

DC-DC
SWITCHING
STEP-UP REGULATOR

TYPE

DRP-2DS
(DRP-2DS + UX10-4)

OPERATION MANUAL



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1. General Utilization and Commissioning Directions

Always make reference to the specific description of the product and to the Manufacturer's instruction. Carefully observe the following warnings.

1.1 - Storage and Transportation

must comply with the environmental conditions stated on the product's instruction or by the applicable IEC standards.

1.2 - Installation

must be properly made and in compliance with the operational ambient conditions stated by the Manufacturer.

1.3 - Electrical Connection

must be made strictly according to the wiring diagram supplied with the Product, to its electrical characteristics and in compliance with the applicable standards particularly with reference to human safety.

1.4 - Measuring Inputs and Power Supply

carefully check that the value of input quantities and power supply voltage are proper and within the permissible variation limits.

1.5 - Outputs Loading

must be compatible with their declared performance.

1.6 - Protection Earthing

When earthing is required, carefully check its effectiveness.

1.7 - Setting and Calibration

Carefully check the proper setting of the different functions according to the configuration of the protected system, the safety regulations and the co-ordination with other equipment.

1.8 - Safety Protection

Carefully check that all safety means are correctly mounted, apply proper seals where required and periodically check their integrity.

1.9 - Handling

Notwithstanding the highest practicable protection means used in designing electronic circuits, the electronic components and semiconductor devices mounted on the modules can be seriously damaged by electrostatic voltage discharge which can be experienced when handling the modules.

The damage caused by electrostatic discharge may not be immediately apparent but the design reliability and the long life of the product will have been reduced. The electronic circuits reduced by are completely safe from electrostatic discharge (8 KV IEC 255.22.2) when housed in their case; withdrawing the modules without proper cautions expose them to the risk of damage.

- a. Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.
- b. Handle the module by its front-plate, frame, or edges of the printed circuit board. Avoid touching the electronic components, printed circuit tracks or connectors.
- c. Do not pass the module to any person without first ensuring that you are both at the same electrostatic potential. Shaking hands achieves equipotential.
- d. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as yourself.
- e. Store or transport the module in a conductive bag.

More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 147-OF.

1.10 - Maintenance

Make reference to the instruction manual of the Manufacturer ; maintenance must be carried-out by specially trained people and in strict conformity with the safety regulations.

1.11 - Waste Disposal of Electrical & Electronic Equipment

(Applicable throughout the European Union and other European countries with separate collection program).

This product should not be treated as household waste when you wish dispose of it. Instead, it should be handed over to an applicable collection point for the recycling of electrical and electronic equipment.

By ensuring this product is disposed of correctly, you will help prevent potential negative consequence to the environment and human health, which could otherwise be caused by inappropriate disposal of this product. The recycling of materials will help to conserve natural resource.

2. General Characteristics

Compact draw-out execution for Flush Mounting.

User friendly front face with 2x8 characters LCD Display, four signal Leds, four keys for complete local management and 9-pin socket for local RS232 serial communication.

4 user programmable Output Relays.

12 optoisolated Digital Inputs.

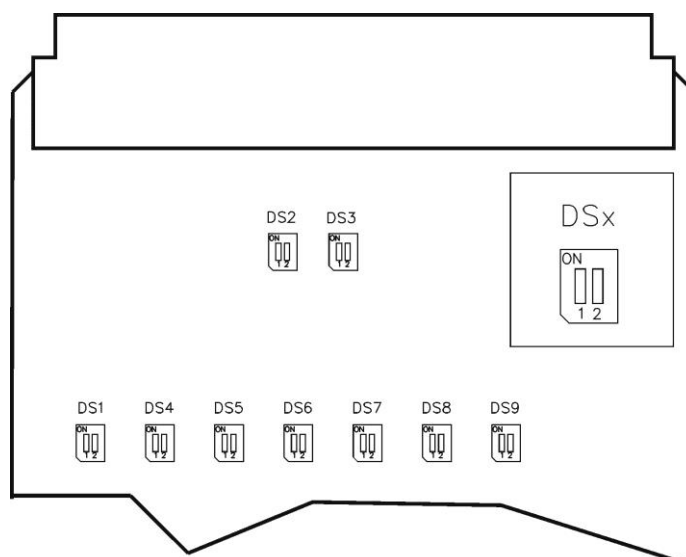
RS485 communication port (independent from the RS232 port on front panel)

The device is made for control IGBT DC/DC switching step up converters.

A PWM (Pulse Width Modulation) output is suitable for controlling IGBT drivers.

The output current can be regulate with high accuracy trough a PID algorithm.

2.1 – Configuration Dip-switch



	1	2	Scale		1	2	Scale		1	2	Scale
DS1 (IN1)	<u>off</u>	<u>off</u>	+/- 18Vcc	DS2 (IN2)	off	off	0.85Vcc	DS3 (IN3)	off	off	0.85Vcc
	off	on	not used		<u>off</u>	<u>on</u>	8.5Vcc		<u>off</u>	<u>on</u>	8.5Vcc
	on	off	not used		on	off	not used		on	off	not used
	on	on	not used		on	on	not used		on	on	not used
DS4 (IN4)	off	off	1.5Vcc	DS5 (IN5)	off	off	30mAcc	DS6 (IN6)	off	off	30mAcc
	<u>off</u>	<u>on</u>	15Vcc		<u>off</u>	<u>on</u>	60mAcc		off	on	60mAcc
	on	off	not used		on	off	20mAcc		<u>on</u>	<u>off</u>	20mAcc
	on	on	not used		on	on	35mAcc		on	on	35mAcc
DS7 (IN7)	off	off	30mAcc	DS8 (IN8)	off	off	1.5Vcc	DS9 (*)	off	off	1.5Vcc
	<u>off</u>	<u>on</u>	60mAcc		<u>off</u>	<u>on</u>	15Vcc		<u>off</u>	<u>on</u>	15Vcc
	on	off	20mAcc		on	off	not used		on	off	not used
	on	on	35mAcc		on	on	not used		on	on	not used

(*) not used

In Bold-underlined the default values

Make electric connection in conformity with the diagram reported on relay's enclosure.

2.2 - Power Supply

The auxiliary power is supplied by a built-in module fully isolated and self protected.

Two options are available:

a) - $\left\{ \begin{array}{l} 24V(-20\%) / 110V(+15\%) \text{ a.c.} \\ 24V(-20\%) / 125V(+20\%) \text{ d.c.} \end{array} \right.$

b) - $\left\{ \begin{array}{l} 80V(-20\%) / 220V(+15\%) \text{ a.c.} \\ 90V(-20\%) / 250V(+20\%) \text{ d.c.} \end{array} \right.$

Before energising the unit check that supply voltage is within the allowed limits.

2.2 - Operation and Algorithms

2.2.1 - Reference Input Values

Display	Description	Setting Range	Step	Unit
BsV 3000 V	Base Voltage	0 - 9999	1	V
BsI 3000 A	Base current	0 - 9999	1	A

Hidden Parameters (reserved for service installation)							
IN1	15	V	Primary nominal value		0 - 9999	1	V
IN1	15	V	Secondary nominal value		0 - 9999	1	V
IN1	0	V	Primary start scale		0 - 9999	1	V
IN1	0	V	Secondary start scale		0 - 9999	1	V
IN1	18	V	DRP Input full scale		0 - 9999	1	V
IN2	3000	A	Primary nominal value	Regulation current Input	0 - 9999	1	A
IN2	4.8	V	Secondary nominal value		0 - 99.99	0.01	V
IN2	0	A	Primary start scale		0 - 9999	1	A
IN2	0	V	Secondary start scale		0 - 9999	1	V
IN2	8.5	V	DRP Input full scale		0 - 99.99	0.01	V
IN3	3000	A	Primary nominal value	Protection current Input	0 - 9999	1	A
IN3	4.8	V	Secondary nominal value		0 - 99.99	0.01	V
IN3	0	A	Primary start scale		0 - 9999	1	A
IN3	0	V	Secondary start scale		0 - 9999	1	V
IN3	8.5	V	DRP Input full scale		0 - 99.99	0.01	V
IN5	1000	V	Primary nominal value		0 - 9999	1	V
IN5	50	mA	Secondary nominal value		0 - 9999	1	mA
IN5	0	V	Primary start scale		0 - 9999	1	V
IN5	0	mA	Secondary start scale		0 - 9999	1	mA
IN5	60	mA	DRP Input full scale		0 - 9999	1	mA
IN6	150	C	Primary nominal value		0 - 9999	1	C
IN6	20	mA	Secondary nominal value		0 - 9999	1	mA
IN6	0	C	Primary start scale		0 - 9999	1	C
IN6	4	mA	Secondary start scale		0 - 9999	1	mA
IN6	20	mA	DRP Input full scale		0 - 9999	1	mA
IN7	1000	V	Primary nominal value		0 - 9999	1	V
IN7	50	mA	Secondary nominal value		0 - 9999	1	mA
IN7	0	V	Primary start scale		0 - 9999	1	V
IN7	0	mA	Secondary start scale		0 - 9999	1	mA
IN7	60	mA	DRP Input full scale		0 - 9999	1	mA
IN8	15	V	Primary nominal value		0 - 9999	1	V
IN8	15	V	Secondary nominal value		0 - 9999	1	V
IN8	0	V	Primary start scale		0 - 9999	1	V
IN8	0	V	Secondary start scale		0 - 9999	1	V
IN8	15	V	DRP Input full scale		0 - 9999	1	V

Example:

For transducer with the following characteristics $(0 \div 1000)V / (4 \div 20)mA$ set :

INx 1000 V	Primary nominal value
INx 20 mA	Secondary nominal value
INx 0 V	Primary start scale
INx 4 mA	Secondary start scale
INx 20 mA	DRP Input full scale (to be set according to dip-switch configuration see § 2.1)

2.2.3 - Functions and Settings (Function)

- "The reference current is expressed in % of the Base current (BsCr), where the Base current is the rated current of the machine.
- "All the protection thresholds are expressed in p.u. (per unit) of the relevant transducer Primary nominal value (In or Vn)

2.2.3.1 - T> - Maximum cooling Temperature

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→ T>	90	C (0.00 ÷ 320) step 1 C
Timers	→ tT>	1	s (0.00 ÷ 100) step 0.01 s

- ☐ **FuncEnab** : If disable the function is deactivated.
- ☐ **T>** : Trip level (Cooling water temperature)
- ☐ **tT>** : Trip time delay

Trip when : The temperature trip level is exceeded for a time tT>

When the function is tripped :

<i>Regulator</i>	=	Is Stopped
<i>Signalization</i>	=	Led "Trip" is illuminated
<i>Last Trip</i>	=	Is recorded

Reset when : Returns in normal condition.

2.2.3.2 - I>> - Overcurrent protection

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→ I>>	0.80	In (0.10 ÷ 1.90) step 0.1 In
Timers	→ tI>>	1	s (0.00 ÷ 100) step 0.01 s

- ☐ **FuncEnab** : If disable the function is deactivated
- ☐ **I>>** : Trip level
- ☐ **tI>>** : Trip time delay

Trip when : The overcurrent trip level is exceeded for time tI>>

When the function is tripped :

<i>Regulator</i>	=	Is Blocked
<i>Signalization</i>	=	Led "Trip" is illuminated
<i>Last Trip</i>	=	Is recorded

Reset when : Returns in normal condition and Reset push-button is pressed

2.2.3.3 - I>>> - Maximum Current

FuncEnab	→	No Param	No Parameters
Options	→ Tds	tdo_10s	Tds (tdo_10s / tdo_20s / tdo_30s) Tds
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

☐ **FuncEnab** : If disable the function is deactivated

☐ **Options** **Tds** Drop-out time delay

Trip when : The threshold exceed the 80% of the full scale of the input lout B"

When the function is tripped :

<i>Regulator</i>	=	Is Blocked
<i>Signalization</i>	=	Led "Trip" is illuminated
<i>Last Trip</i>	=	Is recorded

Reset when : Returns in normal condition and after that "Tds" is expired, reset push-button is pressed

2.2.3.4 - V> – Output Overvoltage element

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→ V>	1.20	Un (0.10 ÷ 1.20) step 0.05 Un
Timers	→ tV>	1	s (0.00 ÷ 100) step 0.1 s

☐ **FuncEnab** : If disable the function is deactivated

☐ **V>** : Trip level

☐ **tV>** : Trip time delay

Trip when : threshold level is exceeded and trip time delay is expired

When the function is tripped :

<i>Regulator</i>	=	Is Blocked
<i>Signalization</i>	=	Led "Trip" is illuminated
<i>Last Trip</i>	=	Is recorded

Reset when : Returns in normal condition and after that "tV>" is expired, reset push-button is pressed

2.2.3.5 - Vb> – Bus Overvoltage

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→ Vb>	1.1	Un (0.80 ÷ 1.20) step 0.05 Un
Timers	→ tVb>	3	s (0.00 ÷ 100) step 0.1 s

☐ **FuncEnab** : If disable the function is deactivated

☐ **Vb>** : Trip level

☐ **tVb>** : Trip time delay

Trip when : threshold level is exceeded and trip time delay is expired

When the function is tripped :

<i>Regulator</i>	=	Is Stopped
<i>Signalization</i>	=	Led "Trip" is illuminated
<i>Last Trip</i>	=	Is recorded

Reset when : Returns in normal condition.

2.2.3.6 – Vb< – Bus Undervoltage

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→ Vb<	0.40	Un (0.40 ÷ 1) step 0.05 Un
Timers	→ tVb<	1	s (0.00 ÷ 100) step 0.1 s

☐ **FuncEnab** : If disable the function is deactivated

☐ **Vb<** : Trip level

☐ **tVb<** : Trip time delay

Trip when : threshold level is exceeded and trip time delay is expired.
Enabled only when regulator is started.

When the function is tripped :

<i>Regulator</i>	=	Is Blocked
<i>Signalization</i>	=	Led "Trip" is illuminated
<i>Last Trip</i>	=	Is recorded

Reset when : Returns in normal condition.

2.2.3.7 – Vaux – Auxiliary Voltage Monitor ON

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

☐ **FuncEnab** : If disable the function is deactivated

The function “Vaux” controls the power supply of the circuits of command of the transducers and the cards of IGBT drivers.

Trip when : *Power Supply “+15Vdc” <13Vdc or
Power Supply “-15Vdc” >-13Vdc*

When the function is tripped : *Regulator = Is Blocked
Signalization = Led “Trip” is illuminated
Last Trip = Is recorded*

Reset when : *Power Supply “+15Vdc” >14Vdc and
Power Supply “-15Vdc” <-14Vdc*

2.2.3.8 – Isc – Short Circuit Current

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→ I>	0.02	In (0.01 ÷ 0.1) step 0.01 In Un (0.01 ÷ 0.1) step 0.01 Un
	→ V<	0.05	
Timers	→ tlsc	0.01	s (0.01 ÷ 10) step 0.01 s

☐ **FuncEnab** : If disable the function is deactivated

☐ **I>** : Current Trip level

☐ **V<** : Voltage Trip level

☐ **tlsc** : Trip time delay

Trip when : The current in output from the regulator exceeds the threshold “I>” **and** the voltage is lower of the threshold “V<”.

When the function is tripped : *Regulator = Is Stopped
Signalization = Led “Trip” is illuminated
Last Trip = Is recorded*

Reset when : Returns in normal condition and Reset push-button is pressed

2.2.3.9 – PID_I – (Current Regulator - Setting)

FuncEnab	→	No Param	No Parameters
Options	→	No Param	No Parameters
TripLev	→ Tr_S	0.1	s (0.00 ÷ 1) step 0.01 s
	→ Tr	1	s (0.00 ÷ 10) step 0.1 s
	→ K_P	0	(0.00 ÷ 300) step 0.01
	→ K_I	1	(0.00 ÷ 300) step 0.01
	→ K_D	0	(0.00 ÷ 300) step 0.01
Timers	→	No Param	No Parameters

- ☐ **Tr_S** : Ramp stop time
- ☐ **Tr** : Reference Ramp Rise/Fall time
- ☐ **K_P** : Proportional gain
- ☐ **K_I** : Integrative gain
- ☐ **K_D** : Derivative gain

Note: the two PID regulators PID_I and PID_V works together in parallel: the outputs of the twos are compared and the minimum value is sent to a PWM controller that drive the IGBTs semiconductors.

2.2.3.10 – PID_V – (Power Regulator - Setting)

FuncEnab	→	No Param	No Parameters
Options	→	No Param	No Parameters
TripLev	→	RIF_V 0	(0.00 ÷ 300) step 0.01 %
	→	VTr_S 0.1	(0.00 ÷ 1) step 0.01 s
	→	VTr 1	(0.00 ÷ 10) step 0.1 s
	→	K_P 0	(0.00 ÷ 300) step 0.01
	→	K_I 1	(0.00 ÷ 300) step 0.01
	→	K_D 0	(0.00 ÷ 300) step 0.01
Timers	→	No Param	No Parameters

☐ **FuncEnab** : If disable the function is disactivated

☐ **RIF_V** : Voltage PID set point.

☐ **Tr_S** : Ramp stop time

☐ **Tr** : Reference Ramp Rise/Fall time

☐ **K_P** : Proportional gain

☐ **K_I** : Integrative gain

☐ **K_D** : Derivative gain

2.2.3.11 - **Test** - (Test)

FuncEnab	→	No Param	No Parameters
Options	→ Tst	Disable	[Disable / Ref. / PWM_Val]
TripLev	→ L_RIF	0.00	% (0.00 ÷ 100) step 1 %
	→ P_PWM	50.00	% (0.00 ÷ 100) step 0.01 %
Timers	→	No Param	No Parameters

- | | |
|---|--|
| <div> <div> <div>□</div> <div> <div>Tst</div> <div>(Test Mode)</div> </div> </div> <div> <div>:</div> <div> <div>Disable</div> <div>Ref</div> <div>PWM_Val</div> </div> </div> </div> | <div> <div>:</div> <div> <div>In this case the “Test” is disabled and apparatus work normally, receiving the signal reference via serial communication from the field.</div> <div>In this case the regulator ignore the reference from the field (serial communication); the value of reference can be adjusted through keyboard of the relay or via serial communication (MCom2) setting the parameter “Ref”.</div> <div>In this case the regulator ignore the reference and the feedback from the field; and regulated and output pulse are generated according to the value of the parameter “PWM_Val”, adjusted through keyboard of the relay or via serial communication (MCom2).</div> </div> </div> |
| <div> <div>□</div> <div> <div>L_RIF</div> </div> </div> | <div> <div>:</div> <div>Current Local reference</div> </div> |
| <div> <div>□</div> <div> <div>P_PWM</div> </div> </div> | <div> <div>:</div> <div>Duty cycle (%PWM)</div> </div> |

2.2.3.12 - Fan - (Fan Control)

FuncEnab	→	No Param	No Parameters
Options	→	No Param	No Parameters
TripLev	→	No Param	No Parameters
Timers	→ tOFF	10	m (1 ÷ 100) step 1 m

☐ **Timers** : **tOFF** Time for turn-off fan after stop command

This function command the start of the FAN (by default on 1.R1 output relay) each time the regulator is started and the stop of the FAN that is delayed of the time “TFOFF” after the regulator is stopped.

The FAN status is controlled via digital input (1.D4 – signalized by led “FAN”).
If after start, this input is not supplied within 5s, the regulator is stopped and signal led “Trip” is illuminated.

Reset when : Reset push-button is pressed

2.2.3.13 - IGBT - (IGBT)

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

☐ **FuncEnab** : If disable the function is deactivated

Not Trip when : *Digital Input 0.D1* = Is supplied with voltage >12Vcc

Trip when : *Digital Input 0.D1* = Is not supplied

When the function is tripped : *Regulator* = Is Blocked
Signalization = Led “Trip” is illuminated
Last Trip = Is recorded

Reset when : *Digital Input 0.D1* = Returns in normal condition.
and Reset push-button is pressed

2.2.3.14 - **Fuse1** - (*Fuse*)

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

- ❑ **FuncEnab** : If disable the function is disactivated

<i>Trip when</i>	: <i>Digital Input 1.D1</i>	=	Is not supplied
<i>When the function is tripped</i>	: <i>Regulator</i>	=	Is Blocked
	: <i>Signalization</i>	=	Led “Alarm” is illuminated
	: <i>Last Trip</i>	=	Is recorded
<i>Reset when</i>	: <i>Digital Input 1.D1</i>	=	Returns in normal condition

2.2.3.14 - **Fuse2** - (*Fuse*)

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

- ❑ **FuncEnab** : If disable the function is disactivated

<i>Trip when</i>	:	<i>Digital Input 1.D2</i>	=	Is not supplied
<i>When the function is tripped</i>	:	<i>Regulator</i>	=	Is Blocked
		<i>Signalization</i>	=	Led "Alarm" is illuminated
		<i>Last Trip</i>	=	Is recorded
<i>Reset when</i>	:	<i>Digital Input 1.D2</i>	=	Returns in normal condition

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

FuncEnab	→	Disable	[Disable / Enable]
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<i>Trip when</i>	:	<i>Digital Input 1.D8</i>	=	Is not supplied
<i>When the function is tripped</i>	:	<i>Regulator</i>	=	Not Stopped
		<i>Signalization</i>	=	Led "Alarm" is illuminated
		<i>Last Trip</i>	=	Is recorded
<i>Reset when</i>	:	<i>Digital Input 1.D8</i>	=	Returns in normal condition.

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

❑ **FuncEnab** : If disable the function is deactivated

<i>Trip when</i>	: <i>Digital Input 1.D6</i>	=	Is not supplied
<i>When the function is tripped</i>	: <i>Regulator</i>	=	Is Stopped
	: <i>Signalization</i>	=	Led “Trip” is illuminated
	: <i>Last Trip</i>	=	Is recorded
<i>Reset when</i>	: <i>Digital Input 1.D6</i>	=	Returns in normal condition.

[illegible]

[illegible]

2.2.3.19 - Oscillo - Oscillographic Recording

FuncEnab	→	Disable	[Disable / Enable]			
Options	→	Trg Disable	[Disable / Start / Trip / Ext.Inp.]			
TripLev	→	No Param	No Parameters			
Timers	→	tPre 5.00	s	(5.00 ÷ 15.00)	step 1	s
	→	tPost 10.00	s	(10.00 ÷ 65.00)	step 0.1	s

- ☐ **FuncEnab** : If disable the function is deactivated
- ☐ **Trg** :
 - Disable* = Function Disable (no recording)
 - Start.* = Trigger on time start of protection functions
 - Trip* = Trigger on trip (time delay end) of protection functions
 - Ext.Inp.* = Trigger when Digital Input 0.D2 (dry contact) is opened
- ☐ **tPre** : Recording time before Trigger
- ☐ **tPost** : Recording time after Trigger

The “Osc” Function includes the wave Form Capture of the output quantities (I, V) and can totally store a record of 70 seconds.

The number of events recorded depends on the duration of each individual recording (tPre + tPost). In any case the number of event stored can not exceed ten (10 x 7 sec).

Any new event beyond the 70 sec capacity of the memory, cancel and overwrites the former records (FIFO Memory).

2.2.3.20 - LoadP – Load Profile

FuncEnab	→	Disable	[Disable / Enable]
Options	→	No Param	No Parameters
TripLev	→	No Param	No Parameters
Timers	→	tLP 1.00 m	(1.00 ÷ 650) step 1 m

- ☐ **FuncEnab** : If disable the function is deactivated
- ☐ **tLP** : Scan time

Every time that comes measured a value of current (> 1%) comes activated with a time of programmable scansion “tLP”, the recording of the load profile.

2.2.4.21 - I.R.F. - Internal Regulator Failure

FuncEnab	→	No Param	No Parameters
Options	→	Opz NoTrip	[NoTrip / Trip]
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

- ☐ **Opz** : The variable “Opz” can be programmed to trip the output relays same as the other protection functions (Opz = TRIP), or to only operate the “IRF” signal led without tripping the output relays (Opz = NoTRIP).

2.2.3.22 - LCD – Display and Buzzer operation

FuncEnab	→	No Param	No Parameters
Options	→	Key BeepOFF	[BeepOFF / BeepON]
	→	BkL Auto	[Auto / On]
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

- ☐ **Key** : Buzzer “Beep” on operation of Keyboard buttons.
- ☐ **BkL** : LCD Backlight continuously “ON” or switched-on Automatically on operation of Keyboard buttons.

2.2.3.23 - Comm – Communication Parameters

FuncEnab	→	No Param	No Parameters
Options	→ LBd	9600	[9600 / 19200 / 38400 / 57600]
	→ RBd	9600	[9600 / 19200]
	→ Mod	8,n,1	[8,n,1 / 8,o,1 / 8,e,1]
	→ RPr	Modbus	[Modbus]
TripLev	→	No Param	No Parameters
Timers	→	No Param	No Parameters

- ☐ **LBd** : Local Baud Rate (Front panel RS232 communication speed)
- ☐ **RBd** : Remote Baud Rate
(Rear panel terminal blocks RS485 communication speed)
- ☐ **Mod** : Remote mode (communication parameters)
Note: Any change of this setting becomes valid at the next power on
- ☐ **RPr** : Remote Protocol

2.2.3.24 – Rstr - (Restart)

FuncEnab	→	Disable	[Disable / Enable]					
Options	→	I>>	NO	[NO / YES]				
	→	V>	NO	[NO / YES]				
	→	Vb>	NO	[NO / YES]				
	→	Vb<	NO	[NO / YES]				
	→	Vax	NO	[NO / YES]				
	→	Isc	NO	[NO / YES]				
	→	T>	NO	[NO / YES]				
	→	I3M	NO	[NO / YES]				
	→	IGB	NO	[NO / YES]				
	→	Nrt	THREE	[ONE / TWO / THREE]				
TripLev	→	No Param	No Parameters					
Timers	→	Tr	1.00	s	(0.10 ÷ 100.00)	step	0.1	s
	→	Tn	2.00	s	(0.10 ÷ 100.00)	step	0.1	s

- ☐ I>> : Restart I>>
 - ☐ V> : Restart V>
 - ☐ Vb> : Restart Vb>
 - ☐ Vb< : Restart Vb<
 - ☐ Vax : Restart Vaux
 - ☐ Isc : Restart Isc
 - ☐ T> : Restart T>
 - ☐ I3M : Restart I>>>
 - ☐ IGB : Restart IGBT
 - ☐ Nrt : Total Restart Number
-
- ☐ Tr : Restart time
 - ☐ Tn : Reclaim time (reset time)

The function “Rstr” (restart) allows the automatic restart of the regulator after that one of selected protection functions trips.

Is possible through the parameter “Nrt”, to set up the number of restart shots after the first trip.

The trip of any programmed functions, starts the timer “Tr” and neutralization time “Tn”, at the end of the time “Tr” the regulator is restarted.

If after a restart, during the time “Tn”, one of the programmed functions is trips, it restart the described sequence for a number of times programmed by the parameter “Nrt”.

If Tn expire the next restart will be count as the first.

2.2.3.25 – **OpMod** – Operation Mode - Hidden Parameters (reserved for service installation)

Timers → **AvNo** 5 (0 ÷ 10) step 1

□ **AvNo** : Average Numbers

3. Output Relays

Four user programmable Output Relays are normally available 1.R1, 1.R2, 1.R3, 1.R4. Each of them can be programmed (see § RelayCfg) to be controlled by any element (instantaneous or time delayed) of any of the Regulator Functions including Internal Regulator Fault. Moreover, the operation of each of the output relays can be programmed to be either Normally Deenergized (energized on tripping of the controlling Functional Element) or Normally Energized (Deenergized on tripping of the controlling Functional Element).

1.R1	Output Relay "R1"	(terminals 288 289 287)	Fan command
1.R2	Output Relay "R2"	(terminals 278 279 277)	
1.R3	Output Relay "R3"	(terminals 268 269 267)	Protection Trip
1.R4	Output Relay "R4"	(terminals 258 259 257)	Regulator in start mode

4. Digital Input

The firmware can manage up to 12 digital inputs and 4 output relays; among these, 2 digital inputs are available on the main regulator module, the remaining are available on additional expansion (UX10-4) modules controlled via the CAN-Bus communication channel.

Available in the Regulator (Board 1)

0.D1	Digital Input "D1"	(terminals 177 - 179)	It is used for Fault IGBT (+24V)
0.D2	Digital Input "D2"	(terminals 177 - 178)	It is usable as Oscillographic Recording (dry contact).

Available in the Expansion Module (UX10-4 – Board 2)

1.D1	Digital Input "D1"	(terminals 252 – 262)	Fuse 1	(+24V)	By the interface program "FriemCom" it is possible to Activate/Deactivate the functions.
1.D2	Digital Input "D2"	(terminals 253 – 263)	Fuse 2	(+24V)	
1.D3	Digital Input "D3"	(terminals 254 – 264)	ThL2	(+24V)	
1.D4	Digital Input "D4"	(terminals 255 – 265)	Fan	(+24V)	
1.D5	Digital Input "D5"	(terminals 256 – 266)	ThL1 (inductance)	(+24V)	
1.D6	Digital Input "D6"	(terminals 272 – 282)	ThT (transformer)	(+24V)	
1.D7	Digital Input "D7"	(terminals 273 – 283)	ThH (heatsink)	(+24V)	
1.D8	Digital Input "D8"	(terminals 274 – 284)	PhSeq	(+24V)	
1.D9	Digital Input "D9"	(terminals 275 – 285)	Start / Stop	(+24V)	
1.D10	Digital Input "D10"	(terminals 276 – 286)	BBg	(+24V)	

Note: +24V = external supply Digital Inputs.

5. Self-diagnostic

The regulator incorporates a sophisticated self-diagnostic feature that continuously checks the following elements:

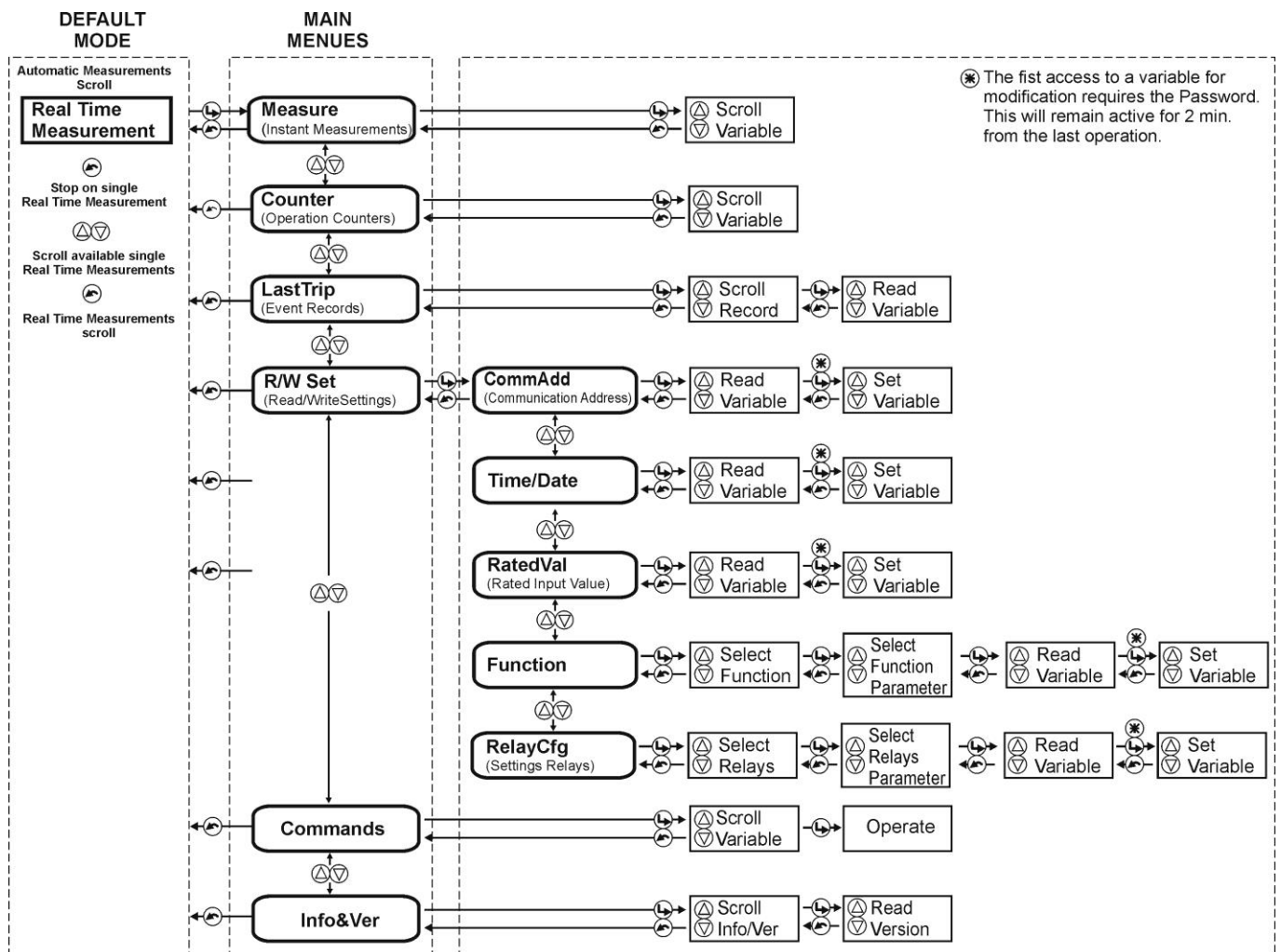
- A/D conversion
- Checksum of the settings stored into E²Prom.
- DSP general operation (Power, Routines, etc.)
- Lamp test (only on manual test).
- I/O board supervision (CANBus)

Any time Power is switched on, a complete test is run; then, during normal operation, the test runs continuously and the checksum is done any time a parameter is stored into E²Prom.

If during the test any Internal Regulator Failure (I.R.F) is detected:

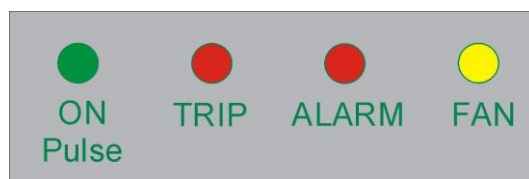
- If “ I.R.F. “ is programmed to “ Trip “, the programmed output relays are operated same as on tripping of any protection function operation, is stored in the “ Last Trip “ and the signal led “ON PULSE “ is switched off , and the regulator is blocked.
- If “ I.R.F. “ is programmed to “NO Trip”, the signal led “ON PULSE “ is switched off.

The regulator can be totally managed locally, either by the RS232 communication port or by the 4 key buttons and the LCD display, or remotely via the communication bus RS485 connected to the rear terminal blocks. The 2 line x 8 characters LCD display shows the available information. Key buttons operate according to the flow-chart herebelow.



7. Signalizations

Four signal leds are available on the Front Face Panel:



a)	Green LED	ON Pulse	☐ Off	: Internal Fault
			☐ Flashing	: When regulator is active.
			☐ Illuminated	: When regulator is stopped.
b)	Red LED	TRIP	☐ Off	: Normal status
			☐ Flashing	: When a timed function starts to operate.
			☐ Illuminated	: When any protection function trips. (Blocking or Stopping the regulator).
b)	Red LED	ALARM	☐ Off	: Normal status.
			☐ Flashing	: -----
			☐ Illuminated	: When external Alarm is activated (not blocking the regulator).
d)	Yellow LED	FAN	☐ Off	: When Fan is not running
			☐ Flashing	: -----
			☐ Illuminated	: When Fan is running.

8. Keyboard

	Enter	Give access to any menu or convalidate any programming changement.
	Reset	Return from the actual selected menu to the former menu.
	Select +	Scrolls variables available in the different menus or increases/decreases setting values.
	Select -	

9. Serial Communication Port

9.1 - Main RS485 Serial Communication Port

This port is accessible via the terminals 152 – 153 – 162 provided on the relay terminal board. It is used for connection to a serial bus interfacing up to 31 units with the Central Supervision System (SCADA, DCS, ecc).

The serial bus is a shielded pair of twisted cables connecting in parallel (Multi Drop) the different units (slaves) by the relevant terminals.

The physical link is RS485 and the Communication Protocol is MODBUS/RTU

The configuration of transmission parameters is selectable.

☐ Baud Rate	: 9600/19200 bps	9600/19200 bps	9600/19200 bps
☐ Start bit	: 1	1	1
☐ Data bit	: 8	8	8
☐ Parity	: None	Odd	Even
☐ Stop bit	: 1	1	1

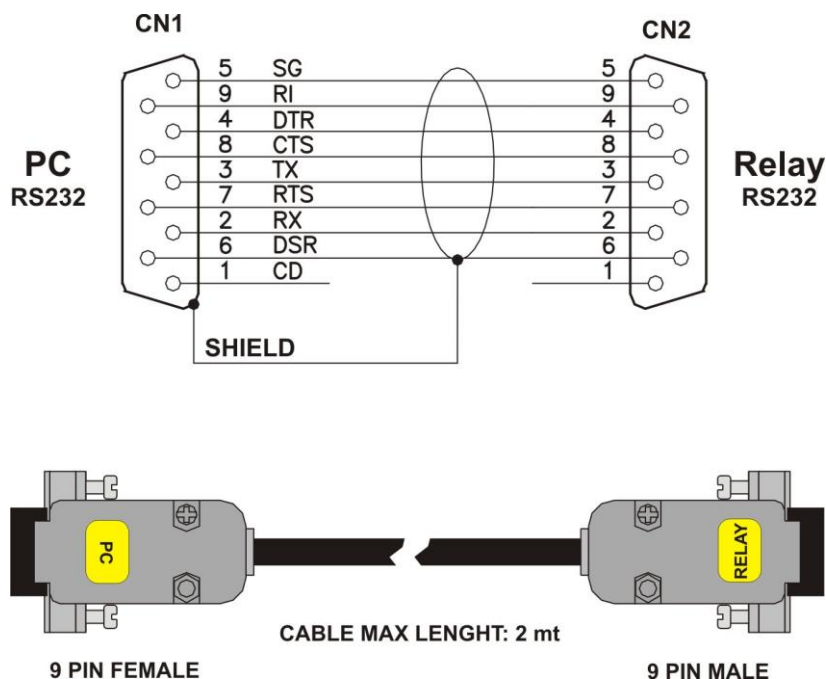
Note: any change of this setting becomes valid at the next power on.

Each relay is identified by its programmable address code (NodeAd) and can be called from the P.C. A dedicated communication software (FriemCom) for windows 95/98/NT4 SP3 (or later) is available. Please refer to the FriemCom instruction manual for more information. Maximum length of the serial bus can be up to 200m.

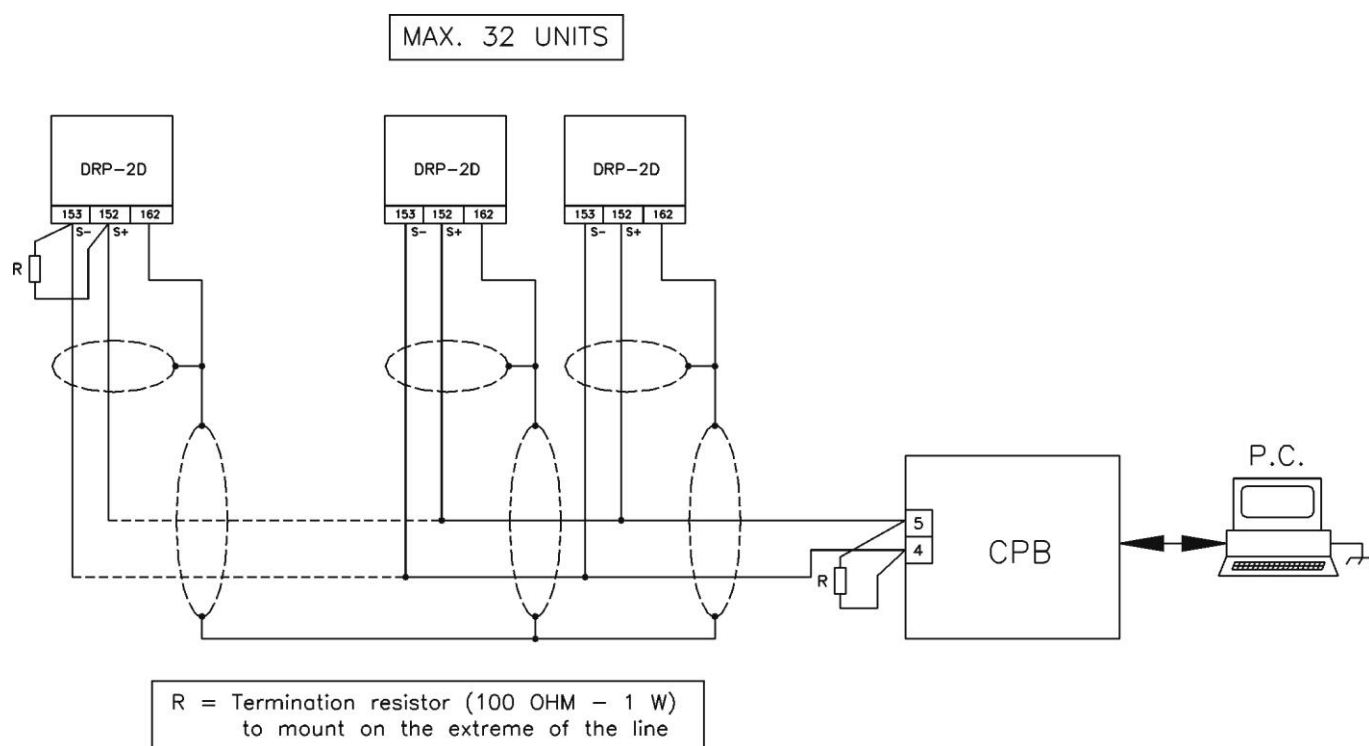
9.2 - Communication Port on Front Face Panel

This port is used for communication through the Front Face Panel between a local Lap-top PC.

The physical link is RS232 by the standard female 9-pin D-sub connector available on the Front Face Panel. Via this Port complete Relay management and data acquisition is possible.



9.3 – Termination resistor



10. Menu and Variables

10.1 - Real Time Measurements

Scrolling display of the Real Time Measurements is the Default operation.

Scrolling can be stopped at any of the measurements and restarted by pressing the Reset button .

When stopped on one variable, * appears aside the measurement and the different available measurements can be selected by the   buttons.

Display			Description
Irg	= 0 – 65535	A	Regulation current
Irp	= 0 – 65535	A	Protection current
V	= 0 – 65535	V	Voltage generated
T	= 0 – 65535	C	Temperature (cooling water temperature)
Vb	= 0 – 65535	V	Input voltage
Rif	= 0 – 65535	%	Current regulation set point
Pwr	= 0 – 65535	kW	Power generated

10.2 - Measure (Instantaneous Measurements)

Real time measurements can be frozen at any moment selecting the menu “ Instant Measure “:

- “ Real Time Meas “ 
- “ Meas “ 
- “ 1st Measurement   other measurements
-  to go back to “ Meas “

Display			Description
Irg	= 0 – 65535	A	Current regulation
Irp	= 0 – 65535	A	Current protection
V	= 0 – 65535	V	Voltage generated
T	= 0 – 65535	C	Temperature (cooling water temperature)
Vb	= 0 – 65535	V	Input voltage
Rif	= 0 – 65535	%	Regulation set point
Pwr	= 0 – 65535	kW	Power generated

10.3 - Counter (Operation Counters)

The operation of any of the function herebelow reported, is counted and recorded in the menu “Counters “.

- “ Real Time Meas “ 
- “Counter “ 
- “ 1st counters  other counters
-  to go back to “Counter “

Display			Description
T>	=	0 – 65535	Number of High Temperature
I>>	=	0 – 65535	Number of Overcurrent protection element
I>>>	=	0 – 65535	Number of Maximum current IGBT
V>	=	0 – 65535	Number of Overvoltage element
Vb>	=	0 – 65535	Number of Bus Overvoltage
Vb<	=	0 – 65535	Number of Bus Undervoltage
Fan	=	0 – 65535	Number of Fan fault
Vax	=	0 – 65535	Number of Voltage ON
Isc	=	0 – 65535	Number of Short circuit current
ThL1	=	0 – 65535	Number of inductance 1 fault
ThL2	=	0 – 65535	Number of inductance 2 fault
IGBT	=	0 – 65535	Number of IGBT fault
ThT	=	0 – 65535	Number of transformer fault
ThH	=	0 – 65535	Number of heatsink fault
Fus1	=	0 – 65535	Number of Fuse 1 fault
Fus2	=	0 – 65535	Number of Fuse 2 fault
PhS	=	0 – 65535	Number of Phase Sequence
BBg	=	0 – 65535	Number of BusBar to Ground
IRF	=	0 – 65535	Number of Internal Regulator Faults
HR	=	0 – 65535	Number of HW recovery operations
Rstr	=	0 – 65535	Number of Restart

10.4 - LastTrip (Event Recording)

The regulator records any tripping and stores the information relevant to the last 20 tripping of protection functions (FIFO).

Each event recording includes the following information.

- " Real Time Meas "
- " LastTrip "
- 1st event,
- to scroll available events,
- to " Rec # " selected,
- to select the different fields;

Display	Description
Func xxxxx	Indication of the protection function which caused the relay tripping. For indication of the TRIP Cause the following acronyms are used:
	- T> = Maximum cooling temperature - I>> = Overcurrent protection level - I>>> = Maximum current IGBT - V> = Output overvoltage element - Vb> = Bus overvoltage - Vb< = Bus undervoltage - Vaux = Auxiliary voltage monitor ON - Isc = Short circuit current - Fan = Fan - IGBT = IGBT - Fus1 = Fuse 1 - Fus2 = Fuse 2 - ThT = transformer - ThH = Heatsink - ThL1 = Inductance 1 - ThL2 = Inductance 2 - IRF = Internal Regulator fault
Date : YYYY/MM/GG	Date: Year/Month/Day
Time : hh:mm:ss:cc	Time: hours/minutes/second/hundredths of seconds
V = 0 – 65535 V	Voltage generated
Vb = 0 – 65535 V	Input Voltage
T = 0 – 65535 C	Temperature (cooling water temperature)
Rif = 0 – 65535 %	Reference

- to go back to " Rec # " ,
- to go back to " Real Time Meas " .

10.5 - R/W Set (Programming / Reading the Relay Settings)

-  " Main Menu "
-  select " Function "
-  select among following sub menus:

10.5.1 - CommAdd (Communication Address)

-  " Common "
-  " Add: # "
-  " Password ???? " (if not yet entered; see § Password)
-  to select the Address (1-250)
-  to validate. Set Done!

The default address is 1.

Display	Description	Setting Range	Step	Unit
Add: 1	Identification number for connection on serial communication bus	1 - 250	1	-

10.5.2 - Time/Date (Time/Date)

-  " Time/Date "  Date: Current Date, Time: Current time
-  " YY/..... "  to set year,
-  " XX/MM "  to set month,
-  " XX/XX/DD "  to set day,
-  " XX/XX/XX "  " hh/mm "  to set hour,
-  " XX/mm "  to set minutes,
-  To validate Set Done!
-  Exit

10.5.3 - RatedVal (Rated Input Values)

-  "RatedVal "
-  1st Variable
-  to scroll variables
-  to modify selected variable
- " Password ???? " (if not yet entered) or #??? (if not yet entered; see § Password)
-  to set variable value,
-  to validate. Set Done!

Display	Description	Setting Range	Step	Unit
BsV 3000 V	Base Voltage	0 - 9999	1	V
BsI 3000 A	Base current	0 - 9999	1	A

10.5.4 - Function (Functions)

- “Function “,
 - 1st function,
 - to scroll available Functions,
 - to Read/Write setting of the selected function,
 - to select the different definable fields
 - to access the selected field and read the actual setting of the relevant variable
 - to modify the actual setting;
 - to set the new value.
 - to validate.
- Set Done!

- FuncEnab

- Options

- TripLev

- Timers

Display						Description	Setting Range	Step
Function	Type		Variable	Default Setting	Unit			
Password = 0000-9999 1111 -						Password for programming enable (see § Password)		
T>	FuncEnab	→	Disable			If disable the function is deactivated	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	T>	90.00	C	Trip level (Cooling water temperature)	0.00 – 320.00	1
	Timers	→	tt>	1.00	s	Trip time delay	0.00 – 100.00	0.01
I>>	FuncEnab	→	Disable			If disable the function is deactivated	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	I>>	0.80	In	Trip level	0.10 – 1.50	0.1
	Timers	→	tl>>	1.00	s	Trip time delay	0.00 – 100.00	0.01
I>>>	FuncEnab	→	Enable			If disable the function is deactivated	Disable/Enable	-
	Options	→	TdS	tdo_10s	Tds	Drop-out time delay	tdo_10s / tdo_20s / tdo_30s /	-
	TripLev	→	No Param			No Parameters		
	Timers	→	No Param			No Parameters		
V>	FuncEnab	→	Disable			If disable the function is deactivated	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	V>	1.20	Un	Trip level	0.10 - 1.20	0.05
	Timers	→	tV>	1.00	s	Trip time delay	0.00 – 100	0.1
Vb>	FuncEnab	→	Disable			If disable the function is deactivated	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	Vb>	1.10	Un	Trip level	0.80 - 1.20	0.05
	Timers	→	tVb>	3.00	s	Trip time delay	0.00 – 100	0.1
Vb<	FuncEnab	→	Disable			If disable the function is deactivated	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	Vb<	0.40	Un	Trip level	0.40 - 1.00	0.05
	Timers	→	tVb<	1.00	s	Trip time delay	0.00 – 100	0.1
Vaux	FuncEnab	→	Disable			If disable the function is deactivated	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	No Param			No Parameters		
	Timers	→	No Param			No Parameters		
Isc	FuncEnab	→	Disable			If disable the function is deactivated	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	I>	0.02	In	Current trip level	0.01 – 0.10	0.01
			V<	0.05	Un	Voltage trip level	0.01 – 0.10	0.01
	Timers	→	tlsc	0.01	s	Trip time delay	0.01 – 10.00	0.01

Function	Display				Description	Setting Range	Step
	Type	Variable	Default Setting	Unit			
PID_I	FuncEnab	→	No Param		No Parameters		
	Options	→	No Param		No Parameters		
	TripLev	→	Tr_S	1.00	s	Fall time current reference	0.00 – 1.00
			Tr	0.00	s	Rise time current reference	0.00 – 10.00
			K_P	0.00	-	Proportional gain	0.00 – 200.00
			K_I	1.00	-	Integrative gain	0.00 – 99.99
			K_D	0.00	-	Derivative Gain	0.00 – 99.99
	Timers	→	No Param		No Parameters		
PID_V	FuncEnab	→	No Param		No Parameters		
	Options	→	No Param		No Parameters		
	TripLev	→	RIF_V	0	-	Voltage PID set point	0 – 300
			VTr_S	0.1	s	Ramp stop time	0 – 1
			VTr	1	s	Reference ramp Rise/Fall time	0 – 10
			K_P	0	-	Proportional gain	0 – 300
			K_I	1	-	Integrative gain	0 – 300
			K_D	0	-	Derivative Gain	0 – 300
	Timers	→	No Param		Over-power limitation time delay	0.50 – 2	0.1
Test	FuncEnab	→	No Param		No Parameters		
	Options	→	Tst	Disable		Test Mode	Disab/Rif/PWM_Val
	TripLev	→	L Rif	0.00	%	Current local reference	0.00 – 100.00
			P_PWM	50.00	%	Duty cycle (% PWM)	0.00 – 100.00
	Timers	→	No Param		No Parameters		
Fan	FuncEnab	→	No Param		No Parameters		
	Options	→	No Param		No Parameters		
	TripLev	→	No Param		No Parameters		
	Timers	→	tOFF	1.00	m	Trip time delay	1.00 – 100.00
IGBT	FuncEnab	→	Disable		If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param		No Parameters		
	TripLev	→	No Param		No Parameters		
	Timers	→	No Param		No Parameters		
Fuse1	FuncEnab	→	Disable		If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param		No Parameters		
	TripLev	→	No Param		No Parameters		
	Timers	→	No Param		No Parameters		
Fuse2	FuncEnab	→	Disable		If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param		No Parameters		
	TripLev	→	No Param		No Parameters		
	Timers	→	No Param		No Parameters		
Pseq	FuncEnab	→	Disable		If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param		No Parameters		
	TripLev	→	No Param		No Parameters		
	Timers	→	No Param		No Parameters		
ThT	FuncEnab	→	Disable		If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param		No Parameters		
	TripLev	→	No Param		No Parameters		
	Timers	→	No Param		No Parameters		
ThH	FuncEnab	→	Disable		If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param		No Parameters		
	TripLev	→	No Param		No Parameters		
	Timers	→	No Param		No Parameters		
ThL1	FuncEnab	→	Disable		If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param		No Parameters		
	TripLev	→	No Param		No Parameters		
	Timers	→	No Param		No Parameters		
ThL2	FuncEnab	→	Disable		If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param		No Parameters		
	TripLev	→	No Param		No Parameters		
	Timers	→	No Param		No Parameters		

BBg	FuncEnab	→	Disable			If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	No Param			No Parameters		
	Timers	→	No Param			No Parameters		
Oscillo	FuncEnab	→	Disable			If disable the function is disactivated	Disable/Enable	-
	Options	→	Trg	Disable		Select command for Trigger (start recording):	Disable / Start Trip / Ext.Imp.	-
	TripLev	→	No Param			No Parameters		
	Timers	→	tPre	5.00	s	Recording time before Trigger	5.00 – 15.00	1
		→	tPost	10.00	s	Recording time after Trigger	10.00 – 65.00	0.1
LoadP	FuncEnab	→	Disable			If disable the function is disactivated	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	No Param			No Parameters		
	Timers	→	tLP	1.00	m	Tempo di scansione	1.00 – 650	1
IRF	FuncEnab	→	Disable			If disable the function is disactivated	Disable/Enable	-
	Options	→	Opz	NoTrip		Internal Failure Trip=Trip; NoTrip=No Trip	Trip-NoTrip	-
	TripLev	→	No Param			No Parameters		
	Timers	→	No Param			No Parameters		
LCD	FuncEnab	→	No Param			No Parameters		
	Options	→	Key	BeepOFF		Buzzer “Beep” on operation of Keyboard buttons.	BeepON-BeepOFF	-
		→	BkL	Auto		LCD Backlight continuously “ON” or switched-on Automatically on operation of Keyboard buttons.	Auto - On	-
	TripLev	→	No Param			No Parameters		
	Timers	→	No Param			No Parameters		
Comm	FuncEnab	→	No Parameters					
	Options	→	LBd	9600		Local Baud Rate (Front panel RS232 communication speed)	9600 - 19200 38400 - 57600	-
		→	RBd	9600		Remote Baud Rate (Rear panel terminal blocks RS485 communication speed)	9600 - 19200	-
		→	Mod	8,n,1		Remote mode (communication parameters) <i>Note: any change of this setting became valid at the next power on</i>	8,n,1 8,o,1 8,e,1	-
		→	Rpr	Modbus		Remote Protocol	Modbus	-
	TripLev	→	No Param			No Parameters		
	Timers	→	No Param			No Parameters		
Rstr	FuncEnab	→	Disable			If disable the function is disactivated	Disable/Enable	-
	Options	→	I>>	NO		Restart I>>	[NO / YES]	-
		→	V>	NO		Restart V>	[NO / YES]	-
		→	Vb>	NO		Restart Vb>	[NO / YES]	-
		→	Vb<	NO		Restart Vb<	[NO / YES]	-
		→	Vax	NO		Restart Vax	[NO / YES]	-
		→	Isc	NO		Restart Isc	[NO / YES]	-
		→	T>	NO		Restart T>	[NO / YES]	-
		→	I3M	NO		Restart I>>>	[NO / YES]	-
		→	IGB	NO		Restart IGBT	[NO / YES]	-
	→	Nrt	3		Total Restart Number	[ONE / TWO / THREE]	-	
	TripLev	→	No Param			No Parameters		
	Timers	→	Tr	1.00	s	Reclaim time	0.10 – 100.00	0.1
		→	Tn	2.00	s	Restart time	0.10 – 100.00	0.1

Settings can also be programmed via the serial communication ports.

10.6 - RelayCfg (Relay Configuration)

To associate one of the Output Relays to one or more functions (see § Password): enter the menu “R/W Set”, select “Relay Cfg”, select the “Relay #” to be programmed, select “Link”; at this stage the list of the available functions is displayed. Scrolling the list by the “+” and “-” keys the function is selected and then assigned by the key “Enter”. The assignation is confirmed by the function indication that switches from blinking to steady.

Any of the Output Relays can be programmed to work in two different modes:

- ☐ **N.D.** Normally Deenergized Relay is energized on trip of the associated functions
- ☐ **N.E.** Normally Energized Relay is deenergized on trip of the associated functions

Programming of working mode is made as above selecting “OpMode” instead of “Link”.

Relay	Display			Description	Setting Range	Step
	Type		Default Value			
1.R1	Link	→	Fan_comm	Association of functions to output relay R1	See Tab 1	-
	OpMode	→	N.D.	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-
1.R2	Link	→		Association of functions to output relay R2	See Tab 1	-
	OpMode	→	N.D.	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-
1.R3	Link	→		Association of functions to output relay R2	See Tab 1	-
	OpMode	→	N.D.	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-
1.R4	Link	→		Association of functions to output relay R3	See Tab 1	-
	OpMode	→	N.D.	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-

Table 1

T>	Start – Maximum cooling temperature	(instantaneous)
tT>	Trip – Maximum cooling temperature	(time delayed)
I>>	Start – Overcurrent protection level	(instantaneous)
tI>>	Trip – Overcurrent protection level	(time delayed)
I>>>	Start – Maximum current IGBT	(instantaneous)
tI>>>_Lock	Trip – Maximum current IGBT	(time delayed)
V>	Start – Output overvoltage element	(instantaneous)
tV>	Trip – Output overvoltage element	(time delayed)
IV=0	Current/Voltage = 0	
Vb>	Start – Bus Overvoltage	(instantaneous)
tVb>	Trip – Bus Overvoltage	(time delayed)
Vb<	Start – Bus Undervoltage	(instantaneous)
tVb<	Trip – Bus Undervoltage	(time delayed)
Vaux	Auxiliary voltage monitor ON	(instantaneous)
Isc	Start – Short circuit current	(time delayed)
tIsc	Trip – Short circuit current	
Test	Test	
Fan_comm	FAN command	
IGBT	IGBT - Fault	
IRF	Internal Failure	
HwRecov	Hardware Recovery	
Ron	Regulator ON	
Fan_on	FAN Running	
ThL1	Coil 1 - Fault	
ThL2	Coil 2 - Fault	
ThH	Heatsink - Fault	
ThT	Transformer - Fault	
PhSeq	Phase Sequence - Fault	
Fuse1	Fuse 1 - Fault	
Fuse2	Fuse 2 - Fault	
BBg	BusBar to Ground - Fault	
ALM	Generic input Alarm	
Trip	Generic Trip	
Start/Stop	Start / Stop	
CanStatus	Can Status	
Restart	Restart	

10.7 - Commands

-  " Commands "
-  1st Control,
-  to select other available control,
-  to operate selected control.

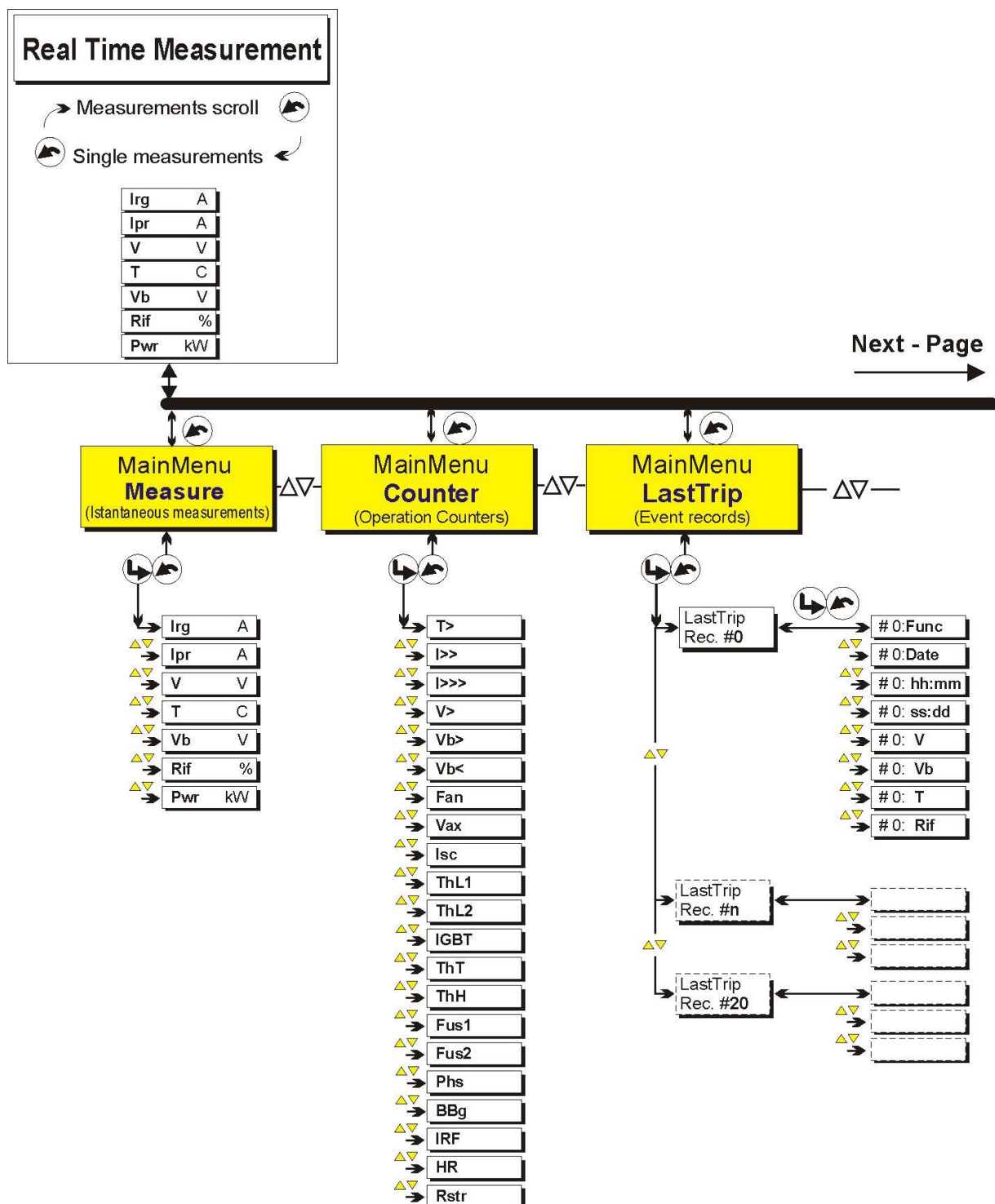
Display	Description
Clear	: Erase memory of Trip Counters, Event Records.
Test	: Starts a relay diagnostic test
Reset	: Reset after trip
Stop	: Stop regulation
Start	: Start regulation (only when start digital input 1.D4 is supplied)

10.8 - Info&Ver

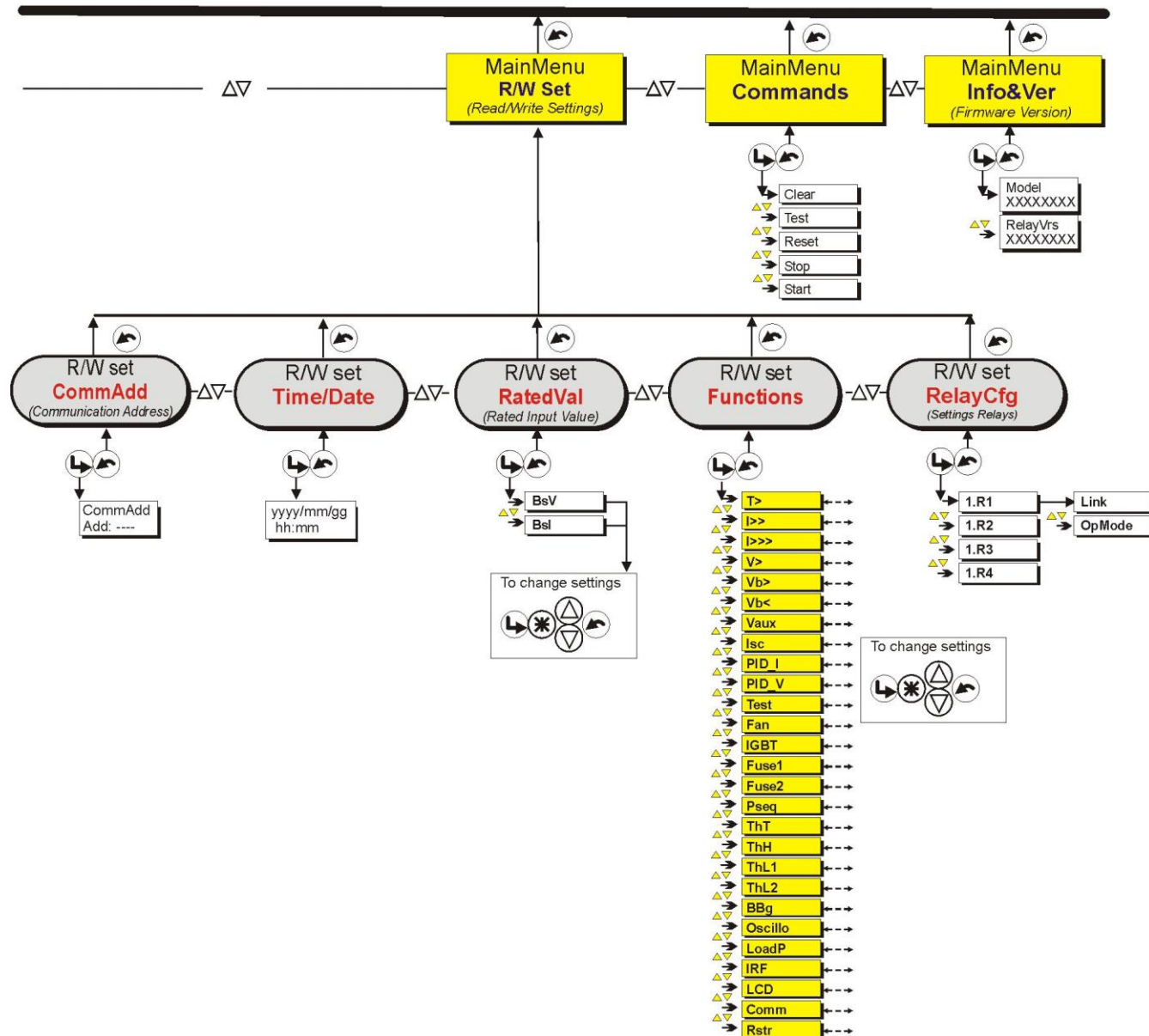
The menu displays the Relay Model and the Firmware Version

- " **Real Time Meas** " 
-  " Info/Ver ",
-  " Model XXXXXX ", Model Relay
-  " RelayVrs ###.#.#X ", Firmware Version
-  to go back to " Info&Ver ".
-  to go back to " **Real Time Meas** "

11. Keyboard Operational Diagram



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12. Password

This password is requested anytime the user wants to write in the “Settings” menu a command of the “Commands” menu.

The default password is “ 1111 “

When password is required, proceed as follows

The Display shows the message “ Password ???? “

- | | | | | |
|---|---|---------------------------------------|---|------------------------|
| - |  | to select 1 st digit (1-9) |  | to validate |
| - |  | to select 2 nd digit (1-9) |  | to validate |
| - |  | to select 3 rd digit (1-9) |  | to validate |
| - |  | to select 4 th digit (1-9) |  | to complete procedure. |

The “ password “ is required any time you attempt to modify one of the programmable variables at the first entrance in the “Settings” and/or “Commands” menus.

The “ password “remains valid for 2 minutes from the last operation of the programming buttons or until the  button is pressed to return to the default display (Real time Measure).

Once the Password has been entered, a “ # “ appears before the variable that can be modified.

12.1 - MS-Com Password

This password is requested anytime the user wants to send to the relay a setting parameters modification or to issue a command through the relay itself using the managing software MSCom.

The user can decide whether inserting his own password (see MS-Com Operational Manual) or keeping the password disabled just clicking on the OK button when the password is requested.

13. Maintenance

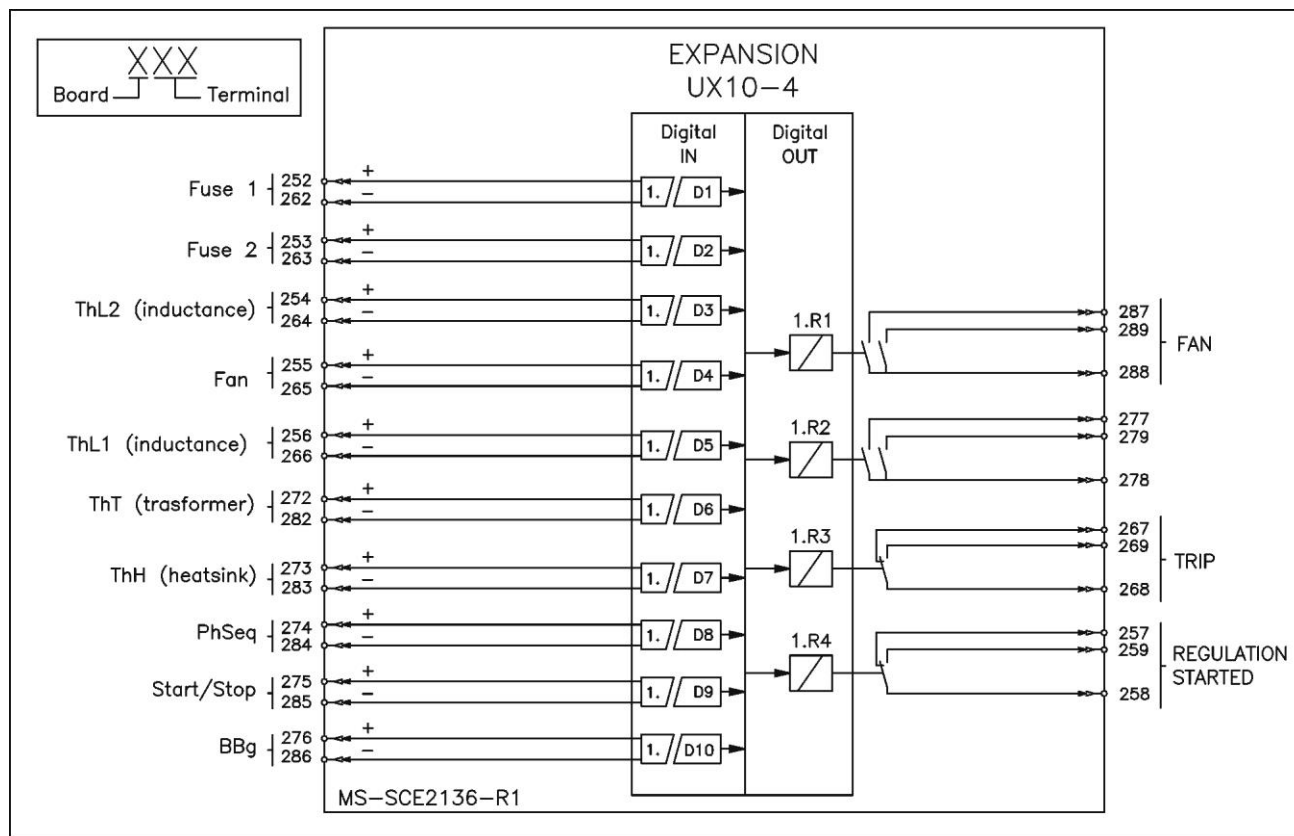
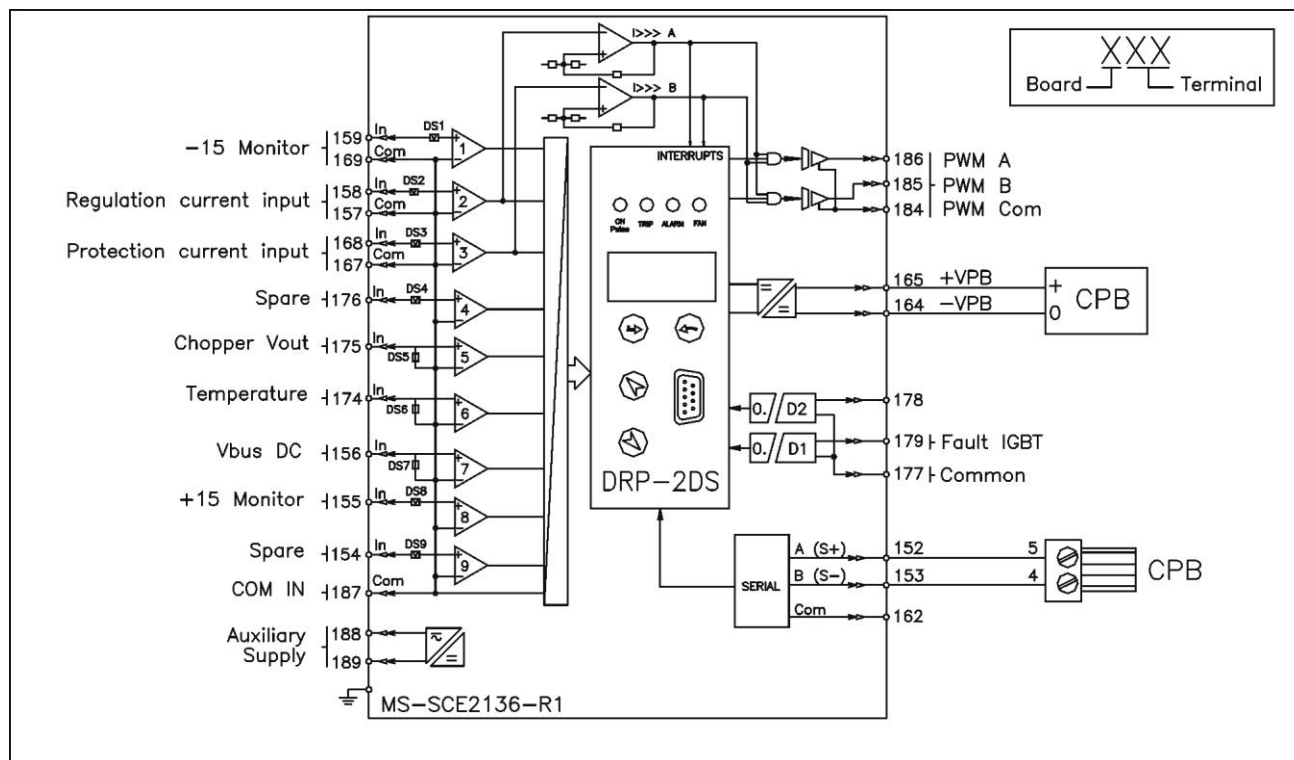
No maintenance is required. In case of malfunctioning please contact FRIEM Service or the local Authorised Dealer mentioning the relay's Serial No reported in the label on relays enclosure.

14. Power Frequency Insulation Test

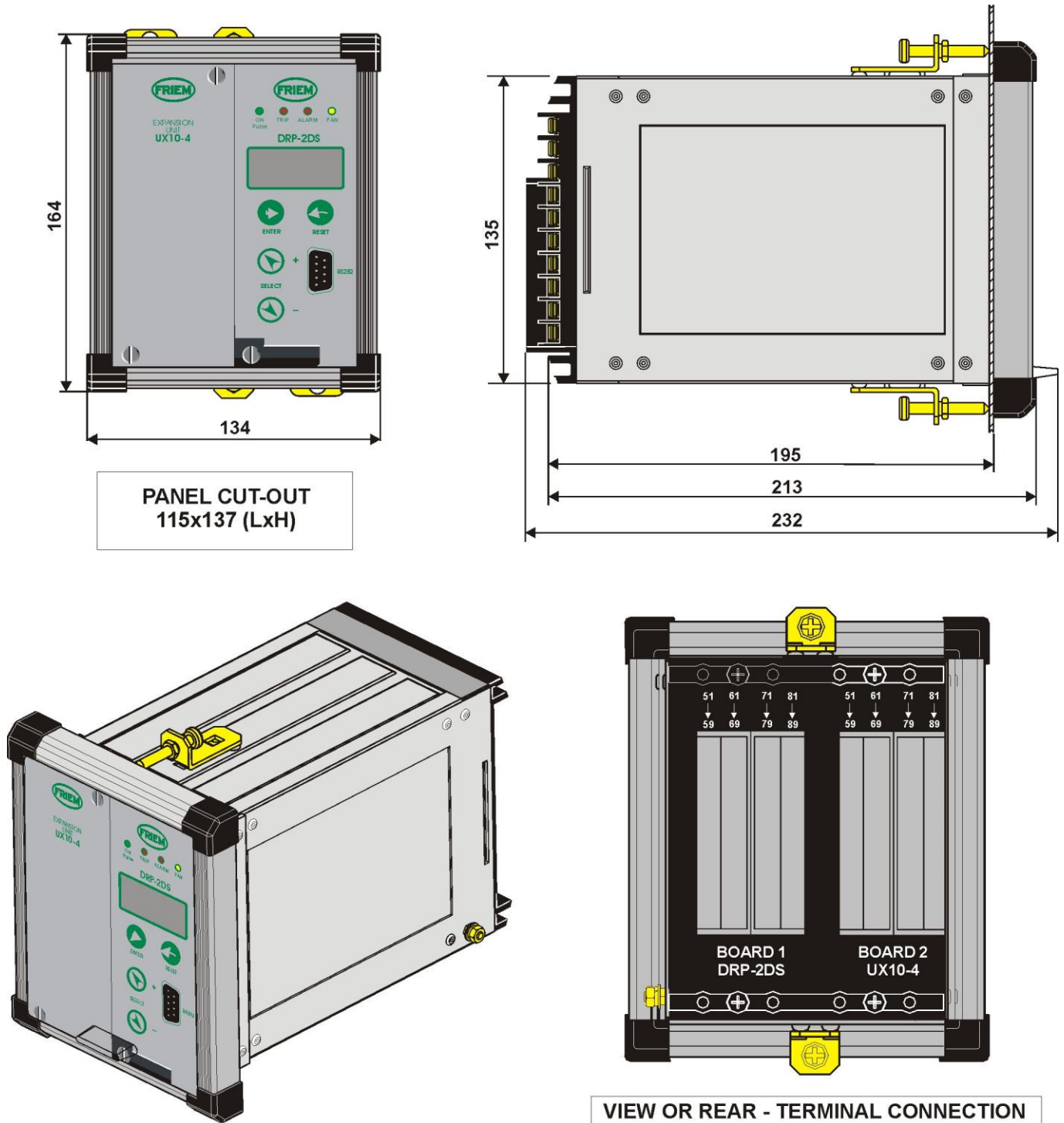
Every relay individually undergoes a factory insulation test according to IEC255-5 standard at 2 kV, 50 Hz 1min. Insulation test should not be repeated as it unusefully stresses the dielectrics.

When doing the insulation test, the terminals relevant to serial output, digital inputs and RTD input must always be short circuited to ground. When relays are mounted in switchboards or relay boards that have to undergo the insulation tests, the relay should be isolated. This is extremely important as discharges eventually tacking place in other parts or components of the board can severely damage the relays or cause damages not immediately evident to the electronic components.

15. Wiring Diagram



16. Overall Dimensions (mm)



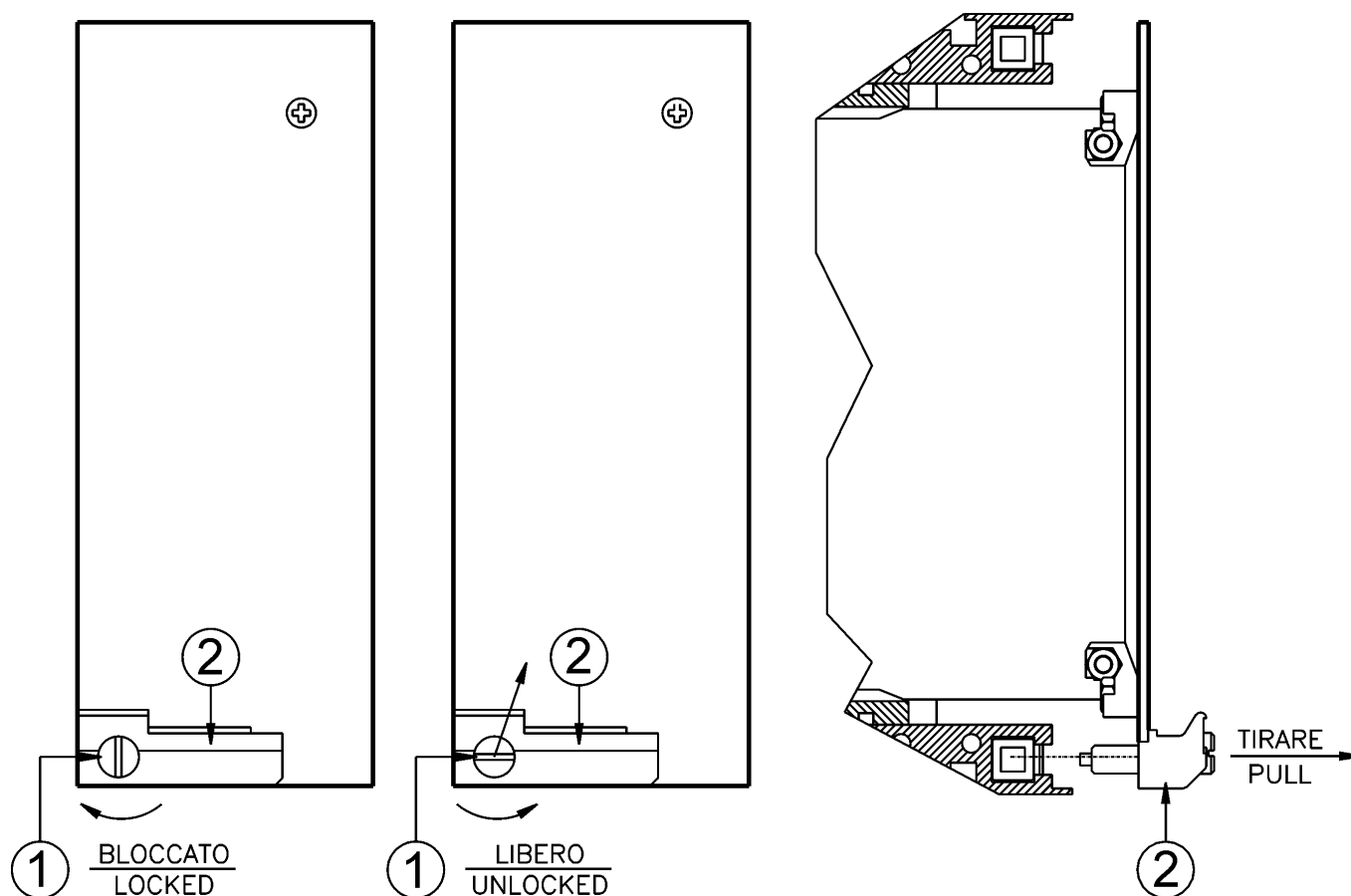
17. Direction for Pcb's Draw-Out and Plug-In

17.1 - Draw-Out

Rotate clockwise the screws ① in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ②

17.2 - Plug-In

Rotate clockwise the screws ① in the horizontal position of the screws-driver mark.
Slide-in the card on the rails provided inside the enclosure.
Plug-in the card completely and by pressing the handle to the closed position.
Rotate anticlockwise the screws ① with the mark in the vertical position (locked).



18. Electrical Characteristics

APPROVAL: CE - REFERENCE STANDARDS IEC 60255 - EN50263 - CE Directive - EN/IEC61000 - IEEE C37

☐ Dielectric test voltage	IEC 60255-5	2kV, 50/60Hz, 1 min.
☐ Impulse test voltage	IEC 60255-5	5kV (c.m.), 2kV (d.m.) – 1,2/50µs
☐ Insulation resistance	> 100MΩ	

Environmental Std. Ref. (IEC 60068)

☐ Operation ambient temperature	-10°C / +55°C	
☐ Storage temperature	-25°C / +70°C	
☐ Environmental testing	(Cold)	IEC60068-2-1
	(Dry heat)	IEC60068-2-2
	(Change of temperature)	IEC60068-2-14
	(Damp heat, steady state)	IEC60068-2-78 RH 93% Without Condensing AT 40°C

CE EMC Compatibility (EN50081-2 - EN50082-2 - EN50263)

☐ Electromagnetic emission	EN55022	industrial environment			
☐ Radiated electromagnetic field immunity test	IEC61000-4-3 ENV50204	level 3	80-2000MHz 900MHz/200Hz	10V/m 10V/m	
☐ Conducted disturbances immunity test	IEC61000-4-6	level 3	0.15-80MHz	10V	
☐ Electrostatic discharge test	IEC61000-4-2	level 4	6kV contact / 8kV air		
☐ Power frequency magnetic test	IEC61000-4-8		1000A/m	50/60Hz	
☐ Pulse magnetic field	IEC61000-4-9		1000A/m, 8/20µs		
☐ Damped oscillatory magnetic field	IEC61000-4-10		100A/m, 0.1-1MHz		
☐ Immunity to conducted common mode disturbance 0Hz-150KHz	IEC61000-4-16	level 4			
☐ Electrical fast transient/burst	IEC61000-4-4	level 3	2kV, 5kHz		
☐ HF disturbance test with damped oscillatory wave (1MHz burst test)	IEC60255-22-1	class 3	400pps, 2,5kV (m.c.), 1kV (d.m.)		
☐ Oscillatory waves (Ring waves)	IEC61000-4-12	level 4	4kV(c.m.), 2kV(d.m.)		
☐ Surge immunity test	IEC61000-4-5	level 4	2kV(c.m.), 1kV(d.m.)		
☐ Voltage interruptions	IEC60255-4-11				
☐ Resistance to vibration and shocks	IEC60255-21-1 - IEC60255-21-2 10-500Hz 1g				

ELECTRIC RATED VALUE

☐ Accuracy at nominal value	<0.5% F.s.	Feedback dc current (Chopper)
	<0.5% F.s.	Voltage dc bus (Vbus dc)
	<0.5% F.s.	Voltage dc output (Chopper Vout)
	<0.5% F.s.	Cooling water Temperature (Temperature)
	2% + to (to=20÷30ms @ 2xIs) for time	
☐ Accuracy on regulation	1% F.s.	
☐ Average power supply consumption	≤ 7 VA	
☐ Output relays	rating 6 A; Vn = 250 V	
	A.C. resistive switching = 1500VA (400V max)	
	make = 30 A (peak) 0,5 sec. - break = 0.3 A, 110 Vcc,	
	L/R = 40 ms (100.000 op.)	

COMMUNICATION PARAMETER

☐ RS485 (Back)	9600/19200/38400/57600 bps – 8,n,1 - 8,e,1 - 8,o,1 – Modbus RTU
☐ RS232 (Front)	9600/19200 – 8,n,1 – Modbus RTU

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The performances and the characteristics reported in this manual are not binding and can modified at any moment without notice