WMPG 1000H

800,1200Watt

Potentiostat/Galvanostat Module

Hardware Manual

English

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www.wonatech.com

This manual has to be read carefully
before switching on the instrument.
The instructions must be followed strictly.

Non-observance of these instructions can
lead to the loss of right to claim for damages
or guarantee.

Manufactured by
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Use this program with other potentiostat/galvanostat system.

Modify the program

Reverse engineer, decompile, or disassemble software program or programmable logic devices.

Term

This license is effective until terminated.

If you have problems

Contact us at your earliest convenience. We can be contacted via;

E-mail: service@wonatech.com

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- If you write to us about a problem, provide as much information as possible.
- We need data file. Send them via e-mail.

Limited Warranty

WonATech warrants to the original user of this product that it shall be free of defects resulting from faulty manufacture of the product or its components for a period of one year from the date of shipment.

WonATech makes no warranties regarding either the satisfactory performance of WonATech system including the software encoded in this product or the fitness of the system for any particular purpose.

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WonATech reserves the right to make revisions to the system at any time without incurring any obligation to install same on systems previously purchased. All system specifications are subject to change without notice.

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Notice

1. Hardware

- You must disable power saving option in Windows OS
- Don't place EMI producing unit nearby this instrument (such as radio, vibration etc.).
- The cell cable itself can work as antenna. (It can receive EMI noise). Especially don't place cell cable on power line cable.
- If the result data is so noisy, make the cell cable as short as possible. (It reduces noise)
- The counter electrode is dangerous. Don't touch this electrode.
- When you turn on WMPG hardware, It is normal that potentiostat LED and galvanostat LED are lighting together. When you execute SServer.exe.exe then potentiostat LED is turn off. If you executed SServer.exe.exe and potentiostat LED is still lighting, It means that the communication between PC and WMPG has a problem. In this case, check the LAN connections,
- If the problem still remain, Please contact our service department via service@wonatech.com.

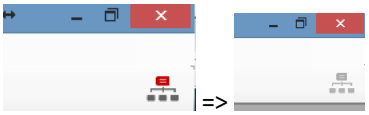
2. Potentiostat mode & Cycler mode

- Potentiostat/Galvanostat; Voltage value (for control or measurement) is based on working electrodes voltage vs. Reference electrode voltage.
- Cycler mode: Voltage value (for control or measurement) is based on positive electrode vs. Negative electrode. The connection is Positive electrode (Counter + Reference) and negative electrode (Working + working sense). So voltage polarity is opposite in Potentiostat/galvanostat mode and cycler mode.
- If you want the control (measurement) voltage as working vs. Reference, you must select potentiostat/galvanostat mode or if you want control (measurement) voltage as counter (reference) vs. Working, you must select cycler mode.
- The main reason, which two modes are existing, came from that Commercial Multichannel Potentiostat/Galvanostat is based on power supply circuit. Power supply circuit has only positive electrode and negative electrode. In this case power supply terminal is connected positive electrode and ground terminal is connected to negative electrode. But in potentiostat/Galvanostat circuit, The counter electrode is connected power supply terminal and working electrode is connected to ground terminal.
- Simply if you want WMPG as potentiostat/galvanostat ,select "potentiostat mode" or if you want use WMPG as Cycler same as other commercial Battery cycler , select cycler mode.
- If your experiment schedule file which you made is potentiostat mode (file extension: cye) and you want to use it's procedure in cycler mode then you just change extension from cye to cyc in file manager etc.

3. LAN connection fail/PC failure

WONATECH WMPG has internal memory and independent CPU inside of unit, so it works independently nevertheless connection with PC or not. You can reconnect working system anytime.

If LAN cable was disconnected by fault or PC failure happens, LAN logo's color on right upper corner on the software will be changed from red color to grey color.



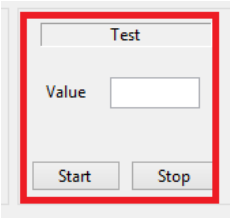
WonATech WMPG will run independently regardless connection with PC so you can connect LAN cable then Smart Interface (SI) software detect connection automatically then the connection logo will be changed to red color.

If PC failure happens, just reboot the PC and run SServer.exe and wmpg.exe then you can see running experiment normally without any loss of data if data points are less than internal memory.

If the problem happened, Don't turn off system power. If you turn off system power, all experiment data will be disappeared.
Please note that if LAN connection was lost, don't try to click run or stop button.
If you click start button by fault, reconnection will not work properly.

4. Calibration

- The calibration parameters are updates when you press "apply" button. So you must press "apply" button after you did calibrate by 4th level. Note: This "apply" button works to calculate the calibration data. **If you want to upload the calculated calibration data to channel, you MUST click "APPLY DEVICE" button**
- General procedure: After you press "apply" button, check whether calibration is successful or not by testing with some value on test area , save the calibration file by pressing "save" button.



- Please note that if you want to apply updated calibration info to channel promptly, you must press "Apply Device" button. After pressing this button, you must press "UPLOAD" button

5. If you have trouble or questions;

If you have trouble on WONATECH WMPG or questions, please send the following file and explanation to service@wonatech.com.
Data file (WRD or WCD)

Chapter 1. General instruction

Please carefully read this operation manual before you start to use WONATECH WMPG .

1. Installation:

WONATECH Smart Interface program can be run under WindowsXP SP3 /Windows7 /8/10 environments. (32bit or 64bit OS available). The minimum specification of PC is PentiumIV CPU and RAM 1024MB and display card supporting 16bit high color and 1600x900 resolution or above. For multi-tasking, we recommend higher RAM size and memory size of video adapter.
If you have any queries regarding installation, please contact with WonATech service department. (service@wonatech.com)
WMPG1000H channel module incorporate with 8channel controller or WMPG1000S/M's channel expansion module.

1) Software installation

Refer to Smart Interface manual

2) Hardware installation

① Connect power cable

② Connect interface cable between channel connector at 8channel controller's rear panel or WMPG1000S/M's channel expansion unit's channel connector.

③ Connect Interconnecting cable between 8ch controller if your system is more than 8channel

④ Connect LAN cable between PC and 8 channel controller's rear panel

⑤ Connect Cell cables at front panel's connector

⑥ Connect your cell to cell cable.

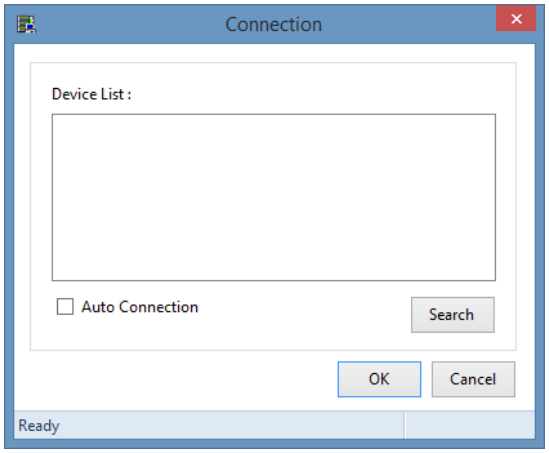
⑦ Power On

a. Direct Connection

①. Connect LAN cable between PC and 8 channel controller's rear panel

②. Run Sserver.exe

If there is no device list, click search button to find device(s)



b. Connection via switching hub

If your system has multiple devices, you need a switching hub.

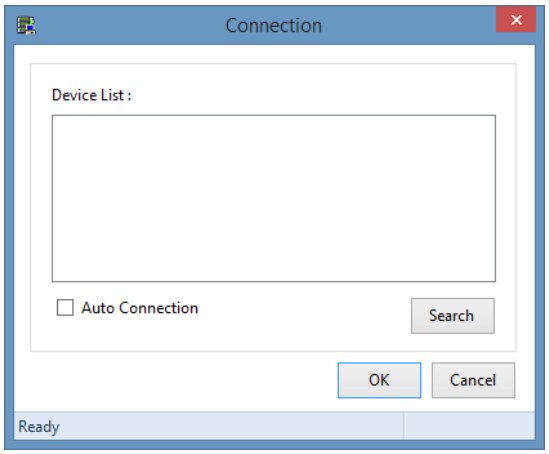
(We do not recommend Router for this purpose).

①. Connect LAN cable between PC and switching hub

②. Connect LAN cables between switching hub and 8 channel controller rear panel's LAN connectors

③. Run Sserver.exe

If there is no device list, click search button to find devices



④. Connect Cell cables at front panel's connector

⑤. Connect your cell to cell cable.

⑥. Power On

2. Checking Point

Before running WONATECH WMPG , please check the following

1) Earth ground on power line
2) Power cord should be grounded.
3) Connect LAN cable between WONATECH 8ch controller and PC.
4) Power on 8ch controller and WMPG1000H (Please check fan working and power switch LED on)
5) Power line cables (PC, Monitor, WMPG, Printer etc) should be for earth ground
6) Power line for WMPG is 220V(**Please check it again**. Some model might be for **110VAC** if you ordered).
7) System fault in device manager in control panel of WindowsXP SP3/7/8/10
8) Virus infection of Software in your PC
9) If there is no problem on the above check procedure, Check the WMPG following the below procedure using dummy cell (resistor).

3. Caution

1) If you find  icon color at right upper side of display, then it means communication is normal but if icon color is  , it means that communication between PC and WONATECH 8ch controller is disconnected.
2) Please note the cell lead cable connector color as the follows
   Working electrode: Black
   Sense: White
   Reference: Green
   Counter: Red
3) Don't touch Counter electrode lead during run
4) Don't remove cell cable lead during run
5) Don't locate noise source(radio, monitor etc) nearby instrument
6) Don't locate something at bottom and rear panel. (There are cooling fans)
7) Don't power off during run
8) Don't disassemble the instrument
9) Place resistor between working+sense and counter+reference for unused channel(s).

Chapter 2. Introduction

1. WMPG1000H System

This system can be used in corrosion research, sensor application, electrochemical analysis, electrolysis (electrosynthesis), electro plating and battery test including life time test, electric characteristics with PC controlled multichannel system. You can control and data acquisition of this system for multiple cells simultaneously. This channel was designed for Application of 400watt to 1200watt

To prevent variance of control value by cell internal resistance change, this analog circuit use feed back circuit for voltage control and current control and this will make high accurate and reliable constant voltage control and constant current control in hardware. This system also have multiple current ranges for various application with full scale current change. The SI software is ready for multichannel control and analysis with user friendly designed software.

The software provides true multitasking functions with universal graphic to represent various axis parameters setting..

Independent power supply per 1channel so you can easily change defective channel without dead time.

This flexible configuration of the system can configure difference channel specification in one system.

SI software can support max 128 channels and there are several models by power level.

- WMPG1000L: Max 200mW
- WMPG1000Le: Max 2Watt.
- WMPG1000S: Max 50Watt
- WMPG1000M1: Max 100Watt
- WMPG1000M2: Max 200Watt
- WMPG10000D: Max 400Watt
- WMPG1000H8: Max 800Watt
- WMPG1000H12: Max 1200Watt
- WMPG1000HP: Over 1200Watt

Feature

1) For 400watt – 1200watt application
2) High resolution ADC, DAC(16bit)
3) Multi-tasking under Windows environment
4) Independent control of each channel
5) Real time graphic function in several channels
6) For safely function, It was designed using double safely protection function is provided for user and testing samples.

7) Automatic current ranging function with multiple current ranges for various applications.
8) This system is designed with Feedback circuit for voltage control and current control. This can be used in multichannel potentiostat/galvanostat and multichannel battery cycler system.
9) You can set data sampling condition per each experiment step for effective file sizing.
10) Group monitoring by channel group setting
11) Universal Graphic function (Universal axis parameter setting)
12) User friendly software design (BCO:Button Click Operation function).

2. System configuration

A. Hardware configuration

(1) IBM compatible PC(Option)
- Windows XP SP3/7/8/10, 32/64bit
- Monitor : 1600 x900 or higher
- Keyboard
- Mouse

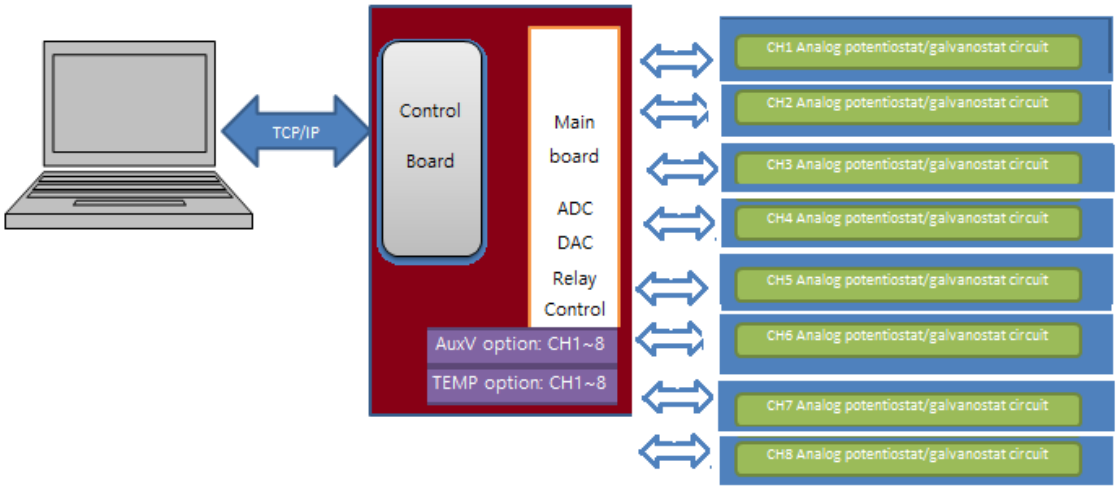
(2) Flat Cable(For channel expansion)
(3) 8ch controller (8ch 1module)
(4) Potentiostat/Galvanostat
1) Channel module
Cell port (working, counter, sense, reference)
RUN & MODE LED
2) Shield Cell Cables (optional item per length)
3) Power Cable
(5) LAN Cable
(6) Dummy Cell

✓ **Optional Accessories**
- Temperature measurement module
- Aux voltage measurement module
- AuxV cable
- Battery Jigs

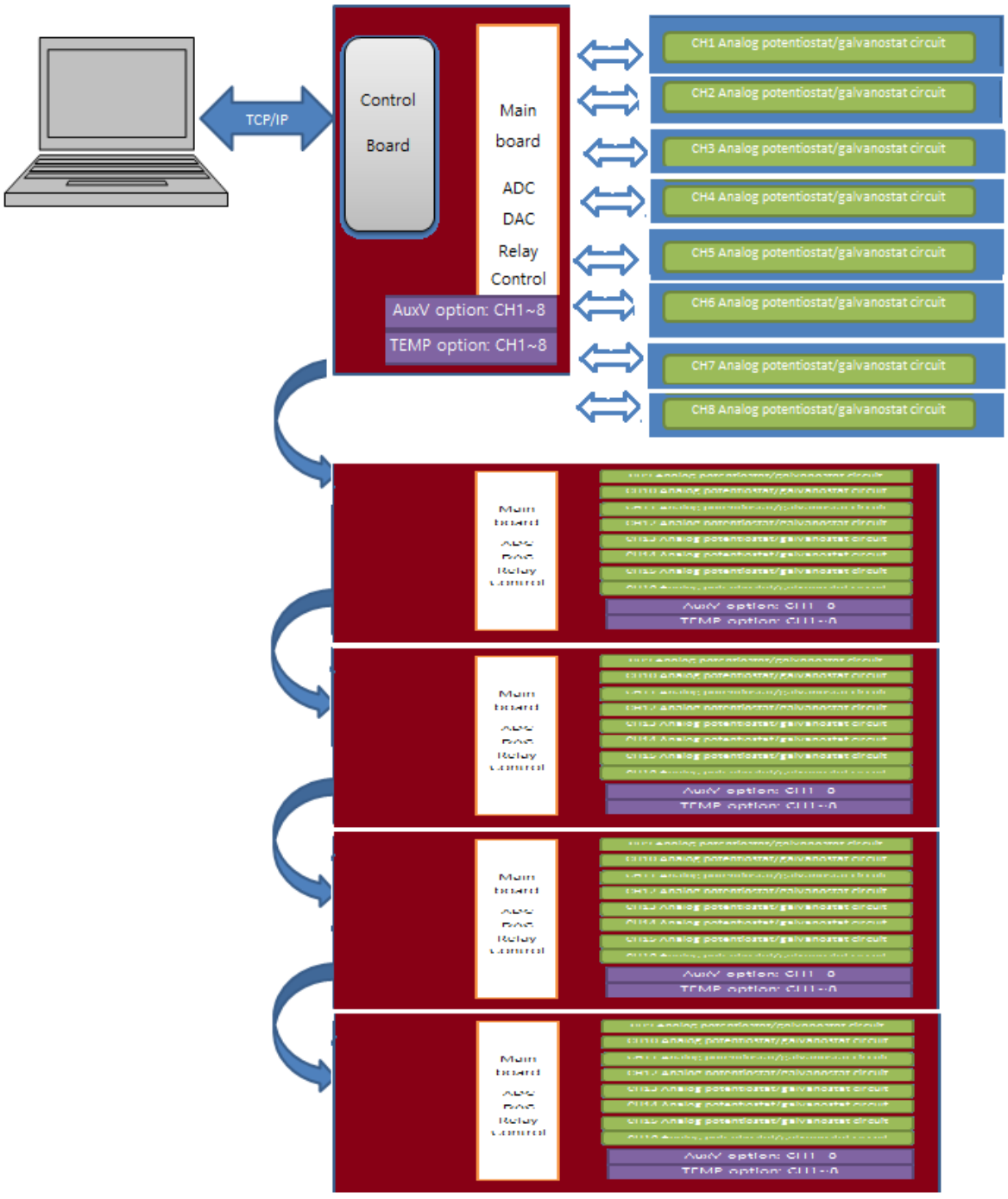
B. SOFTWARE feature

1) Operating System : Windows XP SP3/7/8/10, 32/64bit
2) Creating / Editing experiment schedule file
3) Data conversion to excel or ascii format
4) Channel monitoring and Grouping
5) Graphic functions
6) Report function

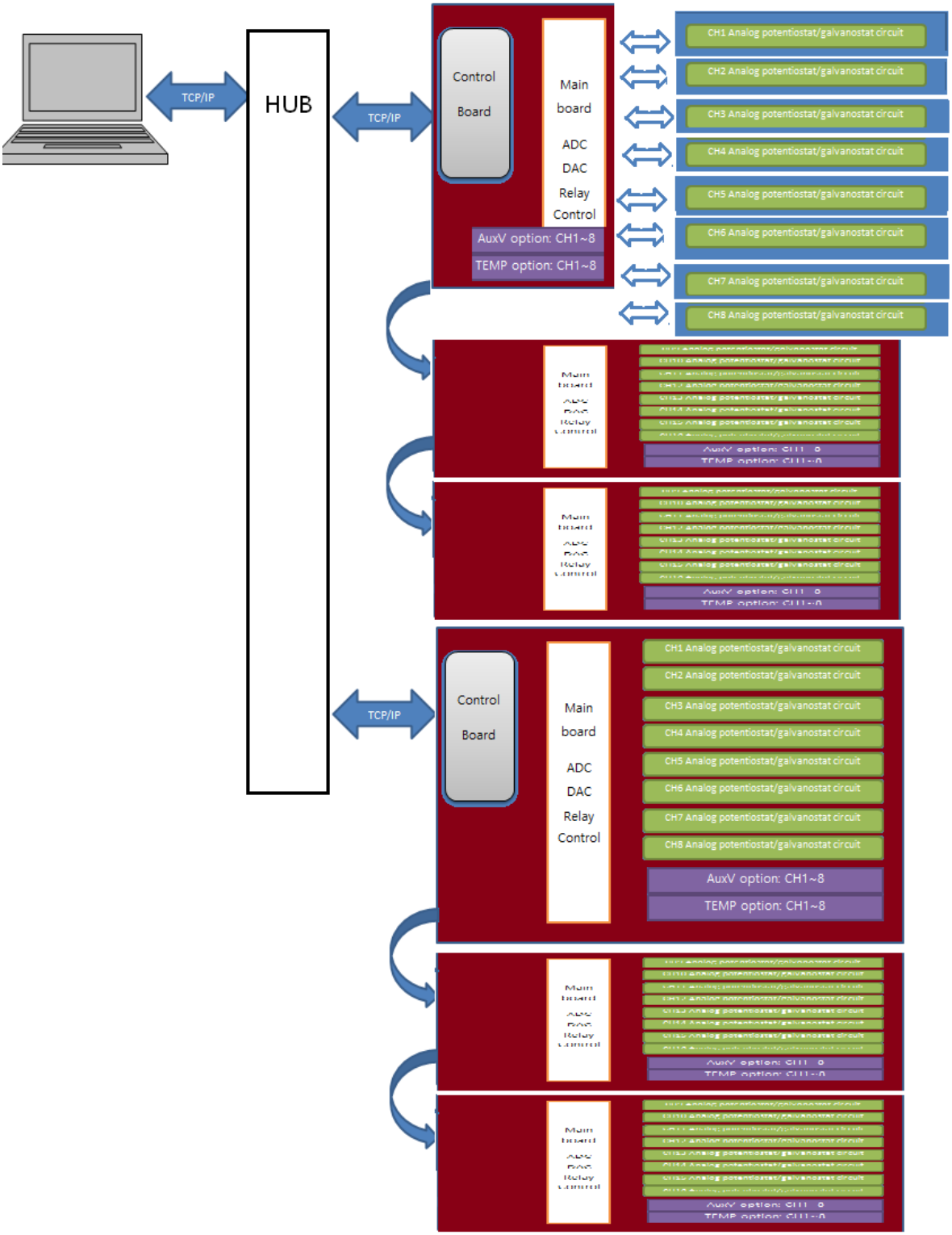
C. System Block Diagram (Example)



Single SIF configuration (above example WMPG1000H 8set :8ch configuration 10msec sampling rate)



Single SIF configuration (above example:40channel: WMPG1000H 8CH+ WMPG1000S32CH 20msec sampling rate)



Multiple SIF configuration(above example: 2SIF 8channel:WMPG1000H 8ch WMPG1000S40ch 10msec sampling rate)

3. Specification

A. PC specification (Option); specification can be changed

1) PentiumⅣ or higher
2) RAM: 1GB or higher
3) Monitor: 1600 x900 resolution or higher
4) HDD: >500GB
5) CD-ROM, Keyboard, Mouse

B. 8ch controller (Option)

Control channel number	8
ADC	16bit 2ea
DAC	16bit 8ea
Communication	TCP/IP
Sampling time	- 8~24 channel system : 10msec - 25~40 channel system : 20msec standard - 41~128 channel system : 50msec standard

C. WMPG1000H Potentiostat/Galvanostat module specification

- Following specification sheet is based on WMPG1000H8:<800Watt standard model. (The specification can be different by user's order specification)
  - **WMPG1000H8 max power per ch: 800watt**
  - **WMPG1000H12 max power per ch: 1200Watt**

Note:

- WMPG1000L: Max 200mW
- WMPG1000Le: Max 2Watt.
- WMPG1000S: Max 50Watt
- WMPG1000M1: Max 100Watt
- WMPG1000M2: Max 200Watt
- WMPG10000D: Max 400Watt
- WMPG1000H8: Max 800Watt
- WMPG1000H12: Max 1200Watt
- WMPG1000HP: Over 1200Watt

1) Specifications

Control voltage range	±20V
Control current range	20A, 1A, 100mA, (3 ranges)
LED	Run: 1ea, Mode: 2ea
Input impedance	10^{12}Ohm

Cell connection	4 probe type, banana connector with alligator clip cables
No. of channels per module	1
Voltage accuracy	±0.05% f.s.
Current accuracy	±0.1% f.s.
Voltage Control/Measurement	
Full scale ranges	Max. 20V
Current Control/Measurement	
Full scale ranges	Max. 20A

2) LED

RUN LED: Channel Running Status LED(Off at rest)

PSTAT LED : Potentiostatic Control LED

GSTAT LED : Galvanostatic Control LED

Chapter3. Cell Connection

1. Cell Cable configuration

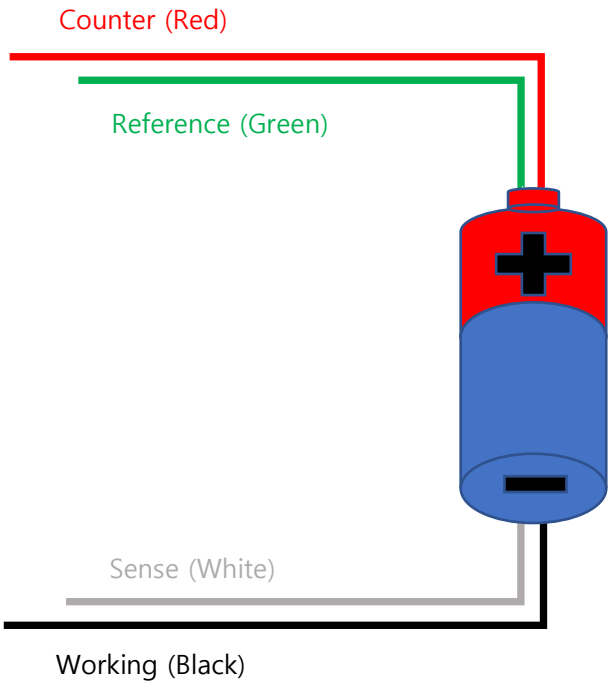
- Counter cable (Red connector)
- Working cable (Black connector)
- Reference cable (Green connector)
- Sense cable (White connector)

2. Battery Test

Connect Counter electrode cable terminal and reference electrode cable terminal to Battery's positive electrode.

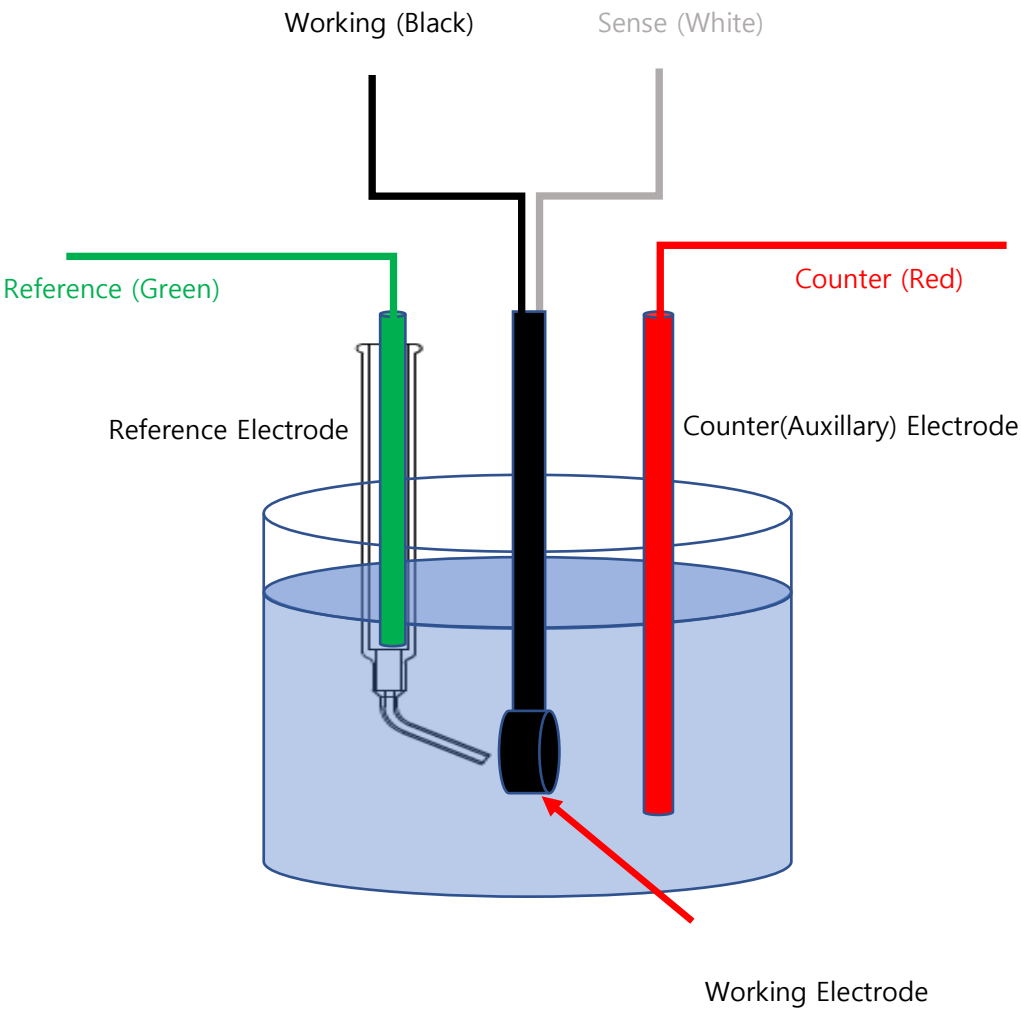
Connect Working electrode cable terminal and working sense electrode terminal to battery's negative electrode

Make schedule file as *.cyc (Cycler mode) and assign this schedule file to channel which you want Run Experiment



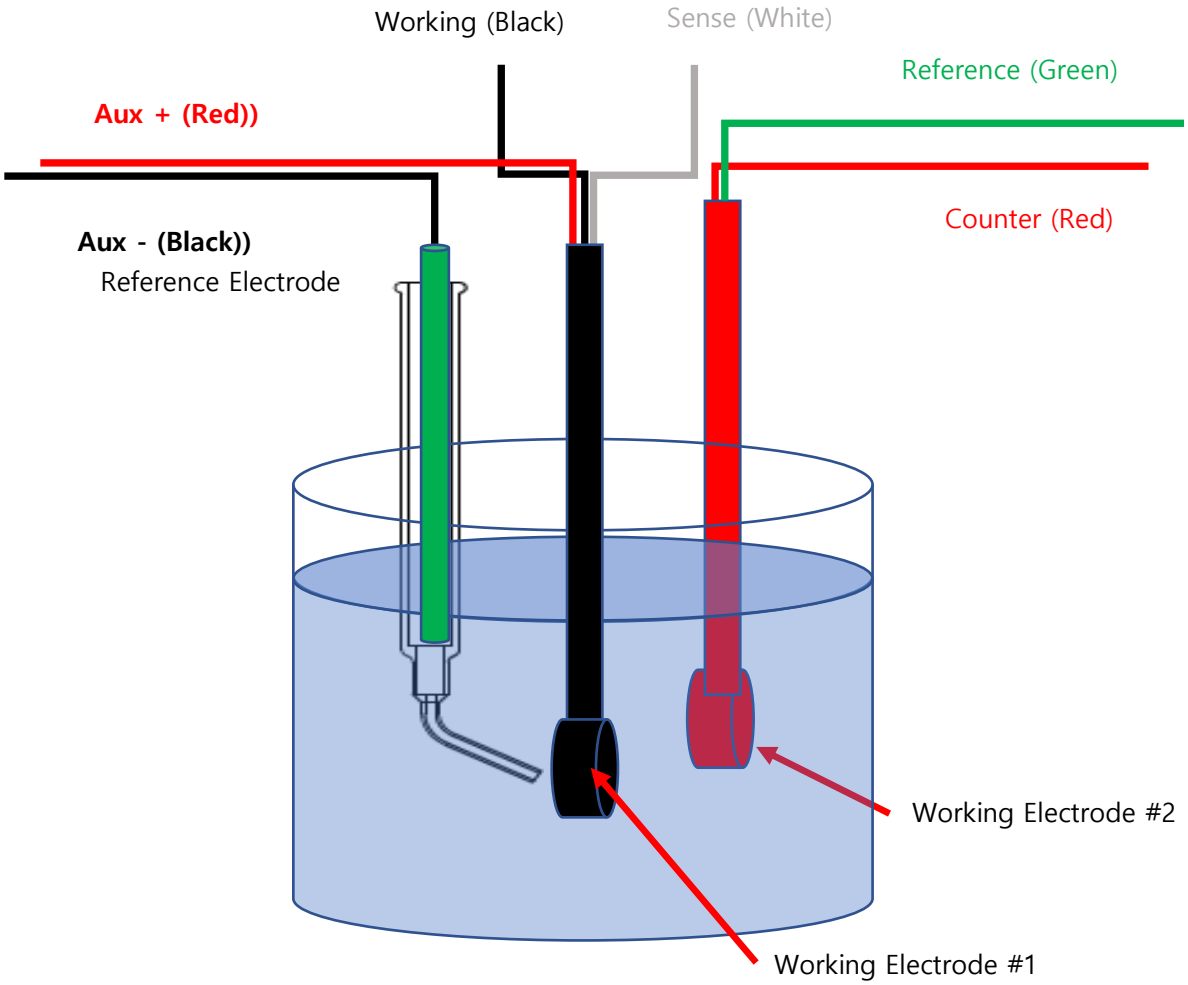
3. Electrochemical Experiment / Half cell test (3electrode configuration)

1) Connect working electrode cable terminal and working sense cable terminal to Working electrode.
2) Connect Reference electrode cable terminal to reference electrode
3) Connect counter electrode cable terminal to counter electrode
4) Make schedule file as *.cye (potentiostat mode) and assign this schedule file to channel which you want to use.
5) Run experiment.



4. ZRA Experiment.(Require Aux option)

1) Connect working electrode cable terminal and working sense electrode terminal and Aux cable positive terminal to Working#1 electrode.
2) Connect reference electrode cable terminal and counter electrode cable terminal to Working #2 electrode.
3) Connect Aux cable negative terminal to reference electrode.
4) Make schedule file as *.cye (potentiostat mode) and assign this schedule file to channel which you want
5) Run experiment



Chapter4. Channel Calibration & Inspection

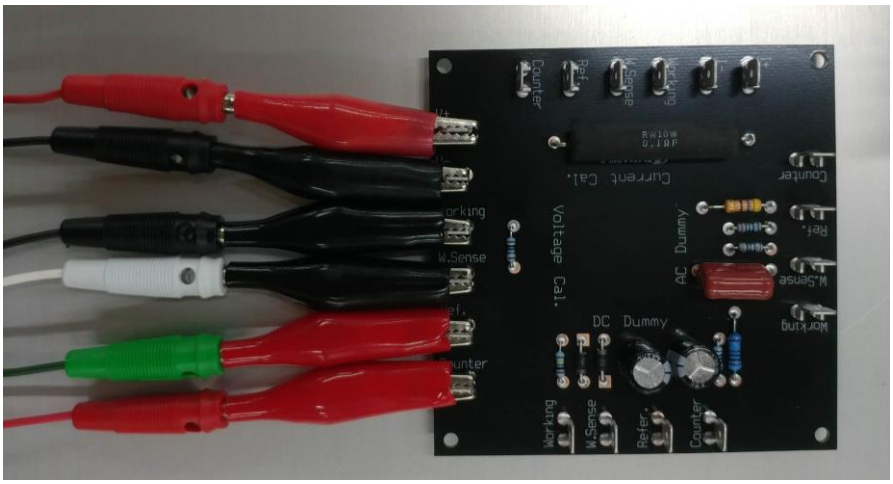
1. Calibration

You need special sensing resistor and high precision multimeter.

Contact with manufacturer for further information

2. Voltage calibration

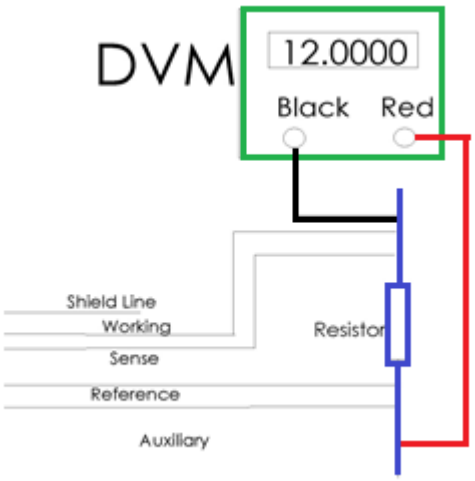
A. <10V



1) Connect the cables from cycler to each terminals at “Voltage Cal”
2) set voltmeter(multimeter) for DC voltage measurement
3) connect red cable from voltmeter to “V+” on dummy cell and black cable from voltmeter to “-“ on dummy cell
4) Select calibration menu in SI software.
5) Refer to 4. Calibration program

B. >10V

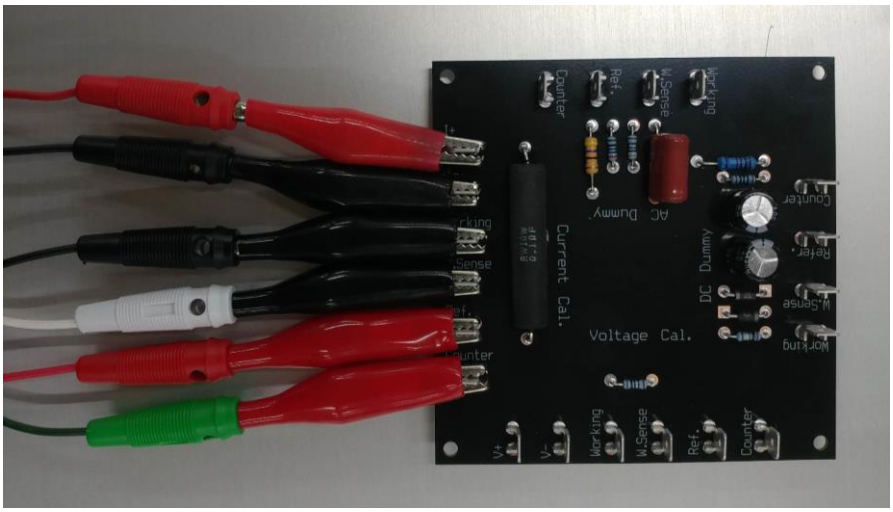
a. How to connect calibrating resistor and voltmeter(ammeter)



1) Connect the cables from battery cycler to each terminals of 10kOhm resistor.
2) set voltmeter(multimeter) for DC voltage measurement
3) connect red cable from voltmeter to end of sensing resistor and connect black cable to the other end of the resistor.
4) Select calibration menu in SI software.
5) Refer to 4. Calibration program for voltage calibration

3. Current calibration

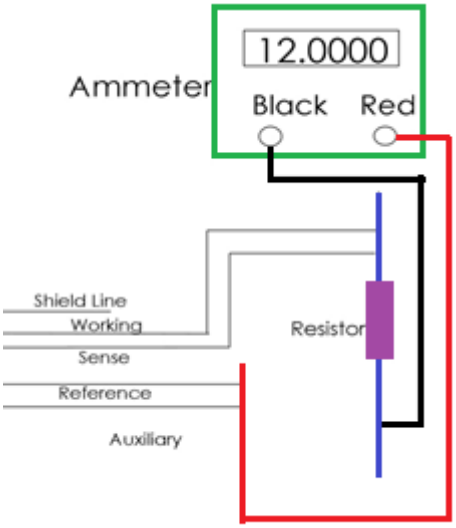
A. Current range : <10Amp



1. Connect the cables from cycler to each terminals at "Current Cal"
2. set ammeter(multimeter) for DC current measurement
3. connect red cable from ammeter to "I+" on dummy cell and black cable from ammeter to "I-" on dummy cell
4. Select calibration menu in SI software.
5. Refer to 4. Calibration program

B. Current range: >10Amp

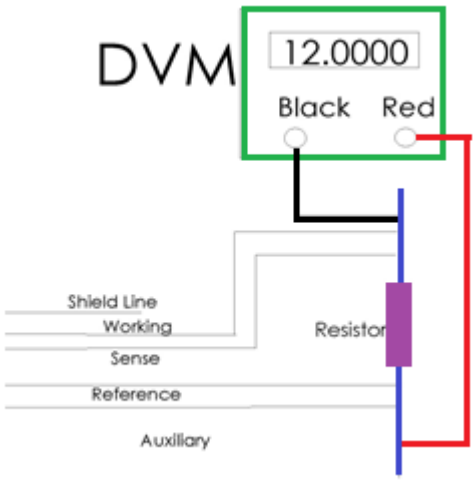
If you have high current ammeter and high power shunt resistor.



1. Connect the cables from battery cycler to each terminals as the above
2. set ammeter(multimeter) for DC current measurement

3. connect red cable from ammeter to “I+” on shunt resistor and black cable from ammeter to “I-“ on shunt resistor as the above
4. Select calibration menu in SI software.
5. Refer to 4. Calibration program for current calibration

If you have high power shunt resistor and voltmeter only.

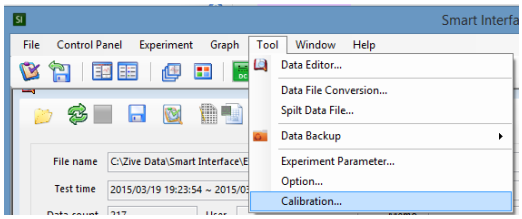


The shunt resistor’s power is higher than calculated value (**I^2R**)

Eg) When you apply 20Amp and shunt resistor value is 0.1ohm the required shunt resistor’s power is higher than 20 x 20 x 0.1 =40Watt

1. Connect the cables from battery cycler to each terminals of high power high precision resistor.
2. set voltmeter(multimeter) for DC voltage measurement
3. connect red cable from voltmeter to end of sensing resistor and connect black cable to the other end of the resistor.
4. Select calibration menu in SI software.
5. Refer to 4. Calibration program for current calibration.
6. Current value should be calculated by yourself using Ohm’s law. (I=Voltmeter’s voltage value x shunt resistor’s resistance value)

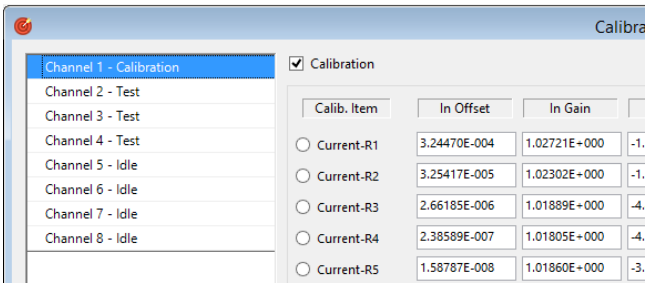
4. Calibration program



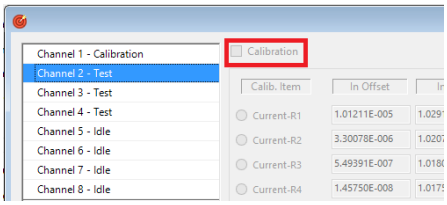
- **Check earth ground**
- **Check connection of resistor & voltmeter(Ammeter) correctly**

You can calibrates WMPG by selecting Tool-Calibration on menu bar or click  icon on tool bar.

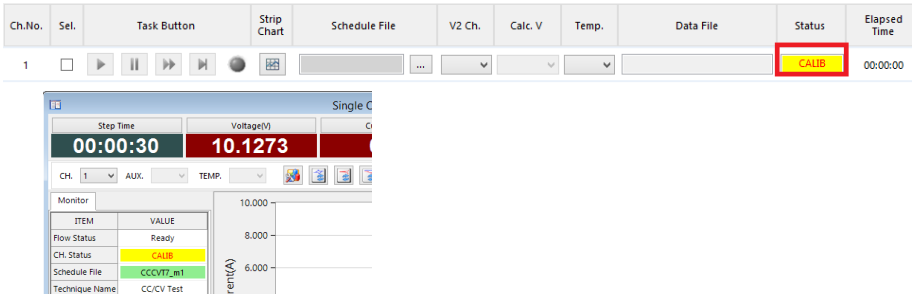
- Select channel on the left channel selection which you want to calibrate and click “calibration check box.



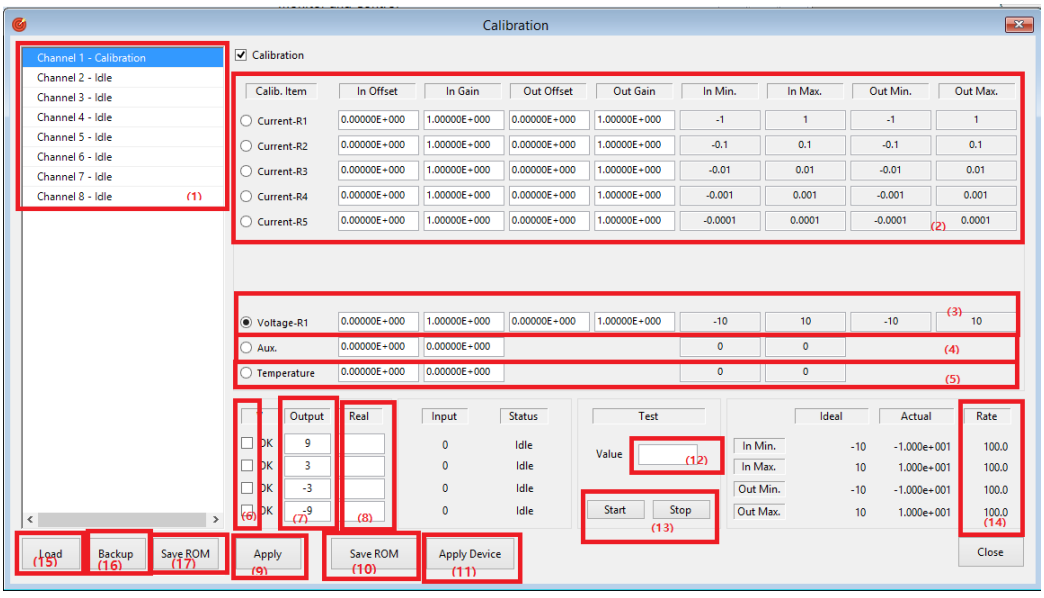
- You cannot calibrate the channel that is running or paused. Running or paused channel’s calibration check box will be disable.



- Multichannel control panel shows calibration channel as the follows.

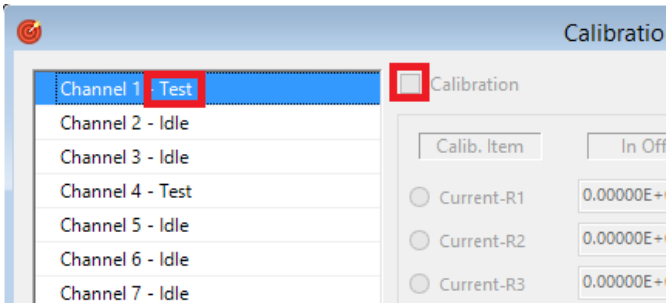


- During calibration, user cannot run this channel for experiment.



1) Select channel number [1] which you want to calibrate and check on “calibration” check box.
2) Select parameter which you want calibrate; [2] Current, [3] Voltage, [4] AuxV, [5] Temperature
3) (Refer to the above guide how to connect resistor connection)
4) Select level1(first row) [6]

5) Input desired output value in output value box[7](Note: You can use default value)
   Tip) Select the value for level1, 2, 3, 4, as 90%, 30%, -30%, -90% of full range value
   e.g.) +/-5Volt case: +4.5V,+1.5V, -1.5V, -4.5V
6) Check the connection between WMPG , resistor and multimeter again
7) Click “Real” input box [8] then run LED is lighting and you can hear Relay’s tick sound. Read the multimeter value and input this value in “Real” input box[8]
8) If run LED is not lighting or multimeter’s reading value is so far from output value which you inputted, check the above procedure 1 to 5 .If you fail to find cause of occurrence, please contact our service department.
9) Select Level 2(second row) [6]
10) Repeat the above procedure 4)-7)
11) After finish level4, click “apply” button [9] then software will calculate calibrated value.
12) Click “Apply Device” [11]. This will send updated calibration data of this channel to SIF control board. After click this button, this channel will work with new calibrated data
    Note: You must click “Save ROM” to save new calibrated data. If not, when you turn off instrument, new calibrated data will be disappear.
13) Click “Save ROM” button [10]. This will save updated calibration data of this channel on Instrument’s ROM.
    Note: When WMPG hardware is power on and sserver.exe connect the hardware, Saved calibration data in ROM will activate.
14) Input middle value of full range value on TEST value box [12] and press “Start” button. Check the reading value (bottom side of Test value box) and multimeter value. They (Reading value & Multimeter value) should be within +/-0.1% of full range value from TEST input value. If any of result (result value or multimeter value) is far from expected, then re-calibrate again.
15) You can check the rate value for calibration. If input value for calibration was wrong, this rate is not around 100%.
16) If you use other channel and you want to use new calibrated data channel, you must click “Apply Device” button..
17) Repeat the procedure from 2) as same manner for other calib type.
    Tip
    A. Unit: For current calibration, use unit for output value. (e.g. Input 30 for 30uA if the unit is uA, Input 0.08 for 80mA if the unit is A)
    B. If you try to calibrate on running channel or paused channel, you cannot check on calibration check box.



18) If you try to TEST to check whether calibration is successful or not, the unit for input value is same as the unit for calibration.
    Caution.

A. Select Resistor value using formula E=IR, I=E/R under system specification.
B. On calibration, SI.exe displays status for calibration channel as CALIB and you cannot use this channel for experiment.

19) You can load backup calibration data for all channel by clicking (15)Load button
20) You can save calibration data backup file by clicking (16) backup button
21) You can save calibration data for all channel into instrument's ROM by clicking (17) Save ROM button

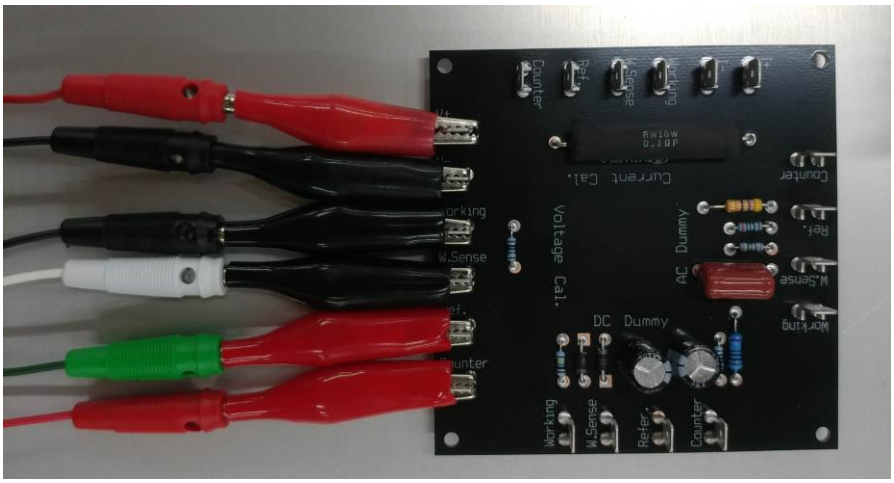
5. Inspection/Hardware check

After calibration or if you want to check the system, you can do instrument check using external dummy cell or resistor.

A. For Voltage check

a. <10V

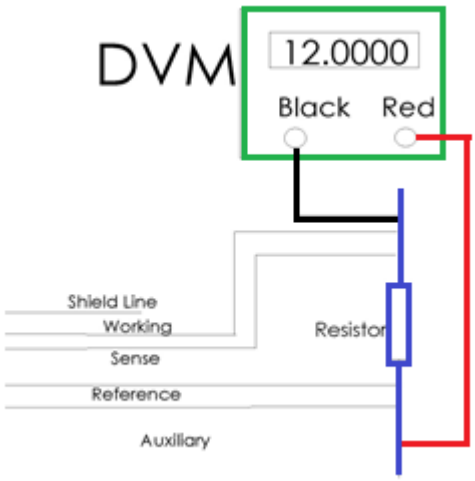
✓ Use external dummy cell's Voltage Cal. Side or 1kΩ resistor



1) As the above, connect cell cable same as for voltage calibration.
2) Make schedule file for constant voltage control or constant current control in SI software and test dummy cell or resistor using this schedule file.
3) If you test constant current control, You MUST set current value below than +/-5mA (For >+/-5V system) because testing resistor value is 1kΩ. (E=IR; 5V=0.005A*1000Ohm)
4) You can check system's accuracy by comparing measurement value as SI software and voltmeter/Ammeter value . If you did not connect multimeter to external dummy cell nor 1kOhm resistor, You can check the system's default by Ohm's Low. (For example, if you apply 1Volt to 1kOhm resistor, measured current should be around 1mA. If measured value is far from 1mA, hardware should be defective or calibration is needed).

b. >10V

✓ Use 10k Ohm resistor

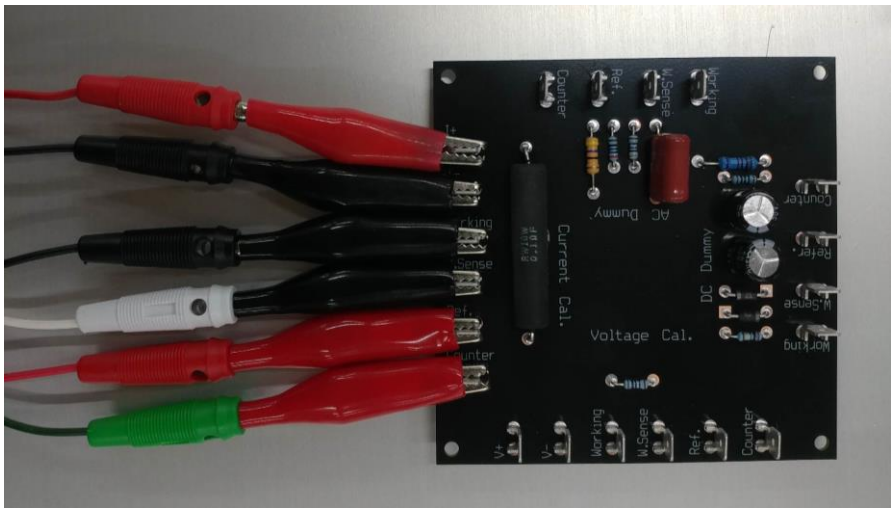


1) As the above, connect cell cable same as for voltage calibration.
2) Make schedule file for constant voltage control in SI software and test dummy cell or resistor using this schedule file.
3) You can check system's accuracy by comparing measurement value as SI software and voltmeter/Ammeter value . If you did not connect multimeter to external dummy cell nor 10k Ohm resistor, You can check the system's default by Ohm's Low. (For example, if you apply 20Volt to 10k Ohm resistor, measured current should be around 2mA. If measured value is far from 2mA, hardware should be defective or calibration is needed.

B. For high current test

a. Current range: <10Amp

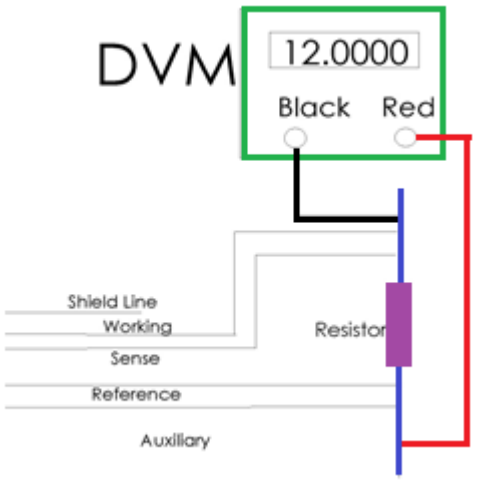
✓ Use external dummy cell's Current Cal. Side or 0.1Ω resistor



1) As the above, connect cell cable same as for current calibration.
2) Make schedule file for constant current control in SI software and test dummy cell(Current CAL side) or resistor(0.1Ω) using this schedule file.
3) If control current value is too high, test resistor might be hot or burnt out. So use constant current value under 2A.
4) You can check system's accuracy by comparing measurement value as SI software and voltmeter/Ammeter value . If you did not connect multimeter to external dummy cell nor 0.1Ohm resistor, You can check the system's default by Ohm's Low. (For example, if you apply 2Amp to 0.1Ohm resistor, measured voltage should be around 0.2V. If measured value is far from 0.2V, hardware should be defective or calibration is needed).

b. Current range: >10Amp

✓ Use shunt resistor 0.1Ω resistor



1) As the above, connect cell cable same as for current calibration.
2) Make schedule file for constant current control in SI software and test shunt resistor(0.1Ω high power) using this schedule file.
3) If control current value is too high, test resistor might be hot or burnt out. Use shunt resistor as higher than I^2 x R Watt. (for example, if 10Amp was applied to 0.1Ω shunt resistor, 20 x 20 x 0.1 watt (40Watt), shunt resistor's power should be higher than 40Watt

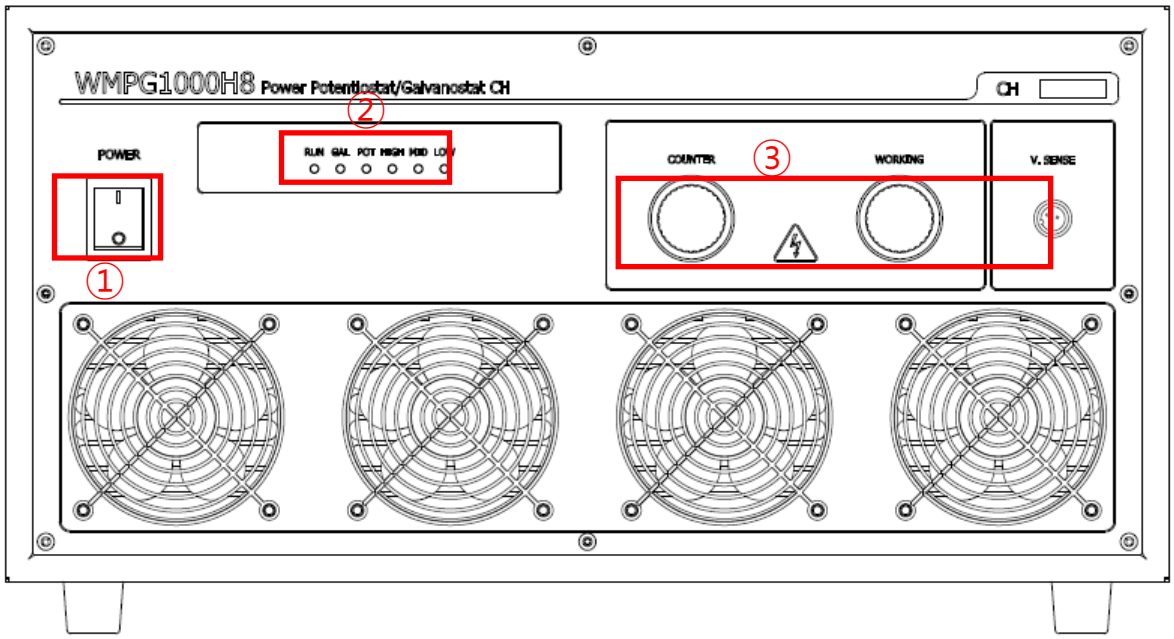
6. Trouble shooting

Problem	Possible Cause	Action
Fail to connect server program	No connection LAN cable	Connect LAN Cable and check SIF module's LED lamp
	Wrong setting LAN connection(Use fixed IP)	Check LAN setting (allocation of automatic IP address)
Disappear control panel during experiment	No connection LAN cable	Connect LAN Cable and check SIF module's LED lamp
	Sserver end	Run Sserver
Control Panel is displayed but no measurement of OCV and can not run experiment (external SIF module or several 8ch controlers were connected)	Power off channel module	Check modules power except the module having SIF module
	No connection between SIF board and channel module	Check the connection of flat cable between SIF module and channel module
Abnormal voltage measurement (Big variation in Volt level on OCP measurement	Cable short	Check cable short of Ref(Green), Sense(White) cable
	Bad contact (corrosion, contamination etc.)	Check contact of electrode
	Malfunction of reference electrode	Check reference electrode (bubble, crystallization, contamination at membrane)
Safety message	Over hardware specification limit or over safety limit setting value	Check safety limit value. (safety limit value at schedule file. If these value is normal, check the hardware)
1) Full voltage value is monitored	Cable short	Check cable short. : Ref(Green), Sense(White) cable
	Bad contact (corrosion, contamination etc.)	Check contact of electrode
	Malfunction of reference electrode	Check reference electrode (bubble, crystallization, contamination at membrane)
2) Full current value is monitored		Fail to control constant current ->A/S required
		If it is constant voltage control, check voltage abnormal solution

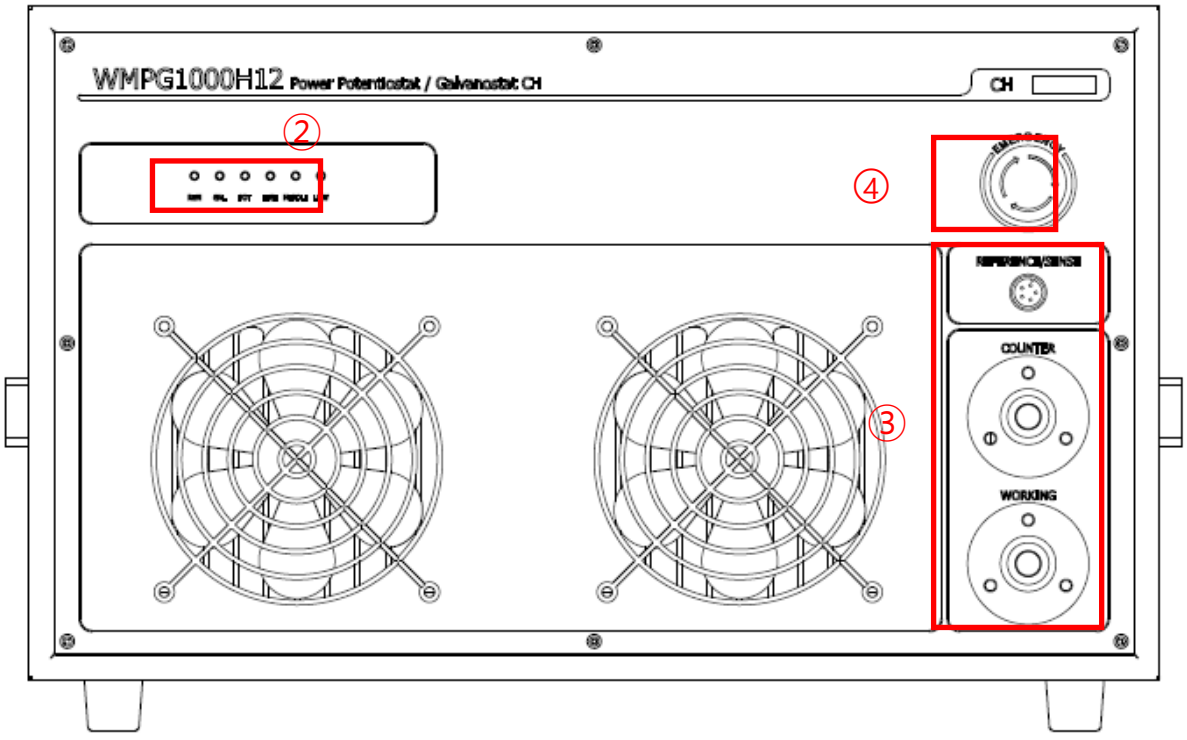
Problem	Possible Cause	Action
Fail display	Big difference between setting value and measurement value	Check the following action. Otherwise, repair is required.
1) Measured current value is around zero	Cable short	Check cable short: Counter(Red), Working(Black) cable
2) Measured voltage value is far different from setting value	Cable short	Check cable short: Counter(Red), Working(Black) Cable
	Cable short	Check cable short :Ref(Green), Sense(White) cable
	Lack of Compliance	Check Compliance Voltage reason on 3 electrodes configuration(check the voltage between WE and CE)
Measured current profile is staircase or big variation	Wrong current range setting	Proper current range setting
Measured current has big peak randomly	Auto current range with high capacitive sample	Set current range manually.

Chapter 5. Module & Accessories

1. Front panel



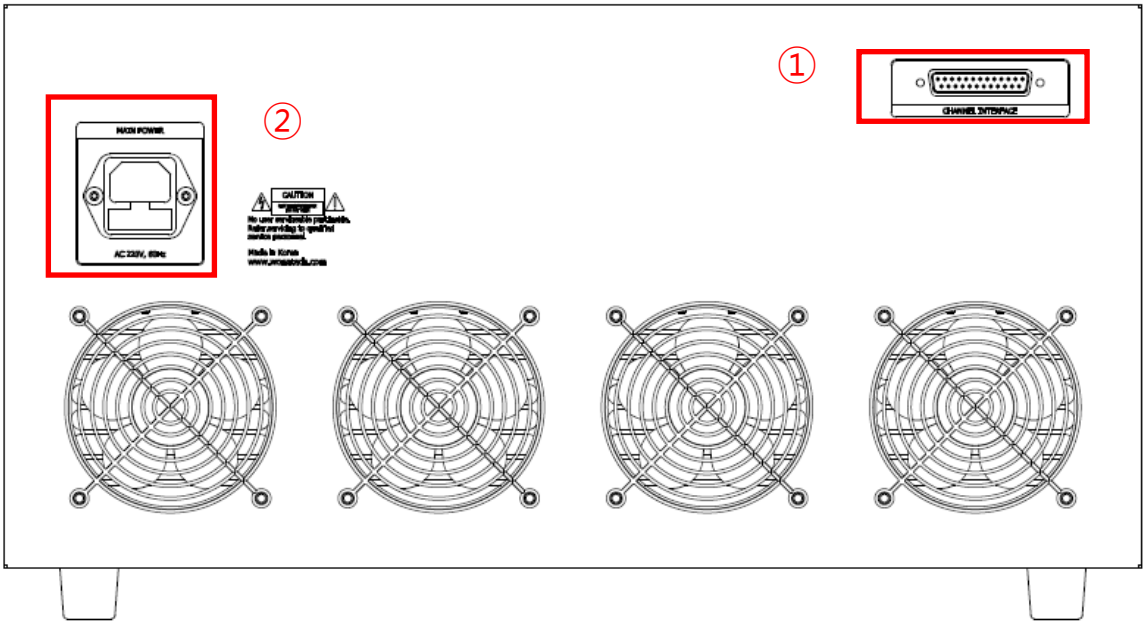
WMPG1000H8



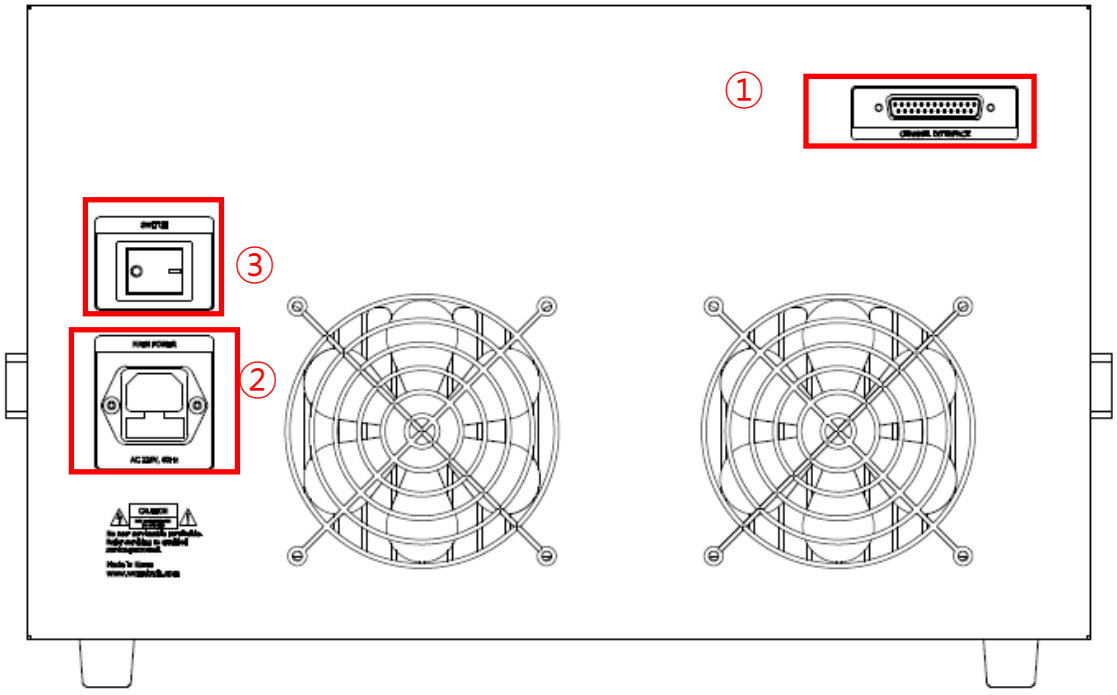
WMPG1000H12

①. Power switch
②. Front panel LED
③. Cell cable connector

2. Rear Panel



WMPG1000H8



WMPG1000H12

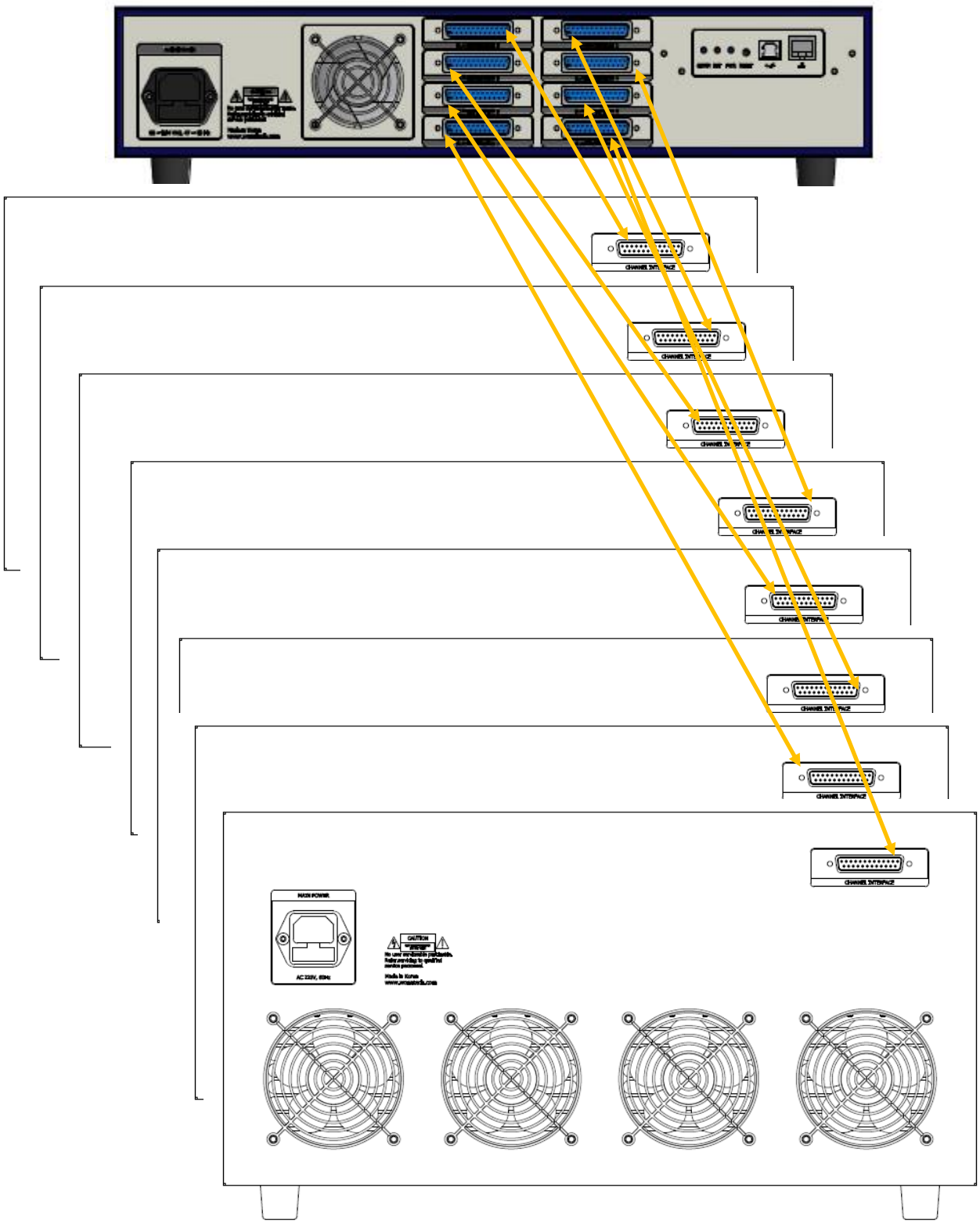
①. Channel interface Cable connector
②. Flat Cable connector
③. Power cable connector

3. Cell cable

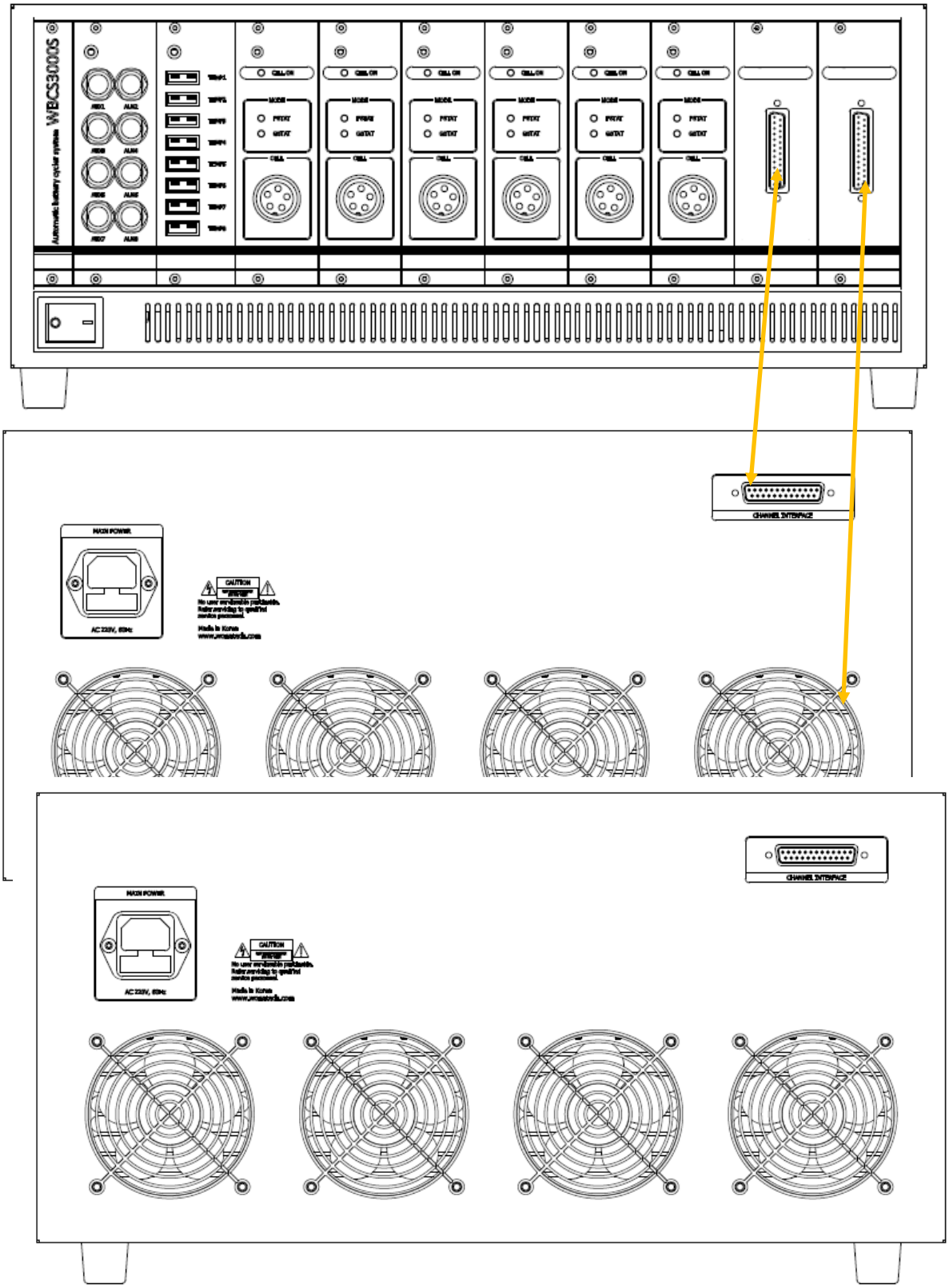
Standard cable length is 1.5 meter. Other length cables are optional

Chapter 6. CH Interface cable connection

(Example : 8ch controller + WMPG1000H8 module connection)



(Example : WMPG1000S 6ch + WMPG1000H8 2 module connection)



Chapter7. Safety limit & Fail function

1. Safety Limit

There are two kinds of safety limit

One is determined by hardware specification. If measurement value of voltage or current or temperature is over the system specification's maximum value, The running channel will be stopped automatically and display "Safety" at status column and simple monitor.

The other one can be determined by user on experiment schedule file (cyc or cye file).

In this experiment schedule file, there is "test info" section. You can input the safety limit value for voltage, current, temperature and auxiliary voltage with skip number. This safety limit is for each test condition with this experiment schedule file. . If measurement value of voltage or current or temperature is over the system specification's maximum value, The running channel will be stopped automatically and display "Safety" at status column and simple monitor.

If there is safety limit stop on experiment, The following reasons may effect this safety limit

- For low capacity sample
  - Too high current applying comparing to sample's characteristic will make high voltage over safety limit's voltage.
  - Between 2 steps, there is big difference of current value setting for current control.
  - Check environmental EMI noise
- For high capacity sample
  - Too high voltage applying comparing to sample's characteristic will make high current over safety limit's current.
  - Voltage step value is too high.
  - Between 2 steps, there is big difference of voltage value setting for voltage control.
- Wrong input value for safety limit in experiment schedule file
- Wrong input value for control value of voltage and/or current on experiment schedule file.
- Wrong cell cable connection
  - If you use 3 electrode configuration, you need to check working sense cable to working electrode.
  - Check connection working electrode to working electrode lead and counter electrode to counter electrode lead
- Select correct experiment schedule file; Identify cyc or cye experiment schedule file.
  - The voltage polarity in cyc experiment schedule file, counter electrode vs. working electrode is positive in two electrode configuration. For 3 electrode configuration, working electrode vs. reference electrode is **negative.**
  - The voltage polarity in cye experiment schedule file, working electrode vs. counter electrode is positive in two electrode configuration. For 3 electrode configuration, working electrode vs. reference electrode is **positive.**
- Wrong cell construction
  - Check shortage between counter electrode and working electrode
  - Check the connection between each electrode's connector and electrode itself

- Check the reference electrode. (You can check it with two electrode configuration without reference electrode; If there is no problem with two electrode configuration, you need to check reference electrode itself)

- Channel malfunction

2. Fail function

If user apply current or voltage etc and measurement value is far different from setting value, the running channel will be stopped automatically and display “Fail” at status column and simple monitor. If there is Fail stop on experiment, The following reasons may effect this fail stop function

- High resistance cell electrolyte.; The system compliance voltage may not be enough to apply control voltage or current.
- EMI noise is too high. You need faradaic cage etc.
- Wrong cell cable connection.
- Cell cable length is too long