need to be installed.)

Terminating Resistor#1:between D-E terminal of 5pin connector in the slave#1 module

Terminating Resistor#2:between D-E terminal of 5pin connector in the master module

Terminating Resistor#3:between D-E terminal of 7pin connector in the master module(optional)

- CAN communication line and DC power line connection

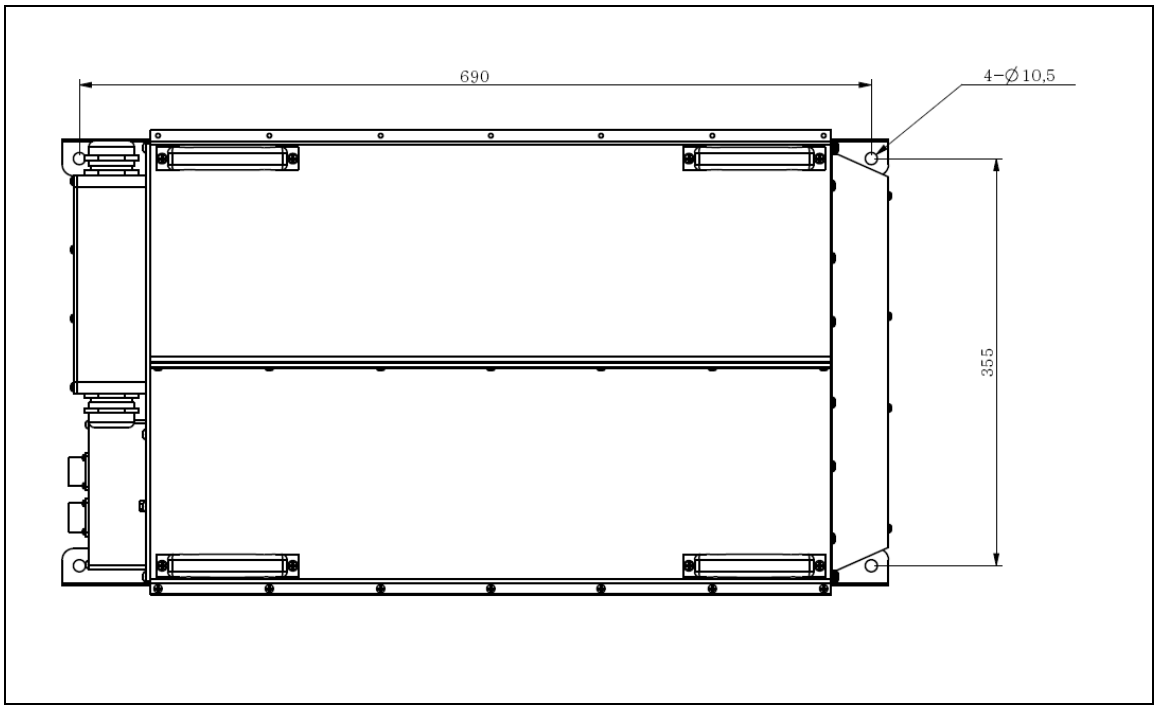


<Fig. 12> CAN communication & DC power line

After Installing Master and Slave modules, solder CAN communication lines and DC power lines with wires in reference with <Fig. 12>.

Mounting

<Fig. 13> shows the mounting positions of the module.



<Fig. 13> Mounting Positions

Accessories

- LS UC module (master) is included with flowing accessories

Description	Quantity
Mating connector for monitoring connector 1 (7-pin)	1
Mating connector for monitoring connector 2 (5-pin)	1
Cable Grand PG-21	2

- LS UC module (slave) is included with flowing accessories

Description	Quantity
Mating connector for monitoring connector 2 (5-pin)	1
Cable Grand PG-21	2

Maintenance

Power Rating

The rated voltage and current of the module max 129.6V. If the applied voltage is over 129.6V, charging the module should be stopped. And the allowable low voltage level of the module depends on the user's requirements, but full discharging to 0V does not affect the module performance.

Temperature

The module has its optimal operating temperature range of -40 to 65. Over 70℃, charging and discharging should be stopped to expect its performance and life cycle.

Maintenance

The module has its expected life cycle over 10years at normal conditions. However the life cycle of the module may be decreased in high temperature condition or over voltage charging.

If following abnormal module performances are detected, operation should be stopped and checking the electrical & mechanical connections is recommended.

- Monitoring high temperature in normal operating conditions

- Internal resistance increase or initial voltage drop increase

- Deformation of the module case

Contact Information

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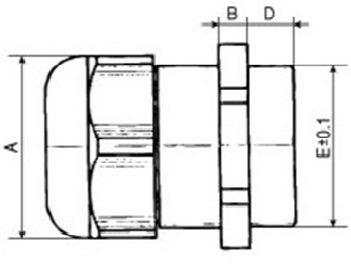
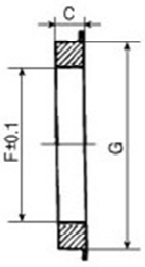
Appendix I

(PG Thread, Cable Glands-IP68)

- Material : Nylon
- Silver-grey or weather resistant UV Black
- Seal insert : Neoprene
- Temperature : -30℃ to+80℃
- Protection class : IP 68
- Flame-retardant : Good Reinforced Nylon. Sealing Nut Weather resistant





Unint : mm

PART NO	To suit cable dia between mm	A	B	C	D	E	F	G	PITCH
PG 7	3-6.5	15.0	5.0	5.0	8.0	12.3	11.6	21.0	1.0
PG 9	4-8	19.0				14.8	14.0	23.7	1.25
PG 11	5-10	22.0				18.2	17.2	26.0	1.25
PG 13.5	6-12	24.0		6.0	9.0	19.9	19.0	29.0	18G
PG 13.5-L					12.5				
PG 16	10-14	27.0	6.0		10.0	22.0	21.2	33.0	1.5
PG 21	13-18	32.60		7.0	11.0	27.6	28.8	38.4	16G
PG 29	18-25	42.0	7.0			36.5	35.6	50.0	1.5
PG 36	24-32	53.0	8.0	8.0	13.0	46.0	45.2	66.0	16G
PG 42	32-38	60.0	9.0	9.0		53.0	52.2	72.0	16G
PG 48	37-44	65.0			14.0	58.5	57.6	76.0	16G

Appendix II