Leading Conversion Technology for Power Resilience

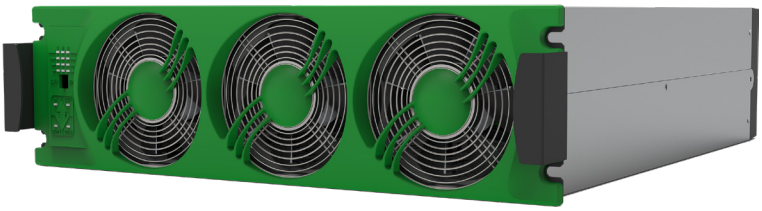
HERCULES - MODULAR PCS

User Manual

RE-INVENTING THE MODULAR PCS

THE NEW GENERATION OF POWER CONVERTERS

- SELECTIVITY
  Adapted response to short circuit and overload
- VERSATILE CHARGING
  Short or long backup recovery time at no extra cost
- BATTERY SUSTAINABILITY
  Qualitative charging for longer battery life expectancy
- HARSHEST AC INPUT CONDITIONS
  Without compromising the quality of the AC output



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VERSION 3.1

Leading Conversion Technology for Power Resilience

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Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
1.0	11/05/2020	-	First release of the Manual
1.1	27/10/2021	-	Removed boost information
2.0	22/09/2023	-	Replaced Catena with Inview X
2.1	13/12/2023	42	Replaced Flat-pack with Eldon cabinet
3.0	23/09/2024	-	Removed Pegasus contents
3.1	28/11/2025	10	Updated illustration in Section 4.2

1. CE+T Power at a glance

CE+T Power i s your trusted partner in **advanced power solutions** engineered to meet the demands of modern and dynamic industrial applications. With over 60 years of experience in power conversion technology, CE+T Power nurtures the industry with **innovative solutions designed for critical power backup and energy management**.

Our complete range of power solutions includes **modular inverters** (DC to AC), **UPS** (securing AC loads with batteries), and **multidirectional converters** (inverter, rectifier, and UPS all-in-one). Coupled with our state-of-the-art **monitoring solution**, you have a real energy blender to connect multiple sources of energy seamlessly!

Whether you require **robust backup power solutions**, **energy management solutions**, **or a combination of both**, CE+T Power delivers tailored solutions to meet your specific needs. Our products are **designed with integration in mind, ensuring seamless compatibility with other components of your system**. CE+T Power is committed to providing you with the expertise and resources needed to maximize the performance of your power systems.

Thank you for choosing CE+T Power as your partner in advanced power management. Let's power the future together.

2. Abbreviations

TSI	Twin Sine Innovation
EPC	Enhanced Power Conversion
REG	Regular
DSP	Digital Signal Processor
AC	Alternating current
DC	Direct current
DI	Digital Input
ESD	Electro Static Discharge
MET	Main Earth Terminal
MBP	Manual By-pass
TCP/IP	Transmission Control Protocol/Internet Protocol
USB	Universal Serial Bus
PE	Protective Earth (also called Main Protective Conductor)
N	Neutral
PCB	Printed Circuit Board
TRS	True Redundant Structure
MCB	Miniature Circuit Breaker
MCCB	Molded Case Circuit Breaker
CB	Circuit Breaker
PCS	Power Converter System
ALCO	Alarm CutOff
BCT	Battery Current Termination
BDT	Battery Discharge Test
BOD	Battery On Discharge
BT	Battery Test (mode)
CAN	Controller Area Network
DOD	Depth Of Discharge
EQ	EQualize (mode or voltage)
FL	FLoat (mode or voltage)
GUI	Graphical User Interface
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LVA	Low Voltage Alarm
LVC	Low Voltage Connect
LVD	Low Voltage Disconnect
MAC	Media Access Control
MIB	Management Information Base
OVP	Over-Voltage Protection
PPP	Point to Point Protocol
RAS	Remote Access Server
SCI	Serial Communication Interface
SNMP	Simple Network Management Protocol
SOC	State Of Charge
Trap	Event Notification
DER	Distributed Energy Resources
ESS	Energy Storage System

3. Warranty and Safety Conditions*

WARNING:

The electronics in the power supply system are designed for an indoor, clean environment.

When installed in a dusty and/or corrosive environment, outdoor or indoor, it is important to:

- Install an appropriate filter on the enclosure door, or on the room's air conditioning system.
- Keep the enclosure door closed during operation.
- Replace the filters on a regular basis.

Important Safety Instructions and Save These Instructions.

3.1 Disclaimer

- The manufacturer declines all responsibilities if equipment is not installed, used or operated according to the instructions herein by skilled technicians according to local regulations.
- Warranty does not apply if the product is not installed, used and handled according to the instructions in the manuals.

3.2 Technical care

- This electric equipment can only be repaired or maintained by a "qualified employee" with adequate training. Even personnel who are in charge of simple repairs or maintenance are required to have knowledge or experience related to electrical maintenance.
- Please follow the procedures contained in this Manual, and note all the "DANGER", "WARNING" AND "NOTICE" marks contained in this manual. Warning labels must not be removed.
- Qualified employees are trained to recognize and avoid any dangers that might be present when working on or near exposed electrical parts.
- Qualified employees should know how to lock out and tag out machines, so the machines will not accidentally be turned on and injure employees working on them.
- Qualified employees also understand safety related work practices, including those by OSHA and NFPA, as well as knowing what personal protective equipment should be worn.
- All operators are to be trained to perform the emergency shut-down procedure.
- Operating ambient temperature is -20°C to 65°C.
- This unit is intended for installation in a temperature-regulated, indoor area that is relatively free of conductive contaminants.
- Never wear metallic objects such as rings, watches, or bracelets during installation, service or maintenance of the product.
- This product is suitable for use in a computer room.

* These instructions are valid for most CE+T Products/Systems. Some points might however not be valid for the product described in this manual

- CAUTION – Risk of electric shock. Capacitors store hazardous energy. Do not remove cover until 5 minutes after disconnecting all sources of supply.
- CAUTION – Risk of electric shock. This Converter / UPS receives power from more than one source. Disconnection of the AC source and DC source is required to de-energize this unit before servicing.
- CAUTION - For continued protection against risk of fire, replace only with same type and rating of fuse.
- Insulated tools must be used at all times when working with live systems.
- When handling the system/units pay attention to sharp edges.

3.3 Installation

- This product is intended to be installed only in a restricted access area as accordance with the National Electrical Code ANSI/NFPA 70, or equivalent local agencies.
- The system may contain output over-current protection in the form of circuit breakers. In addition to these circuit breakers, the user must observe the recommended upstream and downstream circuit breaker requirements as defined in this manual.
- Please use extreme caution when accessing circuits that may be at hazardous voltages or energy levels.
- The system rack is a dual input power supply. The complete system shall be wired in a way that both input and output leads can be made power free in a single action.
- The systems that have no AC input wired and connected, can be seen as independent power sources. To comply with local and international safety standards, N (input) and PE shall be bonded. The bonded connection between N (input) and PE must be removed once the AC input is connected.
- When AC Mains is not connected, the output AC circuit is considered as a separately-derived source. If local codes require grounding of this circuit, use the identified terminal for bonding this circuit to the enclosure. Ground the enclosure to a suitable grounding electrode in accordance with local code requirements.
- Use 90°C copper wires / conductors only.
- AC and DC circuits shall be terminated with no voltage / power applied.
- The safety standard IEC/EN62040-1-1 requires that, in the event of an output short circuit, the converter must disconnect in 5 seconds. The parameter can be adjusted on monitoring ; however, if the parameter is set at a value > 5 seconds, an external protection must be provided so that the short circuit protection operates within 5 seconds. Default setting is 60 seconds.
- All illustrations in the manual are for general reference, refer to the technical drawing which is received along with the system for exact information.

3.3.1 Handling

- The cabinet shall not be lifted using lifting eyes.
- Remove weight from the cabinet by unplugging the converters. Mark converters clearly with shelf and position for correct rebuild. This is especially important in dual or three phase configurations.
- The converter slots must not be left open. Replace with a dummy cover or front plate.
- A minimum of two people are required to handle modules.

3.3.2 Surge and Transients

The mains (AC) supply of the modular converter system shall be fitted with Surge protective device (SPD) and Transient voltage surge suppression suitable for the application at hand. Manufacturer's recommendations of installation shall be adhered to. Selecting a device with an alarm relay for function failure is advised.

Indoor sites are considered to have a working lightning surge suppression device in service.

- Indoor sites Min Class II.
- Outdoor sites Min Class I + Class II or combined Class I+II.

Note:

Choosing and installing surge arrestors must obey to precise technical rules. Distance to equipment to protect, cable gage and cable routing have significant influence on proper device service.

Some areas are more susceptible to be hit by electrical strikes, especially when altitude increases.

Good earthing is also crucial for surge arrestors to work properly.

CE+T declines any liability in regard to damaged caused to equipment not correctly or not sufficiently protected.

3.3.3 Other

- Isolation test (Hi-Pot) must not be performed without instructions from the manufacturer.

3.4 Maintenance

- The converter system/rack can reach hazardous leakage currents. Earthing must be carried out prior to energizing the system. Earthing shall be made according to local regulations.
- Prior to any work conducted to a system/unit, make sure that AC input voltage and Battery are disconnected.
- Prior to accessing the system or modules, make sure all source of supply is disconnected.
  CAUTION – Risk of electric shock. Capacitors store hazardous energy. Do not remove cover until 5 minutes after disconnecting all sources of supply.
- Some components and terminals carry high voltage during operation. Contact may result in fatal injury.

3.5 Replacement and Dismantling

- ESD Strap must be worn while handling PCBs and open units. It is not recommended to open the modules at the site unless properly trained by CE+T.
- The UPS system/rack is not supplied with internal disconnect devices on input nor output.
- CE+T cannot be held responsible for disposal of the UPS system and therefore the customer must segregate and dispose of the materials which are potentially harmful to the environment, in accordance with the local regulations in force in the country of installation.
- If the equipment is dismantled to dispose of its component products, you must comply with the local regulations in force in the country of destination and in any case avoid causing any kind of pollution.

To download the latest documentation and software, please visit our website at
www.cet-power.com

4. Introduction - Hercules

4.1 Scope of the manual

This document describes the software features, on-site setup and operation of the Hercules Modular PCS with Pegasus controller and monitoring hub. Please refer to Hercules Installation manual for hardware installation and wiring information.

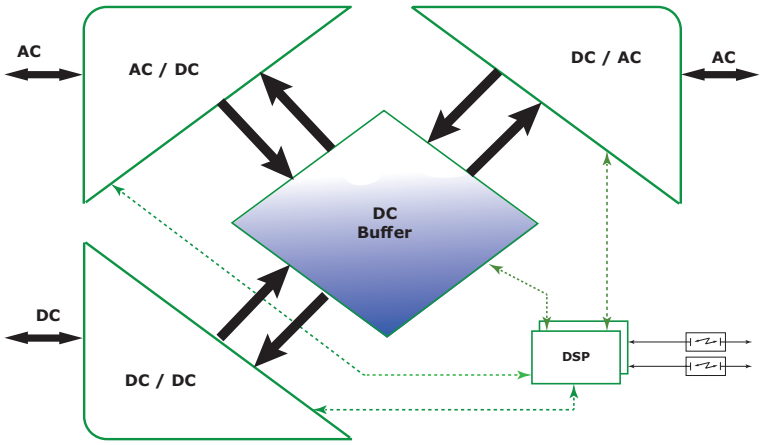
4.2 Hercules module description

The Hercules module is a modular PCS of 20 kVA / 20 kW.

The design of the module allows battery power controlling, dynamic load transfer, high efficiency, unsurpassed flexibility and scalability. The module is hot pluggable and hot swappable.

Hercules PCS modules are triple port converters (AC Input, DC, AC Output). Sinusoidal output is converted from AC Input or/and DC.

The block diagram here below gives an explicit description of the topology and operation.



The module is built around the following sub-converters:

- AC to DC at input
- DC to DC at input
- DC to AC at output

The energy can flow either from/to the AC source or from/to the DC source under the control of the local DSP controller. Thanks to internal energy buffering, the output sine wave is constant and disturbance free regardless of the active source.

The TSI works according to True Redundant Structure (TRS) that features decentralized and independent logic, redundant communication bus and three internal levels of disconnection to isolate a module after internal failure. The functionality is included in every PCS module. Running them in parallel provides a modular system with, no single point of failure, always conditioned output, high system efficiency and 0ms source transfer time.

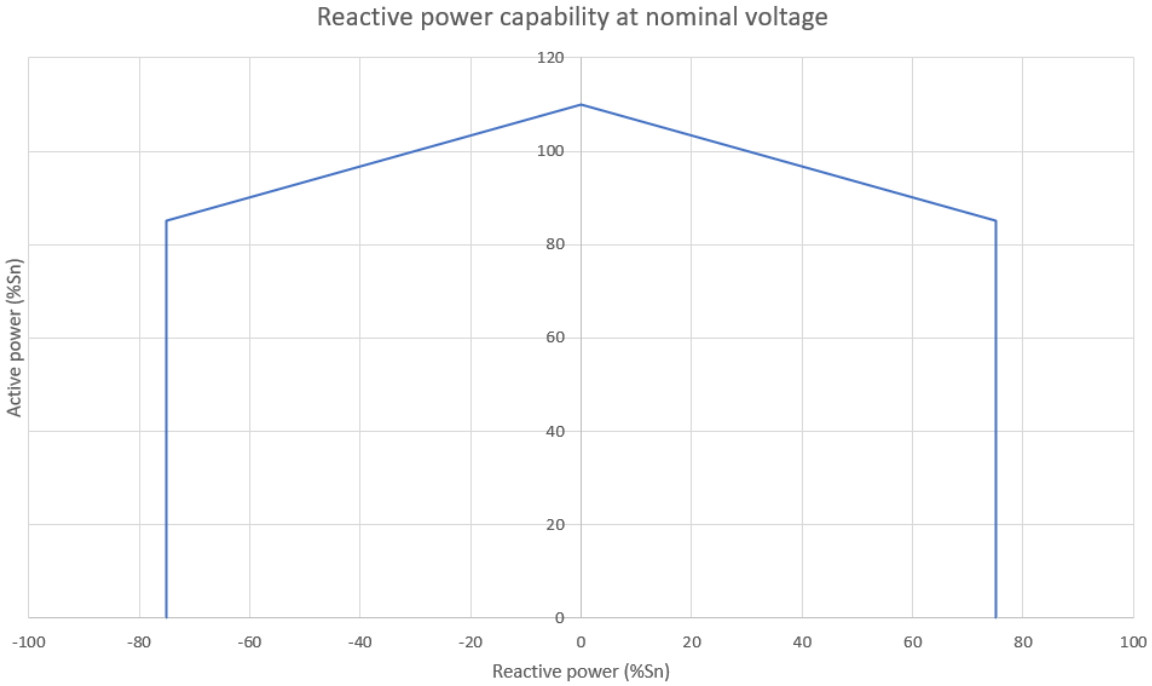
The TSI is designed to firstly operate on AC Input on permanent basis to deliver output voltage conditioned with low THD. A battery power setpoint is also available to fix the power charging/discharging the battery. Maximum power will always still 20 kVA / 20 kW on each port with the highest priority always on AC Output supply.

There is no physical difference on the output sine wave whether the source is AC and/or DC. If the Ac Input is out of tolerance or goes down, the converter seamlessly switches to DC and the converter operates in “Back-up mode” (Switching time back and forth is 0 ms).

As soon as the AC Input returns into valid range, nominal operation is automatically resumed.

4.3 Reactive power capability of Hercules PCS module

Concerning the reactive power, the capability of Hercules modules is given in the following figure.



The ways to control this reactive power are multiple:

- Reactive power setpoint
- Power factor setpoint
- Voltage related control mode Q(u)
- Power related control mode

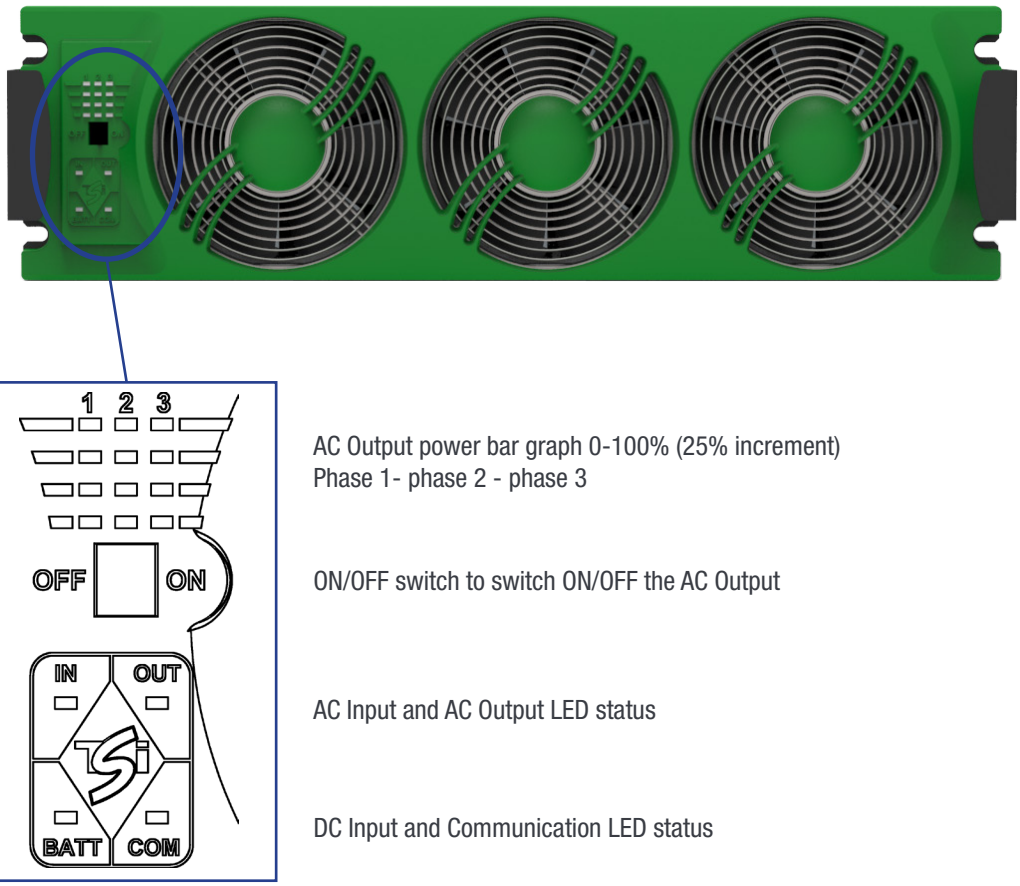
The configuration, activation and deactivation of the control modes of these functions are field adjustable and password protected.

4.4 Specifications

Refer to the datasheet available in the below link for Hercules PCS specifications.

https://datasheet.cet-power.com/CET - Multidirectional Converter - Datasheet - Hercules - EN.pdf

4.5 Hercules PCS module User Interface



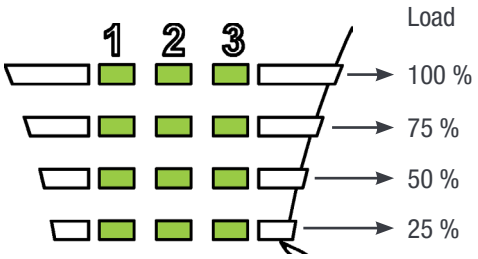
AC Output power bar graph 0-100% (25% increment)
Phase 1- phase 2 - phase 3

ON/OFF switch to switch ON/OFF the AC Output

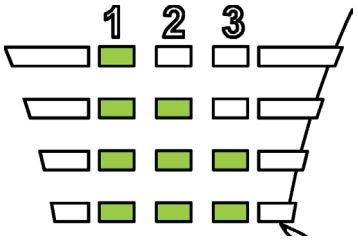
AC Input and AC Output LED status

DC Input and Communication LED status

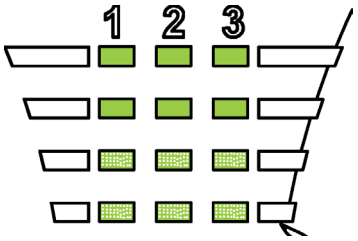
4.5.1 Output Power LED interface :



Each segment represent 25% load.



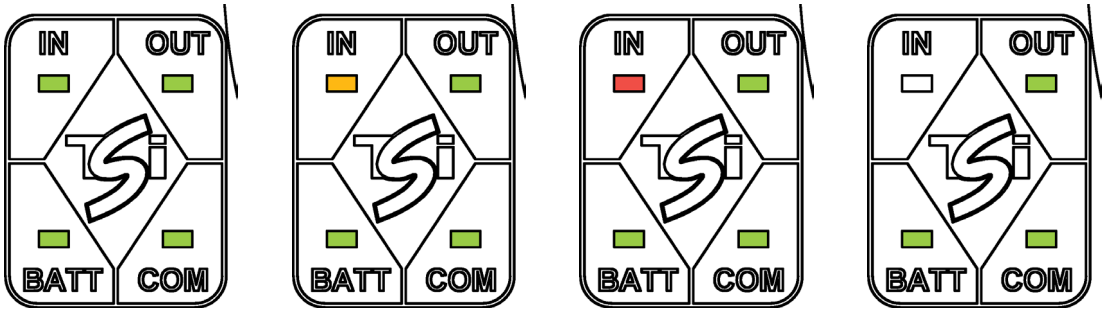
Load can differ between the 3 phases in one module.
Load can differ in one phase in several modules.



Overload (blinking)
100% - 110% segment 0-25 blinking
110,1% - 135% segment 0-50 blinking

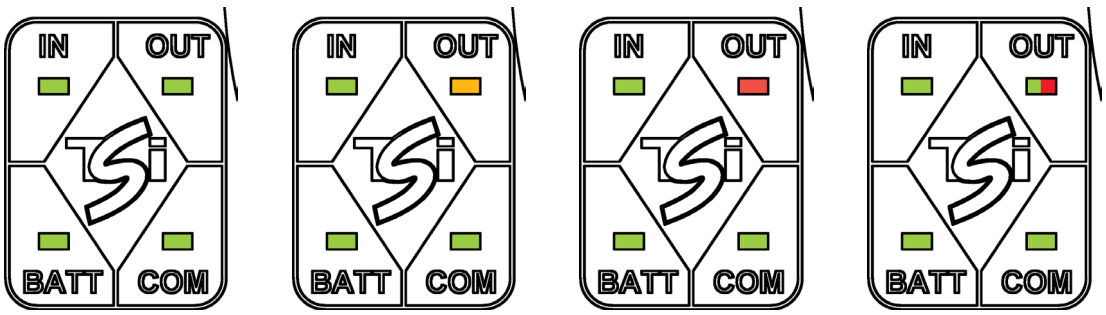
4.5.2 Module status LEDs interface

AC input LEDs interface



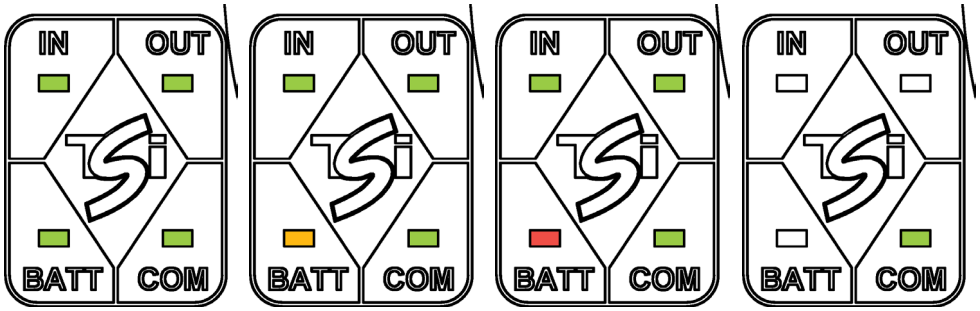
Starting up		GREEN Blink
AC Input OK	(within limits)	GREEN
AC Input not OK	(out of limits)	ORANGE
	(Auto restart)	ORANGE Blink
	(Manual restart)	RED Blink
	(Non recoverable)	RED
AC failure		OFF + external alarm

AC output LEDs interface



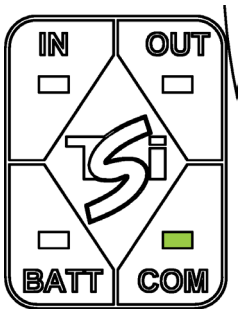
Starting up		GREEN Blink
AC Output OK	(within limits)	GREEN
AC Output not OK	(out of limits)	ORANGE
	(Auto restart)	ORANGE Blink
	(Manual restart)	RED Blink
	(Non-recoverable)	RED
Remote OFF	(Manual restart))	OR/GR/OR/GR
		sequence every x seconds

DC Input LEDs interface



Starting up		GREEN Blink
DC OK	(within limits)	GREEN
DC not OK	(out of limits)	ORANGE
	(Auto restart)	ORANGE Blink
	(Manual restart)	RED Blink
	(non-recoverable)	RED
No battery connected		OFF

Communication LEDs interface



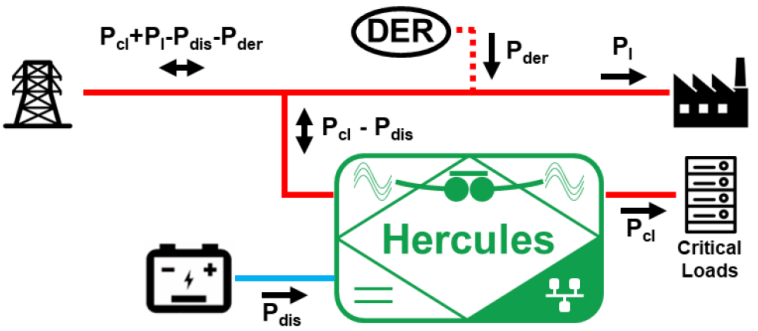
COM OK		GREEN
COM ERROR	(Bus A or B)	GREEN Blink still one bus present
COM ERROR	(Bus A & B)	RED Blink

Module and system will continue working with one BUS failing.
Incase two bus fails, the module/system will isolate and shut down.

5. Hercules use case examples

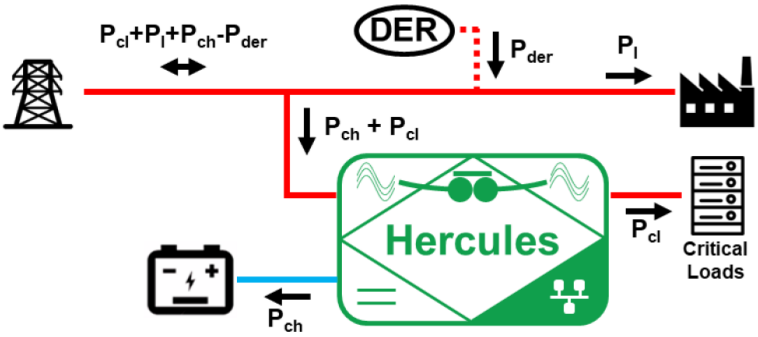
5.1 Discharging

- Battery discharge power fixed to Pdis.
- AC Input power is consuming power if Pdis < Pcl, or it is injecting power if Pdis > Pcl. If maximum AC Input power is reached (consumption or injection), Pdis will decrease to avoid over-voltage in the DC buffer of the Hercules module.



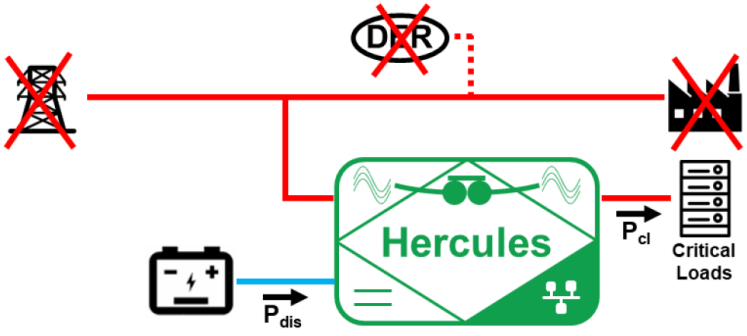
5.2 Charging

- Battery charge power fixed to Pch.
- AC Input power is consuming power. If maximum AC Input power is reached, Pch will decrease to guarantee power Pcl for critical loads.



5.3 Back-up

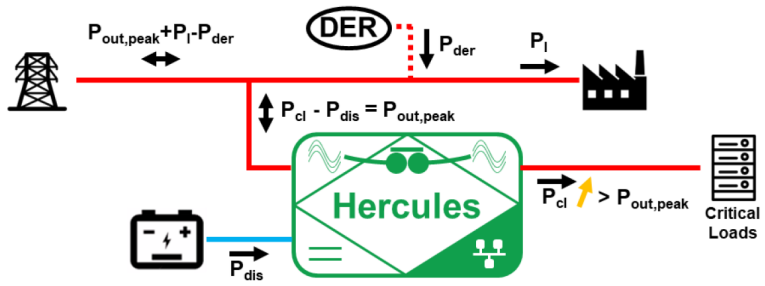
- Grid failure → Noncritical load and DER are lost.
- Critical loads are supplied by the battery (supposing that some capacity is remaining inside)



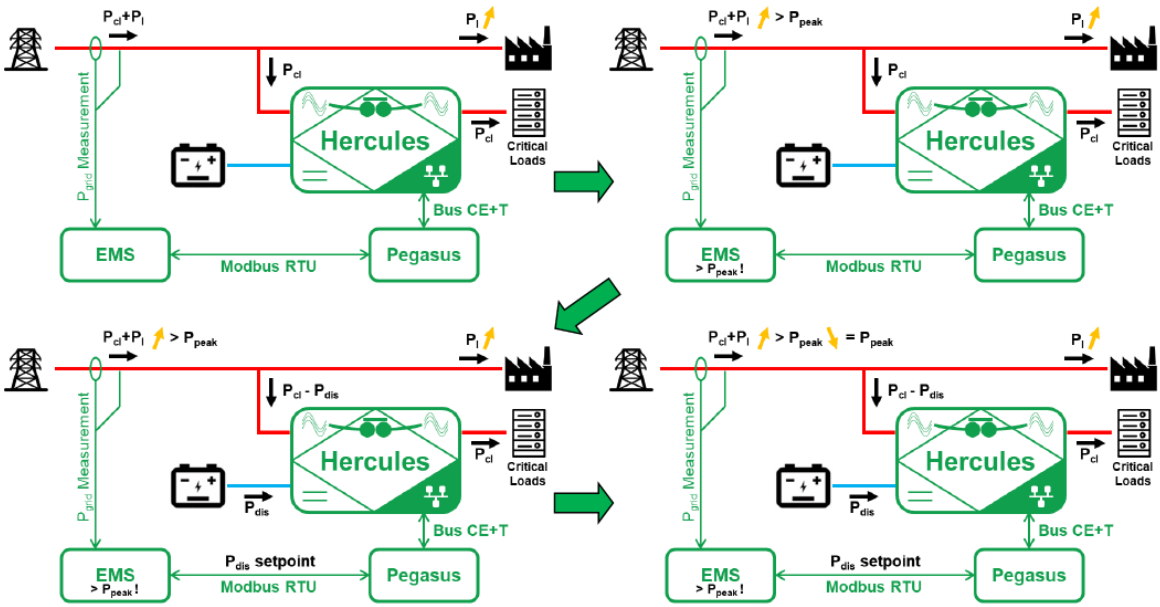
5.4 Peak shaving

When we are talking about peak shaving with Hercules module, we can address two situations:

- Peak shaving on output load connected to AC Output of Hercules modules
  - Peak shaving limit fixed to $P_{out,peak}$
  - Hercules modules discharges battery to limit power on AC input at $P_{out,peak}$



- Peak shaving on the entire building installation
  - Peak shaving limit fixed to Ppeak.
  - Total building consumption = Pl + Pcl , and measured by an EMS (or another supervisor).
  - An EMS (or another supervision) is required to perform measurement and send power setpoint to Hercules system.

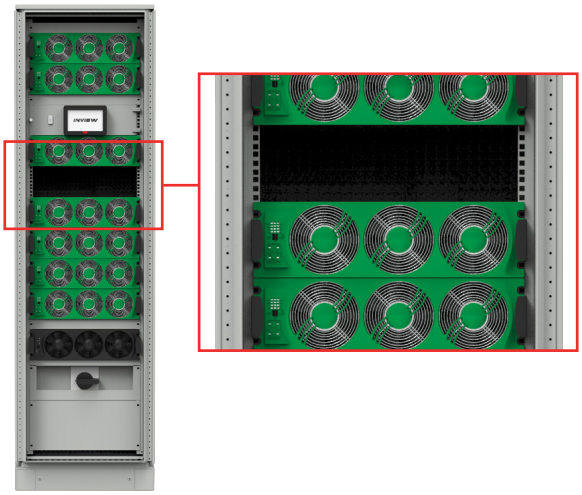


6. Product Replacement Procedures

6.1 Hercules module replacement

Caution:

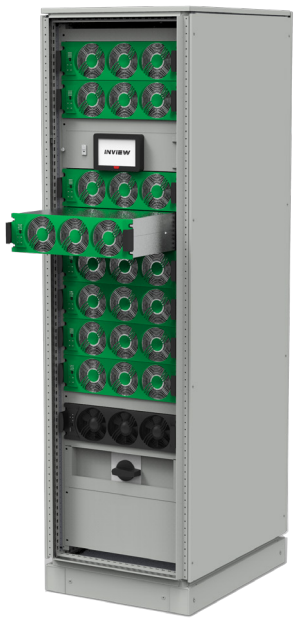
Before sliding the module into the cabinet, make sure nothing is blocking the module such as objects, Inview X wires and other wires..



Step 1. Place the module in the cabinet.

Step 2. Using the front handle, slide in firmly until the module is properly engaged.

Place the module



Slide in Firmly

6.2 Fan Replacement

The FAN pre-alarm “FAN life elapse” has been set to 5 years. An event will appear on the Inview X to remind the “FAN life elapse”..

Perform the following steps to replace the Hercules Fan Kit:

1. Order and receive a replacement Hercules Fan Kit which consist of a metallic front plate on which the new three fans are already fixed (T451030001).
2. Remove the module from the system and **let it rest at least five minutes** prior to initiating the work.
3. Remove the **Front Green Plastic** by releasing all the five latches (3 latches at top and 2 latches at bottom) in the module.
4. Remove the **Hercules Fan Kit** (Front Metallic Plate) by unscrewing the eight screws.

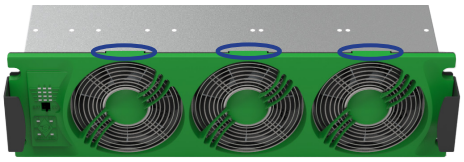


Figure 1: Remove Front Plastic

Figure 2: Remove FAN Kit

5. Unplug the **Fan wires** from the terminal in the module.
6. Remove the **Synoptic Board** and **Mylar sheet** from the Hercules Fan Kit by unscrewing the four screws.

Figure 3: Disconnect the fan wires

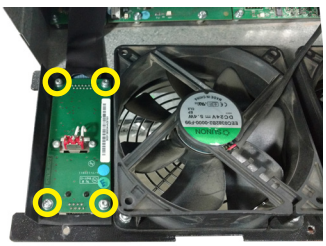


Figure 4: Remove Synoptic Board

7. Take the new **Hercules Fan Kit** (T451030001).
8. Fix the **Synoptic Board** into the new Hercules Fan Kit by using four screws, refer “Figure 4”.
   Note: Place the Synoptic Board and Mylar sheet in exact position before tightening the screws.
9. Connect the **Fan wires** from Hercules Fan Kit to terminal in the module, refer “Figure 3”.
10. Fix the **Hercules Fan Kit** back in place by tightening the eight screws, refer “Figure 2”.
11. Fix the **Front Green Plastic** back in place, make sure all the five latches are fixed properly, refer “Figure 1”.
12. Insert the module in the system.
13. Once it has started, access the fan counter through the Pegasus/Inview X and reset it (Refer Pegasus with Inview X user manual).

7. Factory Ranges and Defaults

7.1 Internal BMS

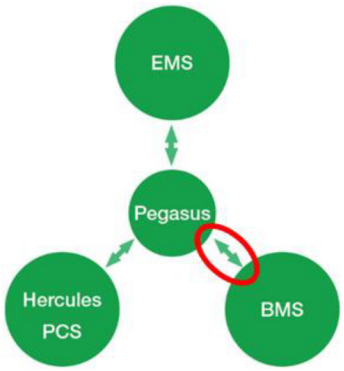
Submenu Item	Programmable range	Default values 408Vdc
Float (FL) Voltage	408 – 490	463 Vdc
Equalize (BOOST) Voltage	408 – 490	480 Vdc (2,35V/per cell)
Test Batterie (BT) Voltage	315 – 490	391 Vdc
Battery current limit	0-1000	=C10/5 (Battery capacity/5)
Battery in discharge	315 – 490	430 Vdc
Battery Low 1 alarm	315 – 490	360 Vdc
Battery Low high	315 – 490	340 Vdc
System Saturation alarm	0 – 100	80%
Equalize Timeout	0 - 48	24 hours
Test Batterie Duration	0-8	8.0 hours

7.2 Network

Submenu Item	Programmable range	Default values
Subnet Mask	N/A	255.255.255.0
Adress IP Pegasus	N/A	192.168.0.2

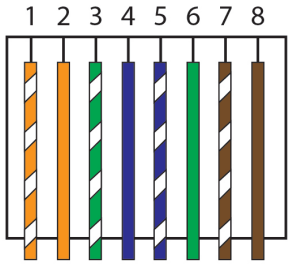
8. CANBUS

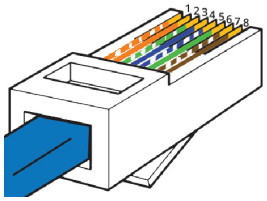
CANBUS is the interface to be used when the Pegasus controller is connected to a battery BMS.



CANBUS interface is accessible through a RJ45 connector. The pinout of this RJ45 is

RJ45 Pinout
T-568B





1. White Orange	**2. Orange**	**3. White Green**	**4. Blue**
5. White Blue	**6. Green**	**7. White Brown**	**8. Brown**

Note: The colour of wires is irrelevant and may vary, but make sure the position of wires is exactly crimped.

- Pin 1 = CAN High
- Pin 2 = CAN Low
- Pins 3&7 = GND

CANBUS is not useful if internal BMS is used or if the BMS is managed by the EMS.

Communication protocol of a BMS should be implemented inside the controller before connecting it.

9. Annexes

9.1 Battery Management with Hercules Technology and internal BMS

9.1.1 Introduction

Battery is critical element in a UPS. Many manufacturers offer high performances of their electronic but sometimes forgot about providing an efficient and reliable battery management.

Battery are fragile and need to be treated accordingly in discharge and recharge conditions. The purpose of this document is to provide an overview of how Hercules and Pegasus manage the batteries through its internal BMS, prevent their end of life and reduce possible occurrence of thermal runaway.

This annex gives more details about how the internal BMS of the Pegasus controller manages a lead-acid battery.

This annex is not applicable in case if an external BMS is used.

9.1.2 Battery charging and discharging Mode

The purpose of a charger is to “refill” the charge tank of the battery. There are many other features which enhance the convenience of the charger or grant protection for the battery being charged. These built-in protection features are what fundamentally elongates the battery’s life, or more correctly, prevents premature failure.

TSI technology provide those features:

- higher current levels reduce recharge times (assuming the battery can accept charge at high rates).
- voltage limits, current limits, and time out to reduce excessive gassing at end-of charge, and prevent dry-out.
- modified voltage and current limits as a function of temperature reduce gassing and electrode damage.
- BOOST or Equalize mode to equalize battery blocs periodically.

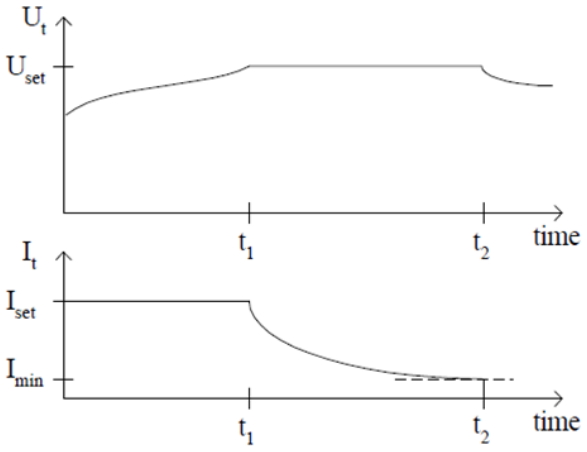
Battery operating mode with internal BMS are described hereafter.

9.1.2.1 Mode 1 Boost

This mode needs to be activated and configured according the battery data from the manufacturer.

A CC-CV (constant current, constant voltage) algorithm provides a “quick and fast” recharge. Ideally to recover 80% of the battery capacity in maximum 8 hours. This mode uses a Uset voltage level associated with current limit protection

Hereafter is shown typical recharge curve versus time for voltage and current.



MODE 1 algorithm can be trigger based on the following parameter:

- Trig Start Voltage: Will activate MODE 1 when battery voltage goes below preset level
- Trig Start Current: will activate MODE 1 when battery current goes above the preset value
- Trig Start Period: Will activate MODE 1 periodically base on preset value.
- Manual Start: Will activate MODE 1 manually through the GUI menu in mode 1. The temperature compensation is disabled.

MODE 1 algorithm can be stopped based on the following parameter:

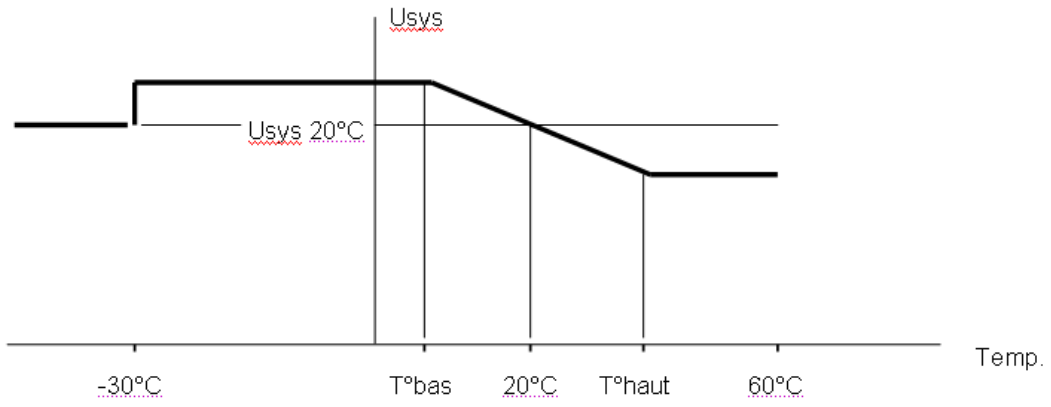
- Trig Stop Current: Will stop MODE 1 when battery voltage goes below preset level and MODE 1 for minimum 5 minutes (to avoid successive Start and Stop)
- Trig Stop Duration: 1H to 48H will stop MODE 1 (always active) will stop the MODE1 after the duration.

Note: If MODE1 stop based on “duration” before the “Stop current” reached an alarm will be generated as the battery need to be checked.

- Trig Start Period: Will activate MODE 1 periodically base on preset value.
- An alarm appears in the system: MODE 1 will be disabled in case of alarm presence.
- Manual stop: will STOP MODE 1 manually through the GUI menu.

9.1.2.2 Mode 2 Float

This is the normal operating mode for maintaining the battery in charge. This mode is enabled by default.



The MODE 2, charging voltage is adapted (provided it is enabled in the configuration) according the temperature. Using the charging curve below.

T° bas-low and T° haut-high are adjustable.

Note : If the temperature probe is disconnected or defective the voltage will come back to the value at 20°C. An alarm T° sensor fail” will be generated.

9.1.2.3 Mode 3 Discharge

Discharge mode is active when energy flow is taken from the battery to the DC/AC converter (inverter) of each module.

In this mode the Pegasus monitoring sent a voltage and current value to the Hercules module. This help in case of one module has AC input failure to take power from DC and is feed through the other module to avoid discharging the battery and assure the continuity of supply for the AC load.

Following alarms and time out available:

- Ubat < Ufloat
- BAT cell V low
- BAT end of autonomy
- BAT discharge time out (Battery in discharge for more than xx minutes)
- V BAT stop: Hercules will stop operating to prevent deep discharge
- Note: During discharge, Pegasus will record battery discharge value

Note: During discharge, Pegasus will record battery discharge value.

9.1.2.4 Mode 4 Battery Test

Battery test is a helpful function to get reliable information on the battery conditions and capacity.

It is recommended to perform periodic tests of the battery but more important to perform those tests in the same conditions in order to obtain comparative data over the years of the battery lifetime.

Starting BATTERY TEST conditions:

- Manual
- Trig Start Period: specify the day of the week to perform the periodic test and the number of weeks between 2 tests..

Note: Periodic test will start only if no discharge during last 96 hrs to guarantee the same start conditions for every test.

Stopping BATTERY TEST conditions:

- Trig Stop Duration: always active. Define the maximum time duration of a test
- Trig Stop Voltage: stop the test when battery voltage reaches the preset value
- An alarm appears in the system:
  - AC IN failure
  - Module failure
  - V BAT too low
  - System Overload
- Manually through the GUI menu

Note: During any test or battery discharge the following data will be recorded according following format.

START BAT x TEST + data and time

FIN BAT x TEST + data and time

For every delta of 1VDC record of:

- Date in seconds
- Battery voltage
- Battery current
- Bat Temperature

END BAT TEST + date+Time, VBAT, Temp+ Success,

FAIL START BAT x DISH + data and time

FIN BAT x DISH + data and time

9.2 Manual Bypass (MBP)

The purpose of this annex is to provide guidelines for customers to implement, assemble, wire and test external manual by-passes using CE+T Hercules modular PCS with Pegasus controller unit.

The CE+T cabinets already delivered with manual bypass are not concerned by this document.

9.2.1 Introduction

The purpose of the Manual Bypass also named “service by pass” is to provide the capability to completely by-pass AC input and AC output of a modular PCS Hercules system in order:

- To perform service maintenance to the equipment.
- To externally by-pass the PCS installation and allow the removal of the equipment

9.2.2 Principle of operation

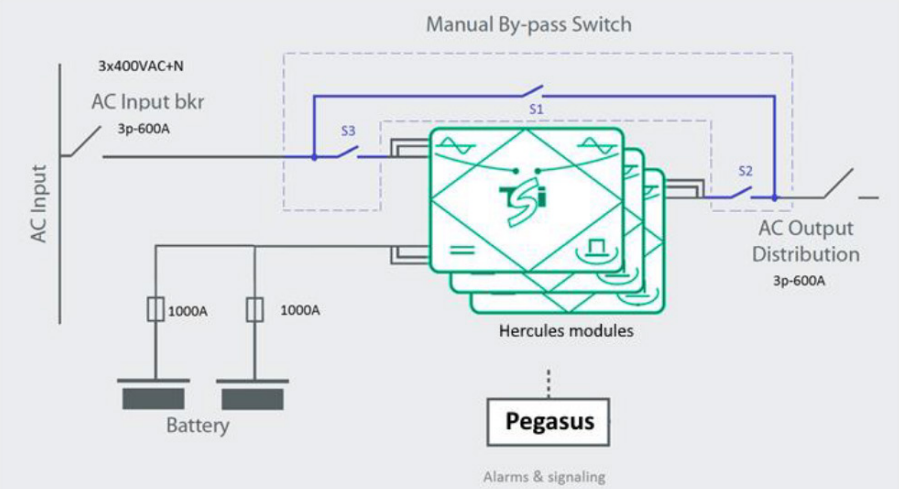
The manual by-pass (MBP) is a “make before break” Bypass manual switch.

The MBP can be in 3 position mode:

OFF or NORMAL:	The MBP is not engaged (OFF) and the PCS normally feeds the critical load.
INTERIM or TRANSFER:	The MBP is in a temporary interim position where the AC load is supplied through the manual by-pass. The Hercules PCS is in startup mode and not yet connected to the AC output..
ON or BY PASS:	The MBP is engaged, the AC input feeds the AC load, the PCS modules are OFF. Disconnect DC source to turn OFF the system completely. (Note: Hercules module auxiliary power supply and monitoring are still power up by DC source once MBP is engaged)

Warning: If MBP is engaged, the neutral connection is not isolated and not voltage free.

Block wiring of the MBP



OFF or NORMAL: S1 is open, S2 and S3 are closed

INTERIM or TRANSFER: S1 is closed
S2 and S3 can be in position OPEN or CLOSED depending where you are in the manual bypass procedure.

Note: This position is only temporary. It is used to allow the modules to start up and synchronize with the AC input. The user should not keep the Bypass in the INTERIM position.

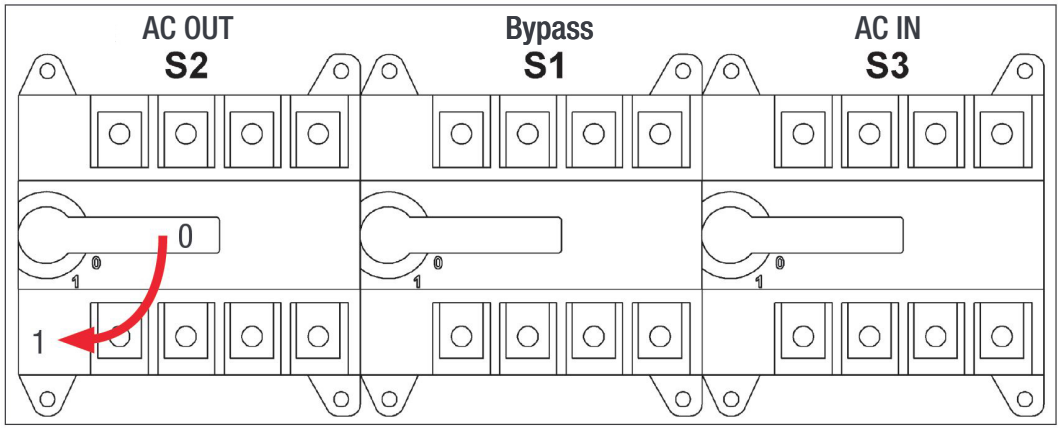
BY-PASS mode or ON: S1 is closed. S2 and S3 are open.

9.2.3 Presentation

The Manual By-pass can be provided with 2 executions:

1. Rotary Switch up to 160kVA system.

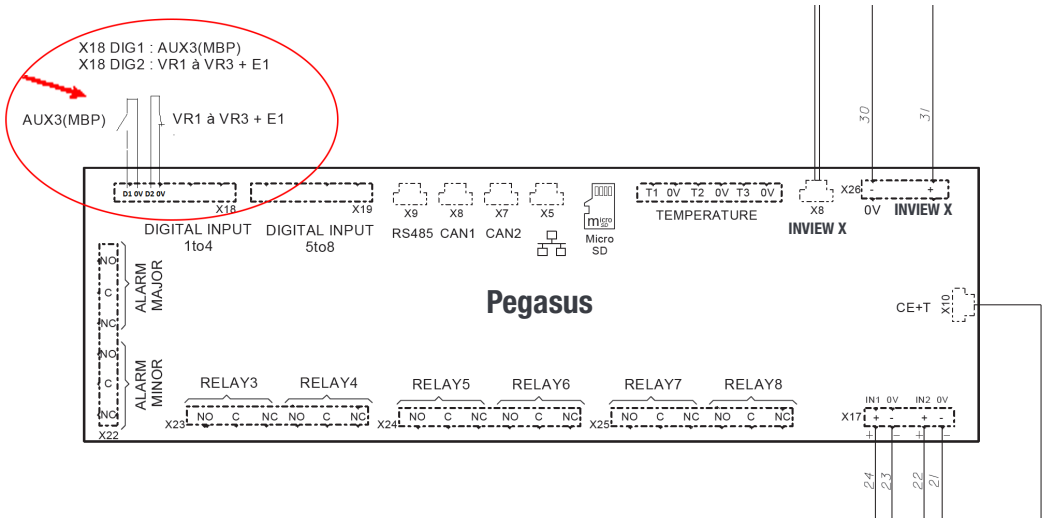
2. Three power switches (S1, S2 and S3) external to the Hercules cabinet for power above 160 kVA.



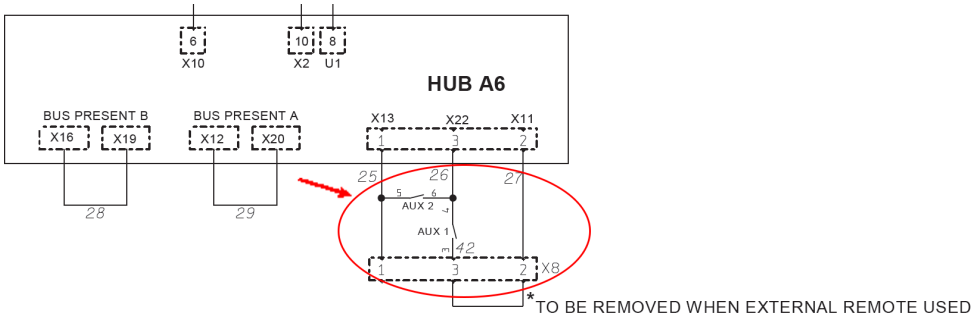
Please refer to the Hercules installation manual for more specific procedures.

9.2.4 MBP Wiring

Both solutions (rotary by-pass or separate switches) need to have auxiliary contacts that need to be wired to the Pegasus controller unit as described below.



"Aux 3" (from the bypass switch): provides an input to the Pegasus controller indicating that the MBP is engaged.



"Aux 1" (from AC input switch) and "Aux 2" (from the bypass switch):

- Switch OFF the Hercules modules once the MBP is engaged.
- Allow the Hercules modules to switch ON when the MBP placed in the INTERIM position.

Note: the parameter "Out voltage consign" set by default to 230 Vac shall be adjusted according nominal AC input voltage. This will limit the inrush current when operating on Manual Bypass.

9.3 Module alarms

Module alarms				
Text ID	**Name**	**Level**	**Def. Map**	**Description**
96	Start	Minor		System is starting
100	Fan to be replaced	Minor		The timeout indicating FAN operates for 7 years
101	Fan failure	Minor		Fans are not functionning properly
102	Power disturbed	Minor		Transient power alarm with output stopped (module KO)
103	Param phase query	Minor		No assigned AC group or DC group yet (in progress)
104	Param mismatch	Minor		Param not compatible with the rest of the system
105	No source	Minor		No AC/DC input
106	Vcap too high	Minor		Internal voltage too high
107	Vcap too low	Minor		Internal voltage too low
108	Vref error	Minor		Reference voltage from auxiliary supply out of acceptable range
109	Memory eeprom error	Minor		Not implemented
110	Memory flash error	Minor		Flash continuous verification failed
111	OFF remote	Minor		Module remote OFF
112	OFF manual	Minor		Module OFF manually (ON / OFF switch)
113	BUS com fail	Minor		Too many missing bus frames
114	Bus A fail	Minor		Sync tops reception issue on bus A (com lost)
115	Bus B fail	Minor		Sync tops reception issue on bus B (com lost)
116	Bus sync filter error	Minor		Sync top filtering circuit fault (detected because sync tops are received at different times)
119	Bus A not present	Minor		bus A present signal of backplane not seen by the module
120	Bus B not present	Minor		bus B present signal of backplane not seen by the module
121	Bus frame collision	Minor		Bus A and bus B are not identical in content
122	Bus fail	Minor		Module can't see what it writes on both bus
123	Warm up too high	Minor		One of the measured temperature is above a threshold
124	Power noise	Minor		Transient power alarm (some trips happening)

Module DC input alarms				
Text ID	**Name**	**Level**	**Def. Map**	**Description**
128	Start up	Minor		
129	Temperature derating	Minor		Power is decreased due to high temperature
130	Temperature too high	Minor		DC converter stopped because of too high temperature
131	Temperature sensor fail	Minor		Communication with temperature probe was lost
132	Auto-calib error	Minor		Error during auto calibration of current offsets
133	Pdc too low	Minor		Pdc = f(Vdc). Alarm if Pdc < Pout
134	Impedance too high	Minor		DC input too high impedance detected
136	Current trip	Minor		Too many consecutive DC-/+ over-current trips
137	Driver error	Minor		Too many “not ready”/”fault” from DC-/+ drivers over some time
144	Source+ too low - transferred	Minor		DC+ V is under input transfer to AC threshold
145	Source- too low - transferred	Minor		DC- V is under input transfer to AC threshold
146	Source+ too high - transferred	Minor		DC+ V is over input transfer to AC threshold
147	Source- too high - transferred	Minor		DC- V is over input stop threshold
148	Source+ too low - stop	Minor		DC+ V is under input stop threshold
149	Source- too low - stop	Minor		DC- V is under input stop threshold
150	Source+ too high - stop	Minor		DC+ V is over input stop threshold
151	Source- too high - stop	Minor		DC- V is over input stop threshold
152	Source+ no voltage	Minor		DC+ V is under input not present threshold
153	Source- no voltage	Minor		DC- V is under input not present threshold
154	Source+ brownout (<150V)	Minor		DC+ V is under extended lower limit for too much time
155	Source- brownout (<150V)	Minor		DC- V is under extended lower limit for too much time

Module AC input alarms				
Text ID	**Name**	**Level**	**Def. Map**	**Description**
160	Start	Minor		
161	Temperature derating	Minor		Power is decreased due to high temperature
162	Temperature too high	Minor		ACin converter stopped because of too high temperature
163	Temperature sensor fail	Minor		Communication with temperature probe was lost
164	Auto-calib error	Minor		Error during auto-calibration of current offsets
165	Impedance Too High	Minor		AC input too high impedance detected
166	Backfeed error	Minor		Input stopped because of backfeed on it
168	Overcurrent	Minor		Too many consecutive ACin over-current trips
169	Driver not ready	Minor		Hardware driver not ready signal received
170	Driver fault	Minor		Hardware driver fault signal received
171	Driver perturbed	Minor		Too many consecutive “not ready”/”fault” from Acin driver or more than a threshold over some hours
175	Vres Absent	Minor		Fast alarm when source V is no longer present
176	Source V too low transferred	Minor		Source V is under input transfer to DC threshold
177	Source V too high transferred	Minor		Source V is over input transfer to DC threshold
178	Vres out of range	Minor		Source V is out of expected envelope
179	Source V too low stop	Minor		Source V is under input stop threshold
180	Source V too high stop	Minor		Source V is over input stop threshold
181	Source frequ too low	Minor		Source freq is under input stop threshold
182	Source frequ too high	Minor		Source freq is over input stop threshold
183	Source no voltage	Minor		Source V RMS is below 60V (SELV threshold) - no sync possible

Module AC output alarms				
Text ID	**Name**	**Level**	**Def. Map**	**Description**
192	Start	Minor		
193	Temperature derating	Minor		Power is decreased due to high temperature
194	Temperature too high	Minor		ACout converter stopped because of too high temperature
195	Temperature sensor fail	Minor		Communication with temperature probe was lost
196	Auto-calib error	Minor		Error during auto calibration of current offsets
197	Overload not ready	Minor		Overload capability is in cool-down
198	Overload	Minor		Output power is higher than a threshold above nominal power
199	Power derating	Minor		Derate output power because it cannot be supplied
200	Vout too Low	Minor		Output V is under a threshold (due to an overload)
201	Overload too long	Minor		Output V is under a threshold (due to an overload) for too much time
202	Vout modify	Minor		Output V setpoint was modified and is being converged on
203	Load-sharing low	Minor		Hercules module is supplying too much power to the load compared to the other modules
204	Load-sharing high	Minor		Hercules module is not supplying enough power to the load compared to the other modules
205	Mode support	Minor		Hercules is supporting the MBP output, i.e. it does not supply any current, but in case of a voltage drop will try to keep the voltage at an acceptable level
206	Igbt driver alarm	Minor		An individual driver is sending an alarm but global drivers monitoring signals are OK
208	Driver not ready	Minor		Hardware driver not ready signal received
209	Driver fault	Minor		Hardware driver fault signal received
210	Over-current	Minor		Too many consecutive ACout over-current trips
211	Igbt error	Minor		Software detected IGBT fault
212	Vout pi2 error	Minor		Output V at Pi/2 (sine max) is out of expected range with open relay
213	Vout mpi2 error	Minor		Output V at -Pi/2 (sine min) is out of expected range with open relay
214	Off (bus)	Minor		Output Off from bus request
215	Backfeed error	Minor		Output stopped because of backfeed from this module or another one
216	Too many start	Minor		Too many attempts to start output over some time
217	AC out fuse open	Minor		Output fuse open or enventualy output connector not connected