TS-Enovations
IMD3 Insulation
Monitoring Device

TS-Enovations IMD3 Insulation Monitoring Device Owner's Manual

Contents

TS-Enovations IMD3 Insulation Monitoring Device

Product Specifications

- Product Name: IMD3 Insulation Monitoring Device
- Operating Voltage: 6-60Vdc
- Fuse Requirement: 1 Amp fuse for DC power line
- Designed for: 230Vac floating circuit installations in vehicles

Product Usage Instructions

Safety Measures
Before assembly and commissioning, read the manual carefully and follow the safety measures outlined below:

- **DANGER!** Only qualified personnel should install the product in a closed-off area to ensure safety.
- **WARNING!** Always observe the risks of electrical shocks, fire hazards, and injuries during installation and use.

Assembly

- **DANGER!** Do not assemble the device in locations with gas/dust explosion risks.
- **WARNING!** Ensure stable assembly to prevent falls or contact with surrounding connections.

Electrical Connection:
Ensure proper electrical connection to prevent insulation errors. If issues arise, seek professional assistance.

Device Usage

- **WARNING!** If the IMD3 malfunctions or the housing is damaged, shut off the installation and seek professional inspection or repair.
- **CAREFUL!** Do not use the device in specific environments (salty/humid/wet, aggressive vapors, flammable materials, explosive environments).

General Description:
The IMD3 monitors insulation in 230Vac floating circuit installations in vehicles generated by inverters. It detects insulation errors between phase and chassis, switching off the installation if insulation levels are below defined thresholds.

The 'MAINS' connection on IMD3 checks if a correct MAINS earthing is in place when connected to a 230Vac circuit.

Operation:
The IMD3 operates on 6-60Vdc voltage. Ensure proper fusing with a 1 Amp fuse for the DC power line.

FAQ

Q: What should I do if the IMD3 malfunctions?
A: If the device malfunctions or the housing is damaged, immediately shut off the installation and seek professional assistance for inspection or repair. Do not attempt self-repair.

PRODUCT SPECIFICATION AND MANUAL
IMD3
MANUAL INSULATION MONITORING DEVICE

Please note! Safety hazard due to electrical current.
Only qualified personnel are authorized to install this product in the appropriate location, where the area being worked on needs to be closed off to ensure a safe environment.

Safety measures

Read this manual carefully before assembly and commissioning.
Store the manual carefully and pass it on to the next user of this device!

Explanation of symbols used

DANGER!

 Safety warning: failure to comply will lead to death or serious injury.

WARNING!

 Safety warning: failure to comply can lead to death.

CAUTION!

 Failure to comply can lead to material damages and limit the product's performance.

INSTRUCTION

 Additional information for handling the product.

General safety instructions

The manufacturer cannot be held responsible for any damage caused by:

- assembly or connection errors
- damage to the device as a result of mechanical impact and overvoltage
- changes to the device without explicit approval from the manufacturer
- any other uses than described in the manual

For safety reasons, always observe the risks of electrical shocks, fire hazards and injuries during installation and use of electrical devices!

General safety

DANGER!
In case of fire, use a fire extinguisher suitable for electrical devices. Always ensure a fire extinguisher is present during installation and when using this device.

WARNING!

- Only use the device in accordance with the instructions.
- Please note positive (+) and negative (-) poles should never be in contact with each other.
- Disconnect the device from the battery in case of:
  - cleaning and maintenance
  - replacing a fuse (only carried out by experts)
- Before dismantling the device:
  - Disconnect all connections.
  - Ensure there is no voltage on entries and exits.
- If the device or the connection cables are visibly damaged, the device should no longer be used.
- If the connection cables of this device are damaged, these should be replaced by qualified personnel only.

- Repairs to this device should only be carried out by the manufacturer. Improper repairs can lead to serious danger.
- This device cannot be used by children or people with reduced physical, sensory or mental capacities or inadequate experience and knowledge.
- Users need to have insight in the dangers of operating this device.
- Electrical devices are no toys. Therefore, store and use this device out of reach of children.

CAUTION!

- Ensure the set voltage of the device corresponds with the system voltage of the power supply available.
- Be aware other devices do not cause a short circuit at the contacts of the device.
- Store the device in a cool and dry place.

Safety measures when assembling the device

DANGER!
Do not assemble the device at a location where there’s a risk of gas/dust explosions.

WARNING!
Ensure a stable assembly!
The device needs to be assembled and secured to prevent falling over, falling down and getting in contact with the area around the connections.

CAUTION!

- Do not expose the device to heat sources (sunshine, central heating etc).
- Prevent additional heating of the device.
- Assemble the device in a dry and splash proof location.

Safety measures when assembling the electrical connection of the device

DANGER!
Danger of fatal electrical shocks!

- When working on an electrical installation, please ensure there is someone nearby who can help you in case of an emergency.
- When installation takes place on a boat: incorrect assembly of electrical devices on boats can lead to corrosion damage of the boat.
- Ensure the device is installed by a qualified technician.

WARNING!

- Ensure the cable diameter has the correct size.
- Position the cables ensuring they will not be damaged by doors or bonnets. Crushed or damaged cables can lead to life threatening situations and need to be replaced.
- Ensure the cables do not cause a tripping hazard and ensure damaging the cables is impossible.

CAUTION!

- Use cable grommets if cables need to be guided through sheet walls or other grommets which have sharp edges.
- Do not install AC cables and DC cables in the same cable grommet.
- Do not install the cables in a loose manner or in a sharp bent.
- Install the cables using the right tools and materials.
- Do not pull the cables.
- Use cables which are long enough, with the appropriate diameter.

Safety when using the device

WARNING!
If the IMD3 not work properly or the housing is damage, shut off the installation and go to a certified company and let the system inspected to ensure the security of the system, or send the IMD3 back to the factory for repair and testing the unit. Self-repair is not allowed!

CAREFUL!

- Do not use the device in case of:
  - a salty, humid or wet environment
  - an environment with aggressive vapours
  - an environment with flammable materials
  - an explosive environment
- Check if cables and connections are dry before use.
- Always disconnect the power supply when carrying out maintenance to the device.
- Parts of the device can still be live after the power supply has been disconnected.
- Do not remove cables when the device is in use.

CAUTION!

- Prevent the device from being covered or being assembled in an area which is too small.
- Ensure proper ventilation.

General description

The IMD3 Insulation Monitoring Device monitors the insulated condition of 230Vac floating circuit installations in vehicles.
The IMD3 has been designed for installations where 230Vac is being generated by inverters.
The IMD3 measures and detects insulation errors between phase and chassis as well as zero and chassis of the 230Vac vehicle installation.
If insulation is below a defined level, the IMD3 switches off the installation to prevent any hazardous situations.
The ‘MAINS’ connection on the IMD3 can detect whether the vehicle installation is being powered from an external (earthed) 230Vac circuit.
If 230Vac is connected on the MAINS, the insulation measurement is not being used to detect insulation errors but to test if a correct MAINS earthing is in place (by approximation). This is possible as the inverter has redirected the MAINS to the INVERTER circuit, connecting the MAINS with the INVERTER net’s PE.

Operation
The IMD3 operates on a 6-60Vdc voltage.(+6-60Vdc on the GND/+Vdc clamps) The DC power line must be fused with a 1 Amp fuse.

The 230Vac floating circuit produced by the inverter is continuously monitored for insulation errors to PE.
The change-over contact (NO/C/NC) manages the inverter activation and deactivation using the ‘remote’ connector on the inverter.
Once the IMD3 is powered, if there are no insulation errors detected, the internal relay activates, enabling the inverter’s operation
(via the NO/C/NC clamps), indicated by the illumination of the green LED.
Upon detection of an insulation error, the relay disengages and the inverter will be switched off. In such case, -OUT is active and the ‘Isolation failure’ led flashes.

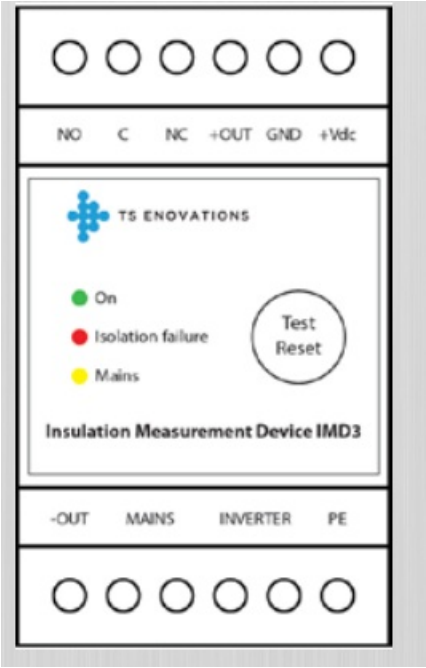
To reset the ‘Isolation failure’, press the RESET button for a minimum of 1 second.
Under normal circumstances where 230Vac is present in the MAINS, the IMD3 does not register an ‘Isolation failure’. This is due to the inverter redirecting the MAINS to the INVERTER circuit, where PE is connected to zero.

Test button
Press the TEST button for at least 3 seconds to test the IMD3 on the most important internal interruption features (an insulation error is simulated internally).
The ‘Isolation failure’ notification and the RESET procedure are identical to the notification and procedure during an external insulation error.

Earth fault indicator
If 230Vac is present on the MAINS, the insulation measurement is not used to detect insulation errors instead, it is used to test if a correct MAINS earthing is present (by approximation).
This is possible as the inverter has diverted the MAINS to the INVERTER circuit, and the MAINS earthing is now connected to the INVERTER circuit’s PE.
The Earth fault measurement is only activated if 230Vac is detected on the INVERTER. In the event of an earth fault, +OUT becomes activated.
+OUT (via the +OUT clamp) follows the input of the voltage on the connected power supply (+Vdc).

Led description

●	On
●	Isolation failure
●	MAINS ***with*** correct earthing: Yellow MAINS is on constantly
●	MAINS ***without*** correct earthing: Yellow MAINS is flashing rapidly
NO	Relay contact normally open
C	Relay contact common
NC	Relay contact normally closed
+OUT	+ output 'Earth fault'
GND	DC power supply GND
+Vdc	DC power supply +6..60Vdc (Dedicated power supply) (1 Amp Fuse in Dc Power line)
-OUT	- output 'Insulation error'
MAINS	230Vac L/N of the Mains
INVERTER	230Vac L/N from the inverter (NET)
PE	PE (earthing) of the floating circuit (internally connected to the GND)



Installation

Before you start
Switch off the converter and shore connections before installing the IMD3.

Positioning of the IMD3
IMD3 must be installed in a suitable enclosure.
If IMD3 is installed without a suitable enclosure, the type approval will be invalidated.

You can also install the IMD3 without an additional housing, but then you must ensure that it is not possible to reach the connections since 230Vac are present there.

Cut and strip cables to a maximum length of 50 mm per cable core. Measurements of the jackets of these cables:
Cable diameter 230Vac sensing: 0.75mm Remote connection 0.75mm
Dc power line at least 1.0mm
One (1) Amp Fuse in the Dc + Power line
Connect all cables according to diagram 1.

Conditions installation

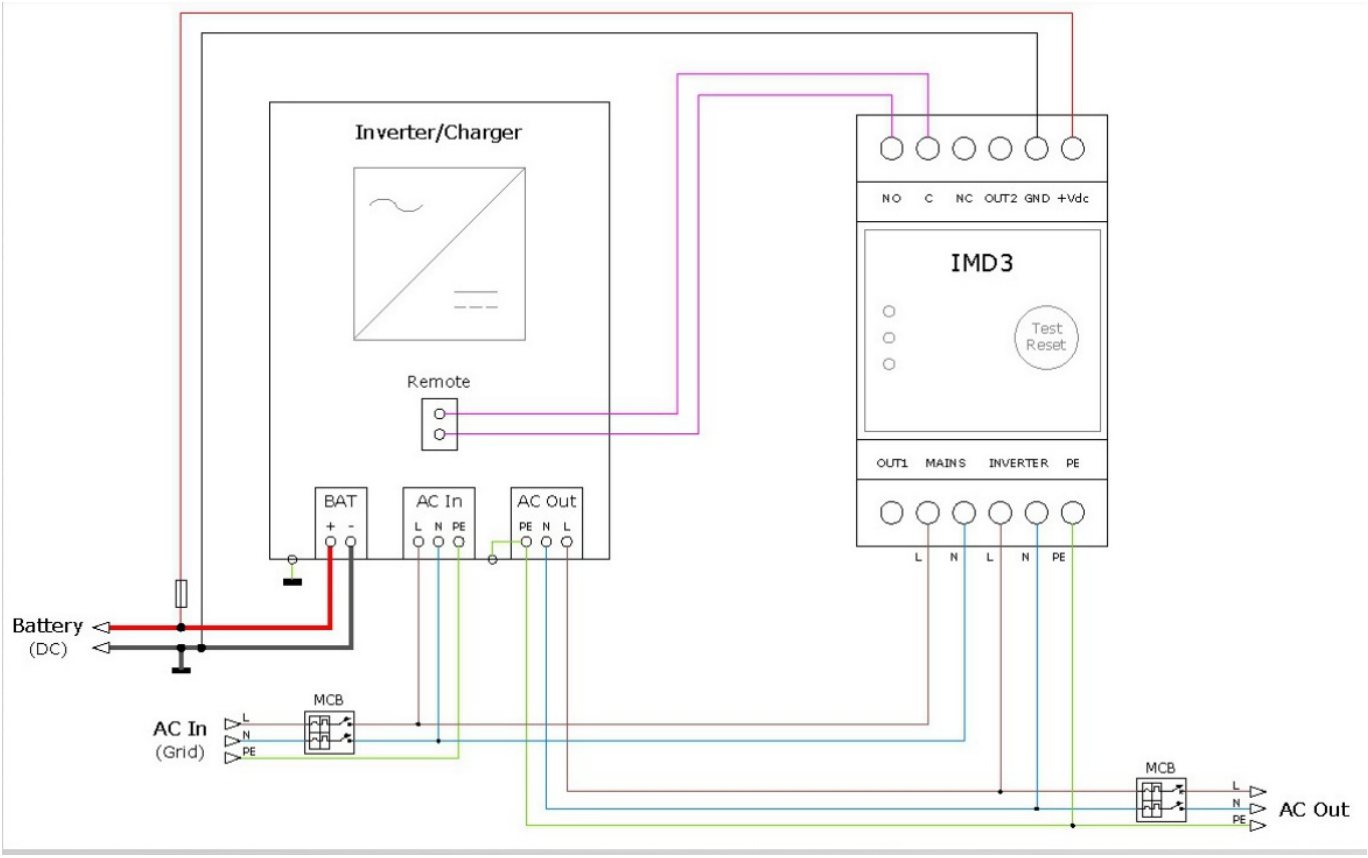
- Configure the converter in order to generate a floating 230Vac circuit. Read the converter's manual before adapting the converter;
- The IMD3 cannot be used in combination with safety components (automatic earth switch or other automated interruption arrangement).

The IMD3 insulation monitoring can only operate correctly if the 230Vac vehicle installation is a floating circuit. Install the IMD3 according to diagram 2, between the Inverter Remote and the IMD3 Remote contacts. Position the IMD3 in a closed off area, which can only be carried out by qualified and authorised personnel.

Important!

- **All** 230Vac users (WCD's, Lights etc) which have an earth-connection need to be connected to the PE-Pipe or connected directly with the vehicle's chassis.
- When Connected to a an external 230Vac grid make sure this grid is properly grounded and protected by a fuse.

Diagram 1



The Victron cable connections to the inverter are not always the same and with a lithium system an assist must be placed in the inverter.

Diagram 2

Inverter/Charger model	Remote Connection & Setup for battery type	
	Victron AGM & GEL Battery Victron Lithium SuperPack Battery	Victron Lithium Battery Smart with VE.Bus BMS Victron Lithium Battery Smart with VE.Bus BMS V2 Victron Lithium Battery Smart with Lynx Smart BMS MG Lithium-Ion LFP Battery with MG Master LV
MultiPlus 12/500/20-16 MultiPlus 12/800/35-16 MultiPlus 12/1200/50-16 MultiPlus 24/500/10-16 MultiPlus 24/800/16-16 MultiPlus 24/1200/25-16	IMD3 Connector: NO C NC MultiPlus Connector REMOTE: ON Ch + Setup: Set Dipswitch DS1 to ON	IMD3 Connector: NO C NC MultiPlus Connector TEMP: - + Setup: Safety Switch Assistant must be installed
MultiPlus 12/1600/70-16 MultiPlus 24/1600/40-16	IMD3 Connector: NO C NC MultiPlus Connector REMOTE	IMD3 Connector: NO C NC MultiPlus Connector REMOTE

Diagram (follow-up)

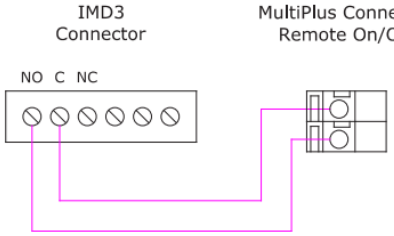
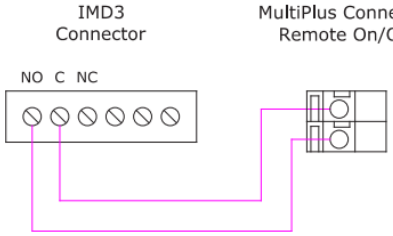
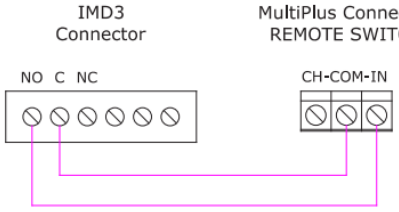
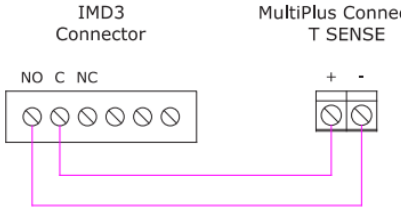
MultiPlus 12/2000/80-32 MultiPlus 24/2000/50-32		
MultiPlus Compact 12/800/35-16 MultiPlus Compact 12/1200/50-16 MultiPlus Compact 12/1600/70-16 MultiPlus Compact 12/2000/80-30 MultiPlus Compact 24/800/16-16 MultiPlus Compact 24/1200/25-16 MultiPlus Compact 24/1600/40-16 MultiPlus Compact 24/2000/50-30	 Setup: Set Dipswitch DS1 & DS2 to OFF	 Setup: Safety Switch Assistant must be installed In systems with a VE.Bus BMS/VE.Bus BMS V2 also Dipswitches must be set: DS1 to ON & DS2 to OFF

Diagram 3

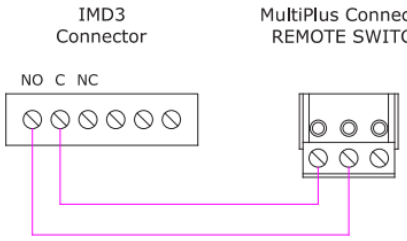
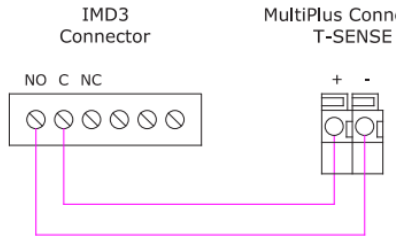
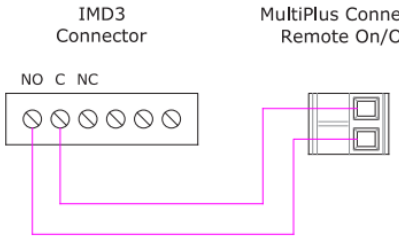
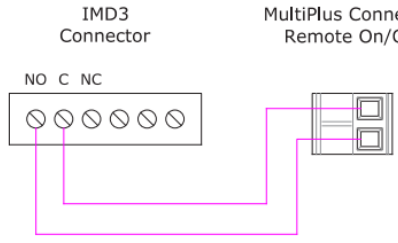
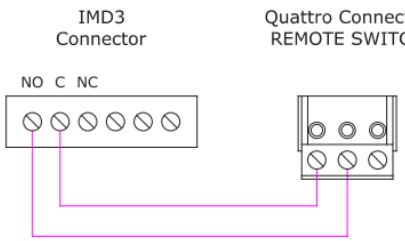
Inverter/Charger model	Remote Connection & Setup for battery type	
	Victron AGM & GEL Battery Victron Lithium SuperPack Battery	Victron Lithium Battery Smart with VE.Bus BMS Victron Lithium Battery Smart with VE.Bus BMS V2 Victron Lithium Battery Smart with Lynx Smart BMS MG Lithium-Ion LFP Battery with MG Master LV
MultiPlus 12/3000/120-16 MultiPlus 12/3000/120-50 MultiPlus 24/3000/70-16 MultiPlus 24/3000/70-50 MultiPlus 24/5000/120-100		 Setup: Safety Switch Assistant must be installed
MultiPlus-II 12/3000/120-32 MultiPlus-II 24/3000/70-32 MultiPlus-II 24/5000/120-50 MultiPlus-II GX 24/3000/70-32		

Diagram (follow-up)

<table>
<tr>
<td>Quattro 12/3000/120-50/50
Quattro 12/5000/220-100/100
Quattro 24/3000/70-50/50
Quattro 24/5000/120-100/100
Quattro 24/8000/200-100/100</td>
<td> 
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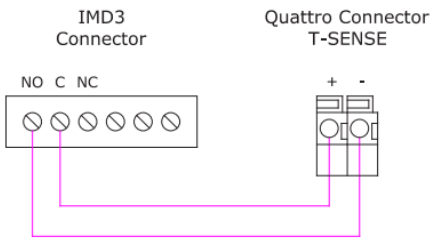
<td> 

Setup: Safety Switch Assistant must be installed</td>
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<tr>
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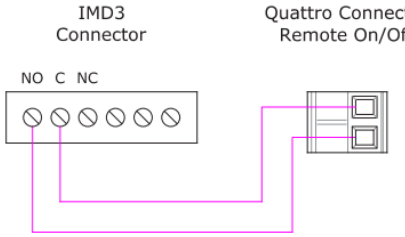
<td> 
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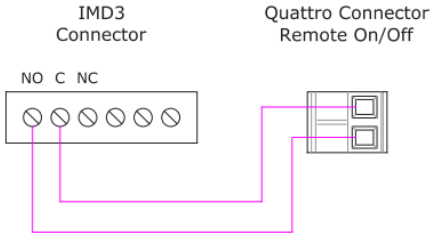
<td> 
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</table>

Safety Switch assistant must be installed in systems with a Ve.Bus BMS/Ve,Bus BMS V2. View Diagram 4.

Diagram 4

- Use VE Configure 3
- Select Tab: Virtual switch
- Select: Do not use VS (Virtual Switch)

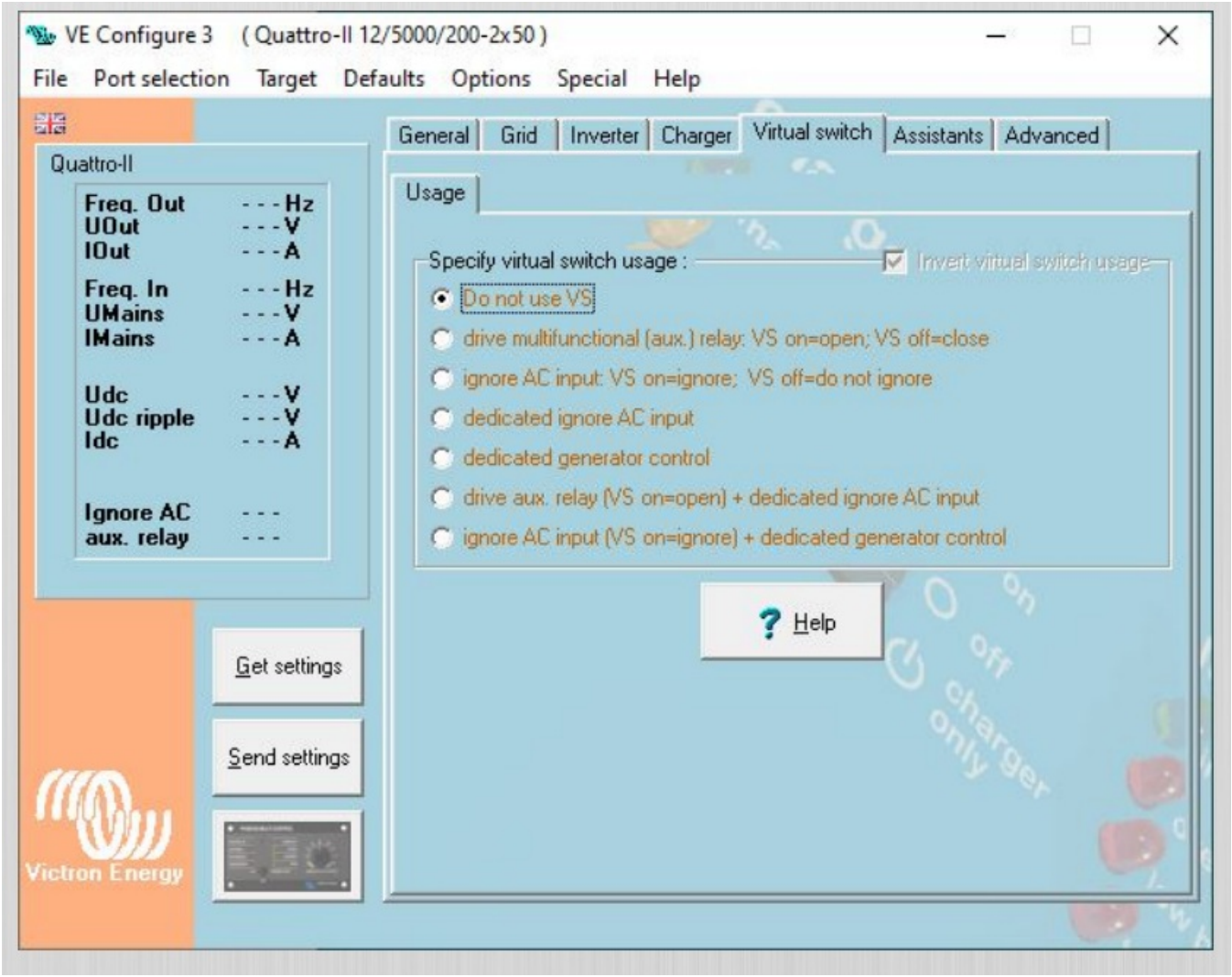


Diagram 4 (follow-up 1/3)

- Select Tab: Assistants
- Select: Add Assistant
- Select: safety switch
- Select: Start assistant and follow instructions
-

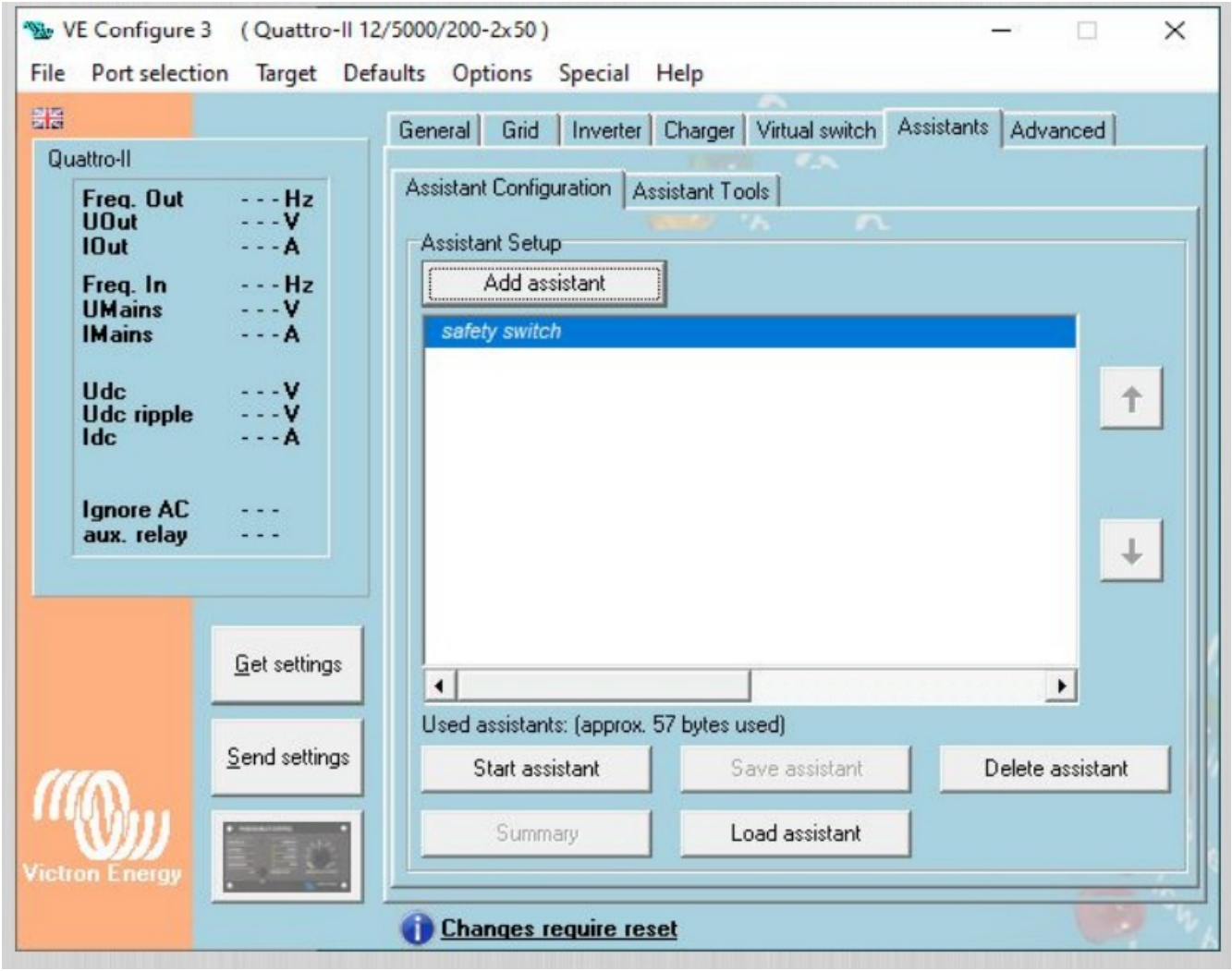


Diagram 4 (follow-up 2/3)

Window: Welcome -> Select: >>

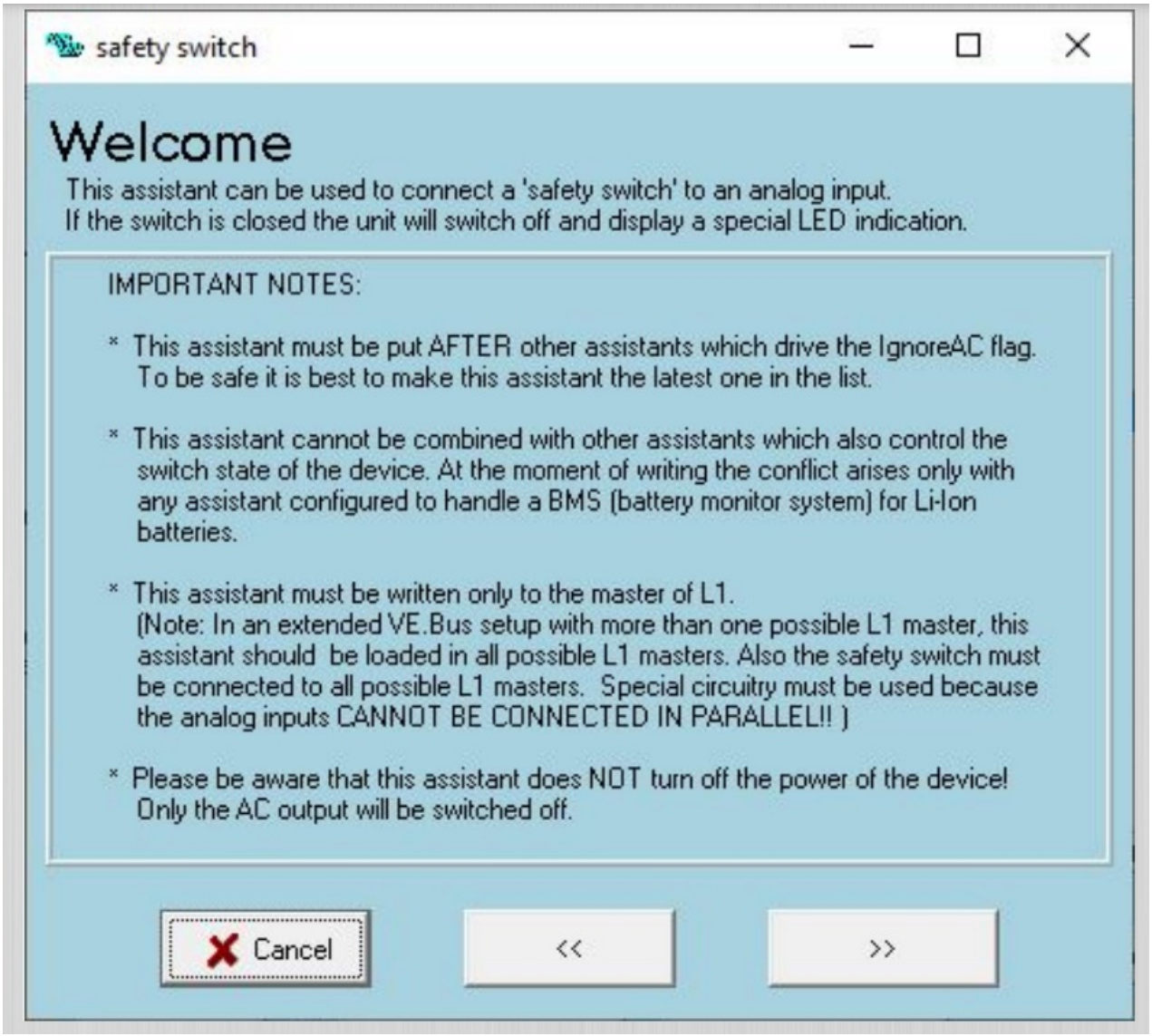
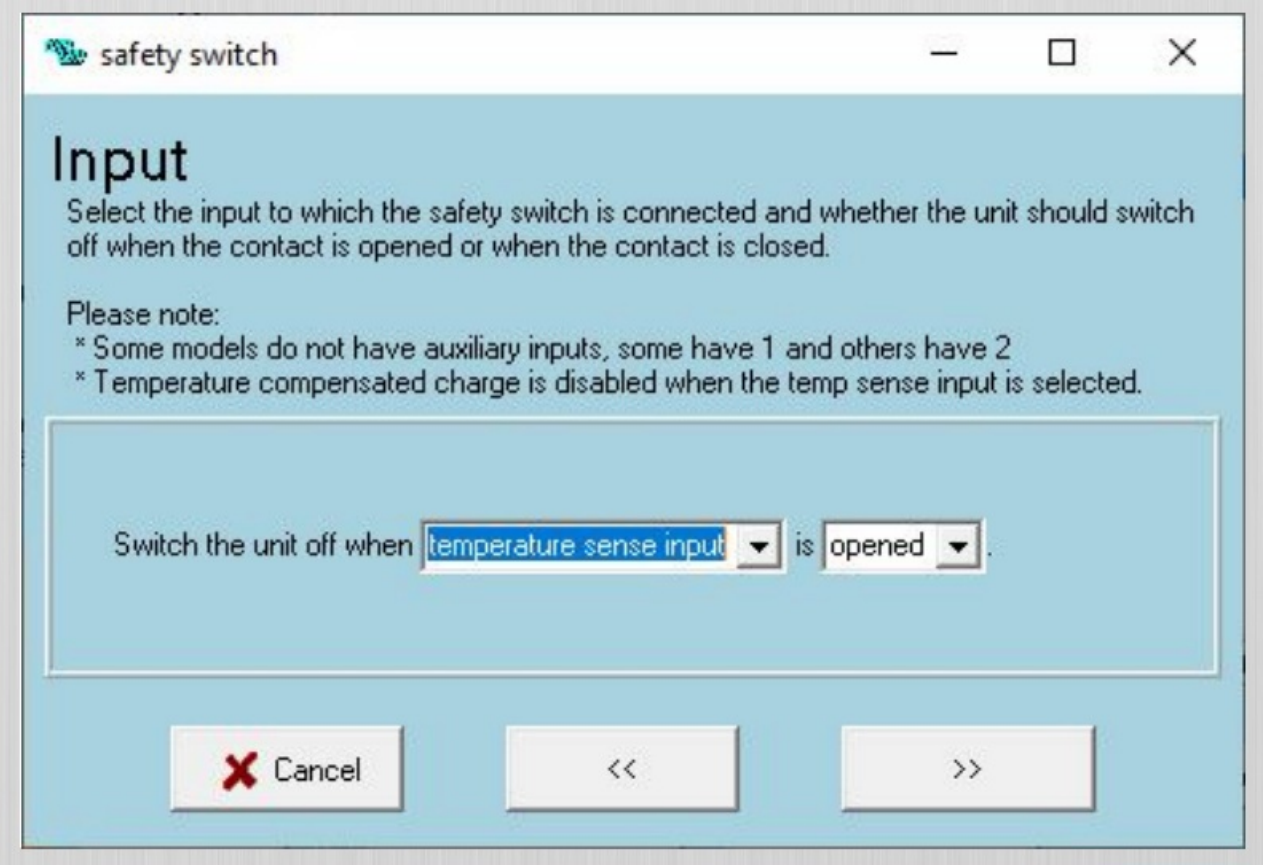


Diagram 4 (follow-up 3/3)

- Window: Input
- Select: Switch the unit off when: temperature sense input is opened
- Select: >>
-



Select: Send settings

- Select: All settings

Floating Circuit

In case of a MultiPlus, a floating circuit is obtained by switching off the internal ‘Ground relay’. In Converter operational, the Neutral is no longer connected to ‘Earth’.
Use software which includes Victron VE.Config or VictronConnect in order to switch off ‘Ground relay’.

The Insulation Monitor can only operate correctly if the 230VAC vehicle installation is a floating circuit (the Neutral is not connected to ‘Earth).
In Victron VE.Config: Tab Inverter -> Clear the selection of the ‘ground relay’ checkbox.

Diagram 5

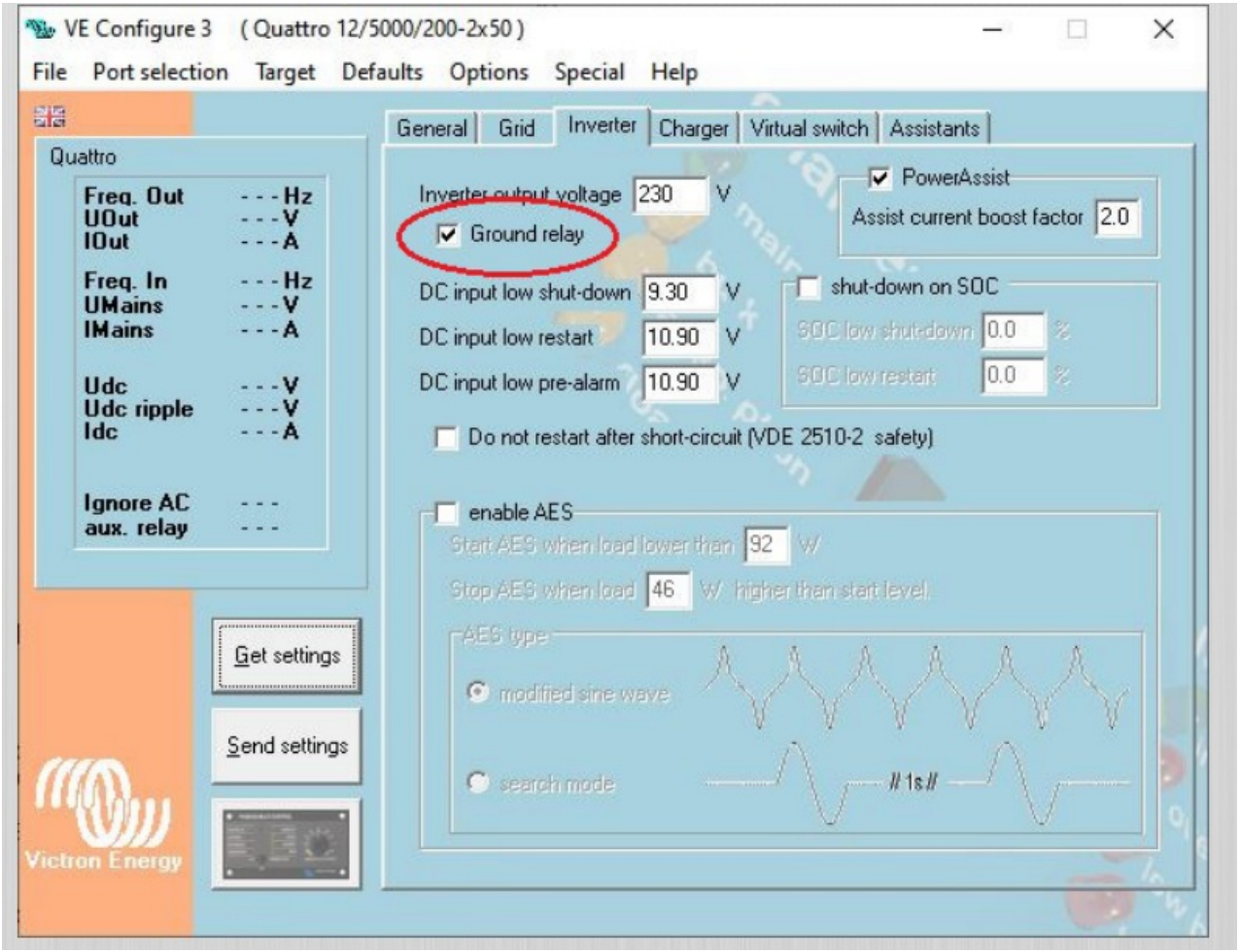
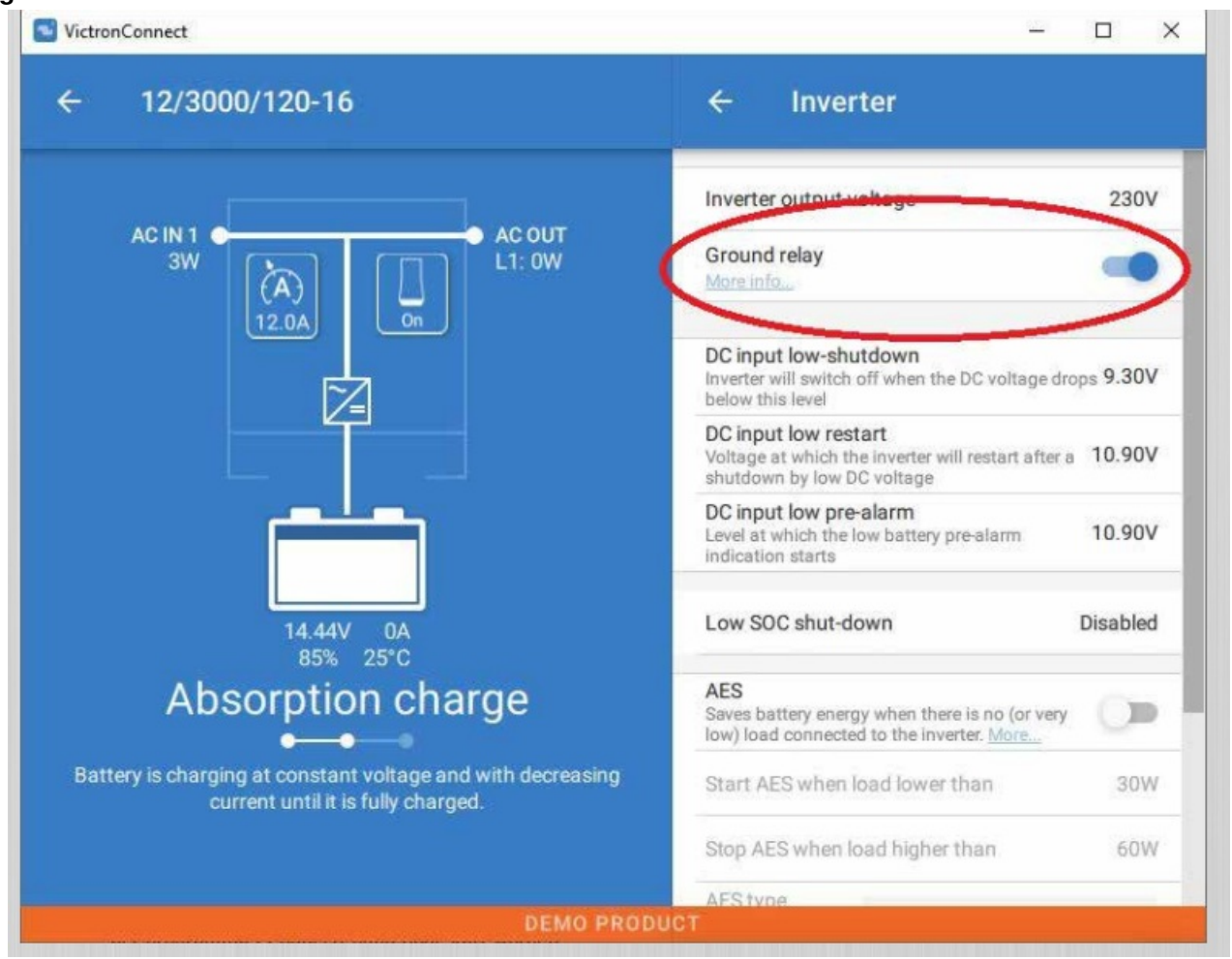


Diagram 6



If everything is connected correctly and the ground relay is disabled, you can test whether the isolation guard

activates after switching on your inverter.

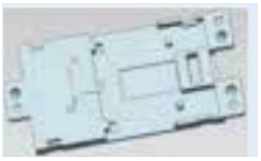
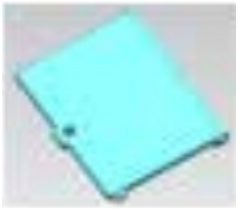
Material of ENCLOSURE
Polycarbonate (Pc), pellets (+) – Indicate 0~0.5% acid scavengers.

Flammability	**Value**	**Test Method**
Flame Rating		
3.0 mm, ALL	HB	UL 94
1.5 mm, ALL	V-2	UL 94 IEC 60695-11-10, -20
2.5 tot 2.8 mm, ALL	V-2	UL 94 IEC 60695-11-10, -20
3.0 mm, ALL	HB40	IEC 60695-11-10, -20
Electrical	**Value**	**Test Method**
Hot-wire Ignition (HWI)		UL 746A
1.5 mm	PLC 2	
2.5 to 2.8 mm	PLC 2	
3.0 mm	PLC 2	
High Amp Arc Ignition (HAI)		UL 746A
1.5 mm	PLC 4	
2.5 to 2.8 mm	PLC 3	
3.0 mm	PLC 3	
Comparative Tracking Index (CTI)	PLC 2	UL 746A
High Voltage Arc Tracking Rate (HVTR)	PLC 2	UL 746A
Arc Resistance	PLC 6	ASTM D495
Thermal	**Value**	**Test Method**
RTI Elec		UL 746B
1.5 mm	125 °C	
2.5 to 2.8 mm	125 °C	
3.0 mm	125 °C	
RTI IMP		UL 746B
1.5 mm	105 °C	
2.5 to 2.8 mm	105 °C	
3.0 mm	105 °C	

RTI Str		UL 746B
1.5 mm	125 °C	
2.5 to 2.8 mm	125 °C	
3.0 mm	125 °C	

Flammability	**Value**	**Test Method**
Flame Rating (1.6 mm, NC)	V-0	UL 94 IEC 60695-11-10, -20
Thermal	**Value**	**Test Method**
RTI Elec (1.6 mm)	60.0 °C	UL 746B
RTI Imp (1.6 mm)	60.0 °C	UL 746B
RTI Str (1.6 mm)	60.0 °C	UL 746B

Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS), pellets

Nr	Part description	File name	Product size (mm)	Cavity n umber	Cavity/ c ore mater ial
M1		GroundInsulation_ Housing_20211118	53x90x64	1×1	NAK80
M2		GroundInsulation_ Bottom_20211203	53×110.4×10	1×1	NAK80
M3		GroundInsulation_ SrewCover_TopBot tom_ 2021118	53×15.5×19.4	1×2	NAK80
M4		GroundInsulation_DinAssembly Plasti c_20211203	31.9×28.5×5.5	1×2	NAK80
M5		GroundInsulation_Transparant Cover_ 20211118	53.43.3×6	1×1	S136H

Slide and lift	Mould Life	Gate	Injection System	Mould Plate Size	Mould weight kg	T1 Time (days)	Remark 1
3	500k shots	Sub gate	Cold runner	300x300x410	290	35	PC/ABS (FR3010)
0	500k shots	Pin point gate	Cold runner	250x300x300	175	30	PC/ABS (FR3010)
0	500k shots	Sub gate	Cold runner	230x250x300	135	30	PC/ABS (FR3010)
0	500k shots	Sub gate	Cold runner	200x270x280	118	30	PC/ABS (FR3010)
0	500k shots	Open gate	Cold runner	250x250x280	136	30	(PC-110) Polycarbonate V2 transparent

5. Technical specifications

Parameter	condition	min	type	max	unit
Dc input clamp +Vdc/GND					
Vin connection voltage reach (clamp +Vdc/GND)		6	12/24/48	60	Vdc
Vin max. voltage (clamp +Vdc/ GND)		–	–	70	Vdc
Max Extraneous Dc voltage continuously				70	Vdc
1 Amp Fuse in + Dc Power line			1 Amp		
Ufg Dc voltage Max				265	Vdc
Vin undervoltage UVLO voltage commutation	Relay internally activated	–	–	5.4	Vdc
Vin undervoltage UVLO cut-in voltage		5.8	–	–	Vdc
Iin current/Watts drawn (clamp +Vdc/GND)	Vin = 12.0V/relay active/ green led on	–	11.9/0.1428	–	mA/W
Iin current/Watts drawn (clamp +Vdc/GND)	Vin = 28.8V/relais actief/ led groen aan		4.9/0.0588	–	mA/W
Iin trip current (PPTC resettable fuse)	Internal error	–	100	–	mA

Temperature working range		-10	–	+65	°C
-OUT1- output (Insulation error) (clamp OUT1)					
Vout1 (via N-FET)	Insulation error active, Iout 1=80mA	–	–	0.85	Vdc
Iout1 trip current (PPTC resettable fuse)	Vin max = 60V	–	100	–	mA
Iout1 hold current (PPTC resettable fuse)	Vin max = 60V	–	50	–	mA
+OUT2 output (earth fault) (clamp +OUT2)					
Vout2 (via PNP transistor)	Earth fault active	–	Vin-0.45	–	Vdc
Iout2 trip current (PPTC resettable fuse)	Vin max = 60V	–	100	–	mA
Iout2 hold current (PPTC resettable fuse)	Vin max = 60V	–	50	–	mA
Relay contact (clamps NO/C/NC)	(type relay: P2 V23079)				
Max. contact voltage AC		–	–	265	Vac
Max. contact voltage DC		–	–	220	Vdc
Max. contact current	Contact voltage = 240Vac	–	–	0.25	A
Max. contact current	Contact voltage = 30Vdc	–	–	2	A

MAINS input (clamps MAINS L/N)					
Detection MAINS active		180		280	Vac
Detection load	(detection via optocoupler and R=450kΩ)	0.25		0.6	mAac
Ufg Dc voltage Max				265	Vdc
INVERTER input (clamps INVERTER L/N)					
Detection INVERTER active		100		260	Vac
Load detection	(detection via optocoupler and R=450kΩ)	0.25		0.6	mAac
Ufg Dc voltage Max				265	Vdc
Measuring circuit Insulation Monitoring on INVERTER circuit.					
Operating value resistance Riso					
Asymmetrical (phase-PE or zero-PE)	No stress on INVERTER circuit.		<=12 ± 10%		kΩ

Symmetrical (phase-PE and zero-PE),			<=100 ± 20%		kΩ
Response delay			<1		sec
Voltage current			<= 32		µA
Voltage measurement			– 14.6		Vdc
Technical details					
Where to use	Indoor use only				
Protection category	IP20				
Altitude	2000M Max				
Relative humidity: (non- condensing)	max 95 %				
Overvoltage category	cat III				
Pollution degree of the intended environment	2				
Measurement category	III				
Cleaning and decontamination	Cleaning with damp cloth and do not use aggressive detergents				
Use in parallel	The IMD3 can't be use in parallel or with other insulation monitors				
Internal impedance Zi /Zr	Normal function nominal frequency		450k		
System leakage capacitances Ce and response time	Max 1uF @ 2s response time				
Test voltage				14,6	Vdc
Dimensions	HxWxD cm		11×5,5×7,5		

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Documents / Resources

	TS-Enovations IMD3 Insulation Monitoring Device [pdf] Owner's Manual IMD3 Insulation Monitoring Device, IMD3, Insulation Monitoring Device, Monitoring Device, Device

References

- enovations.com
- TS ENOVATIONS - Coming soon
- User Manual