cinergia

ePLUS Family units

Parallel and Serial operation using MODULAR HUB

User Manual

Revision number	Document changes	Date
A00	Creation	November 20
A01	Revised document	February 21

CONTENTS

1. GENERAL

The purpose of this manual is to provide information to connect the Cinergia converters with all its different functionalities in SERIAL and PARALLEL option operation. It is important for the user to have this manual nearby and familiarize with it to operate efficiently with the converter.

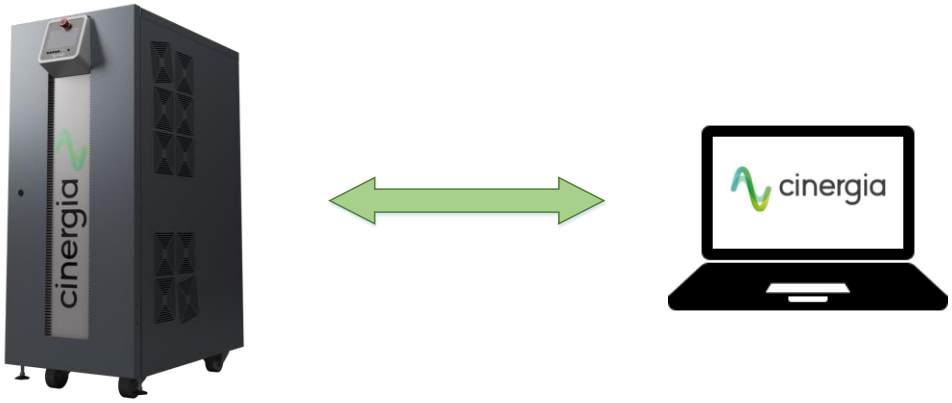
The ePLUS platform has the possibility to connect **up to 8 units in PARALLEL**, in AC or DC mode, **2 units in SERIE** in DC mode via *optical fiber (FO)* and the *optical fiber Modular HUB* (HUB_FO_V2). Also, there is the possibility to connect in MATRICIAL mode: 2 units in SERIE and 4 group of 2 units in SERIE in PARALLEL via *optical fiber (FO)* and the *optical fiber Modular HUB* (HUB_FO_V2).

This extra mode is only available on ePLUS platform units with the same POWER RANGE.

The end user must read all the information provided with the unit (in the USB) before operating the unit in any case.

This document tries to be easy to understand, created with schematics and real pictures of the equipment and the interface with parts marked with letters and numbers which you can find the explanation just below the picture.

Cinergia is in constant development to deliver always the best service to you, so it is possible to find some discrepancy between this manual and the real converter itself. Do not hesitate to contact us and ask for the latest version of the documentation.



This manual is valid for the ePLUS platform units.

Any change on wiring must be done with no power in the system (input/grid and output/EUT) and following the premises of the *Cinergia Unit Installation and Operation manual* provided with the units.

This manual is designed to be an extension of the standard CNG unit Installation and Operation manual. Please refer to it before using the unit. Connections, wiring sections and security issues are not all included in the current document.

This optional mode must be required before purchasing the unit. Cinergia will provided some extra elements and password codes to enable and disable this mode if the user and the final application requires it.

This optional mode is only available on ePLUS platform units with the same POWER RANGE.

If the units are working in PARALLEL, be sure that all the output wires of each unit are connected phase by phase (these means that each U channel, V channel, W channel of each unit are connected). The section of each power cable has to be installed according to the power (current) of the unit.

In case of AC, all the units must have the NEUTRAL wire connected at the same point. In case of DC, all the units must have all the DC COMMON TERMINAL wire connected at the same point.

If the units are working in SERIAL be sure that the connection between both units are connected as the specific diagram: identify the MASTER and the SLAVE unit.

Take into account that the PARALLEL connection and the SERIAL connection needs hardware changes (wire changes connections). The user must work in safety mode and all the units must be disconnected from the grid and EUT equipment before any works on.

2. UNITS IN SERIAL AND PARALLEL OPERATION

CINERGIA ePLUS units has the capability to increase power and current at the output in AC and DC using two or more units connected in parallel (up to 8 units).

CINERGIA ePLUS units has the capability to increase the voltage at the output in DC using two units connected in serial. In that case, the maximum voltage at the output of the units is 1500VDC instead of the 750VDC or 800VDC from the standard units.

In both power structure connections, the CINERGIA ePLUS units are controlling as one ONLY unit for the end user. The user must connect to the master of the system.

It is only possible to serialize or parallelize two or more units from the ePLUS family. It is only possible to serialize or parallelize two or more units with same POWER range.

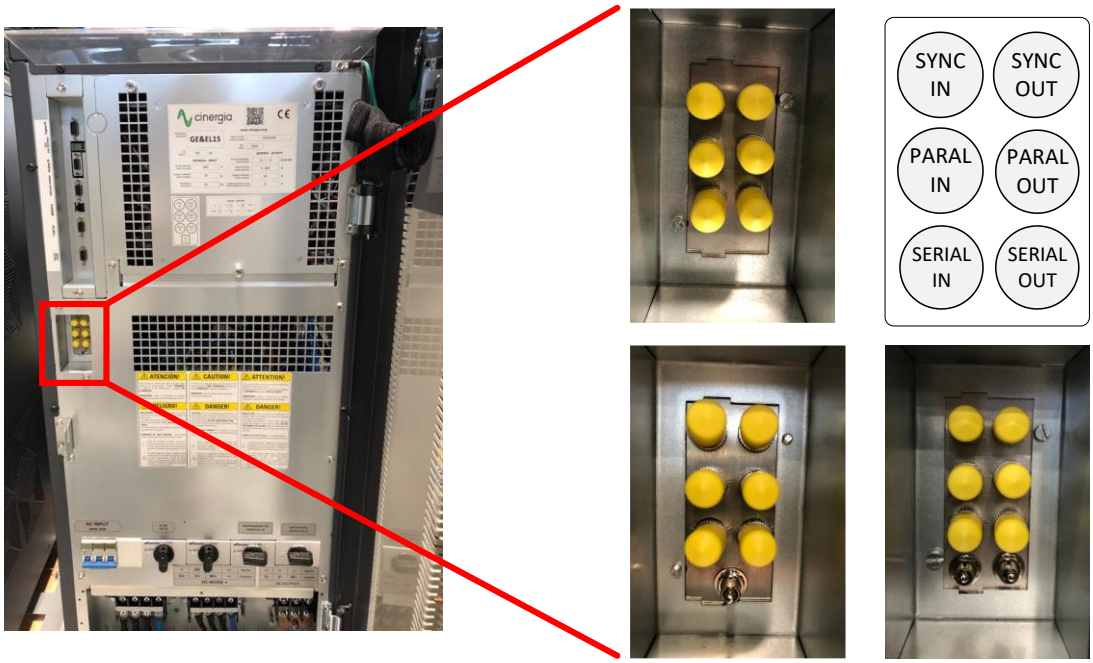
The user must connect all the interconnection power wires according to the final setup. The CINERGIA units have no chance to confirm the power wiring. The CINERGIA units do not have any previous confirmation of the correct power wiring connection.

Take into account that the power wiring interconnection between units has only one option and it is mandatory to follow the instructions of this manual depends on the final setup to be performed. The performance of these power wiring must be installed according to the total power, current and voltage of the final setup to be performed.

2.1. How does the user need for the FO connection?

To serialize or parallelize some ePLUS units (up to 8 units) is necessary to use:

- **ePLUS UNITS** are required. The user can find at the front of the unit (opening the frontal door) all the OPTICAL FIBER connectors:



Please, follow the labels located at the front of the unit for the right arrangement of the Optical fiber cables connection.

- **OPTCAL FIBER (FO) CABLES** are required. The FO cable must be ST to ST (Simplex - Single Mode Multimode). Cinergia provides 5meters FO cables for free if the purchase order has two or more ePLUS units and the final application requires to use two or more units in parallel or serial connection mode:
  - 2 paired FO cable (5m length) in case of only AC units
  - 3 paired FO cables (5m length) in case of AC&DC or DC units

In case that the final setup needs other specification of length, please take into account the performance of the FO cable required for the final application.

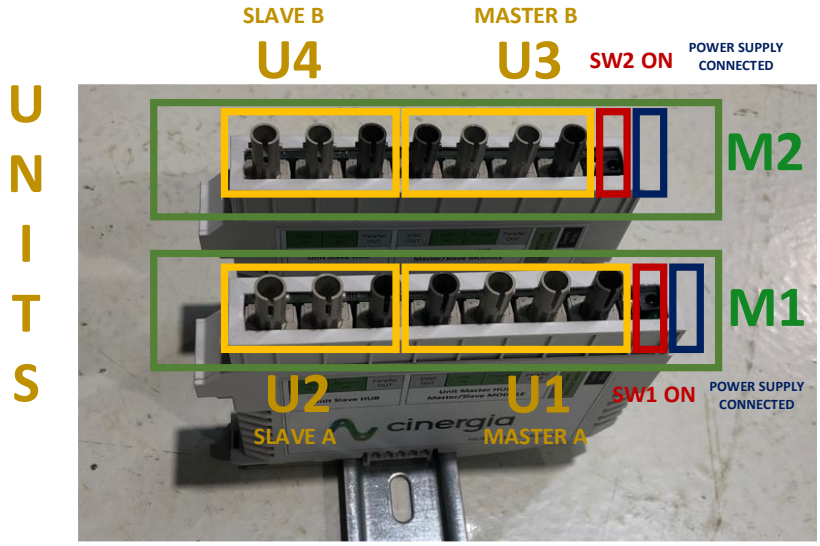
- **HUB_FO_V2:** This element is required in case of 3 or more units need to work in parallel operation. Cinergia provides HUB_FO_V2 for free if the purchase order has more than two ePLUS units and the final application requires to use three or more units in parallel or serial connection mode. A power supply is need.

In case that the final setup needs a HUB_FO_V2 and CINERGIA has not provided it, please contact CINERGIA.

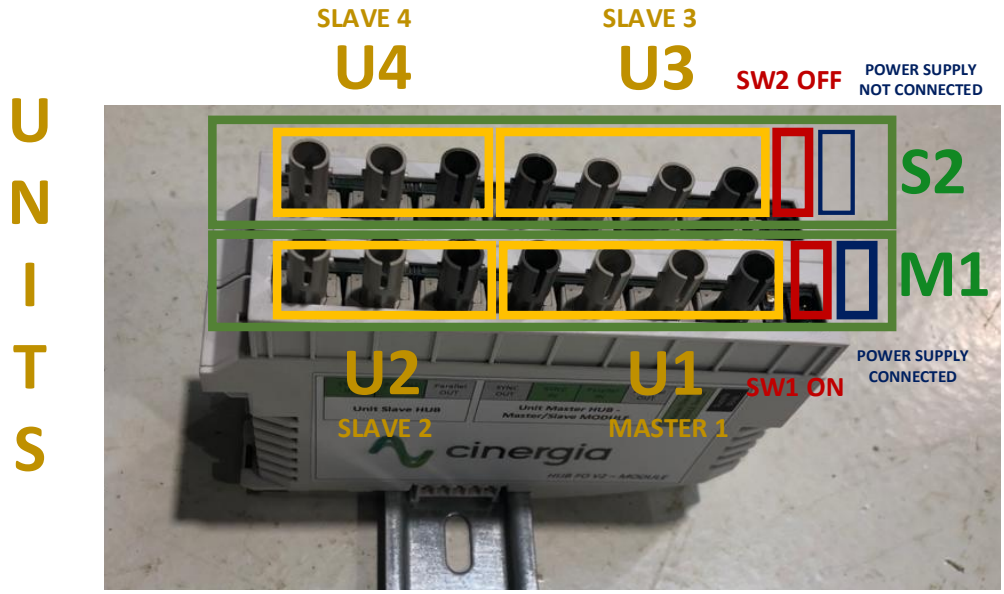
In case that the final setup needs ONLY one MASTER, only one HUB_FO_V2 will need a power supply connected.

The HUB_FO_V2 can connect up to 2 units through FO per module. It can connect up to 4 HUB_FO_V2 to work with up to 8 units.

IMPORTANT: if the user wants to work with different Master, take into account to separate the HUB_FO_V2 elements and configure all SWITCHes according to. Each HUB_FO_V2 needs a power supply.



IMPORTANT: if the user wants to work with ONLY one Master, take into account to join all the HUB_FO_V2 elements and configure all SWITCHes according to. Only the HUB_FO_V2, who is the MASTER of the system, needs a power supply. All the others must be disconnected.

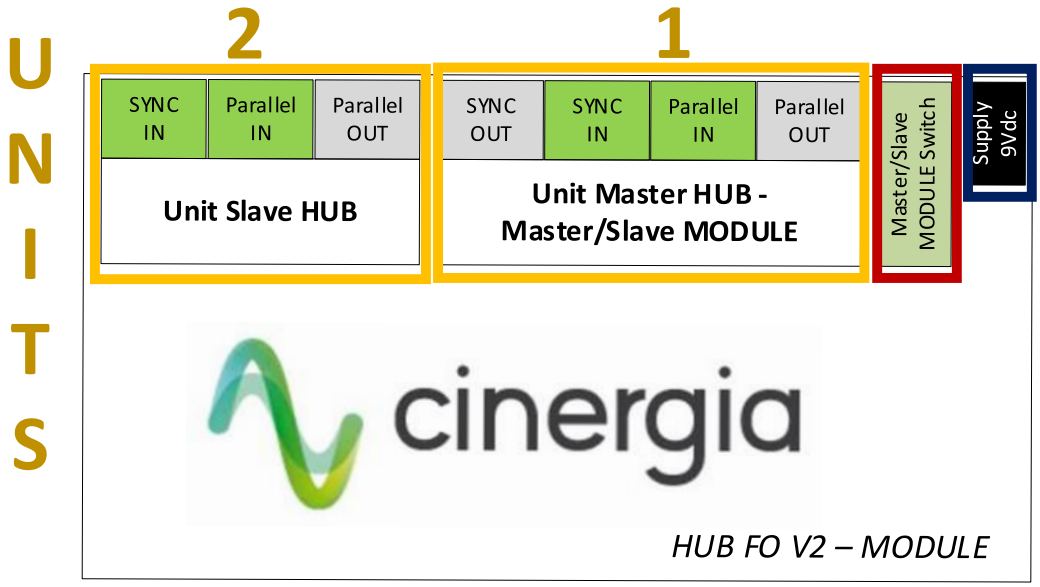


In case that the SETUP requires 4 HUB_FO_V2 working in parallel, CINERGIA recommends the follow configuration: the master not on left or right edge.

MODULE SWITCH:
In OFF – MODULE SLAVE
In ON – MODULE MASTER

FO CONNECTORS
UNIT 2 – UNIT 1

Power supply



3. UNITS IN PARALLEL OPERATION (AC mode)

CINERGIA ePLUS units has the capability to increase power and current at the output in AC and DC using two or more units connected in parallel (up to 8 units).

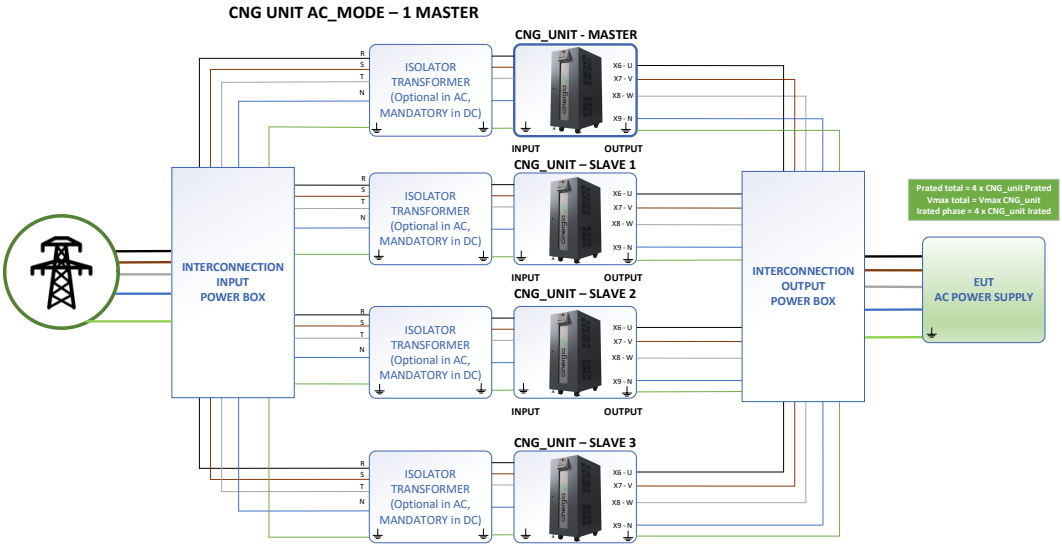
3.1. Power wiring connection

Please, check the connection diagram[1] shown below for the final four units in AC parallel system:

Any change on wiring must be done with no power in the system (input/grid and output/EUT) and following the premises of the *Cinergia Unit Installation and Operation manual* provided with the units.

The wiring connection of each unit must be done according the power and current of each unit. The interconnection must be done using cables according of the final power and current of all the units working in parallel.

If the units are working in PARALLEL, be sure that all the output wires of each unit are connected phase by phase (these means that each U channel, V channel, W channel of each unit are connected). The section of each power cable has to be installed according to the power (current) of the unit.



Cinergia recommend using an INTERCONNECTION BOX for the all the connection between units and the EUT and on GRID side. The interconnection box is not provided by Cinergia, neither designed nor manufactured.

In case of only two or three units, the power wiring connection is the same (only two or three units will be represented on the final diagram).

The GROUND WIRE or EARTH CABLE must be connected at the input and also at the output of the unit.

[1] *Check more diagram options at the end of the document*

3.2. Emergency sequence wiring

CINERGIA units are equipped with a local Emergency Stop pushbutton (EPO) at the front panel. When this local pushbutton (EPO) is pressed, the unit will be completely switched off by disconnecting the main contactors at the input and at the output. For safety reasons, the operation is done by hardware. The Emergency Stop pushbutton installed on the front panel of equipment has a normally close contact (**X12B**) which indicates the state of it. This output (EPO OTUPUT) will be ACTIVE (NC) when the local emergency stop button is NOT pressed.

In addition, CINERGIA units also integrate two terminals dedicated to an external Emergency Power Off (EPO) (**X12A**). When these terminals are used, the unit will have two Emergency Pushbuttons active: the local pushbutton and the external-remote pushbutton.

As all the units from the setup will work as ONLY ONE, the customer must be sure that every EPO stops by hardware all the units at the same time. So, an external remote emergency sequence must be wired to all units.

The external remote emergency sequence needs to be wired to all units from the same system in order to be ensure that all units will go to an Emergency state once any EPO is pressed by hardware.

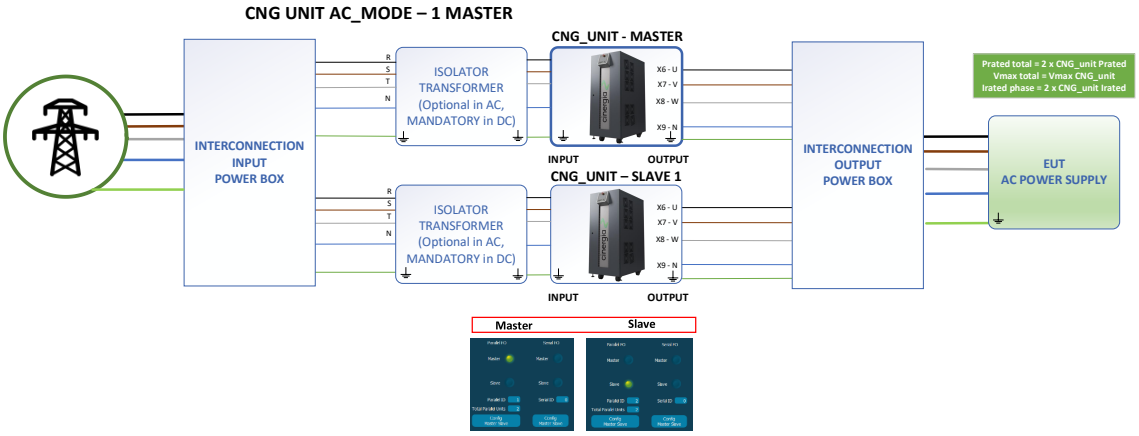
Please, read the *Cinergia Unit Installation and operation manual* for more information about this point and the EPO connection options.

3.3. FO connection

To parallelize some ePLUS units (up to 8 units) in AC is necessary to use:

3.3.1. Only 2 units (2P)

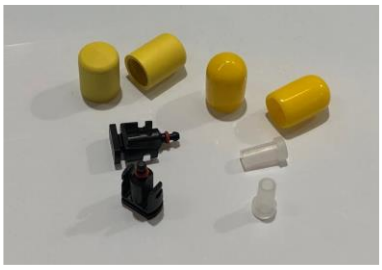
- 2 paired FO cable (5m length) (case AC unit)
- 2 ePLUS units with the same range and same AC mode available



In case that any FO connectors will not be used, please leave the FO safety protector elements installed just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

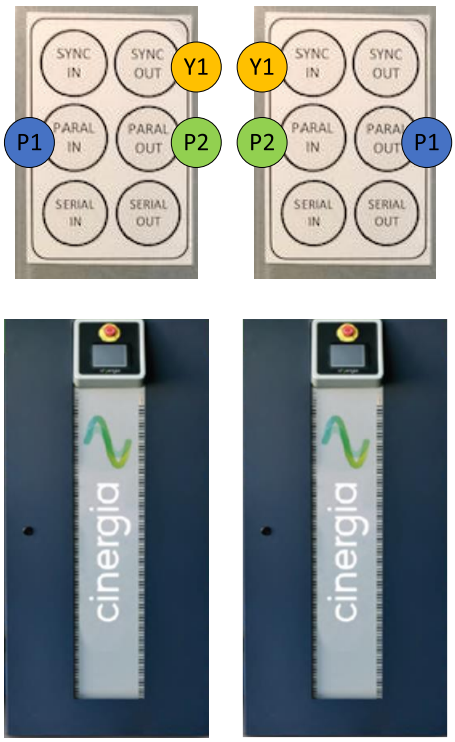
In case that any FO connectors will not be used anymore, please put on the FO safety protector elements just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

DO NOT THROW IT AWAY. Keep with you all the safety protector elements from FO circuitry from the unit, from the HUB_FO_V2 and even from the FO cables. You will need once these elements will not be used. Please, see pictures below:



On the picture above, you can identify safety protector elements: from the unit (yellow elements), from the HUB_FO_V2 (black elements), from the FO cables (white elements).

Follow the diagram below for the correctly connection of the Optical Fiber (FO) cable (***Note** that not all FO must be connected*):



Unit 1
Master

Unit 2
Slave 1

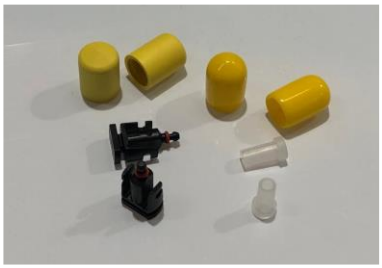
3.3.2. Using HUB_FO_V2 (Up to 8 units)

- 2 paired FO cable (5m length) per unit (case AC unit)
- 1 HUB_FO_V2 module for every two units
- Up to 8 ePLUS units with the same range and same AC mode available

In case that any FO connectors will not be used, please leave the FO safety protector elements installed just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

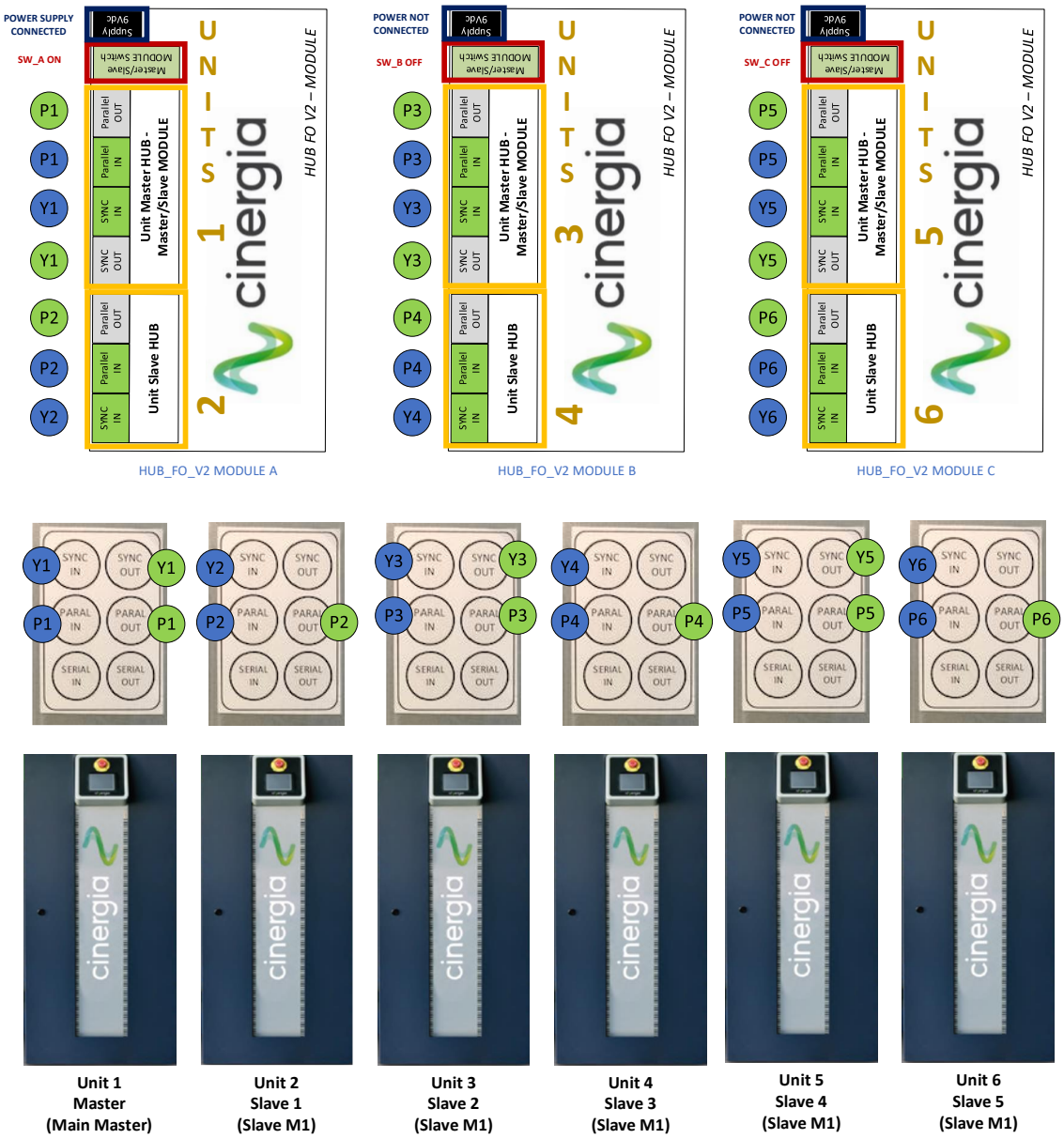
In case that any FO connectors will not be used anymore, please put on the FO safety protector elements just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

DO NOT THROW IT AWAY. Keep with you all the safety protector elements from FO circuitry from the unit, from the HUB_FO_V2 and even from the FO cables. Please, see pictures below:



On the picture above, you can identify safety protector elements: from the unit (yellow elements), from the HUB_FO_V2 (black elements), from the FO cables (white elements).

Follow the diagram below for the correctly connection of the Optical Fiber (FO) cable (***Note** that not all FO must be connected*):



Noted that the SWITCH A from the **HUB_FO_V2** Module A must be in **ON** position and the SWITCH B and C from the **HUB_FO_V2** Module B and C must be in **OFF** position.

Noted that the module A must be powered, while the module B and C should NOT be powered connected.

Noted that all the HUB_FO_V2 must be joined as shown on page 10.

3.4. Configuration (by interface)

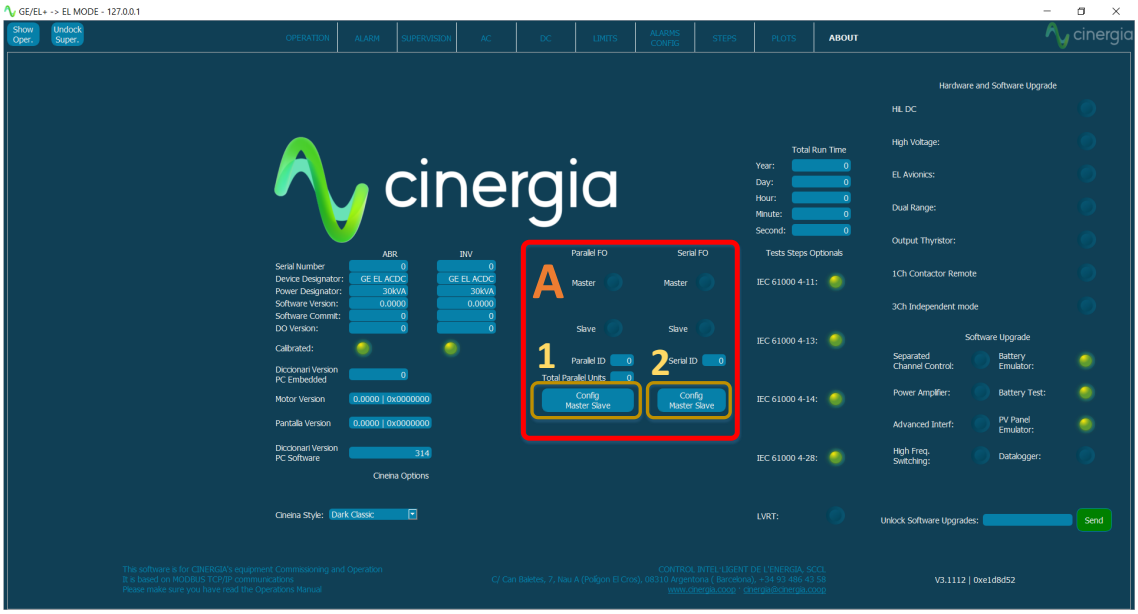
At this point, all the power wiring and the FO cables are properly connected and verified by the supervisor.

Before turning ON the unit, be sure that all the units that must work in parallel operation must be configured with the same control mode (as hardware). If all the units are not properly configured, the master will remain on Alarm status.

All the CNG units must be connected through ethernet for the configuration by the Modbus interface provided by Cinergia.
Once the units are connected by the interface, the user can introduce all the codes to activate the functionality required.

The user must choose one MASTER from all the units connected in that configuration, so for the final setup, ONLY this unit is existing. This unit is the only ONE to operate and control by interface. For the final user, only one unit is working. All other units MUST be configured as a SLAVE.

Please go the **ABOUT TAB**. Press the button *Config master slave* (number **1** on the picture below):



3.4.1. MASTER configuration

To configure the unit as a **Master configuration:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Parallel FO (number **1** in the figure below).

Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. Press the *Refresh* button (number **2** in the figure below), just to be sure the final configuration of the unit.

Fill the *Parallel ID* blank space (number **3** in the figure below) with the Parallel ID value of the unit to configure, as a Master always must be a 1. Please, refer to the *Table 1* for the configuration of the final setup.

Parallel Total Units value	**Parallel ID configuration value (depends on the Total units)**							
Total units connected	**Master**	Slave 1	Slave 2	Slave 3	Slave 4	Slave 5	Slave 6	Slave 7
2	1	2	-	-	-	-	-	-
3	1	2	3	-	-	-	-	-
4	1	2	3	4	-	-	-	-
5	1	2	3	4	5	-	-	-
6	1	2	3	4	5	6	-	-
7	1	2	3	4	5	6	7	-
8	1	2	3	4	5	6	7	8

Table 1: value to fill in the configuration dialog box

Fill the *Parallel Total Units* blank space (number **4** in the figure below) with the Total number of units to connect in Parallel from the final setup. Please, refer to the *Table 1* to help about the configuration.

Press the button ***Send Config*** (number **5** in the figure below).

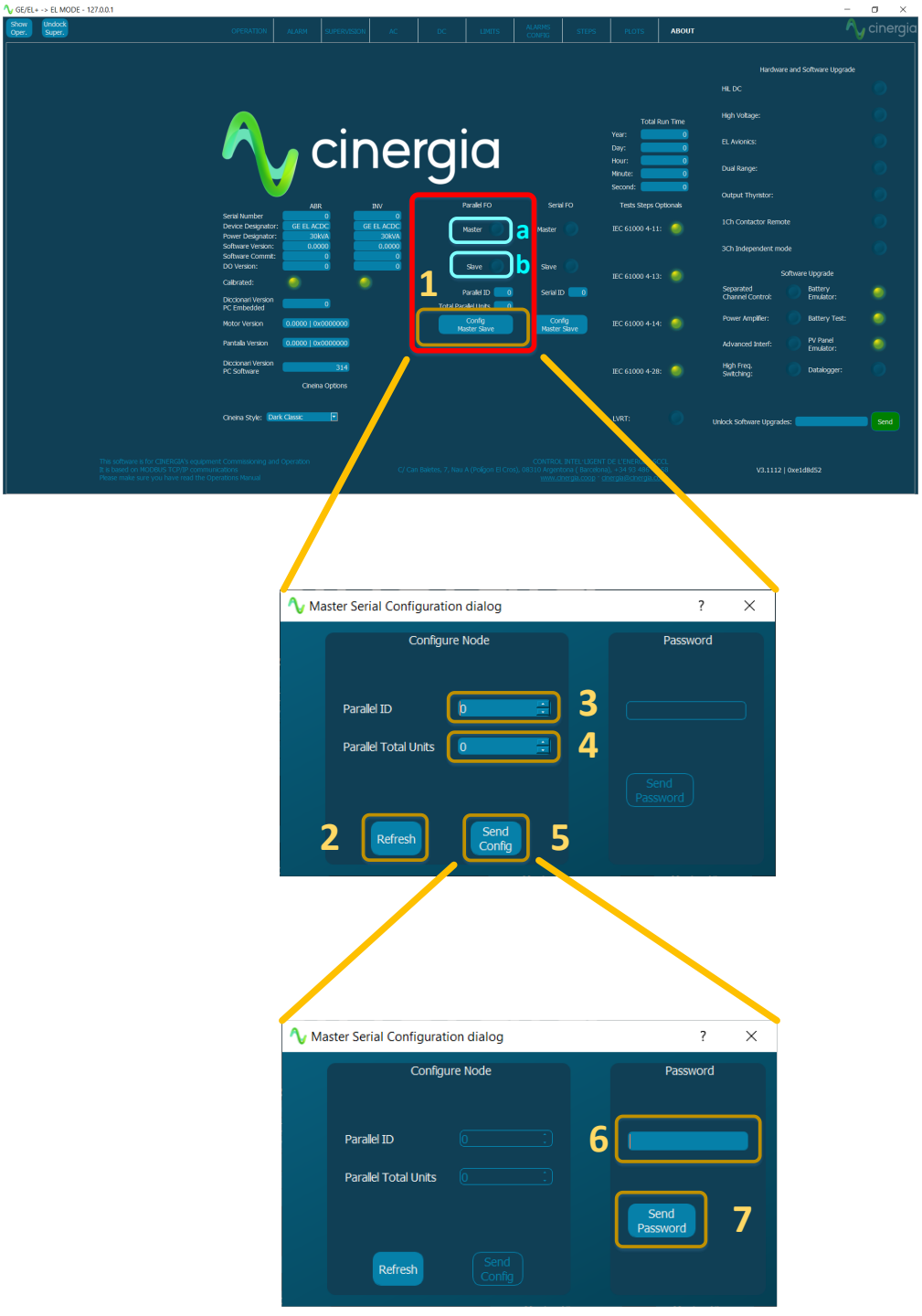
Once the button is pressed, the right part of the present dialog will be unlocked. The delivered code[2] *Password_Upgrade_Paralel_ON_Master* must be introduced in the *Password* reserved space (number **6** in the figure below) and, afterwards, press the button *Send Password* (number **7** in the figure below). You can find the code provided under these lines:

[2] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

Password_Upgrade_Serial_ON_Master
Password_Upgrade_Serial_ON_Slave
Password_Upgrade_Serial_OFF
Password_Upgrade_Paralel_ON_Master
Password_Upgrade_Paralel_ON_Slave
Password_Upgrade_Paralel_OFF

← ENABLE as a MASTER
← ENABLE as a SLAVE
← DISABLE any configuration

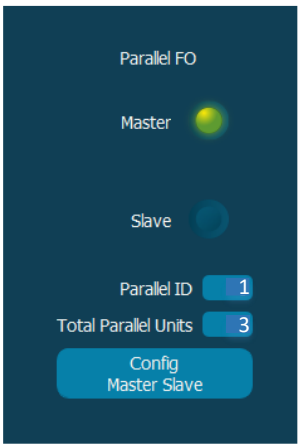
When the configuration is activated, the LED beside the option (marked with an **a** in the figure below) will be shining and the final configuration will appear on the reserved spaces.



When the configuration is activated and the codes are correct, the specific space configuration marked as a Parallel FO will show the final configuration sent. The user can press the button *Refresh* (number **2** in the figure above), just in case.

The LED beside the option Master will be shining and the final configuration will appear on the reserved spaces configuration.

As an example of 3 units working in parallel, and the current unit configured as a Master of the final setup, the specific space Parallel FO configuration will show:



If all units from the final system (Master and all slaves) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time.

3.4.2. SLAVE configuration

To configure the unit as a **Slave configuration:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Parallel FO (number **1** in the figure below).

Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. Press the *Refresh* button (number **2** in the figure below), just to be sure the final configuration of the unit.

Fill the *Parallel ID* blank space (number **3** in the figure below) with the Parallel ID value of the unit to configure, as a Slave the user must know which unit has to be. Please, refer to the *Table 2* for the configuration of the final setup.

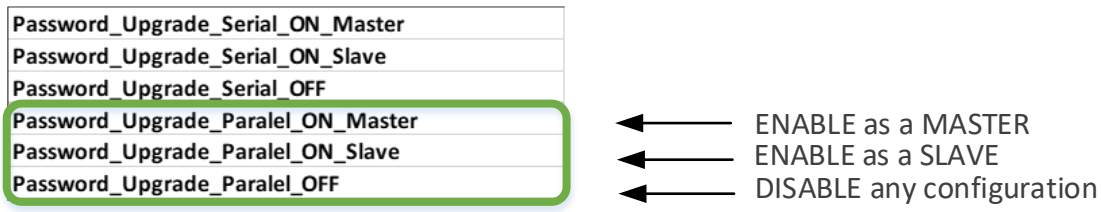
Parallel Total Units value	Parallel ID configuration value (depends on the Total units)							
Total units connected	Master	**Slave 1**	**Slave 2**	**Slave 3**	**Slave 4**	**Slave 5**	**Slave 6**	**Slave 7**
2	1	2	-	-	-	-	-	-
3	1	2	3	-	-	-	-	-
4	1	2	3	4	-	-	-	-
5	1	2	3	4	5	-	-	-
6	1	2	3	4	5	6	-	-
7	1	2	3	4	5	6	7	-
8	1	2	3	4	5	6	7	8

Table 2: value to fill in the configuration dialog box

Fill the *Parallel Total Units* blank space (number **4** in the figure below) with the Total number of units to connect in Parallel from the final setup. Please, refer to the *Table 2* to help about the configuration.

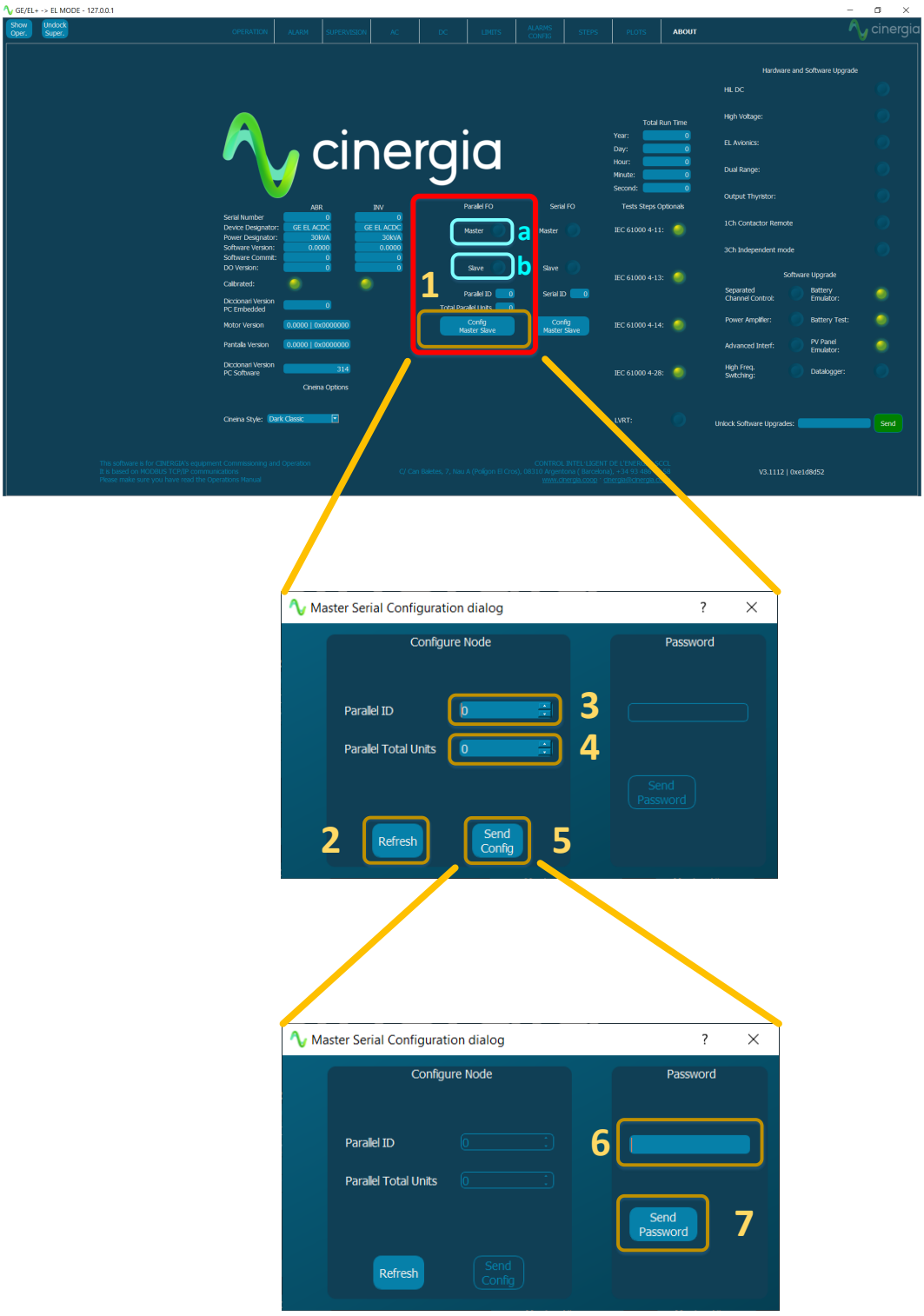
Press the button ***Send Config*** (number **5** in the figure below).

Once the button is pressed, the right part of the present dialog will be unlocked. The delivered code[3] *Password_Upgrade_Paralel_ON_Slave* must be introduced in the *Password* reserved space (number **6** in the figure below) and, afterwards, press the button *Send Password* (number **7** in the figure below). You can find the code provided under these lines:



When the configuration is activated, the LED beside the option (marked with an **b** in the figure below) will be shining and the final configuration will appear on the reserved spaces.

[3] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*



When the configuration is activated and the codes are correct, the specific space configuration marked as a Parallel FO will show the final configuration sent. The user can press the button *Refresh* (number **2** in the figure above), just in case.

The LED beside the option Slave will be shining and the final configuration will appear on the reserved spaces configuration.

As an example of 3 units working in parallel, and the units configured as the second and third Slave of the final setup, the specific space Parallel FO configuration will show:

If all units from the final system (Master and all slaves) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time.

3.4.3. Remove the configuration

To remove the actual configuration of any unit**:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Parallel FO (number **1** in the figure above).

Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. Press the button ***Send Config*** (number **5** in the figure above).

Once the button is pressed, the right part of the present dialog will be unlocked. The delivered code[4] *Password_Upgrade_Paralel_OFF* must be introduced in the *Password* reserved space (number **6** in the figure above) and, afterwards, press the button *Send Password* (number **7** in the figure above). You can find the code provided under these lines:

Password_Upgrade_Serial_ON_Master
Password_Upgrade_Serial_ON_Slave
Password_Upgrade_Serial_OFF
Password_Upgrade_Paralel_ON_Master
Password_Upgrade_Paralel_ON_Slave
Password_Upgrade_Paralel_OFF

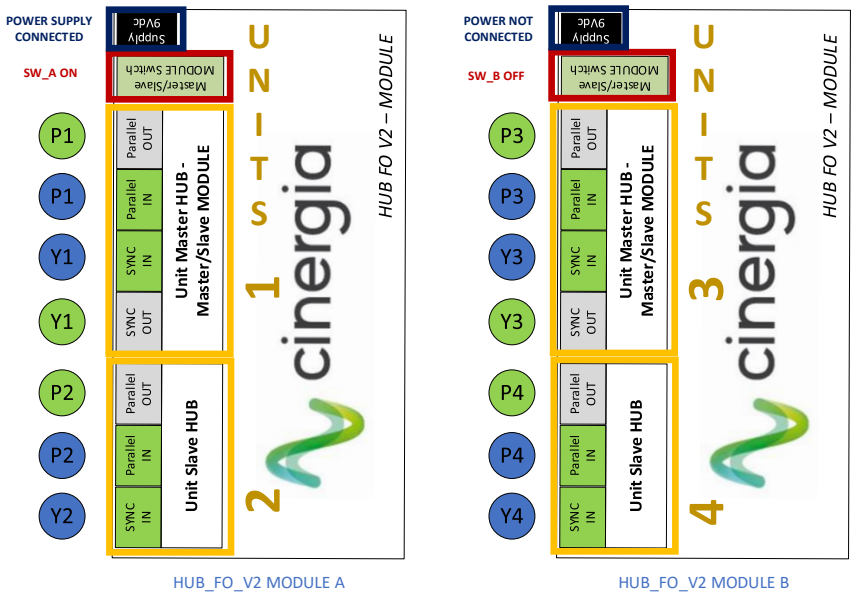
← ENABLE as a MASTER
← ENABLE as a SLAVE
← DISABLE any configuration

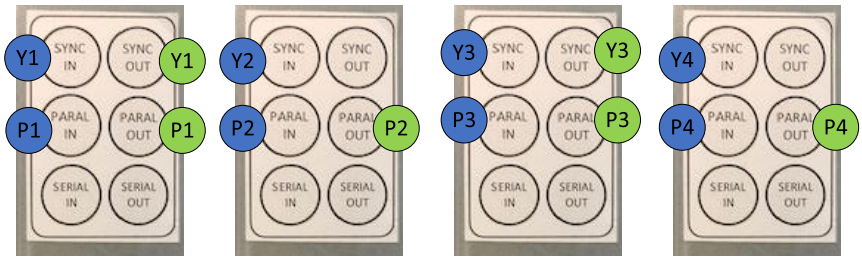
When the configuration is disabled, the LED beside the option (marked with an **a** or **b** in the figure above) will turn off and the final configuration will appear on the reserved spaces removing any configuration.

[4] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

3.5. Example Operation 4 units in AC parallel

In case of 4 units working in AC parallel, using a HUB_FO_V2 modules, the final power diagram and the interface parallel and serial configuration must be according the pictures below:





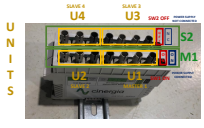
Unit 1
Master
(Main Master M1)

Unit 2
Slave 1
(Slave M1)

Unit 3
Slave 2
(Slave M1)

Unit 4
Slave 3
(Slave M1)

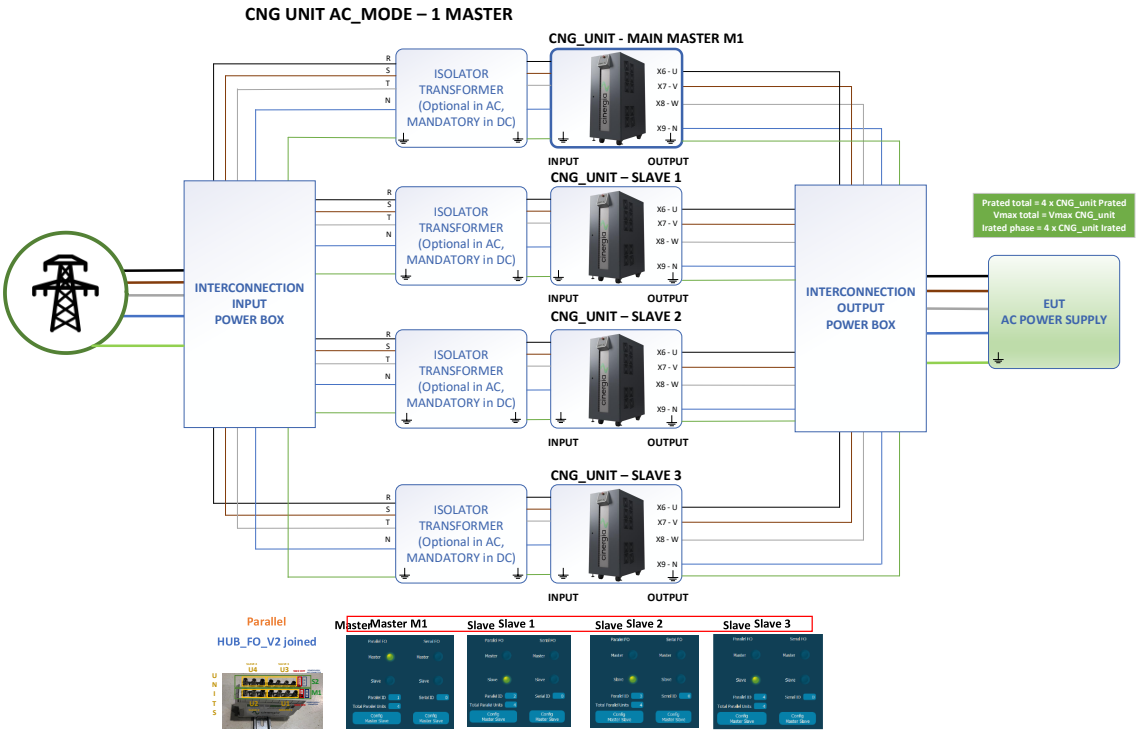
Parallel
HUB_FO_V2 joined



Noted that the SWITCH A from the **HUB_FO_V2** Module A must be in **ON** position and the SWITCH B from the **HUB_FO_V2** Module B must be in **OFF** position.

Noted that the module A must be powered, while the module B should NOT be powered connected.

Noted that both HUB_FO_V2 must be joined as shown on page 10.



Once, all the connections and configuration are correctly done, the user must connect via Modbus by Cinergia Interface with the MAIN MASTER M1, Unit 1, introducing the Master's IP.

In this case, the interface is showing the value of the complete system: the limits and alarm values shown on the LIMITS and ALARM CONFIG TAB are from the complete system. The values shown on the SUPERVISION TAB are from the whole system.

More than two RESET sequence must be done. It is possible that the user must press the RESET button three or four times before all Alarm clears at all.

In case of any unit has an alarm, the MASTER will show this alarm, as always, on the ALARM TAB.

4. UNITS IN PARALLEL OPERATION (DC mode)

CINERGIA ePLUS units has the capability to increase power and current at the output in AC and DC using two or more units connected in parallel (up to 8 units).

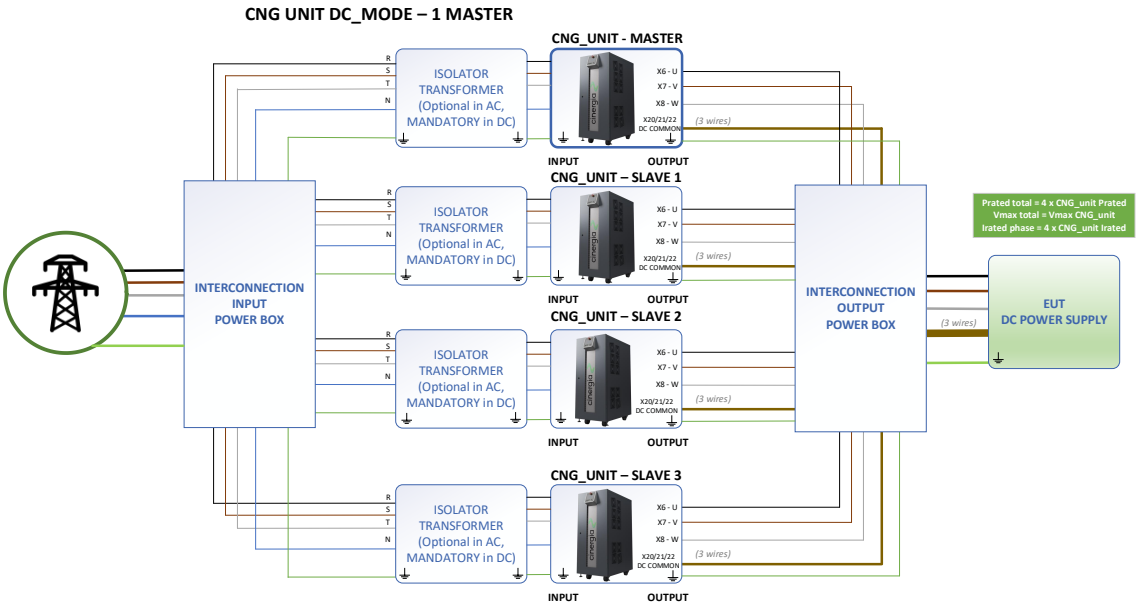
4.1. Power wiring connection

Please, check the connection diagram[5] shown below for the final four units in DC parallel system:

Any change on wiring must be done with no power in the system (input/grid and output/EUT) and following the premises of the *Cinergia Unit Installation and Operation manual* provided with the units.

The wiring connection of each unit must be done according the power and current of each unit. The interconnection must be done using cables according of the final power and current of all the units working in parallel.

If the units are working in PARALLEL, be sure that all the output wires of each unit are connected phase by phase (these means that each U channel, V channel, W channel of each unit are connected). The section of each power cable has to be installed according to the power (current) of the unit.



Cinergia recommend using an INTERCONNECTION BOX for the all the connection between units and the EUT and on GRID side. The interconnection box is not provided by Cinergia, neither designed nor manufactured.

In case of only two or three units, the power wiring connection is the same (only two or three units will be represented on the final diagram).

The GROUND WIRE or EARTH CABLE must be connected at the input and also at the output of the unit.

[5] *Check more diagram options at the end of the document*

4.2. Emergency sequence wiring

CINERGIA units are equipped with a local Emergency Stop pushbutton (EPO) at the front panel. When this local pushbutton (EPO) is pressed, the unit will be completely switched off by disconnecting the main contactors at the input and at the output. For safety reasons, the operation is done by hardware. The Emergency Stop pushbutton installed on the front panel of equipment has a normally close contact (**X12B**) which indicates the state of it. This output (EPO OTUPUT) will be ACTIVE (NC) when the local emergency stop button is NOT pressed.

In addition, CINERGIA units also integrate two terminals dedicated to an external Emergency Power Off (EPO) (**X12A**). When these terminals are used, the unit will have two Emergency Pushbuttons active: the local pushbutton and the external-remote pushbutton.

As all the units from the setup will work as ONLY ONE, the customer must be sure that every EPO stops by hardware all the units at the same time. So, an external remote emergency sequence must be wired to all units.

The external remote emergency sequence needs to be wired to all units from the same system in order to be ensure that all units will go to an Emergency state once any EPO is pressed by hardware.

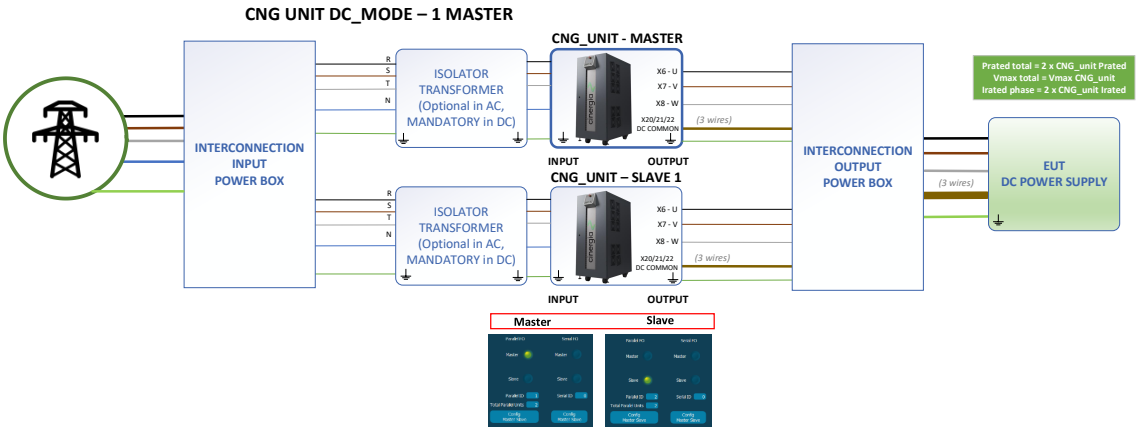
Please, read the *Cinergia Unit Installation and operation manual* for more information about this point and the EPO connection options.

4.3. FO connection

To parallelize some ePLUS units (up to 8 units) in DC is necessary to use:

4.3.1. Only 2 units (2P)

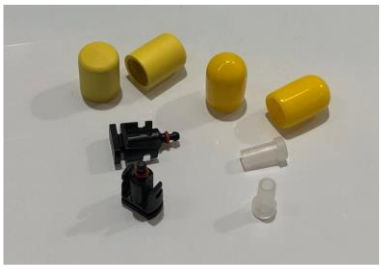
- 2 paired FO cable (5m length) (case DC unit in parallel)
- 2 ePLUS units with the same range and same DC mode available



In case that any FO connectors will not be used, please leave the FO safety protector elements installed just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

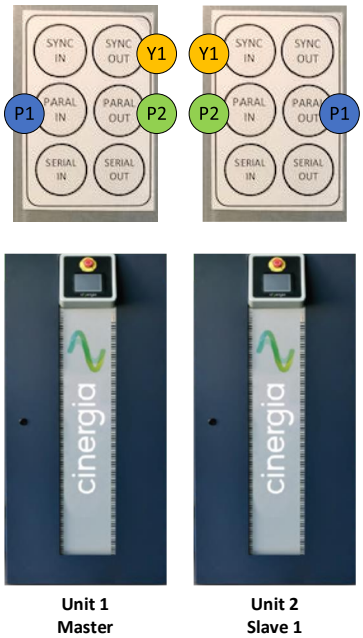
In case that any FO connectors will not be used anymore, please put on the FO safety protector elements just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

DO NOT THROW IT AWAY. Keep with you all the safety protector elements from FO circuitry from the unit, from the HUB_FO_V2 and even from the FO cables. Please, see pictures below:



On the picture above, you can identify safety protector elements: from the unit (yellow elements), from the HUB_FO_V2 (black elements), from the FO cables (white elements).

Follow the diagram below for the correctly connection of the Optical Fiber (FO) cable (***Note** that not all FO must be connected*):



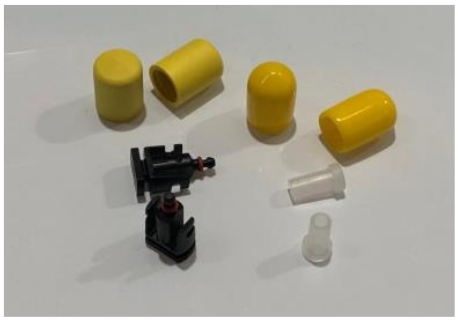
4.3.2. Using HUB FO (Up to 8 units)

- 2 paired FO cable (5m length) per unit (case DC unit)
- 1 HUB_FO_V2 module for every two units
- Up to 8 ePLUS units with the same range and same DC mode available

In case that any FO connectors will not be used, please leave the FO safety protector elements installed just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

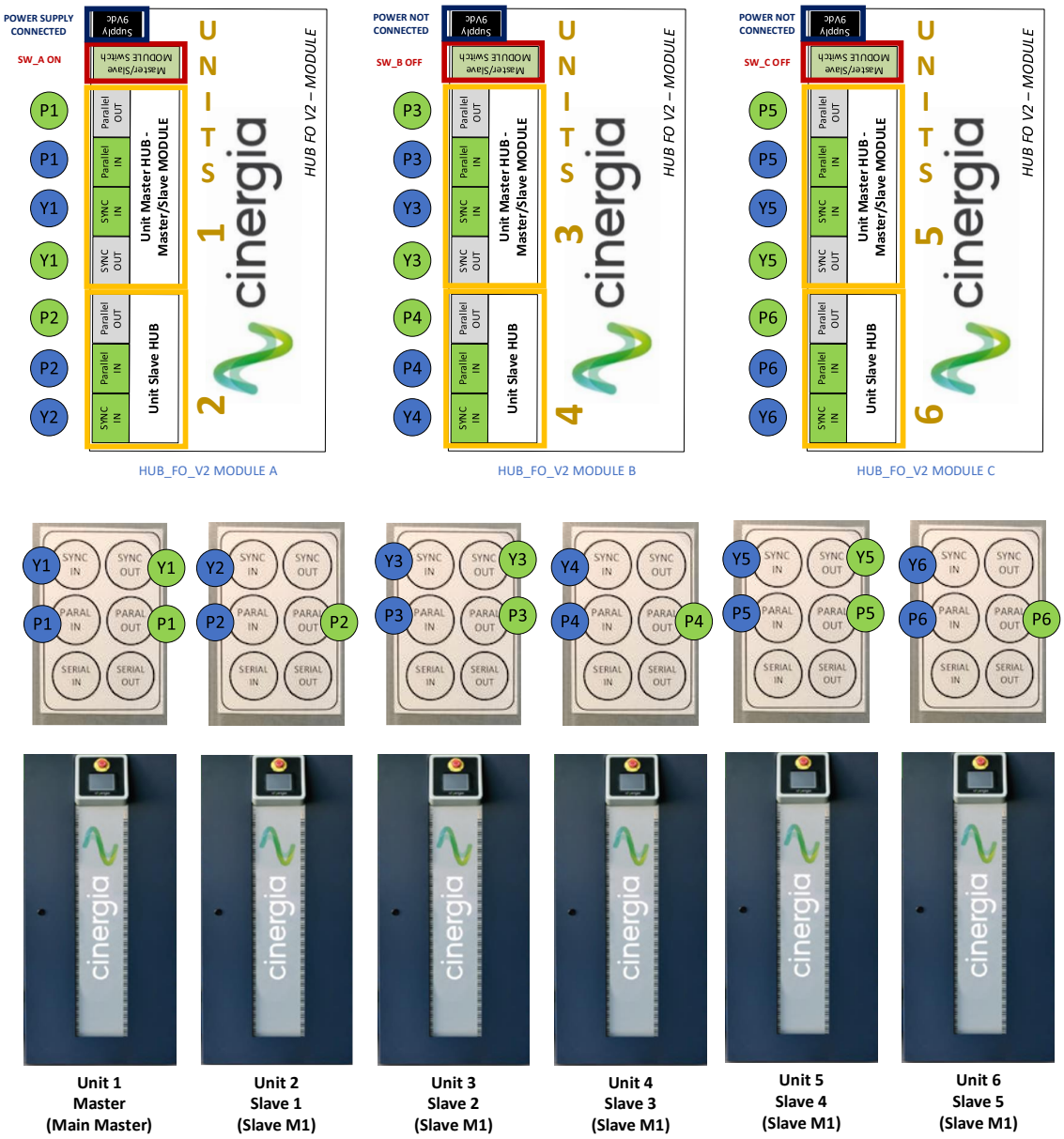
In case that any FO connectors will not be used anymore, please put on the FO safety protector elements just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

DO NOT THROW IT AWAY. Keep with you all the safety protector elements from FO circuitry from the unit, from the HUB_FO_V2 and even from the FO cables. Please, see pictures below:



On the picture above, you can identify safety protector elements: from the unit (yellow elements), from the HUB_FO_V2 (black elements), from the FO cables (white elements).

Follow the diagram below for the correctly connection of the Optical Fiber (FO) cable (***Note** that not all FO must be connected*):



Noted that the SWITCH A from the **HUB_FO_V2** Module A must be in **ON** position and the SWITCH B and C from the **HUB_FO_V2** Module B and C must be in **OFF** position.

Noted that the module A must be powered, while the module B and C should NOT be powered connected.

Noted that all the HUB_FO_V2 must be joined as shown on page 10.

4.4. Configuration (by interface)

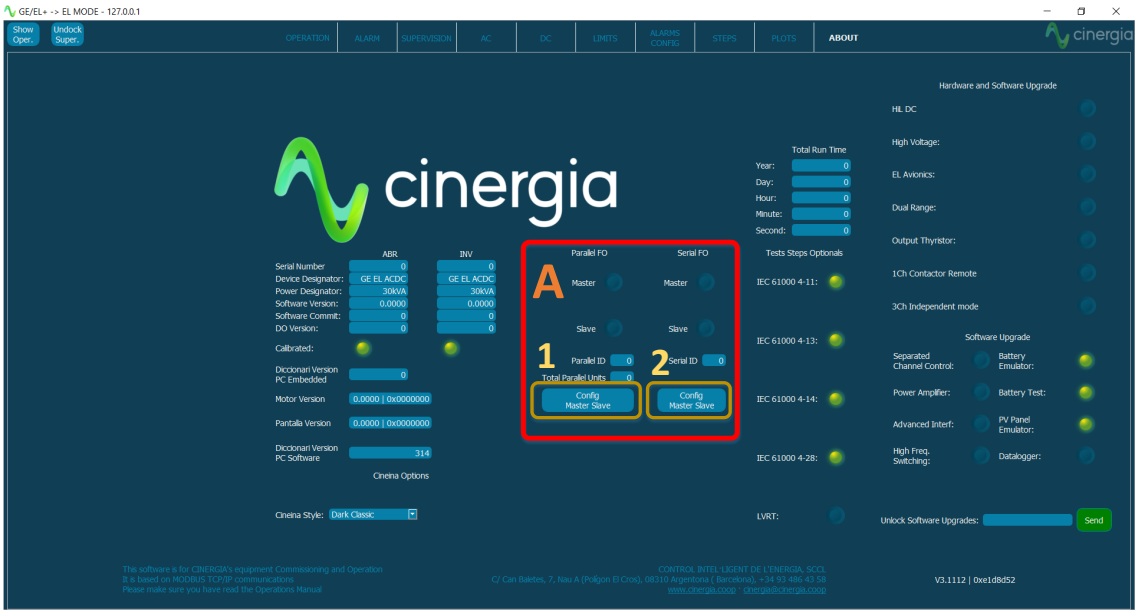
At this point, all the power wiring and the FO cables are properly connected and verified by the supervisor.

Before turning ON the unit, be sure that all the units that must work in parallel operation must be configured with the same control mode (as hardware). If all the units are not properly configured, the master will remain on Alarm status.

All the CNG units must be connected through ethernet for the configuration by the Modbus interface provided by Cinergia.
Once the units are connected by the interface, the user can introduce all the codes to activate the functionality required.

The user must choose one MASTER from all the units connected in that configuration, so for the final setup, ONLY this unit is existing. This unit is the only ONE to operate and control by interface. For the final user, only one unit is working. All other units MUST be configured as a SLAVE.

Please go the **ABOUT TAB**. Press the button *Config master slave* (number **1** on the picture below):



4.4.1. MASTER configuration

To configure the unit as a **Master configuration:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Parallel FO (number **1** in the figure below).

Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. Press the *Refresh* button (number **2** in the figure below), just to be sure the final configuration of the unit.

Fill the *Parallel ID* blank space (number **3** in the figure below) with the Parallel ID value of the unit to configure, as a Master always must be a 1. Please, refer to the *Table 1* for the configuration of the final setup.

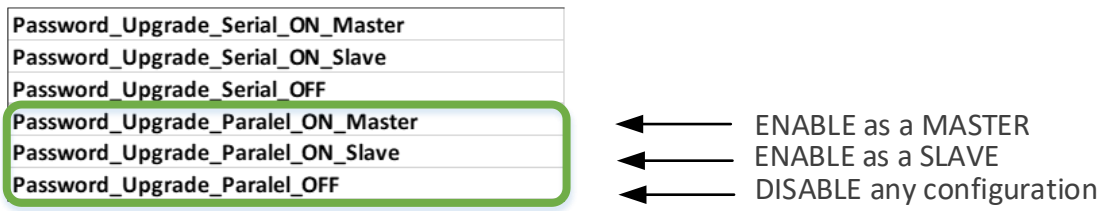
Parallel Total Units value	**Parallel ID configuration value (depends on the Total units)**							
Total units connected	**Master**	Slave 1	Slave 2	Slave 3	Slave 4	Slave 5	Slave 6	Slave 7
2	1	2	-	-	-	-	-	-
3	1	2	3	-	-	-	-	-
4	1	2	3	4	-	-	-	-
5	1	2	3	4	5	-	-	-
6	1	2	3	4	5	6	-	-
7	1	2	3	4	5	6	7	-
8	1	2	3	4	5	6	7	8

Table 1: value to fill in the configuration dialog box

Fill the *Parallel Total Units* blank space (number **4** in the figure below) with the Total number of units to connect in Parallel from the final setup. Please, refer to the *Table 1* to help about the configuration.

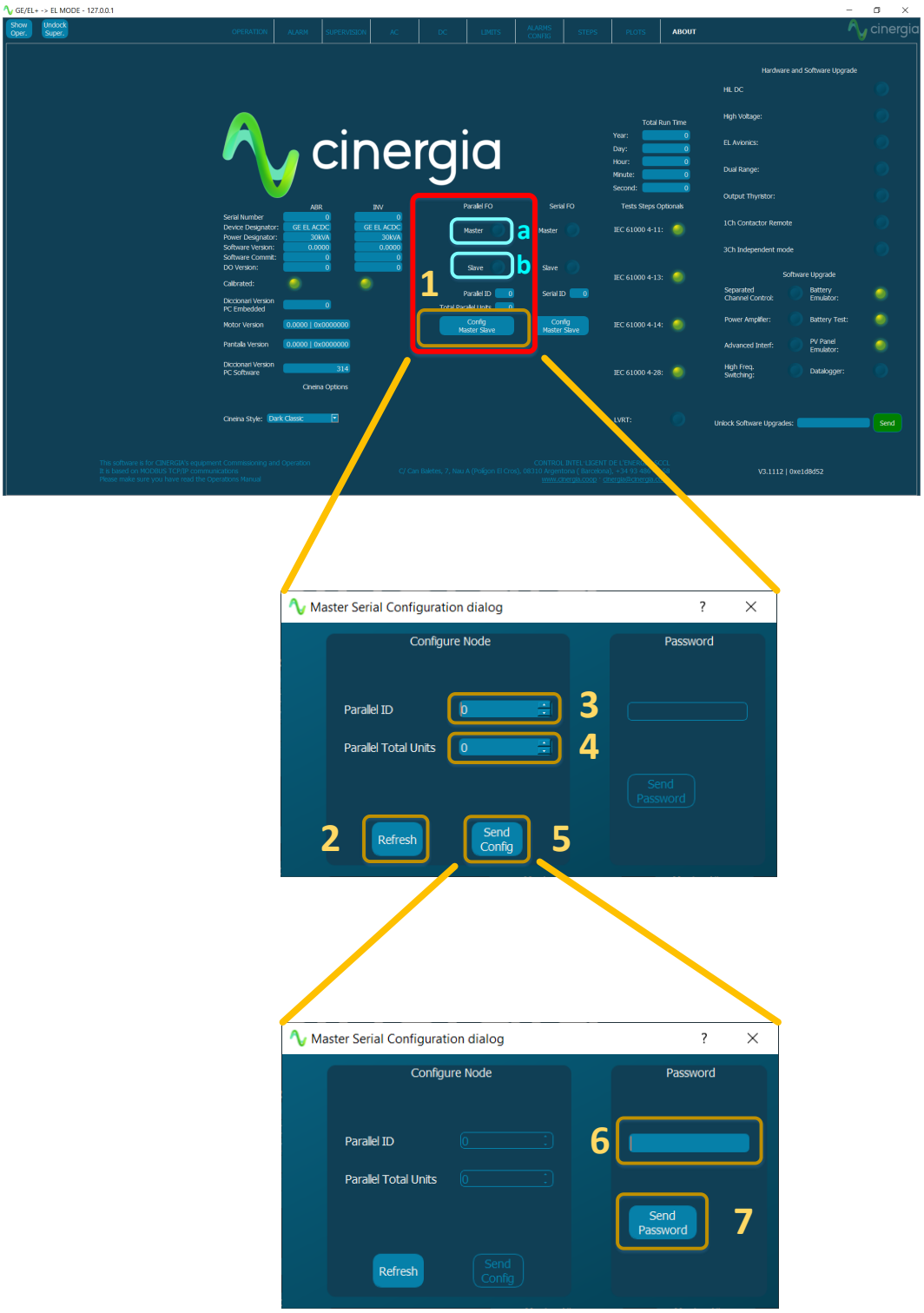
Press the button ***Send Config*** (number **5** in the figure below).

Once the button is pressed, the right part of the present dialog will be unlocked. The delivered code[6] *Password_Upgrade_Paralel_ON_Master* must be introduced in the *Password* reserved space (number **6** in the figure below) and, afterwards, press the button *Send Password* (number **7** in the figure below). You can find the code provided under these lines:



[6] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

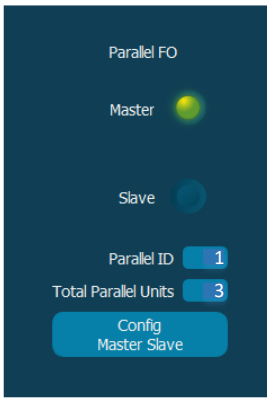
When the configuration is activated, the LED beside the option (marked with an **a** in the figure below) will be shining and the final configuration will appear on the reserved spaces.



When the configuration is activated and the codes are correct, the specific space configuration marked as a Parallel FO will show the final configuration sent. The user can press the button *Refresh* (number **2** in the figure above), just in case.

The LED beside the option Master will be shining and the final configuration will appear on the reserved spaces configuration.

As an example of 3 units working in parallel, and the current unit configured as a Master of the final setup, the specific space Parallel FO configuration will show:



If all units from the final system (Master and all slaves) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time.

4.4.2. SLAVE configuration

To configure the unit as a **Slave configuration:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Parallel FO (number **1** in the figure below).

Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. Press the *Refresh* button (number **2** in the figure below), just to be sure the final configuration of the unit.

Fill the *Parallel ID* blank space (number **3** in the figure below) with the Parallel ID value of the unit to configure, as a Slave the user must know which unit has to be. Please, refer to the *Table 2* for the configuration of the final setup.

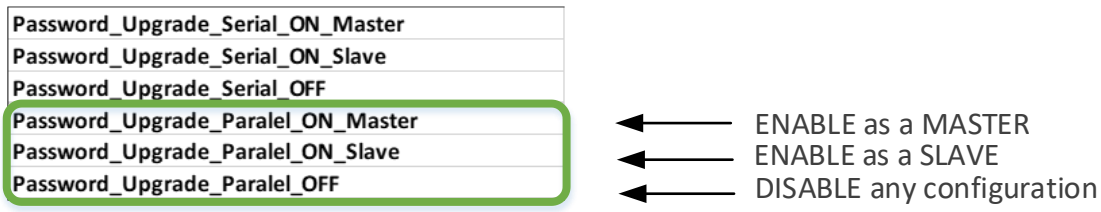
Parallel Total Units value	Parallel ID configuration value (depends on the Total units)							
Total units connected	Master	**Slave 1**	**Slave 2**	**Slave 3**	**Slave 4**	**Slave 5**	**Slave 6**	**Slave 7**
2	1	2	-	-	-	-	-	-
3	1	2	3	-	-	-	-	-
4	1	2	3	4	-	-	-	-
5	1	2	3	4	5	-	-	-
6	1	2	3	4	5	6	-	-
7	1	2	3	4	5	6	7	-
8	1	2	3	4	5	6	7	8

Table 2: value to fill in the configuration dialog box

Fill the *Parallel Total Units* blank space (number **4** in the figure below) with the Total number of units to connect in Parallel from the final setup. Please, refer to the *Table 2* to help about the configuration.

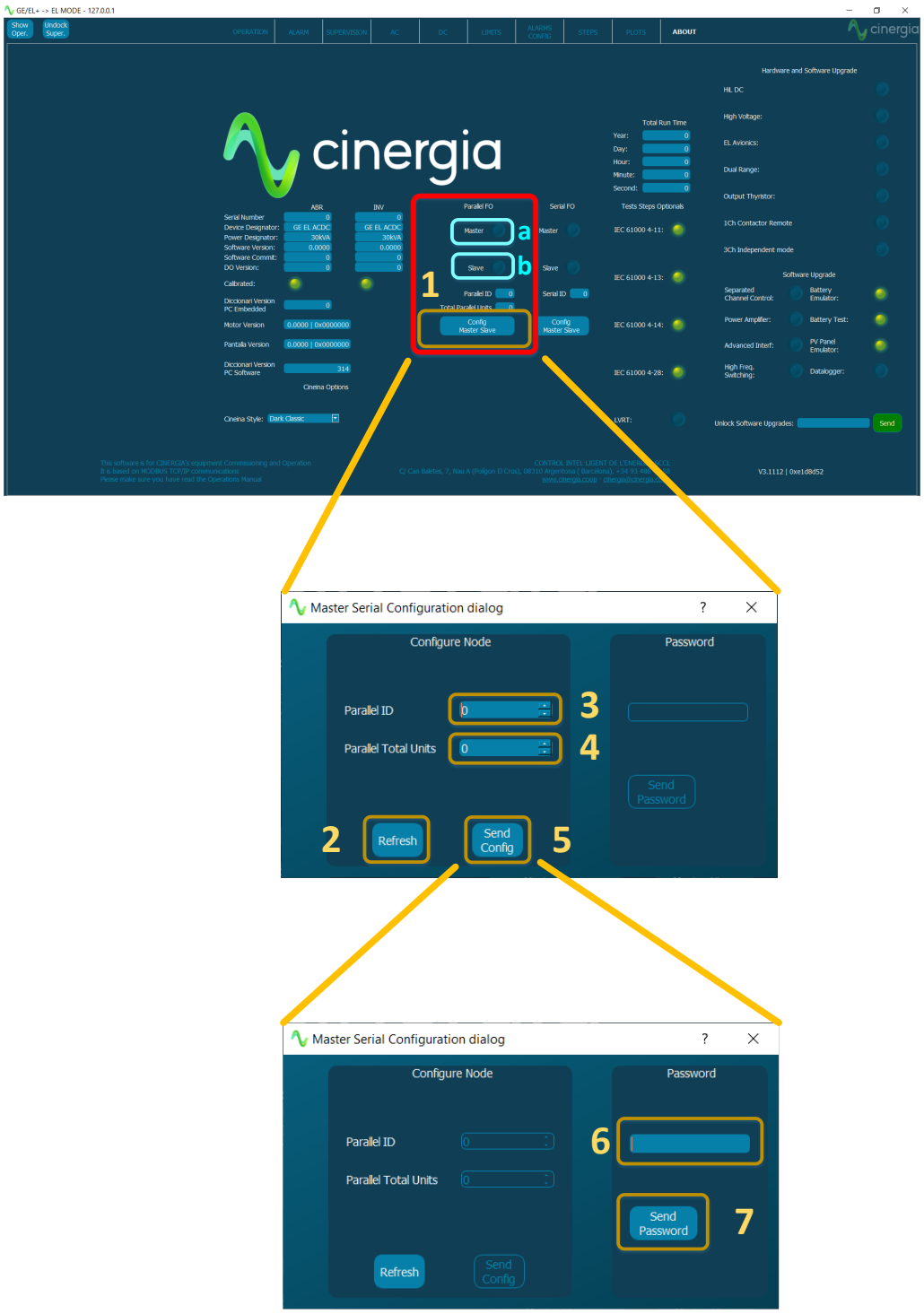
Press the button ***Send Config*** (number **5** in the figure below).

Once the button is pressed, the right part of the present dialog will be unlocked. The delivered code[7] *Password_Upgrade_Paralel_ON_Slave* must be introduced in the *Password* reserved space (number **6** in the figure below) and, afterwards, press the button *Send Password* (number **7** in the figure below). You can find the code provided under these lines:



When the configuration is activated, the LED beside the option (marked with an **b** in the figure below) will be shining and the final configuration will appear on the reserved spaces.

[7] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*



When the configuration is activated and the codes are correct, the specific space configuration marked as a Parallel FO will show the final configuration sent. The user can press the button *Refresh* (number **2** in the figure above), just in case.

The LED beside the option Slave will be shining and the final configuration will appear on the reserved spaces configuration.

As an example of 3 units working in parallel, and the units configured as the second and third Slave of the final setup, the specific space Parallel FO configuration will show:

If all units from the final system (Master and all slaves) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time.

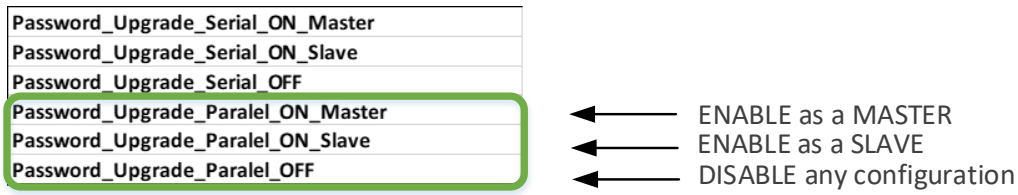
4.4.3. Remove the configuration

To remove the actual configuration of any unit**:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Parallel FO (number **1** in the figure above).

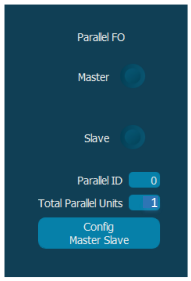
Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. Press the button ***Send Config*** (number **5** in the figure above).

Once the button is pressed, the right part of the present dialog will be unlocked. The delivered code[8] *Password_Upgrade_Paralel_OFF* must be introduced in the *Password* reserved space (number **6** in the figure above) and, afterwards, press the button *Send Password* (number **7** in the figure above). You can find the code provided under these lines:



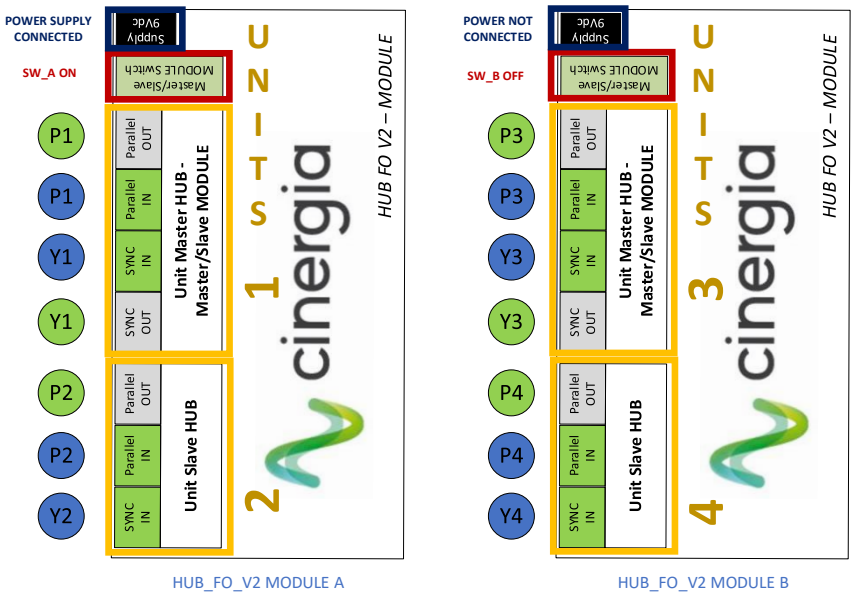
When the configuration is disabled, the LED beside the option (marked with an **a** or **b** in the figure above) will turn off and the final configuration will appear on the reserved spaces as shown in the picture below, removing any configuration:

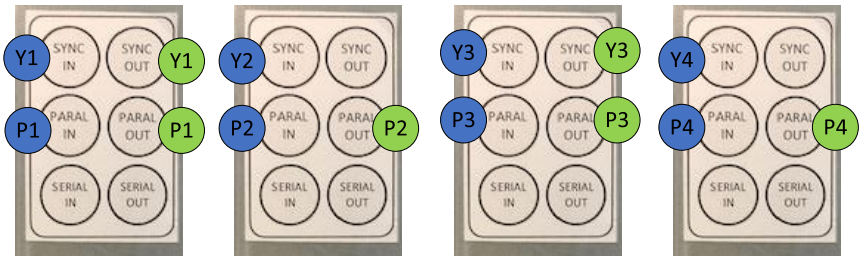


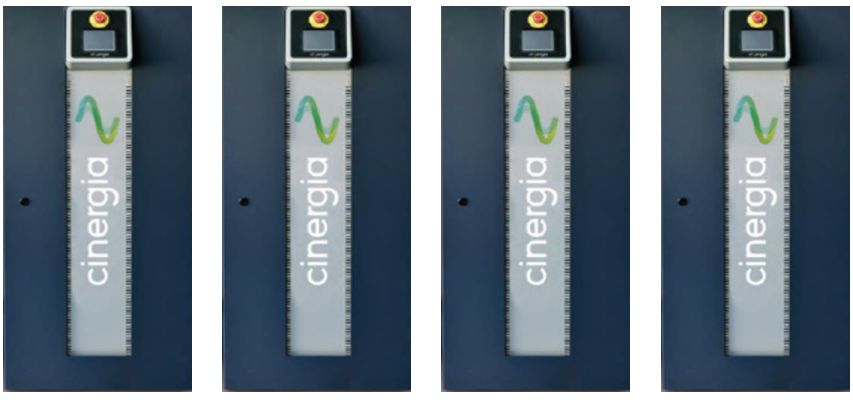
[8] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

4.5. Example Operation 4 units in DC parallel

In case of 4 units working in DC parallel, using a HUB_FO_V2, the final power diagram and the interface parallel and serial configuration must be according the pictures below:







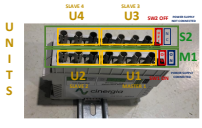
Unit 1
Master
(Main Master M1)

Unit 2
Slave 1
(Slave M1)

Unit 3
Slave 2
(Slave M1)

Unit 4
Slave 3
(Slave M1)

Parallel
HUB_FO_V2 joined

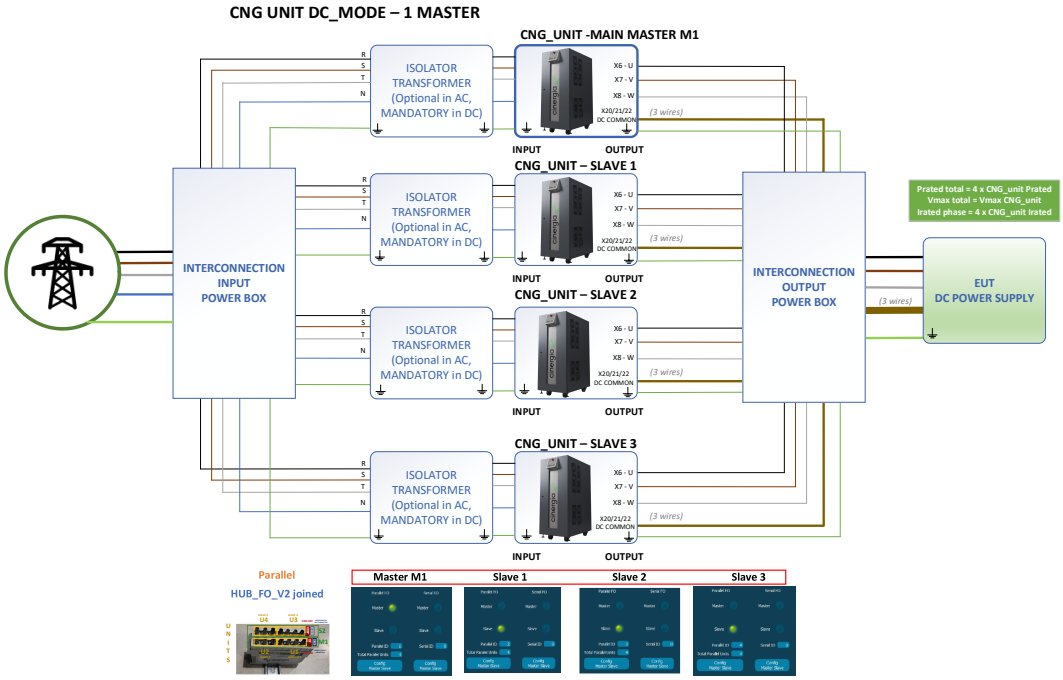


Noted that the SWITCH A from the **HUB_FO_V2** Module A must be in **ON** position and the SWITCH B from the **HUB_FO_V2** Module B must be in **OFF** position.

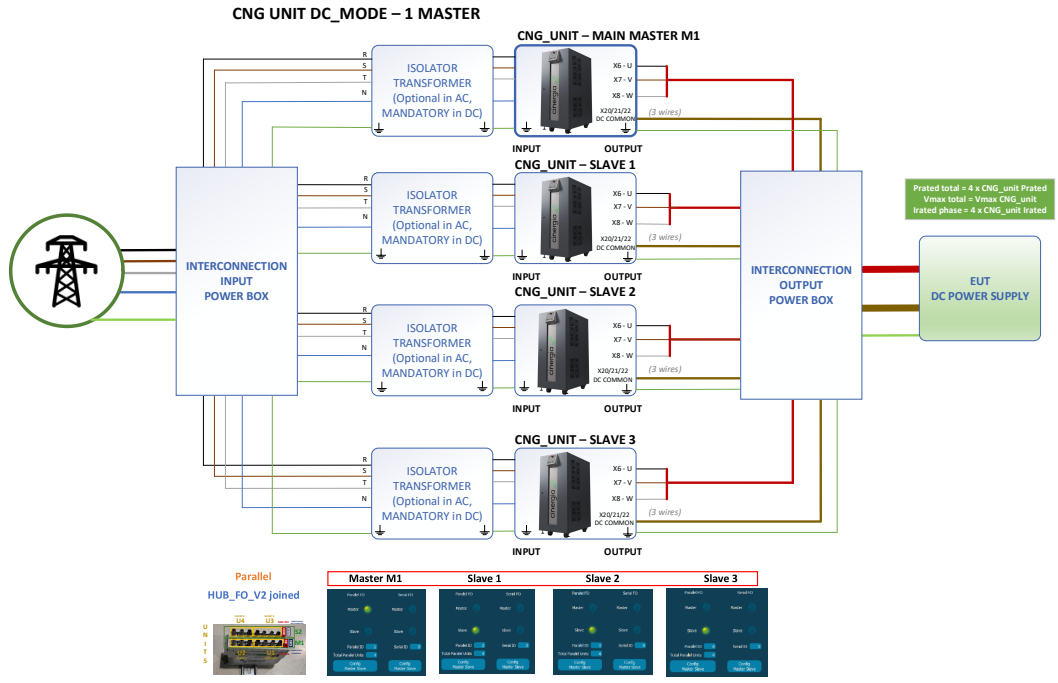
Noted that the module A must be powered, while the module B should NOT be powered connected.

Noted that both HUB_FO_V2 must be joined as shown on page 10.

In case of 3 channels: the power diagram will be as follow:



In case of 1 channel: the power diagram will be as follow:



Once, all the connections and configuration are correctly done, the user must connect via Modbus by Cinergia Interface with the MASTER M1, Unit 1, introducing the Master's IP.

In this case, the interface is showing the value of the complete system: the limits and alarm values shown on the LIMITS and ALARM CONFIG TAB are from the complete system. The values shown on the SUPERVISION TAB are from the whole system.

More than two RESET sequence must be done. It is possible that the user must press the RESET button three or four times before all Alarm clears at all.

In case of any unit has an alarm, the MASTER will show this alarm, as always, on the ALARM TAB.

5. UNITS IN SERIAL OPERATION (DC only)

CINERGIA ePLUS units has the capability to increase the voltage at the output in DC using two units connected in serial. In that case, the maximum voltage at the output of the units is 1500VDC instead of the 750VDC from the standard units.

In this configuration, the SERIAL FO connection must be done directly to the units to work. In case of only 2 units, the HUB_FO_v2 module is NOT need.

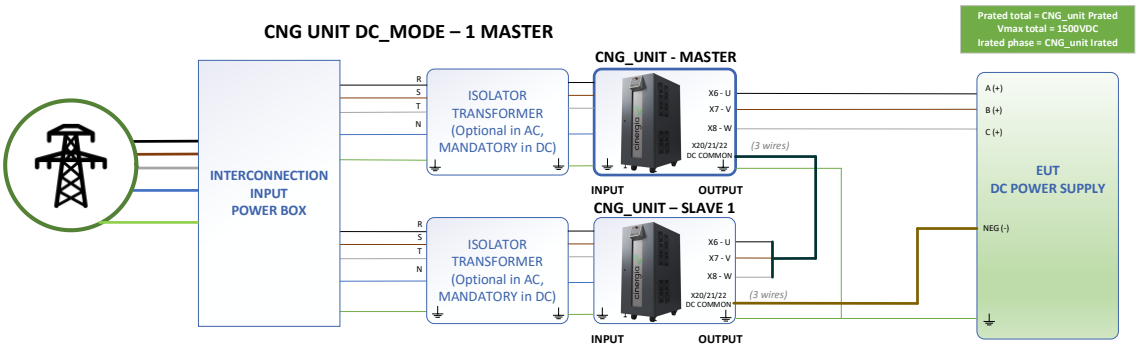
5.1. Power wiring connection

Please, check the connection diagram[9] shown below for the final two units in DC serial system:

Any change on wiring must be done with no power in the system (input/grid and output/EUT) and following the premises of the *Cinergia Unit Installation and Operation manual* provided with the units.

The wiring connection of each unit must be done according the power and current of each unit. The interconnection must be done using cables according of the final power and current of all the units working in parallel.

If the units are working in PARALLEL, be sure that all the output wires of each unit are connected phase by phase (these means that each U channel, V channel, W channel of each unit are connected). The section of each power cable has to be installed according to the power (current) of the unit.



Cinergia recommend using an INTERCONNECTION BOX for the all the connection between units on GRID side. The interconnection box is not provided by Cinergia, neither designed nor manufactured.

The GROUND WIRE or EARTH CABLE must be connected at the input and also at the output of the unit.

[9] *Check more diagram options at the end of the document*

5.2. Emergency sequence wiring

CINERGIA units are equipped with a local Emergency Stop pushbutton (EPO) at the front panel. When this local pushbutton (EPO) is pressed, the unit will be completely switched off by disconnecting the main contactors at the input and at the output. For safety reasons, the operation is done by hardware. The Emergency Stop pushbutton installed on the front panel of equipment has a normally close contact (**X12B**) which indicates the state of it. This output (EPO OTUPUT) will be ACTIVE (NC) when the local emergency stop button is NOT pressed.

In addition, CINERGIA units also integrate two terminals dedicated to an external Emergency Power Off (EPO) (**X12A**). When these terminals are used, the unit will have two Emergency Pushbuttons active: the local pushbutton and the external-remote pushbutton.

As all the units from the setup will work as ONLY ONE, the customer must be sure that every EPO stops by hardware all the units at the same time. So, an external remote emergency sequence must be wired to all units.

The external remote emergency sequence needs to be wired to all units from the same system in order to be ensure that all units will go to an Emergency state once any EPO is pressed by hardware.

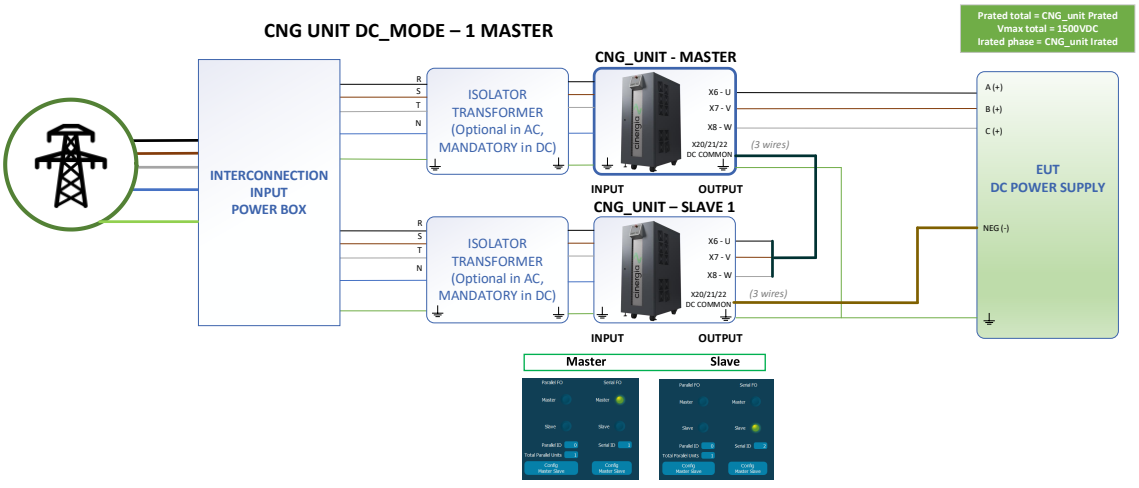
Please, read the *Cinergia Unit Installation and operation manual* for more information about this point and the EPO connection options.

5.3. FO connection

To serialize two ePLUS units in DC is necessary to use:

5.3.1. Only 2 units

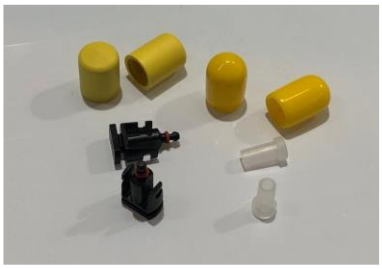
- 2 paired FO cable (5m length) (case DC unit in serial)
- 2 ePLUS units: it is mandatory to configure the SLAVE in 1 channel mode.



In case that any FO connectors will not be used, please leave the FO safety protector elements installed just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

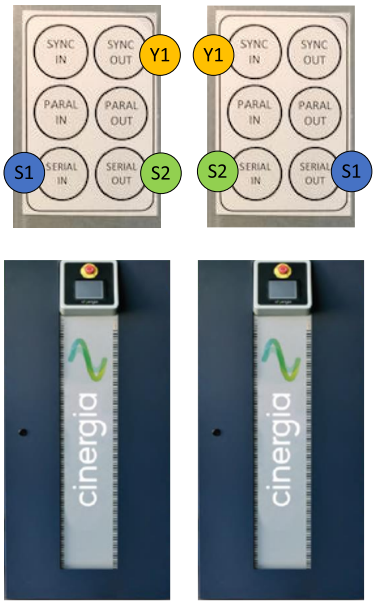
In case that any FO connectors will not be used anymore, please put on the FO safety protector elements just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

DO NOT THROW IT AWAY. Keep with you all the safety protector elements from FO circuitry from the unit, from the HUB_FO_V2 and even from the FO cables. Please, see pictures below:



On the picture above, you can identify safety protector elements: from the unit (yellow elements), from the HUB_FO_V2 (black elements), from the FO cables (white elements).

Follow the diagram below for the correctly connection of the Optical Fiber (FO) cable (***Note** that not all FO must be connected*):



5.3.2. Using HUB FO (Up to 8 units)

- 2 paired FO cable (5m length) every two units (case DC unit)
- 1 HUB_FO_V2 module for every two units **in case of using more than 2 units*
- 2 ePLUS units with DC mode available: it is mandatory to configure the SLAVE in 1 channel mode.

In case that any FO connectors will not be used, please leave the FO safety protector elements installed just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

In case that any FO connectors will not be used anymore, please put on the FO safety protector elements just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

DO NOT THROW IT AWAY. Keep with you all the safety protector elements from FO circuitry from the unit, from the HUB_FO_V2 and even from the FO cables. Please, see pictures below:

On the picture above, you can identify safety protector elements: from the unit (yellow elements), from the HUB_FO_V2 (black elements), from the FO cables (white elements).

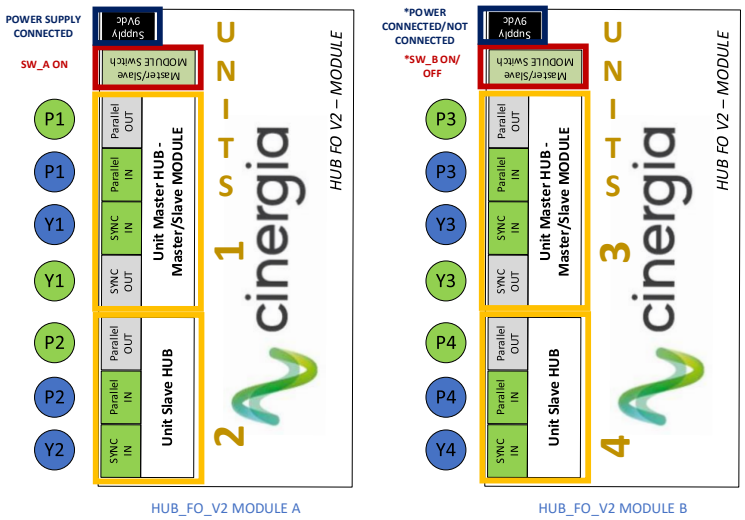
The configuration below represents, two groups of two units working in SERIAL mode. If the two HUB_FO_V2 modules are **JOINED** (remember only one power supply must be connected), all the four units will works **as ONLY one UNIT (only one master).** In case of the two HUB_FO_V2 modules are **NOT JOINED** (separated), the four units will works **as TWO units.**

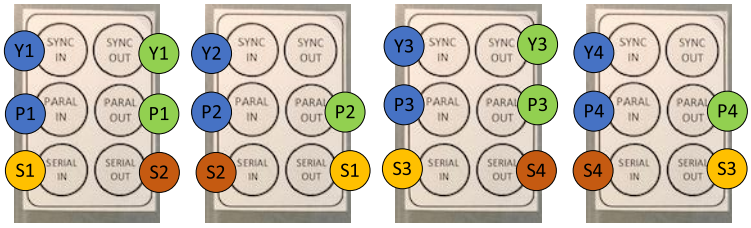
Noted that in case of the two HUB_FO_V2 are joined, the SWITCH A from the **HUB_FO_V2** Module A must be in **ON** position and the SWITCH B from the **HUB_FO_V2** Module B must be in **OFF** position.

Noted that the module A must be powered, while the module B should NOT be powered connected.

Noted that all the HUB_FO_V2 must be joined as shown on page 10.

Follow the diagram below for the correctly connection of the Optical Fiber (FO) cable (***Note** that not all FO must be connected*):





Unit 1
Master A
(Main Master M1)

Unit 2
Slave A

Unit 3
Master B
(Slave M1)

Unit 4
Slave B

5.4. Configuration (by interface)

At this point, all the power wiring and the FO cables are properly connected and verified by the supervisor.

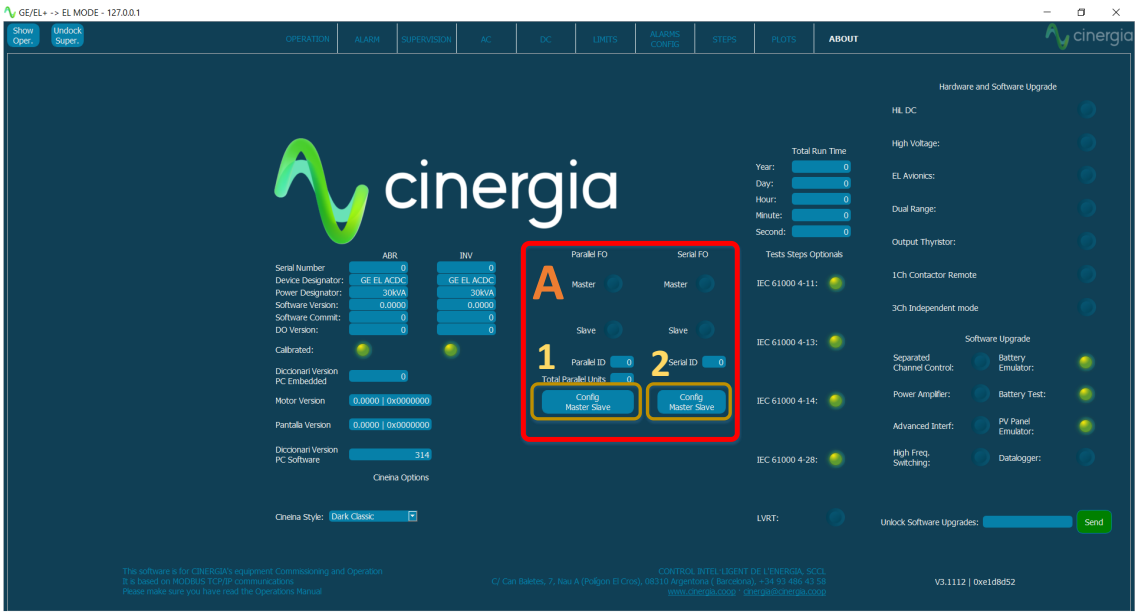
Before turning ON the unit, be sure that all the units that must work in serial operation must be configured with the specific control mode as a Master and as a SLAVE. If all the units are not properly configured, the master will remain on Alarm status all the time. Please, read this document before operating and activate this option. The SLAVE must always be configured as a 1CHANNEL mode.

Take into account that the unit configured as a SLAVE must be configured and connected as a 1 channel mode ALWAYS.

All the CNG units must be connected through ethernet for the configuration by the Modbus interface provided by Cinergia.
Once the units are connected by the interface, the user can introduce all the codes to activate the functionality required.

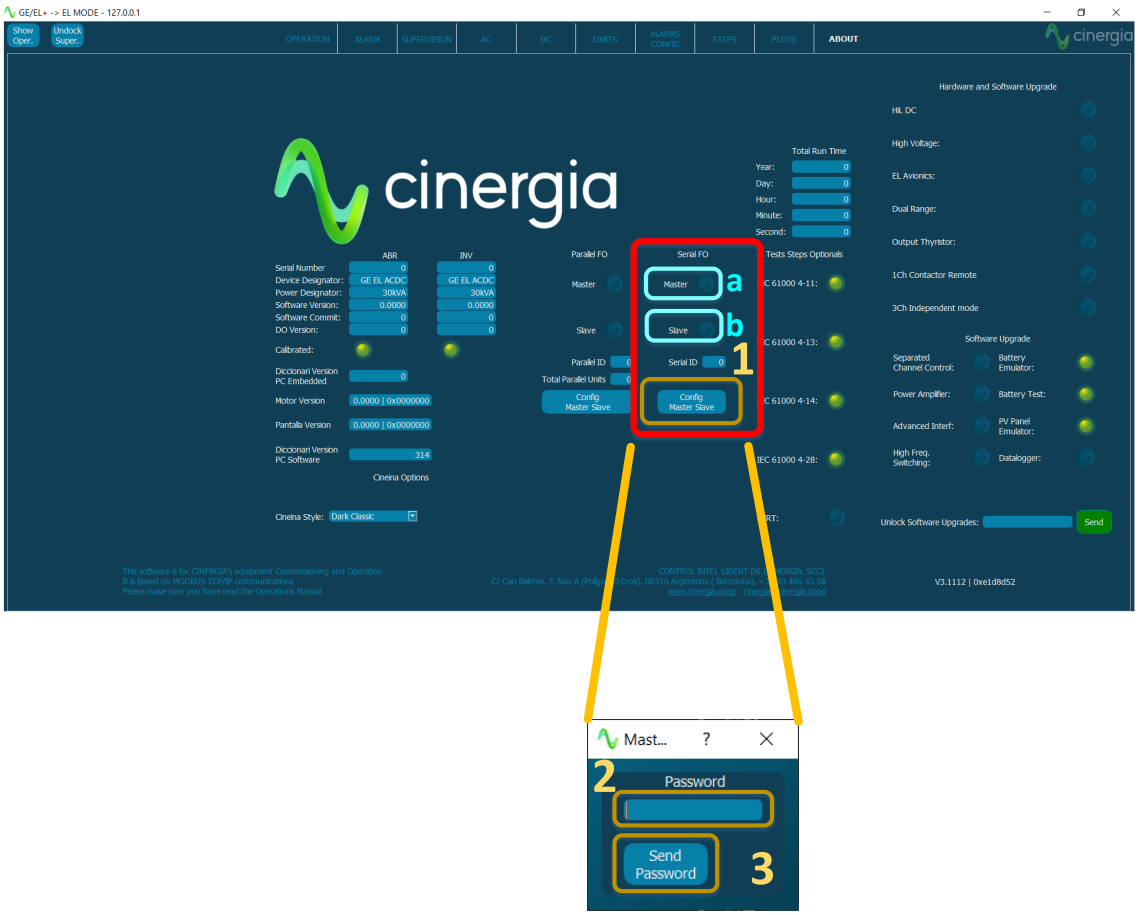
The user must choose the MASTER, so for the final setup, ONLY this unit is existing. This unit is the only ONE to operate and control by interface. For the final user, only one unit is working.

Please go the **ABOUT TAB**. Press the button *Config master slave* (number **2** on the picture below) depends on the setup to configure:



5.4.1. MASTER configuration in serial operation

To configure the unit as a **Master configuration:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Serial FO (number **1** in the figure below).



Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. The delivered code[10] *Password_Upgrade_Serial_ON_Master* must be introduced in the *Password* reserved space (number **2** in the figure above) and, afterwards, press the button *Send Password* (number **3** in the figure above). You can find the code provided under these lines:

Password_Upgrade_Serial_ON_Master	← ENABLE as a MASTER
Password_Upgrade_Serial_ON_Slave	← ENABLE as a SLAVE
Password_Upgrade_Serial_OFF	← DISABLE any configuration
Password_Upgrade_Paralel_ON_Master	
Password_Upgrade_Paralel_ON_Slave	
Password_Upgrade_Paralel_OFF	

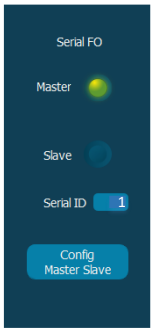
When the configuration is activated, the LED beside the option (marked with an **a** in the figure below) will be shining and the final configuration will appear on the reserved spaces.

When the configuration is activated and the codes are correct, the specific space configuration marked as a Serial FO will show the final configuration sent.

[10] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

The LED beside the option Master will be shining and the final configuration will appear on the reserved spaces configuration.

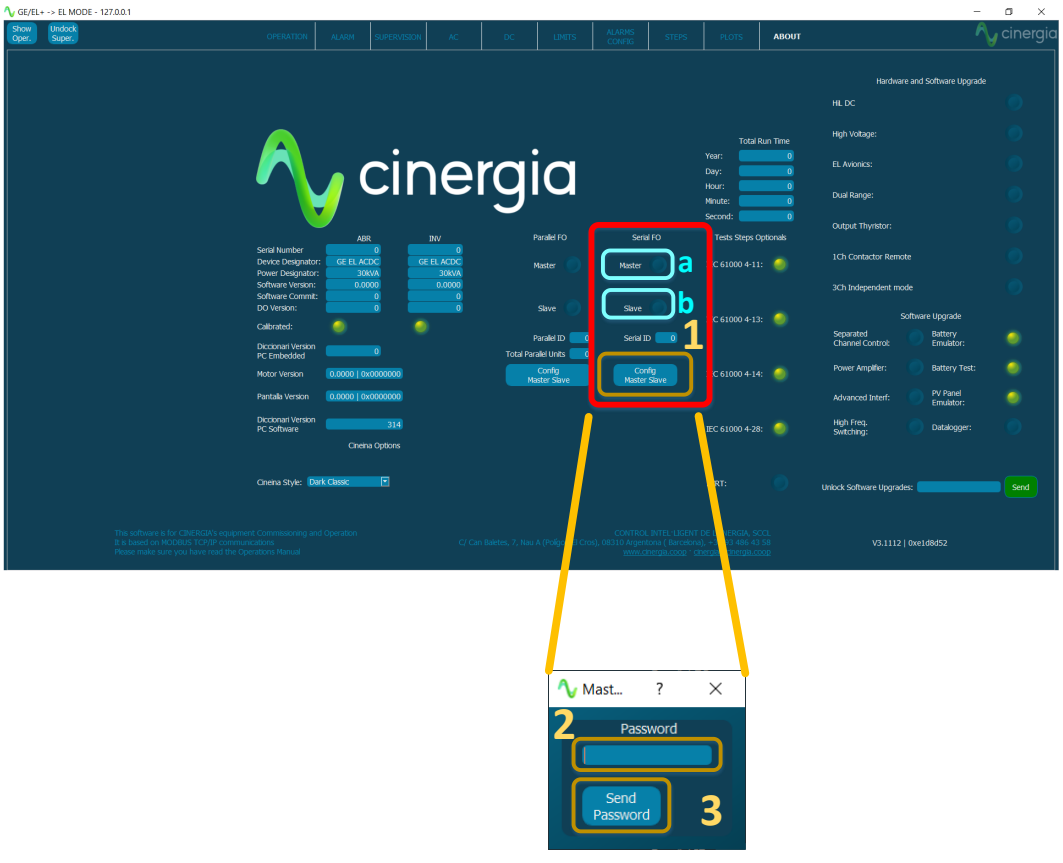
As an example of 2 units working in serial, and the current unit configured as a Master of the final setup, the specific space Serial FO configuration will show:



If all units from the final system (Master and slave) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time.

5.4.2. SLAVE configuration

To configure the unit as a **Slave configuration:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Serial FO (number **1** in the figure below).



Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. The delivered code[11] *Password_Upgrade_Serial_ON_Slave* must be introduced in the *Password* reserved space (number **2** in the figure above) and, afterwards, press the button *Send Password* (number **3** in the figure above). You can find the code provided under these lines:

Password_Upgrade_Serial_ON_Master
Password_Upgrade_Serial_ON_Slave
Password_Upgrade_Serial_OFF
Password_Upgrade_Paralel_ON_Master
Password_Upgrade_Paralel_ON_Slave
Password_Upgrade_Paralel_OFF

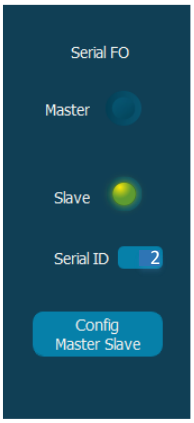
ENABLE as a MASTER
ENABLE as a SLAVE
DISABLE any configuration

When the configuration is activated, the LED beside the option (marked with an **b** in the figure below) will be shining and the final configuration will appear on the reserved spaces.

When the configuration is activated and the codes are correct, the specific space configuration marked as a Serial FO will show the final configuration sent.

The LED beside the option Slave will be shining and the final configuration will appear on the reserved spaces configuration.

As an example of 2 units working in serial, and the current unit configured as a Slave of the final setup, the specific space Serial FO configuration will show:



If all units from the final system (Master and slave) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time.

[11] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

5.4.3. Remove the configuration

To remove the actual configuration of any unit**:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Serial FO (number **1** in the figure above).

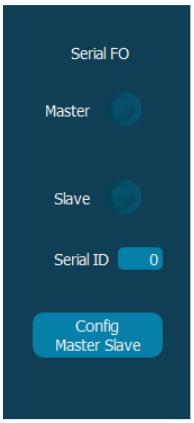
Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. The delivered code[12] *Password_Upgrade_Serial_OFF* must be introduced in the *Password* reserved space (number **2** in the figure above) and, afterwards, press the button *Send Password* (number **3** in the figure above). You can find the code provided under these lines:

Password_Upgrade_Serial_ON_Master
Password_Upgrade_Serial_ON_Slave
Password_Upgrade_Serial_OFF
Password_Upgrade_Paralel_ON_Master
Password_Upgrade_Paralel_ON_Slave
Password_Upgrade_Paralel_OFF

ENABLE as a MASTER
ENABLE as a SLAVE
DISABLE any configuration

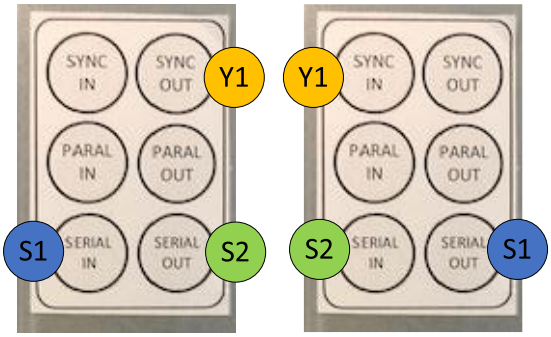
When the configuration is disabled, the LED beside the option (marked with an **a** or **b** in the figure above) will turn off and the final configuration will appear on the reserved spaces as shown in the picture below, removing any configuration:



[12] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

5.5. Example Operation 2 units in DC serial

In case of 2 units working in DC serial as ONLY one MASTER, is not necessary to use the HUB_FO_V2, the final power diagram and the interface parallel and serial configuration must be according the pictures below:



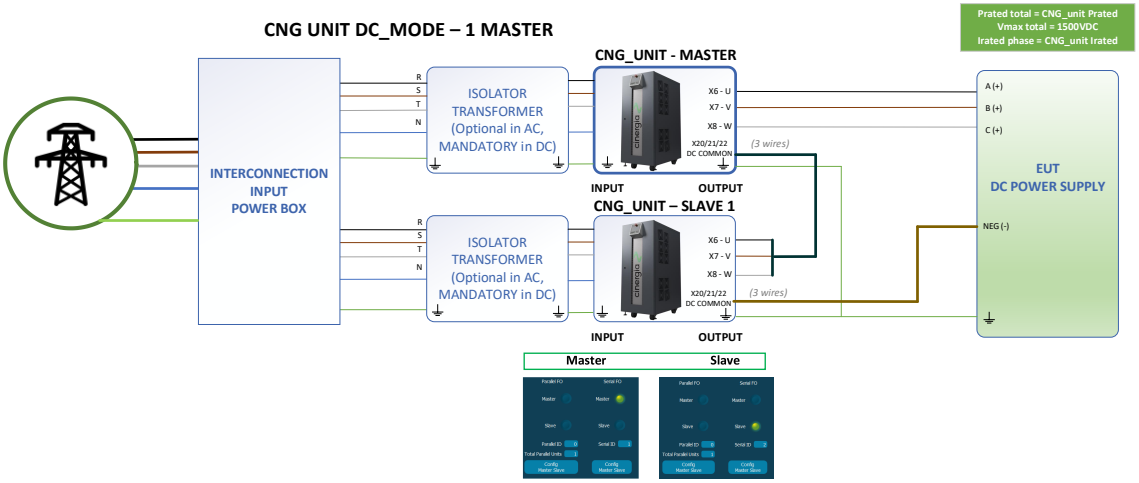
Unit 1
Master

Unit 2
Slave 1

Notice that the SYNC FO must be also connected between two units.

5.5.1. 3 channel configuration

In case of 3 channels: the power diagram will be as follow:



Once, all the connections and configuration are correctly done, the user must connect via Modbus by Cinergia Interface with the MASTER unit, Unit 1, introducing the Master's IP.

In this case, the interface is showing the value of the complete system: the limits and alarm values shown on the LIMITS and ALARM CONFIG TAB are from the complete system. The values shown on the SUPERVISION TAB are from the whole system.

More than two RESET sequence could be necessary. It is possible that the user must press the RESET button three or four times before all Alarm clears.

In case of any unit has an alarm, the MASTER will show this alarm, as always, on the ALARM TAB.

To operate the system in this specific configuration (serial DC connection mode and 3 channels), the user must configure the ***Slave voltage Setpoint*** or the **DC value of the setpoint of the SLAVE** once the unit is in RUN and before sending the full setpoint that the unit must apply at the output of each three channels.

- STEP 1: **Send the Slave Serial voltage setpoint**: The user could send a slave DC voltage setpoint depend on the final voltage value that the system will apply at the output. Write the setpoint value on the reserved space marked with number **8** and press the *Send Serial Voltage* button (number **8** on the picture below).
- STEP 2: **Send the full output setpoint**: the user could send the output DC voltage, current, power or resistor setpoint (number **1, 2, 3** and **4** on the picture below) and press the *Send Setpoints* button (number **6** on the picture below).

As an example, the user wants to apply a DC voltage setpoint of 1000VDC, 1200VDC and 1400VDC.

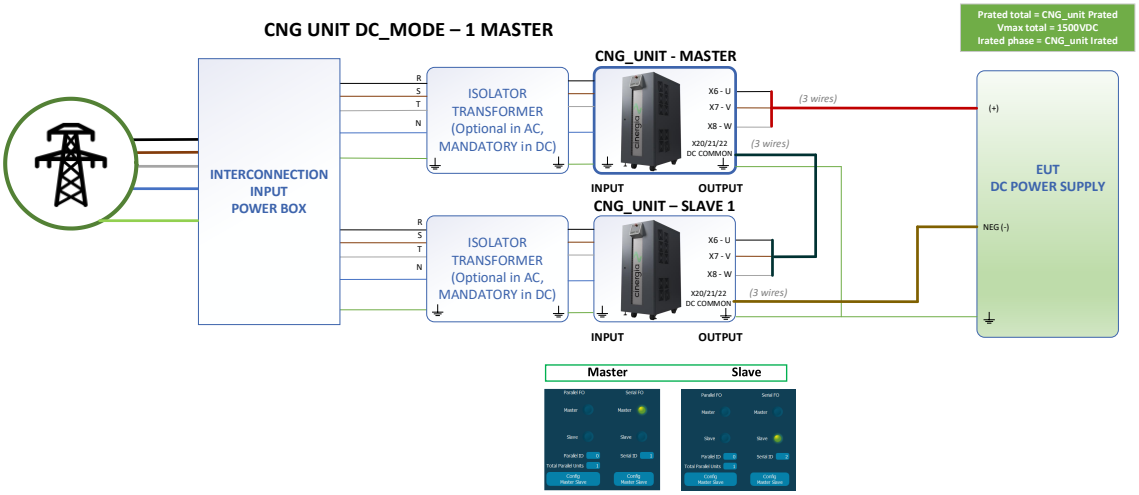
- STEP 1: **Send the Slave Serial voltage setpoint**: The user could send a slave DC voltage setpoint of 700VDC.
- STEP 2: **Send the full output setpoint**: the user could send the output DC voltage setpoint of 1000VDC, 1200VDC and 1400VDC. In this case, the slave unit will apply 700VDC and the master unit will apply 300VDC, 400VDC and 700VDC, respectively.

Of course, there are a lot of combination available and there are a lot of setpoints that cannot be performed.

The user must send the DC slave setpoint via interface (marked number 8) previous sending any final output setpoint.

5.5.2. 1 channel configuration

In case of 1 channel: the power diagram will be as follow:



Once, all the connections and configuration are correctly done, the user must connect via Modbus by Cinergia Interface with the MASTER unit, Unit 1, introducing the Master's IP.

In this case, the interface is showing the value of the complete system: the limits and alarm values shown on the LIMITS and ALARM CONFIG TAB are from the complete system. The values shown on the SUPERVISION TAB are from the whole system.

More than two RESET sequence must be done. It is possible that the user must press the RESET button three or four times before all Alarm clears at all.

In case of any unit has an alarm, the MASTER will show this alarm, as always, on the ALARM TAB.

6. MATRICIAL MODE: 2S+2S both working in parallel

As a MATRICIAL mode operation (special one), the user can increase the power of a 1500VDC system working with two group of two units connected in serial, working in parallel.

CINERGIA ePLUS units has the capability to increase the voltage at the output in DC using two units connected in serial and to increase the power and current at the output in DC using two group of two units in serial working in parallel. In that case, the maximum voltage at the output of the units is 1500VDC instead of the 750VDC from the standard units.

6.1. Power wiring connection

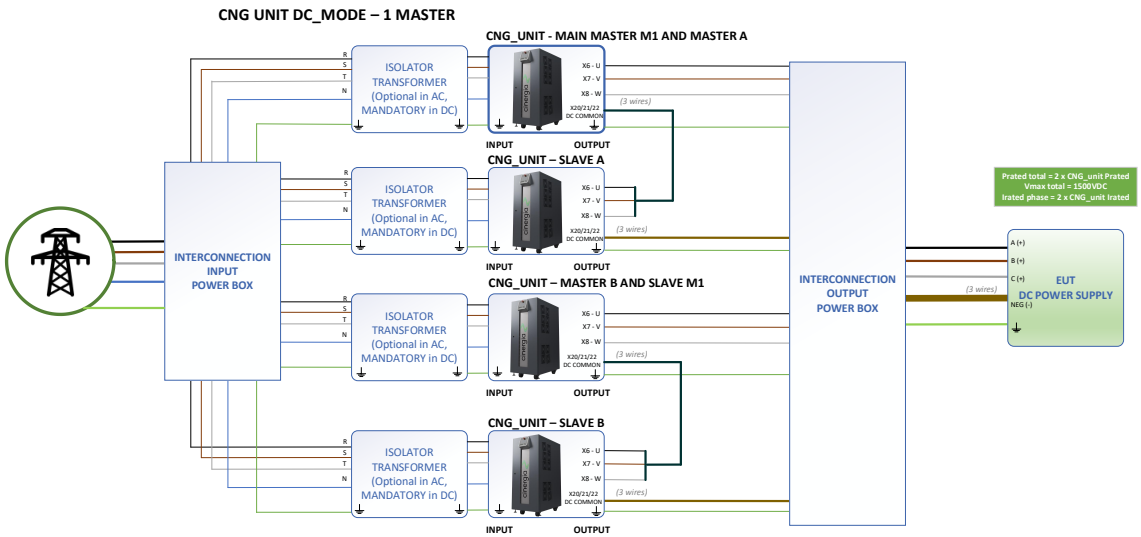
Please, check the connection diagram shown below for the final two group of units in DC serial system working in parallel:

Any change on wiring must be done with no power in the system (input/grid and output/EUT) and following the premises of the *Cinergia Unit Installation and Operation manual* provided with the units.

The wiring connection of each unit must be done according the power and current of each unit. The interconnection must be done using cables according of the final power and current of all the units working in parallel.

If the units are working in PARALLEL, be sure that all the output wires of each unit are connected phase by phase (these means that each U channel, V channel, W channel of each unit are connected). The section of each power cable has to be installed according to the power (current) of the unit.

Cinergia recommend using an INTERCONNECTION BOX for the all the connection between units on EUT output and on GRID side. The interconnection box is not provided by Cinergia, neither designed nor manufactured.



The GROUND WIRE or EARTH CABLE must be connected at the input and also at the output of the unit.

IMPORTANT: On this CONFIGURATION:

- The **UNIT 1** will be a MASTER A in serial mode to the **UNIT 2** and will be MAIN MASTER M1 in parallel mode to the **UNIT 3** at the same time.
- The **UNIT 3** will be a MASTERB in serial mode to the **UNIT 4** and will be SLAVE M1 in parallel mode to the **UNIT 1** at the same time.
- The **UNIT 2** will be the SLAVE A in serial mode to the **UNIT 1**.
- The **UNIT 4** will be the SLAVE B in serial mode to the **UNIT 3**.

6.2. Emergency sequence wiring

CINERGIA units are equipped with a local Emergency Stop pushbutton (EPO) at the front panel. When this local pushbutton (EPO) is pressed, the unit will be completely switched off by disconnecting the main contactors at the input and at the output. For safety reasons, the operation is done by hardware. The Emergency Stop pushbutton installed on the front panel of equipment has a normally close contact (**X12B**) which indicates the state of it. This output (EPO OTUPUT) will be ACTIVE (NC) when the local emergency stop button is NOT pressed.

In addition, CINERGIA units also integrate two terminals dedicated to an external Emergency Power Off (EPO) (**X12A**). When these terminals are used, the unit will have two Emergency Pushbuttons active: the local pushbutton and the external-remote pushbutton.

As all the units from the setup will work as ONLY ONE, the customer must be sure that every EPO stops by hardware all the units at the same time. So, an external remote emergency sequence must be wired to all units.

The external remote emergency sequence needs to be wired to all units from the same system in order to be ensure that all units will go to an Emergency state once any EPO is pressed by hardware.

Please, read the *Cinergia Unit Installation and operation manual* for more information about this point and the EPO connection options.

6.3. FO connection

To work on MATRICIAL mode with 4 ePLUS units in DC is necessary to use:

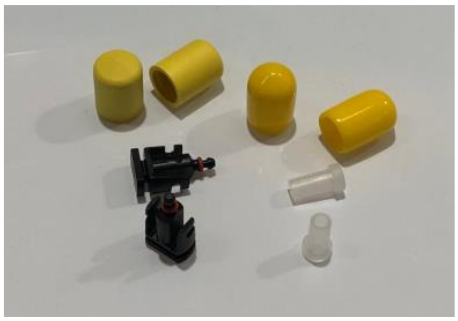
6.3.1. Using HUB FO (Up to 8 units)

- 3 paired FO cable (5m length) every two units (case DC unit)
- 2 HUB_FO_V2 module, one for every two units
- 4 ePLUS units with DC mode available: it is mandatory to configure the SLAVE in 1 channel mode.

In case that any FO connectors will not be used, please leave the FO safety protector elements installed just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

In case that any FO connectors will not be used anymore, please put on the FO safety protector elements just to avoid any internal damaged on the FO system. It could cause some permanent damage on the unit if this safety protector element is not installed properly.

DO NOT THROW IT AWAY. Keep with you all the safety protector elements from FO circuitry from the unit, from the HUB_FO_V2 and even from the FO cables. Please, see pictures below:



On the picture above, you can identify safety protector elements: from the unit (yellow elements), from the HUB_FO_V2 (black elements), from the FO cables (white elements).

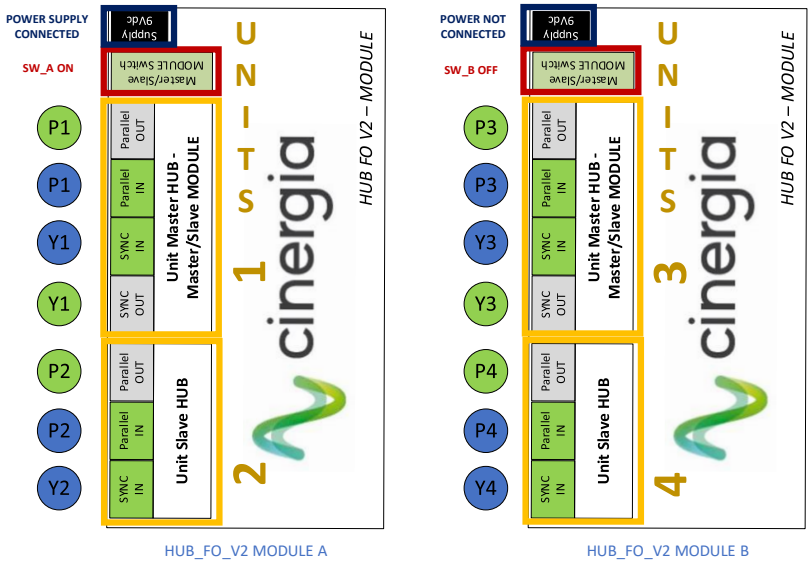
The configuration below represents, two groups of two units working in SERIAL mode. Both HUB_FO_V2 modules (module A and B) must be **JOINED** (remember only one power supply must be connected), all the four units will works **as ONLY one UNIT (only one master).**

Noted that the SWITCH A from the **HUB_FO_V2** Module A must be in **ON** position and the SWITCH B from the **HUB_FO_V2** Module B must be in **OFF** position.

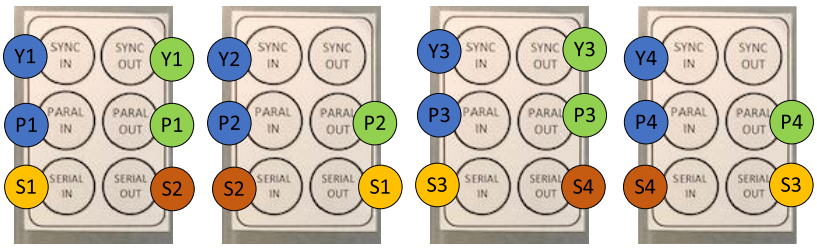
Noted that the module A must be powered, while the module B should NOT be powered connected.

Noted that all the HUB_FO_V2 must be joined as shown on page 10.

Follow the diagram below for the correctly connection of the Optical Fiber (FO) cable (***Note** that not all FO must be connected*):



HUB_FO_V2 MODULE A HUB_FO_V2 MODULE B



Unit 1
Master A
(Main Master M1)

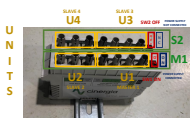
Unit 2
Slave A

Unit 3
Master B
(Slave M1)

Unit 4
Slave B

Serial + Parallel

HUB_FO_V2 joined



6.4. Configuration (by interface)

At this point, all the power wiring and the FO cables are properly connected and verified by the supervisor.

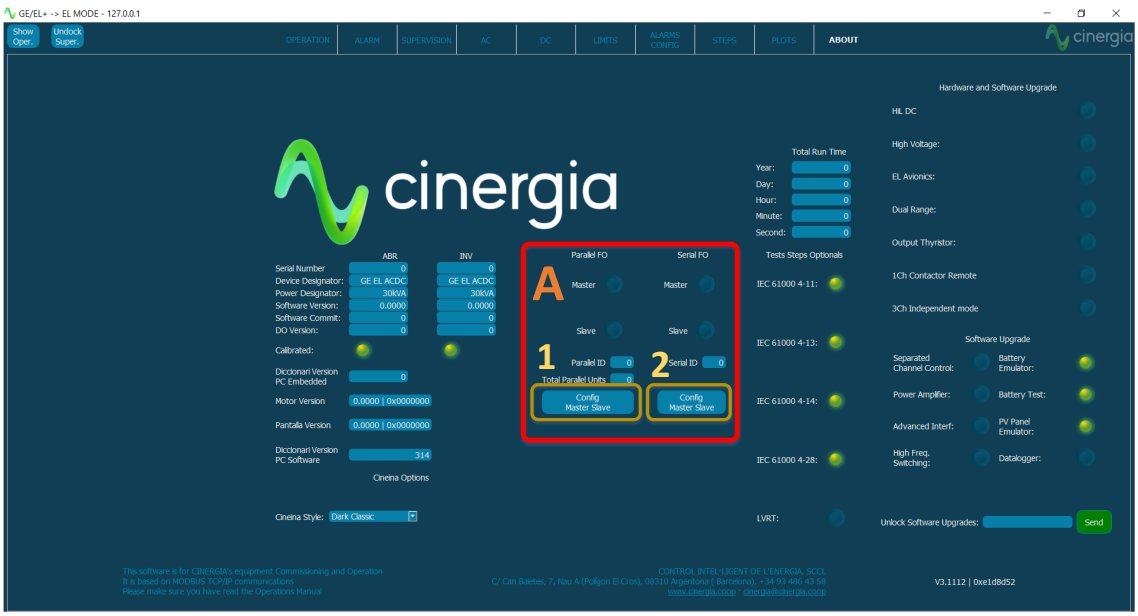
Before turning ON the unit, be sure that all the units that must work in serial operation must be configured with the specific control mode as a Master and as a SLAVE. If all the units are not properly configured, the master will remain on Alarm status all the time. Please, read this document before operating and activate this option. All the SLAVEs must always be configured as a 1CHANNEL mode.

Take into account that units configured as a SLAVE must be configured and connected as a 1 channel mode ALWAYS.

All the CNG units must be connected through ethernet for the configuration by the Modbus interface provided by Cinergia.
Once the units are connected by the interface, the user can introduce all the codes to activate the functionality required.

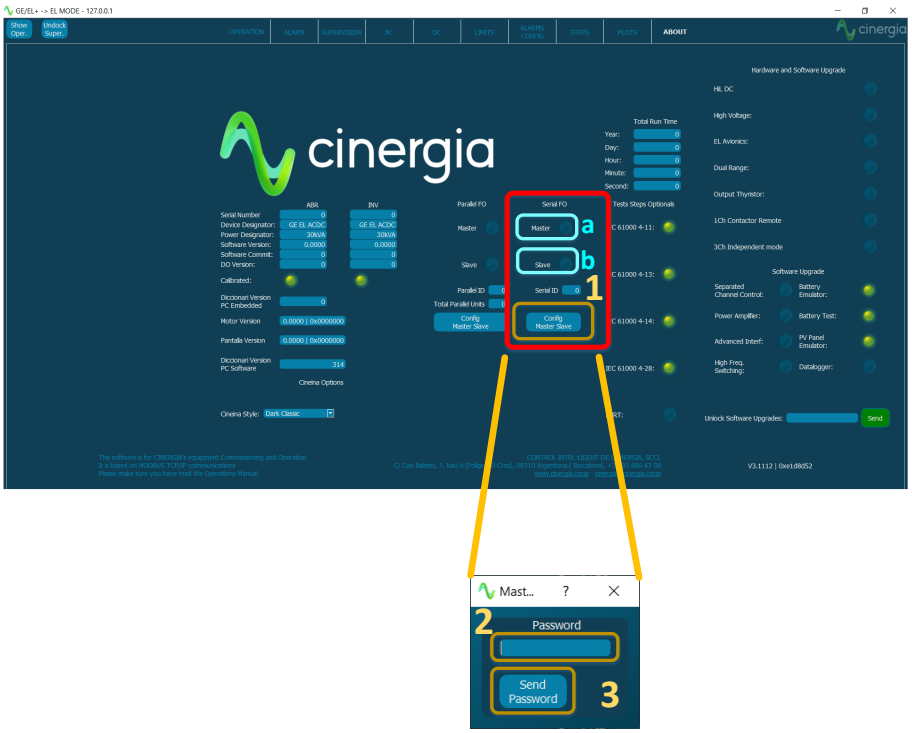
The user must choose the MAIN MASTER, so for the final setup, ONLY this unit is existing. This unit is the only ONE to operate and control by interface. For the final user, only one unit is working.

Please go the **ABOUT TAB**. Press the button *Config master slave* (number **2** on the picture below) depends on the setup to configure:



6.4.1. STEP 1: MASTER configuration in serial operation (Unit 1)

To configure the unit as a **Master configuration (Unit 1 and 3):** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Serial FO (number **1** in the figure below).



Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. The delivered code[13] *Password_Upgrade_Serial_ON_Master* must be introduced in the *Password* reserved space (number **2** in the figure above) and, afterwards, press the button *Send Password* (number **3** in the figure above). You can find the code provided under these lines:

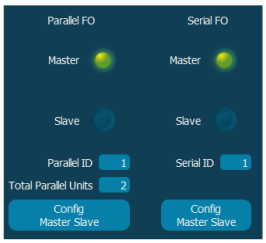
Password_Upgrade_Serial_ON_Master	← ENABLE as a MASTER
Password_Upgrade_Serial_ON_Slave	← ENABLE as a SLAVE
Password_Upgrade_Serial_OFF	← DISABLE any configuration
Password_Upgrade_Paralel_ON_Master	
Password_Upgrade_Paralel_ON_Slave	
Password_Upgrade_Paralel_OFF	

When the configuration is activated, the LED beside the option (marked with an **a** in the figure below) will be shining and the final configuration will appear on the reserved spaces.

When the configuration is activated and the codes are correct, the specific space configuration marked as a Serial FO will show the final configuration sent.

[13] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

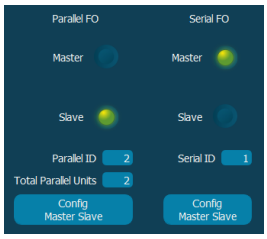
The LED beside the option Master will be shining and the final configuration will appear on the reserved spaces configuration.



If all units from the final system (Master and slave) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time. (on two units)

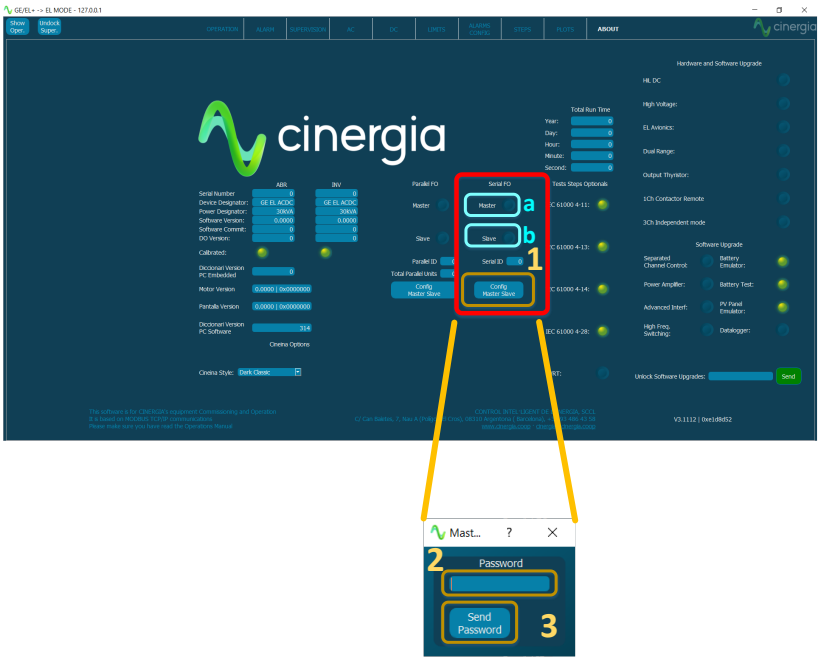
6.4.2. STEP 2: MASTER configuration in serial operation (Unit 3)

Repeat the same instructions of the section 6.4.1 for the unit 3 (Unit 3 as the second serial Master).



6.4.3. STEP 3: SLAVE configuration in serial operation (Unit 2)

To configure the unit as a **Slave configuration (Unit 2 and 4):** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Serial FO (number **1** in the figure below).



Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. The delivered code[14] *Password_Upgrade_Serial_ON_Slave* must be introduced in the *Password* reserved space (number **2** in the figure above) and, afterwards, press the button *Send Password* (number **3** in the figure above). You can find the code provided under these lines:

Password_Upgrade_Serial_ON_Master
Password_Upgrade_Serial_ON_Slave
Password_Upgrade_Serial_OFF
Password_Upgrade_Paralel_ON_Master
Password_Upgrade_Paralel_ON_Slave
Password_Upgrade_Paralel_OFF

ENABLE as a MASTER
ENABLE as a SLAVE
DISABLE any configuration

When the configuration is activated, the LED beside the option (marked with an **b** in the figure below) will be shining and the final configuration will appear on the reserved spaces.

When the configuration is activated and the codes are correct, the specific space configuration marked as a Serial FO will show the final configuration sent.

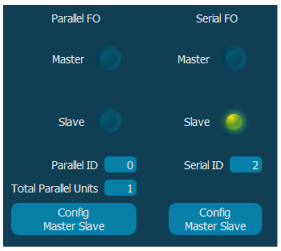
The LED beside the option Slave will be shining and the final configuration will appear on the reserved spaces configuration.

[14] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

If all units from the final system (Master and slave) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time.

6.4.4. STEP 4: SLAVE configuration in serial operation (Unit 4)

Repeat the same instructions of the section 6.4.3 for the unit 4 (Unit 4 as the second serial Slave from the second serial Master, Unit 3).



6.4.5. STEP 5: (MAIN) MASTER configuration in parallel operation (Unit 1)

To configure the unit as a **MAIN Master configuration (Unit 1):** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Serial FO (number **1** in the figure below).

IMPORTANT: This UNIT 1 will be a MASTER in serial mode to the UNIT 2 and will be MASTER in parallel mode to the UNIT 3.

Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. Press the *Refresh* button (number **2** in the figure below), just to be sure the final configuration of the unit.

Fill the *Parallel ID* blank space (number **3** in the figure below) with the Parallel ID value of the unit to configure, as a Master always must be a 1. Please, refer to the *Table 1* for the configuration of the final setup.

Parallel Total Units value	Parallel ID configuration value (depends on the Total units)			
Total units connected	**Master**	Slave 1	Slave 2	Slave 3
2	1	2	-	-
3	1	2	3	-
4	1	2	3	4

Table 1: value to fill in the configuration dialog box

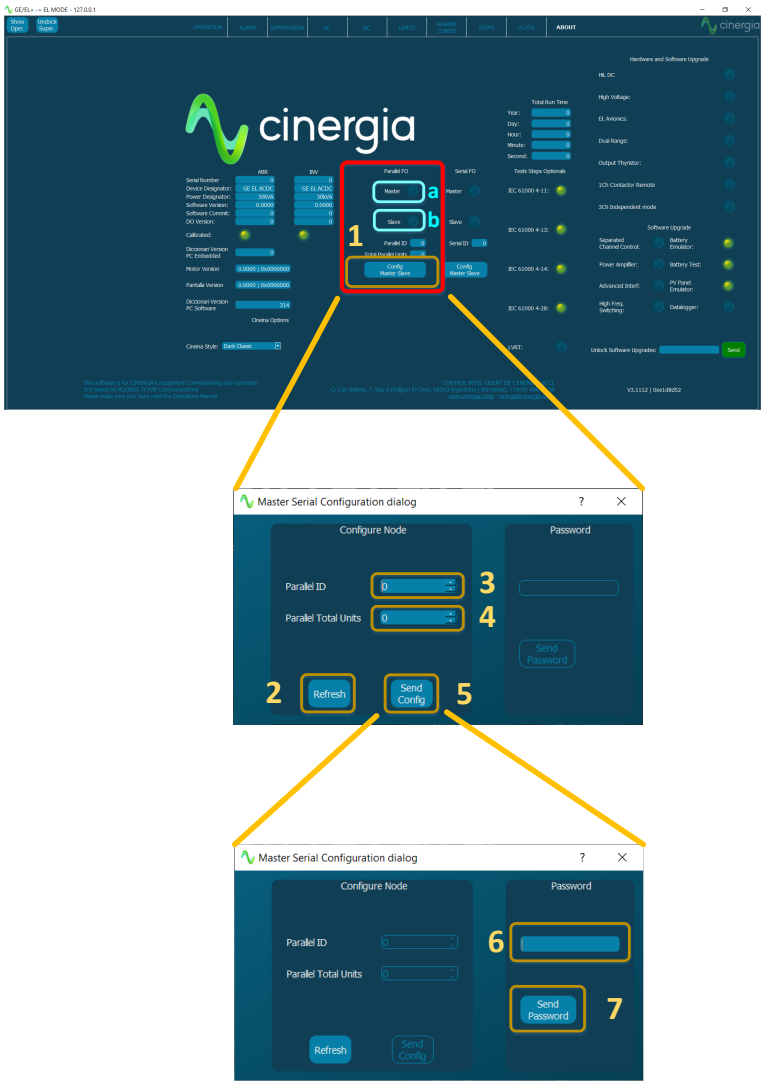
Fill the *Parallel Total Units* blank space (number **4** in the figure below) with the Total number of units to connect in Parallel from the final setup. Please, refer to the *Table 1* to help about the configuration.

Press the button ***Send Config*** (number **5** in the figure below).

Once the button is pressed, the right part of the present dialog will be unlocked. The delivered code[15] *Password_Upgrade_Paralel_ON_Master* must be introduced in the *Password* reserved space (number **6** in the figure below) and, afterwards, press the button *Send Password* (number **7** in the figure below). You can find the code provided under these lines:

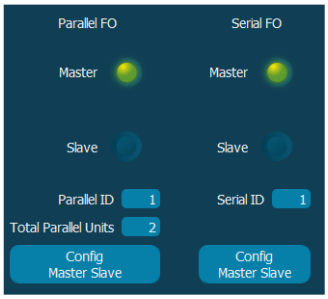
When the configuration is activated, the LED beside the option (marked with an **a** in the figure below) will be shining and the final configuration will appear on the reserved spaces.

[15] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*



When the configuration is activated and the codes are correct, the specific space configuration marked as a Parallel FO will show the final configuration sent. The user can press the button *Refresh* (number **2** in the figure above), just in case.

The LED beside the option Master will be shining and the final configuration will appear on the reserved spaces configuration.



If all units from the final system (Master and all slaves) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time.

6.4.6. STEP 6: SLAVE configuration in parallel operation (Unit 3)

To configure the unit as a **Slave configuration (Unit 3):** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Parallel FO (number **1** in the figure below).

IMPORTANT: This UNIT 3 will be a MASTER in serial mode to the UNIT 4 and will be SLAVE in parallel mode to the UNIT 1.

Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

Once the button is pressed, a dialog box called ***Master Serial Configuration dialog*** will appear. Press the *Refresh* button (number **2** in the figure below), just to be sure the final configuration of the unit.

Fill the *Parallel ID* blank space (number **3** in the figure below) with the Parallel ID value of the unit to configure, as a Slave the user must know which unit has to be. Please, refer to the *Table 2* for the configuration of the final setup.

Parallel Total Units value	**Parallel ID configuration value (depends on the Total units)**			
Total units connected	Master	**Slave 1**	**Slave 2**	**Slave 3**
2	1	2	-	-
3	1	2	3	-
4	1	2	3	4

Table 2: value to fill in the configuration dialog box

Fill the *Parallel Total Units* blank space (number **4** in the figure below) with the Total number of units to connect in Parallel from the final setup. Please, refer to the *Table 2* to help about the configuration.

Press the button ***Send Config*** (number **5** in the figure below).

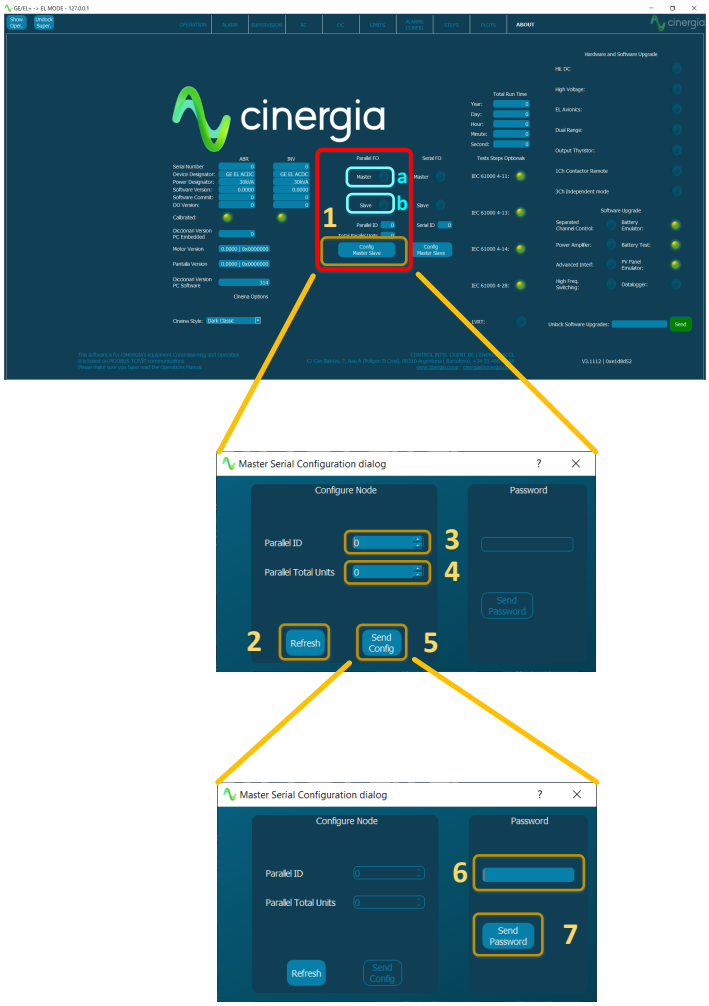
Once the button is pressed, the right part of the present dialog will be unlocked. The delivered code[16] *Password_Upgrade_Paralel_ON_Slave* must be introduced in the *Password* reserved space (number **6** in the figure below) and, afterwards, press the button *Send Password* (number **7** in the figure below). You can find the code provided under these lines:

[16] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

Password_Upgrade_Serial_ON_Master
Password_Upgrade_Serial_ON_Slave
Password_Upgrade_Serial_OFF
Password_Upgrade_Paralel_ON_Master
Password_Upgrade_Paralel_ON_Slave
Password_Upgrade_Paralel_OFF

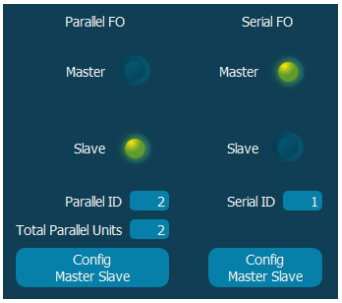
← ENABLE as a MASTER
← ENABLE as a SLAVE
← DISABLE any configuration

When the configuration is activated, the LED beside the option (marked with an **b** in the figure below) will be shining and the final configuration will appear on the reserved spaces.



When the configuration is activated and the codes are correct, the specific space configuration marked as a Parallel FO will show the final configuration sent. The user can press the button *Refresh* (number **2** in the figure above), just in case.

The LED beside the option Slave will be shining and the final configuration will appear on the reserved spaces configuration.



If all units from the final system (Master and all slaves) are NOT properly configured and even the FO are not properly connected, the Master will remain to Alarm status all the time.

6.4.7. Remove all configurations

To remove the actual configuration of any unit**:** the user must connect to the unit with the Cinergia interface: Press the button *Config Master Slave* from the Parallel FO and Serial FO.

Take into account that the unit must be in Alarm or Stand by Status to proceed with these instructions.

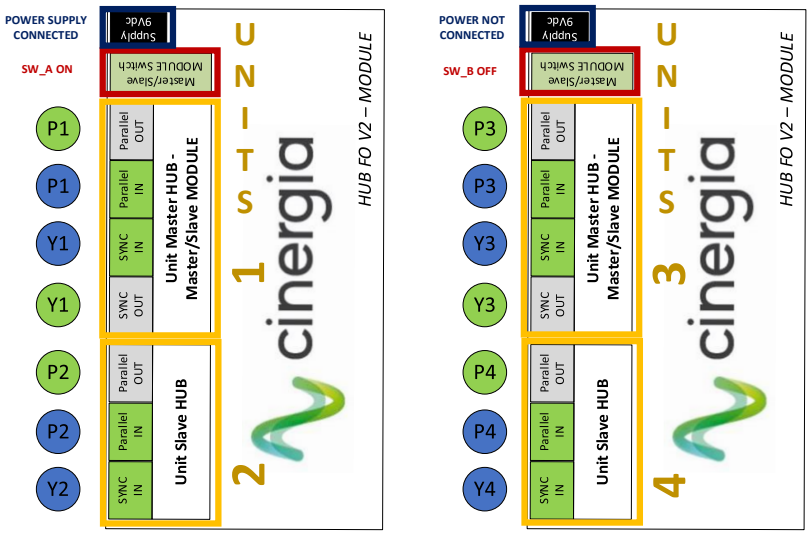
The delivered code[17] *Password_Upgrade_Paralel_OFF* and *Password_Upgrade_Serial_OFF* must be introduced in the *Password* reserved space. Follow the instructions shown on section 3.4.3. and 5.4.3.

When the configuration is disabled, the LEDs beside each option will turn off and the final configuration will appear on the reserved spaces as shown in the picture below, removing any configuration in all units:

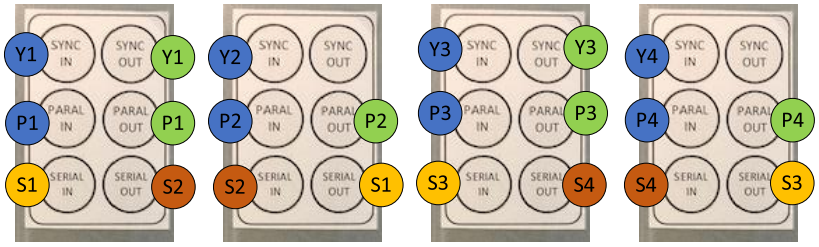
[17] *The user would find all the delivered codes for these functionalities in the USB provided with the unit*

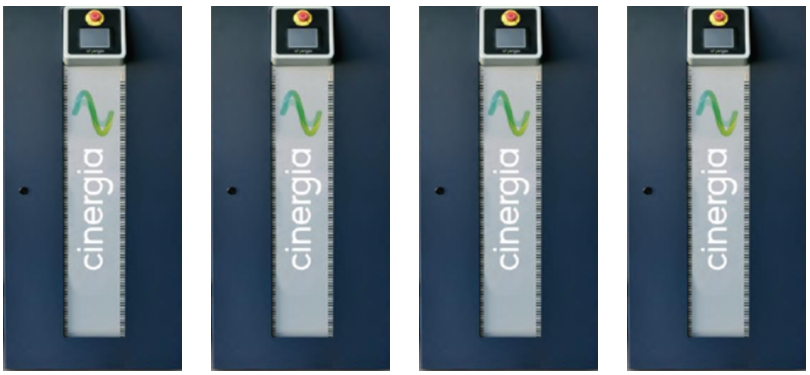
6.5. Operation

In case of 2 group of 2 units working in DC serial as only one unit (one Master), using a HUB_FO_V2, the final power diagram and the interface parallel and serial configuration must be according the pictures below:



HUB_FO_V2 MODULE A HUB_FO_V2 MODULE B





Unit 1
Master A
(Main Master M1)

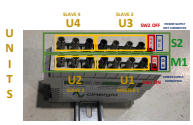
Unit 2
Slave A

Unit 3
Master B
(Slave M1)

Unit 4
Slave B

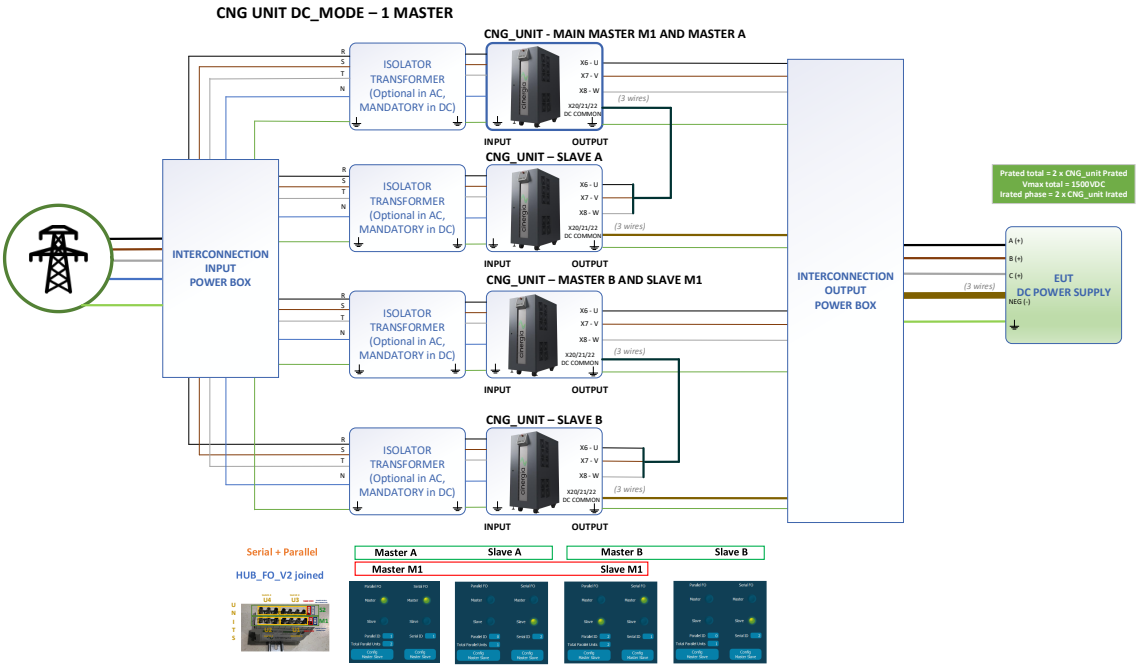
Serial + Parallel

HUB_FO_V2 joined



6.5.1. 3 channel configuration

In case of 3 channels: the power diagram will be as follow:



Once, all the connections and configuration are correctly done, the user must connect via Modbus by Cinergia Interface with the MAIN MASTER M1, Unit 1, introducing the Master's IP.

In this case, the interface is showing the value of the complete system: the limits and alarm values shown on the LIMITS and ALARM CONFIG TAB are from the complete system. The values shown on the SUPERVISION TAB are from the whole system.

More than two RESET sequence could be necessary. It is possible that the user must press the RESET button three or four times before all Alarm clears.

In case of any unit has an alarm, the MASTER will show this alarm, as always, on the ALARM TAB.

To operate the system in this specific configuration (serial DC connection mode and 3 channels), the user must configure the ***Slave voltage Setpoint*** or the **DC value of the setpoint of the SLAVE** once the unit is in RUN and before sending the full setpoint that the unit must apply at the output of each three channels.

- STEP 1: **Send the Slave Serial voltage setpoint**: The user could send a slave DC voltage setpoint depend on the final voltage value that the system will apply at the output. Write the setpoint value on the reserved space marked with number **8** and press the *Send Serial Voltage* button (number **8** on the picture below).
- STEP 2: **Send the full output setpoint**: the user could send the output DC voltage, current, power or resistor setpoint (number **1, 2, 3** and **4** on the picture below) and press the *Send Setpoints* button (number **6** on the picture below).

As an example, the user wants to apply a DC voltage setpoint of 1000VDC, 1200VDC and 1400VDC.

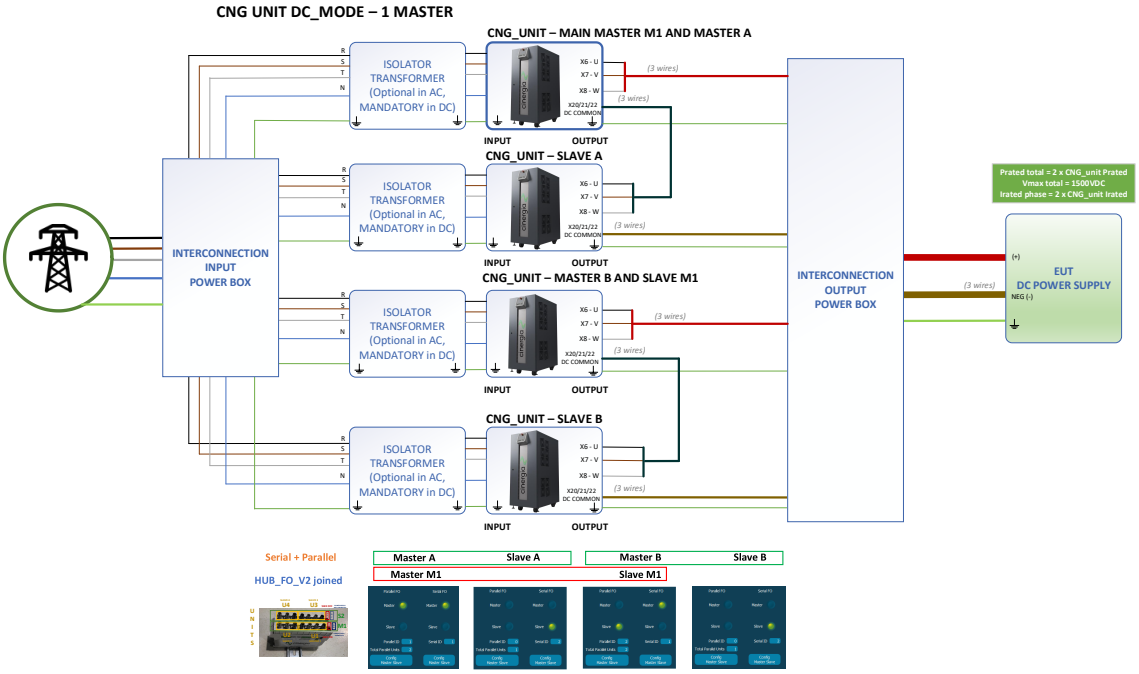
- STEP 1: **Send the Slave Serial voltage setpoint**: The user could send a slave DC voltage setpoint of 700VDC.
- STEP 2: **Send the full output setpoint**: the user could send the output DC voltage setpoint of 1000VDC, 1200VDC and 1400VDC. In this case, the slave unit will apply 700VDC and the master unit will apply 300VDC, 400VDC and 700VDC, respectively.

Of course, there are a lot of combination available and there are a lot of setpoints that cannot be performed.

The user must send the DC slave setpoint via interface (marked number 8) previous sending any final output setpoint.

6.5.2. 1 channel configuration

In case of 1 channel: the power diagram will be as follow:



Once, all the connections and configuration are correctly done, the user must connect via Modbus by Cinergia Interface with the MAIN MASTER M1, Unit 1, introducing the Master's IP.

In this case, the interface is showing the value of the complete system: the limits and alarm values shown on the LIMITS and ALARM CONFIG TAB are from the complete system. The values shown on the SUPERVISION TAB are from the whole system.

More than two RESET sequence must be done. It is possible that the user must press the RESET button three or four times before all Alarm clears at all.

In case of any unit has an alarm, the MASTER will show this alarm, as always, on the ALARM TAB.

7. OTHER CONFIGURATION with HUB_FO_V2

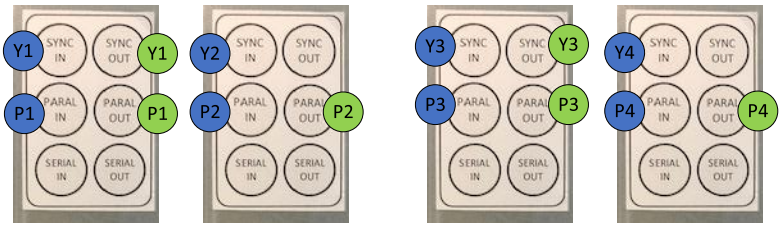
There are lots of combination to operate with 2, 3, 4 up to 8 units with a HUB_FO_V2. Cinergia will provide more information about some of them.

7.1. 2p+2p (2 Masters - 2 different EUT)

In case of 2 group of 2 units working in DC parallel but as two independent power supply connected to two different EUT, the final power diagram and the interface parallel and serial configuration must be according the pictures below:

HUB_FO_V2 MODULE A

HUB_FO_V2 MODULE B



Unit 1
Master A

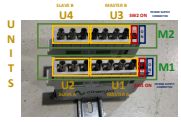
Unit 2
Slave A

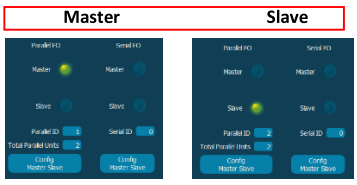
Unit 3
Mater B

Unit 4
Slave B

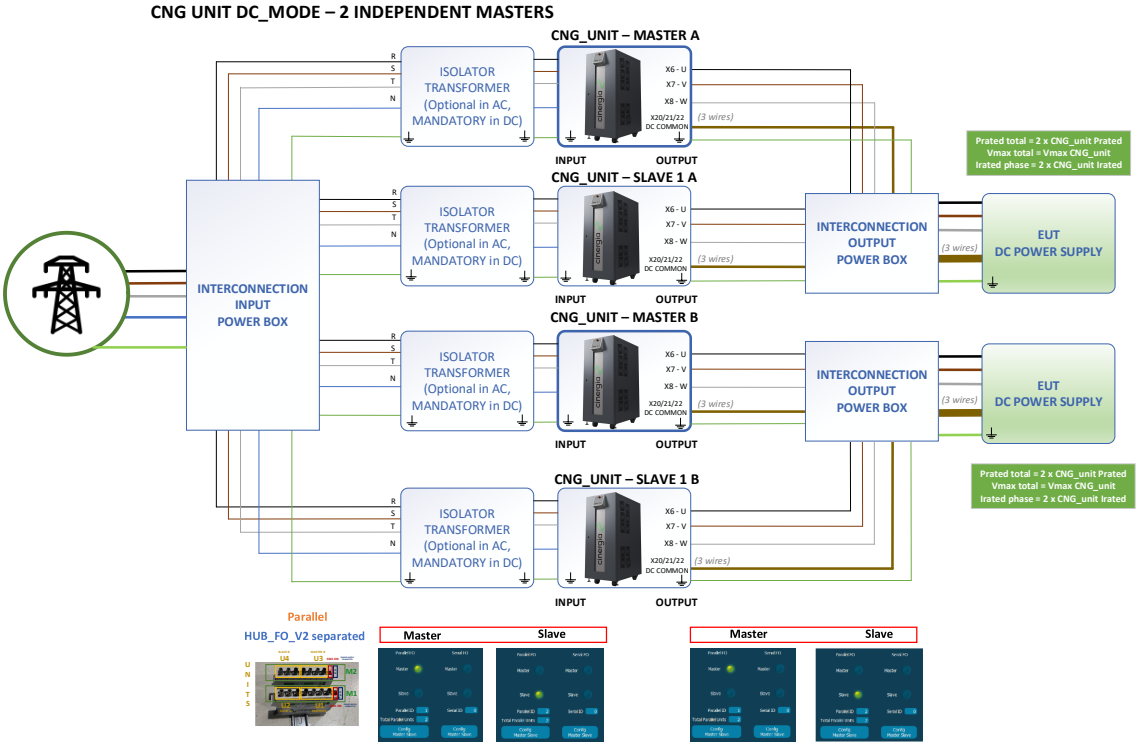
Parallel

HUB_FO_V2 separated





The power diagram will be as follow:

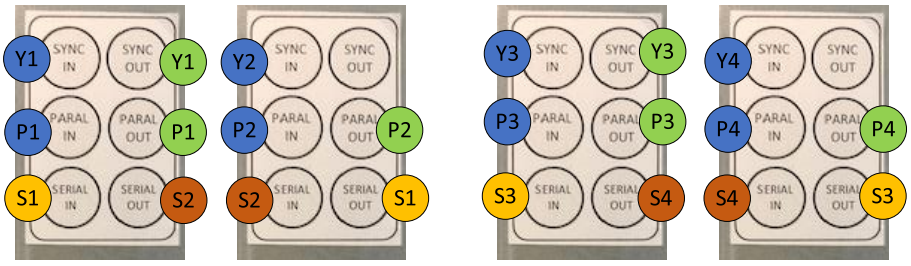


7.2. 2s+2s (2 Masters - 2 different EUT)

In case of 2 groups of 2 units working in DC serial but as two independent power supply, the final power diagram and the interface parallel and serial configuration must be according the pictures below:

HUB_FO_V2 MODULE A

HUB_FO_V2 MODULE B



Unit 1
Master A

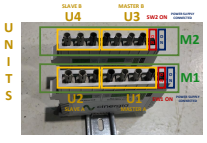
Unit 2
Slave A

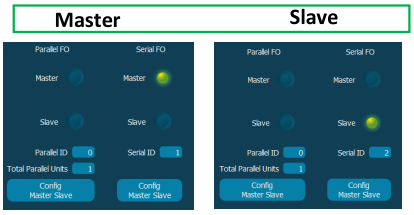
Unit 3
Master B

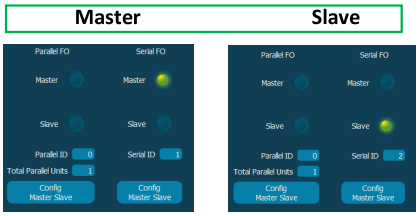
Unit 4
Slave B

Serial

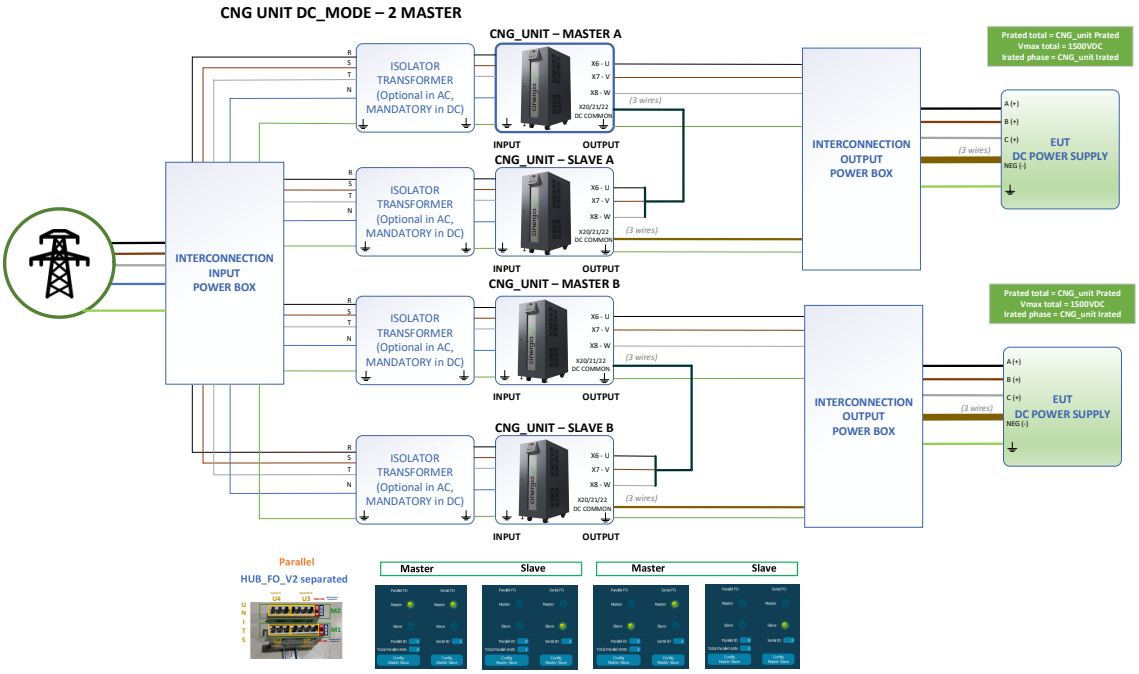
HUB_FO_V2 separated





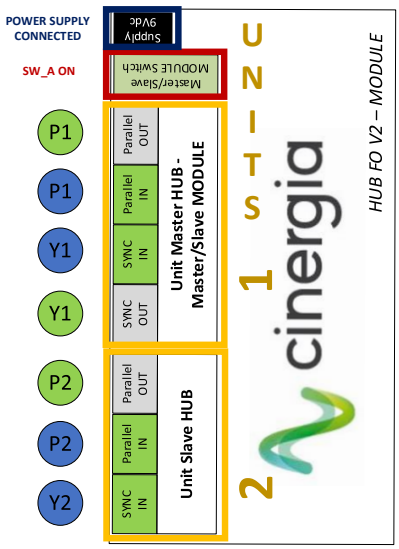


The power diagram will be as follow:

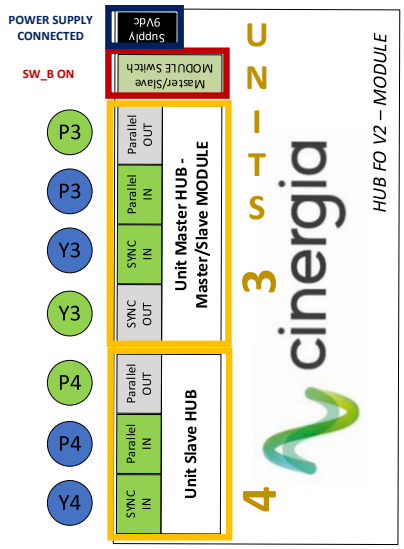


7.3. 2p+2s (2 Masters - 2 different EUT)

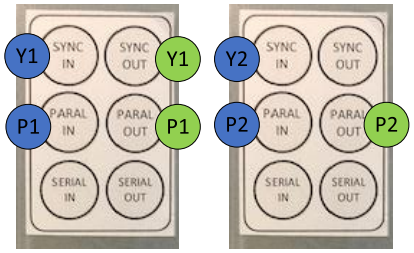
In case of 2 units working in DC serial and 2 units working in DC parallel as two independent power supply, the final power diagram and the interface parallel and serial configuration must be according the pictures below:

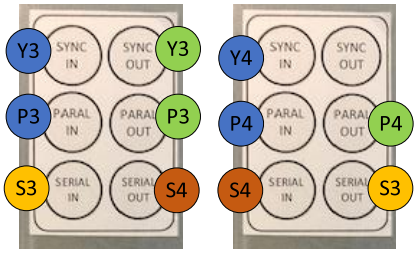


HUB_FO_V2 MODULE A



HUB_FO_V2 MODULE B





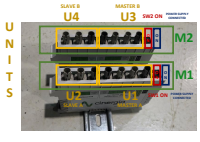
Unit 1
Master A

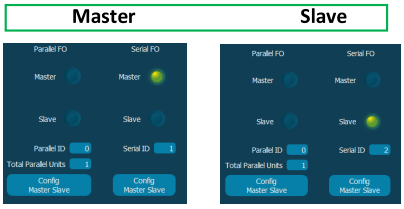
Unit 2
Slave A

Unit 3
Master B

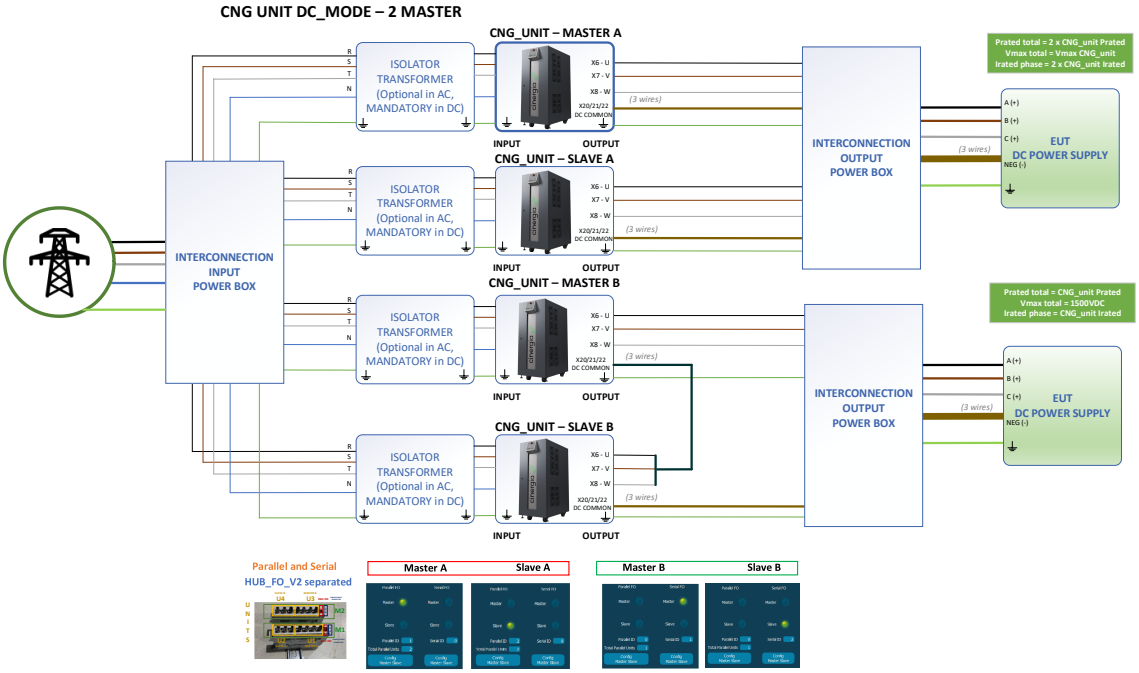
Unit 4
Slave B

Parallel and Serial
HUB_FO_V2 separated



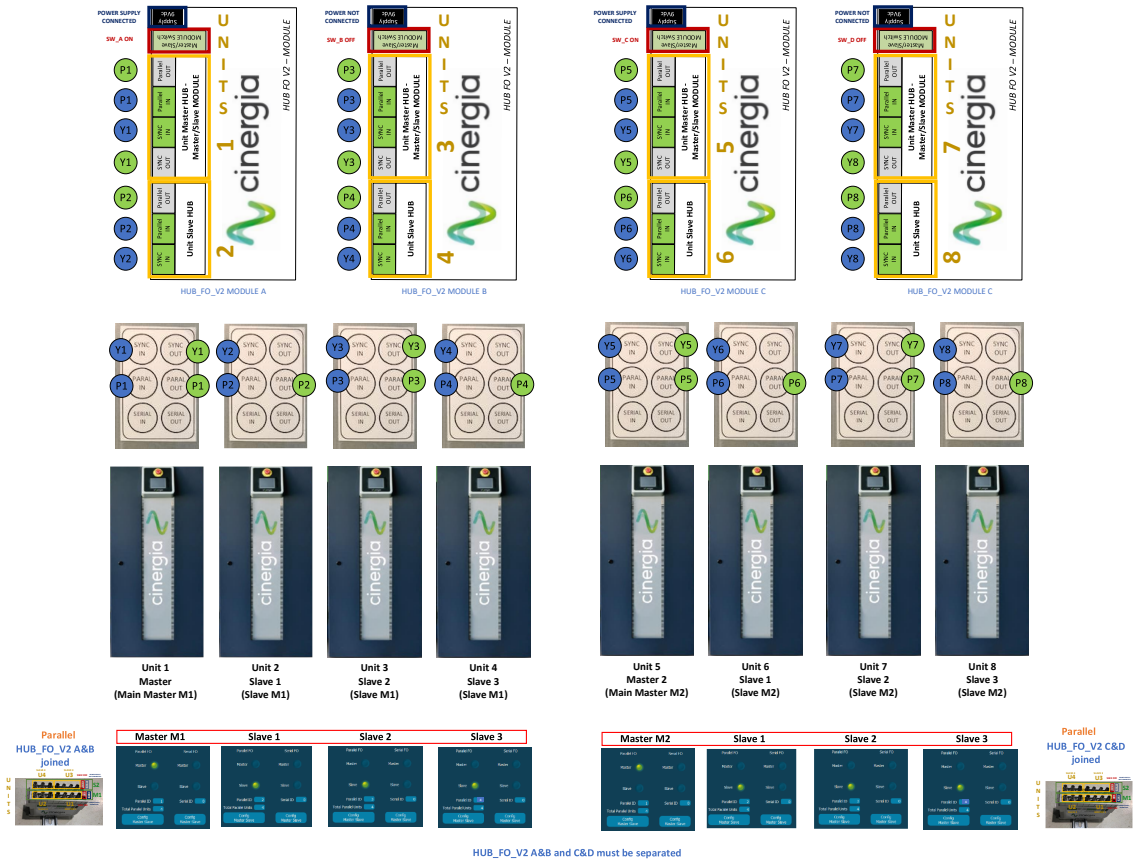


The power diagram will be as follow:



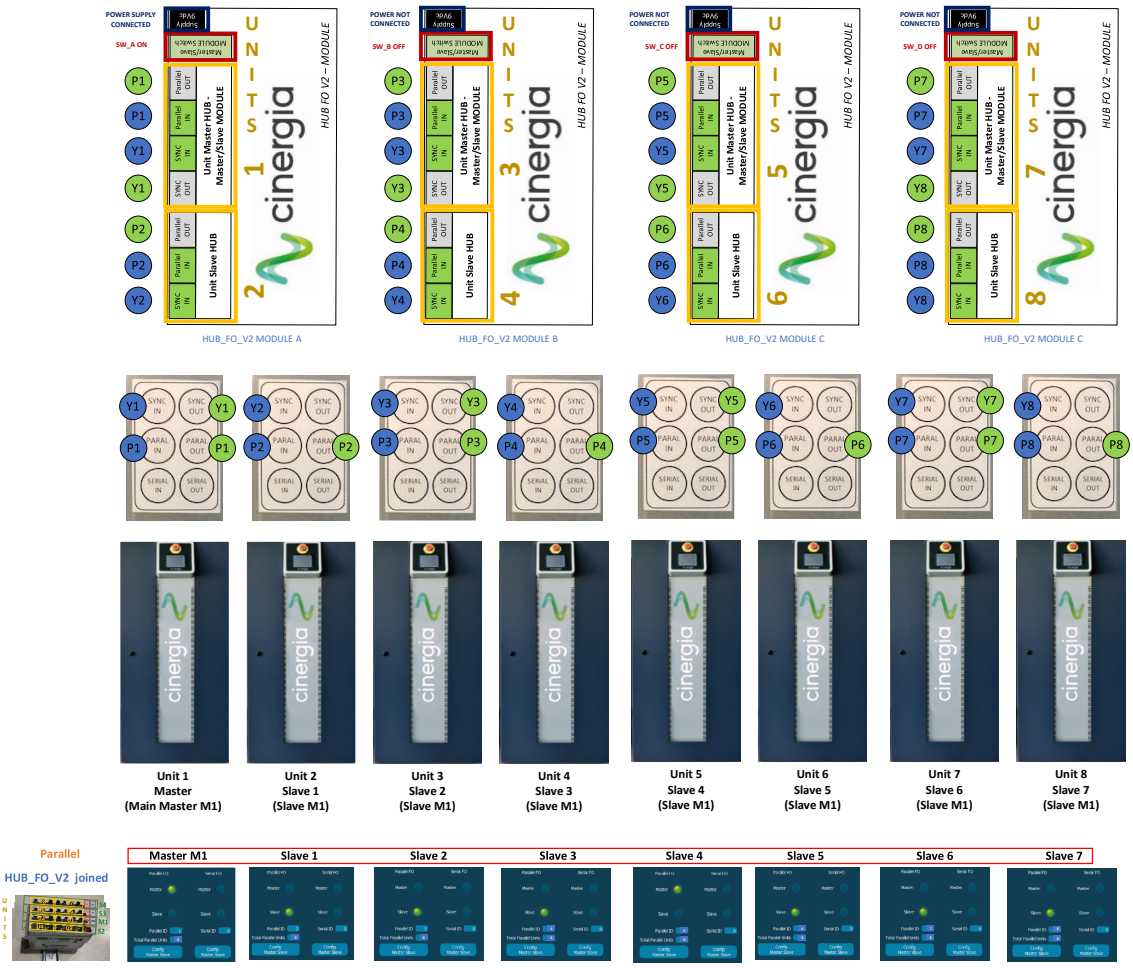
7.4. 4p+4p (2 Masters - 2 different EUT)

In case of 2 groups of 4 units working in DC parallel but as two independent power supply, the final FO diagram connection and the interface parallel and serial configuration must be according the pictures below:



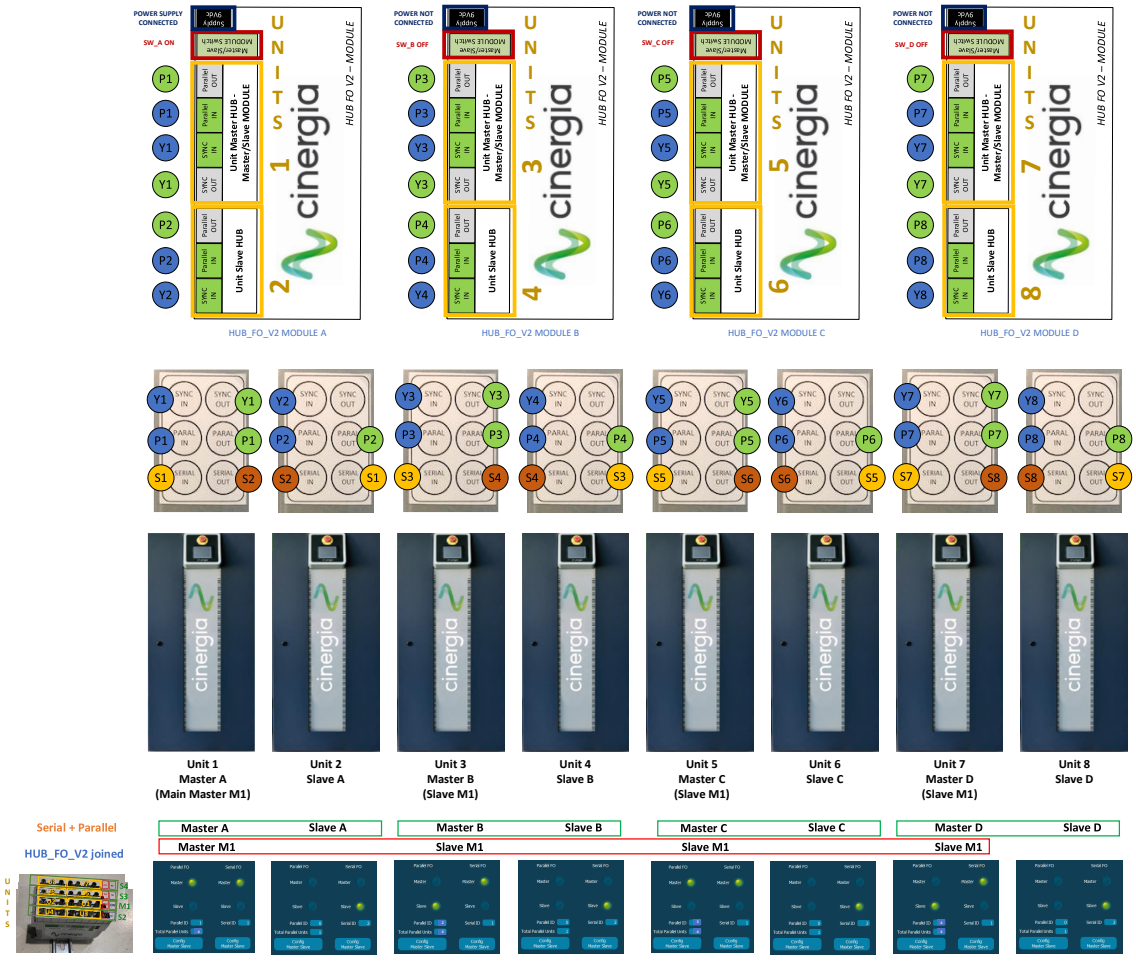
7.5. 8p (ONLY 1 Masters - 1 different EUT)

In case of 8 units working in DC parallel, the final FO diagram connection and the interface parallel and serial configuration must be according the pictures below:



7.6. MATRICIAL 4 groups of 2s (ONLY 1 Master - 1 EUT)

In case of 4 groups of 2 units working in DC serial, the final FO diagram connection and the interface parallel and serial configuration must be according the pictures below:



In case of problems with the converter, please make a screenshot of the ABOUT TAB and send it to Cinergia. The user must connect to the equipment to be sure that the interface tab charges all the internal parameters of the unit.

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t. 93 486 43 58

Please, don't hesitate to contact on support@cinergia.coop our technical support team in case of any doubt or question.