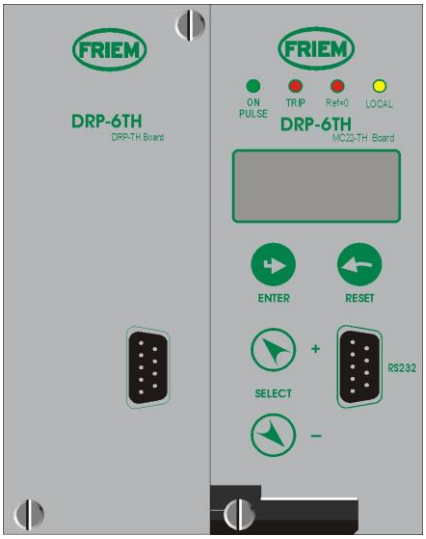
THREE PHASE
SCR
RECTIFIER REGULATOR

OPERATION MANUAL

TYPE

DRP6-TH



DRP6+6TH

CE

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.

3 user programmable Output Relays.

5 optoisolated Digital Inputs.

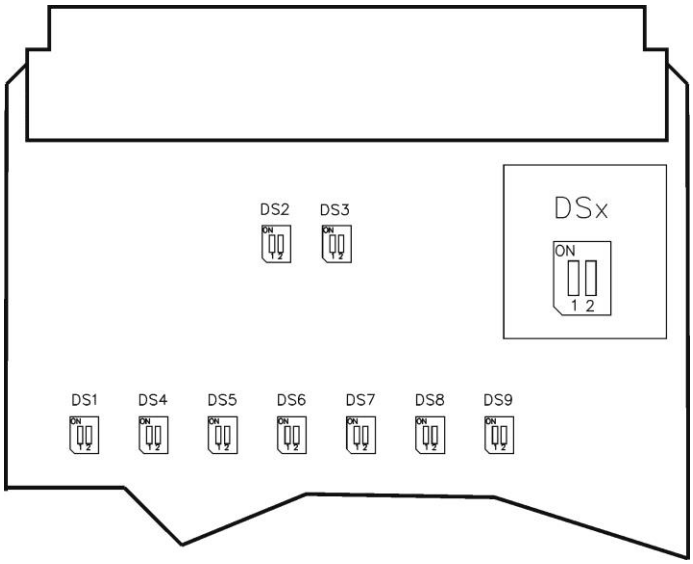
RS485 communication port (independent from the RS232 port on front panel)

The device is made for control three phase SCR Rectifier Regulator.

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

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

2.1 – Configuration Dip-switch



	1	2	Scale		1	2	Scale		1	2	Scale
DS1 (IN1)	off	off	120Vac	**DS2 (IN2)**	off	off	30mAcc	**DS3 (IN3)**	off	off	30mAcc
	off	**on**	**150Vac**		off	on	60mAcc		off	on	60mAcc
	on	off	67.5Vac		**on**	**off**	**20mAcc**		**on**	**off**	**20mAcc**
	on	on	74Vac		on	on	35mAcc		on	on	35mAcc
DS4 (IN4)	off	off	1.5Vcc	**DS5 (IN5)**	off	off	1.5Vcc	**DS6 (IN6)**	off	off	30mAcc
	off	**on**	**15Vcc**		**off**	**on**	**15Vcc**		**off**	**on**	**60mAcc**
	on	off	not used		on	off	not used		on	off	20mAcc
	on	on	not used		on	on	not used		on	on	35mAcc
DS7 (IN7)	off	off	30mAcc	**DS8 (IN8)**	off	off	1.5Vcc	**DS9 (IN9)**	off	off	1.5Vcc
	off	**on**	**60mAcc**		**off**	**on**	**15Vcc**		**off**	**on**	**15Vcc**
	on	off	20mAcc		on	off	not used		on	off	not used
	on	on	35mAcc		on	on	not used		on	on	not used

In Bold-underline default value

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 an self protected.

Two options are available:

a) - 24V(-20%) / 110V(+15%) a.c.
24V(-20%) / 125V(+20%) d.c.

b) - 80V(-20%) / 220V(+15%) a.c.
90V(-20%) / 250V(+20%) d.c.

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

2.3 - Operation and Algorithms

2.3.1 - Reference Input Values

Display			Description	Setting Range			Step	Unit
I1	1	kA	Rated Primary current of phase C.T.	1	-	400	0.01	kA
I2	5	A	Rated Secondary current of phase C.T.	1	-	5	1/5	A
In	1	kA	Reference primary current of the relay	1	-	400	0.01	kA
V1	10	kV	Rated Primary voltage of phase V.T.	0.05	-	500	0.01	kV
V2	500	V	Rated Secondary voltage of phase V.T.	50	-	115	0.01	V
Freq	50	Hz	System rated frequency	50	-	60	10	Hz

Hidden Parameters (reserved for service installation)

Note: The nominal parameter of the transducers connected to the regulator must be set via dedicated serial port available on DRP-TH board.

VFR	1000	V	"V" Ref. Primary value Transducer	0	-	9999	1	V
VFR	20	mA	"V" Ref. Secondary value Transducer	0	-	999.9	0.1	mA
VFR	0	V	"V" Ref. Primary Start scale	0	-	9999	1	V
VFR	0	mA	"V" Ref. Secondary Start scale	0	-	999.9	0.1	mA
VFR	20	mA	"V" Ref. Input end scale DRP-TH	0	-	9999	1	mA
IFR	2.5	kA	"I" Ref. Primary value Transducer	0	-	400	0.01	kA
IFR	20	mA	"I" Ref. Secondary value Transducer	0	-	999.9	0.1	mA
IFR	0	kA	"I" Ref. Primary Start scale	0	-	400	0.01	kA
IFR	0	mA	"I" Ref. Secondary Start scale	0	-	999.9	0.1	mA
IFR	20	mA	"I" Ref. Input end scale DRP-TH	0	-	999.9	0.1	mA
FBI	2.5	kA	"I" Fdb. Primary value Transducer	0	-	400	0.01	kA
FBI	4	-	"I" Fdb. Secondary value Transducer	0	-	999.9	0.1	-
FBI	0	kA	"I" Fdb. Primary Start scale	0	-	400	0.01	kA
FBI	0	-	"I" Fdb. Secondary Start scale	0	-	999.9	0.1	-
FBI	15	-	"I" Fdb. Input end scale DRP-TH	0	-	999.9	0.1	-
FBI	2.5	kA	"I" Fdb .Base value	0	-	400	0.01	kA
FBV	1000	V	"V" Fdb. Primary value Transducer	0	-	9999	1	V
FBV	50	-	"V" Fdb. Secondary value Transducer	0	-	999.9	0.1	-
FBV	0	V	"V" Fdb. Primary Start scale	0	-	9999	1	V
FBV	0	-	"V" Fdb. Secondary Start scale	0	-	999.9	0.1	-
FBV	60	-	"V" Fdb.. Input end scale DRP-TH	0	-	999.9	0.1	-
FBV	1000	V	"V" Fdb .Base value	0	-	9999	1	V
IP	1	kA	"IP" Primary value Transducer	0	-	400	0.01	kA
IP	50	-	"IP" Secondary value Transducer	0	-	999.9	0.1	-
IP	0	kA	"IP" Primary Start scale	0	-	400	0.01	kA
IP	0	-	"IP" Secondary Start scale	0	-	999.9	0.1	-
IP	60	-	"IP" Input end scale DRP-TH	0	-	999.9	0.1	-
IP	1	kA	"IP" Base value	0	-	400	0.01	kA

"*FBI – FBV*" = Input channels used for feedback are user selectable via parameters "FBI" and "FBV" (see hidden settings).

"*IP*" = Input channel used for protection is user selectable via parameters "IP - Select Input for Protection" (see hidden setting).

2.3.2 – Analog Inputs

Signals Input - MC22-T (Board 0)			
Current 1	(terminals 4 – 5)	Input Current 1	See § Wiring Diagram
Current 2	(terminals 4 – 6)	Input Current 2	
Voltage R	(terminals 7)	Input Voltage R	
Voltage S	(terminals 8)	Input Voltage S	
Voltage T	(terminals 9)	Input Voltage T	

Signals Input – DRP6-T (Board 1)				
R	(terminals 159)		Synch. reference input	See § Wiring Diagram
S	(terminals 169)		Synch. reference input	
Ref. V	(terminals 158)	+	Voltage Input Reference	
	(terminals 157)	-		
Ref. I	(terminals 168)	+	Current Input Reference	
	(terminals 167)	-		
Lem / Rogowsky	(terminals 176)	+	Input Lem / Rogowsky	
Rogowsky / Lem	(terminals 175)	+	Available	
Shunt / Voltage Conv	(terminals 174)	+	Input Shunt / Voltage Conv	
Shunt	(terminals 156)	+	Available	
Lem / Rogowsky	(terminals 155)	+	Available	
Rogowsky / Lem	(terminals 154)	+	Available	
Com In	(terminals 187)	-	Common	

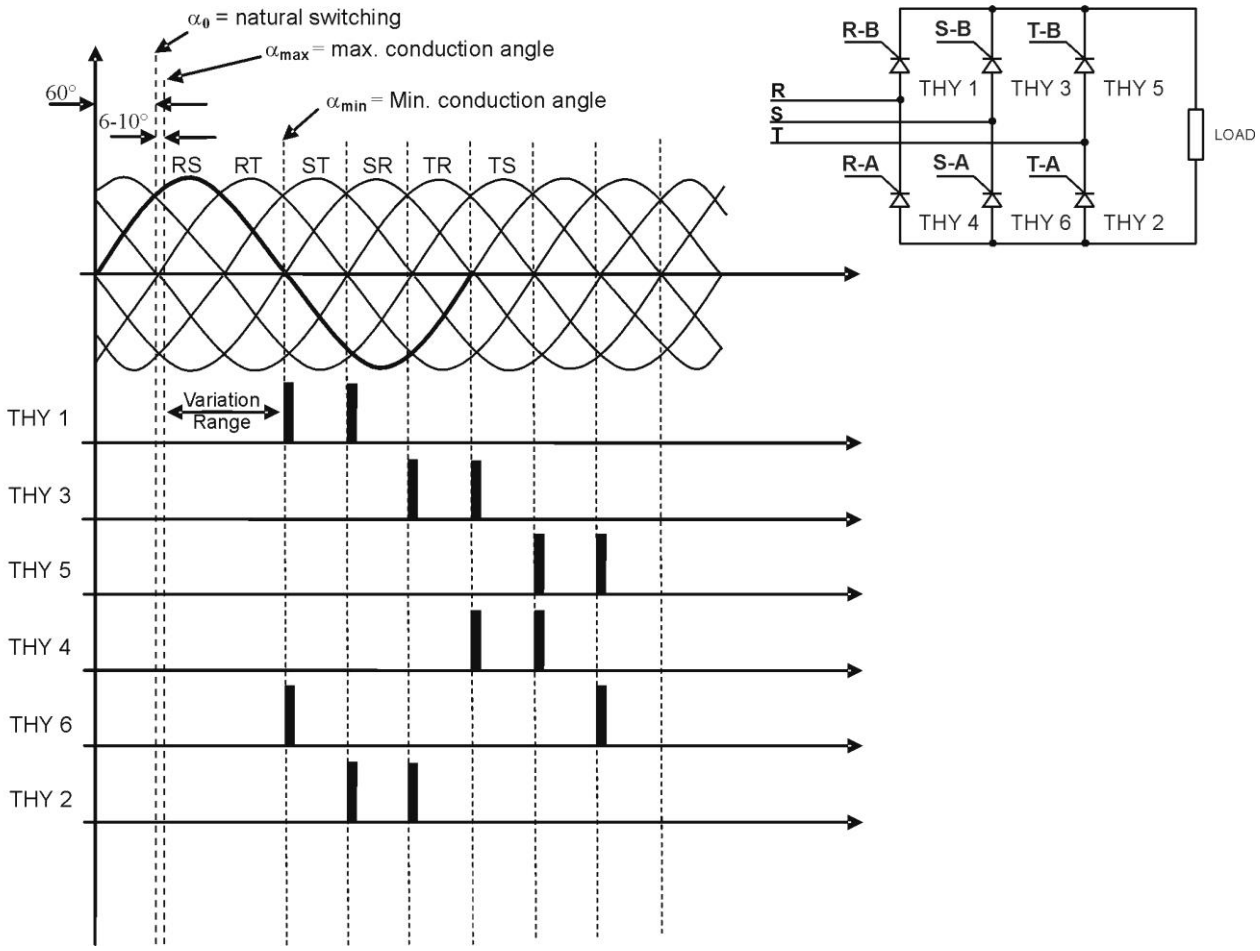
Signals Input – DRP6-T (Board 2) (Only for DRP6+6-T version)			
R	(terminals 259)	Synch. reference input	See § Wiring Diagram
S	(terminals 269)	Synch. reference input	

2.3.3 - Signal Outputs

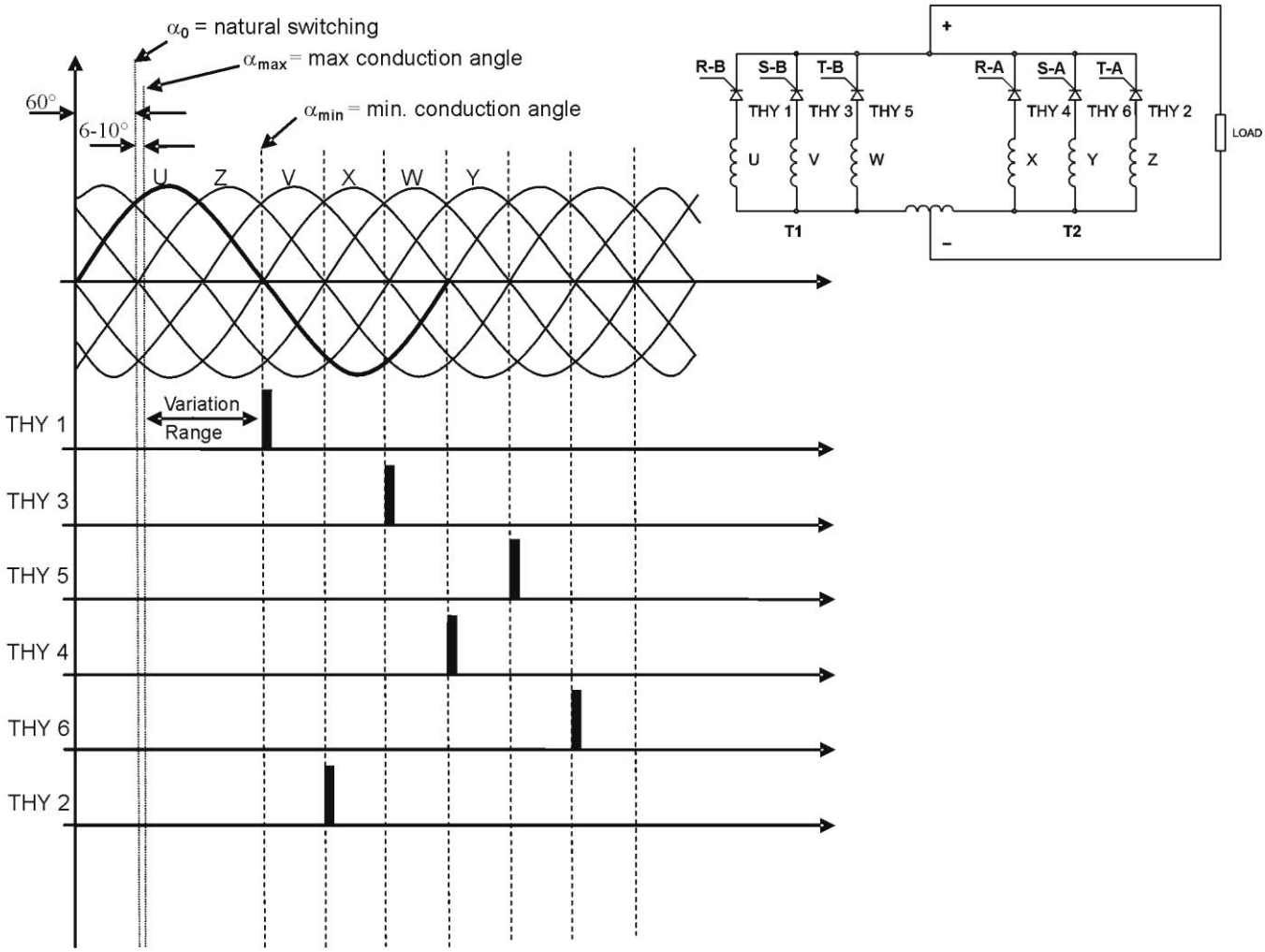
Signal Outputs – DRP6-T (Board 1)		
R-A	(terminals 186)	Output THY4
R-B	(terminals 185)	Output THY1
R-COM	(terminals 184)	Common
S-A	(terminals 166)	Output THY6
S-B	(terminals 165)	Output THY3
S-COM	(terminals 164)	Common
T-A	(terminals 183)	Output THY2
T-B	(terminals 182)	Output THY5
T-COM	(terminals 163)	Common

Signals Output – DRP6-T (Board 2) (Only for DRP6+6T version)		
R-A	(terminals 286)	Output THY4
R-B	(terminals 285)	Output THY1
R-COM	(terminals 284)	Common
S-A	(terminals 266)	Output THY6
S-B	(terminals 265)	Output THY3
S-COM	(terminals 264)	Common
T-A	(terminals 283)	Output THY2
T-B	(terminals 282)	Output THY5
T-COM	(terminals 263)	Common

Bridge Mode PH_3



Bridge Mode PH_6



2.3.4 - Input quantities

2.3.4.1 - Mains Frequency (Freq)

The relay can operate either in 50Hz or 60Hz systems.
The rated Mains Frequency " Freq " must be set accordingly.

2.3.4.2 - Algorithm of the time current curves

The Time Current Curves are generally calculated with the following equation :

(1) $$t(I) = \left[\frac{A}{\left(\frac{I}{Is} \right)^{a^{\alpha}} - 1} + B \right] \bullet K \bullet T_s + t_r$$

where :

t(I) = Actual trip time delay when the input current equals "I"

I = Maximum of the three input currents.

Is = Set minimum pick-up level

K = $$\left(\frac{A}{2^a - 1} \right)^{-1}$$

T_s = Set time delay : $t(I) = T_s$ when $\frac{I}{I_s} = 2$

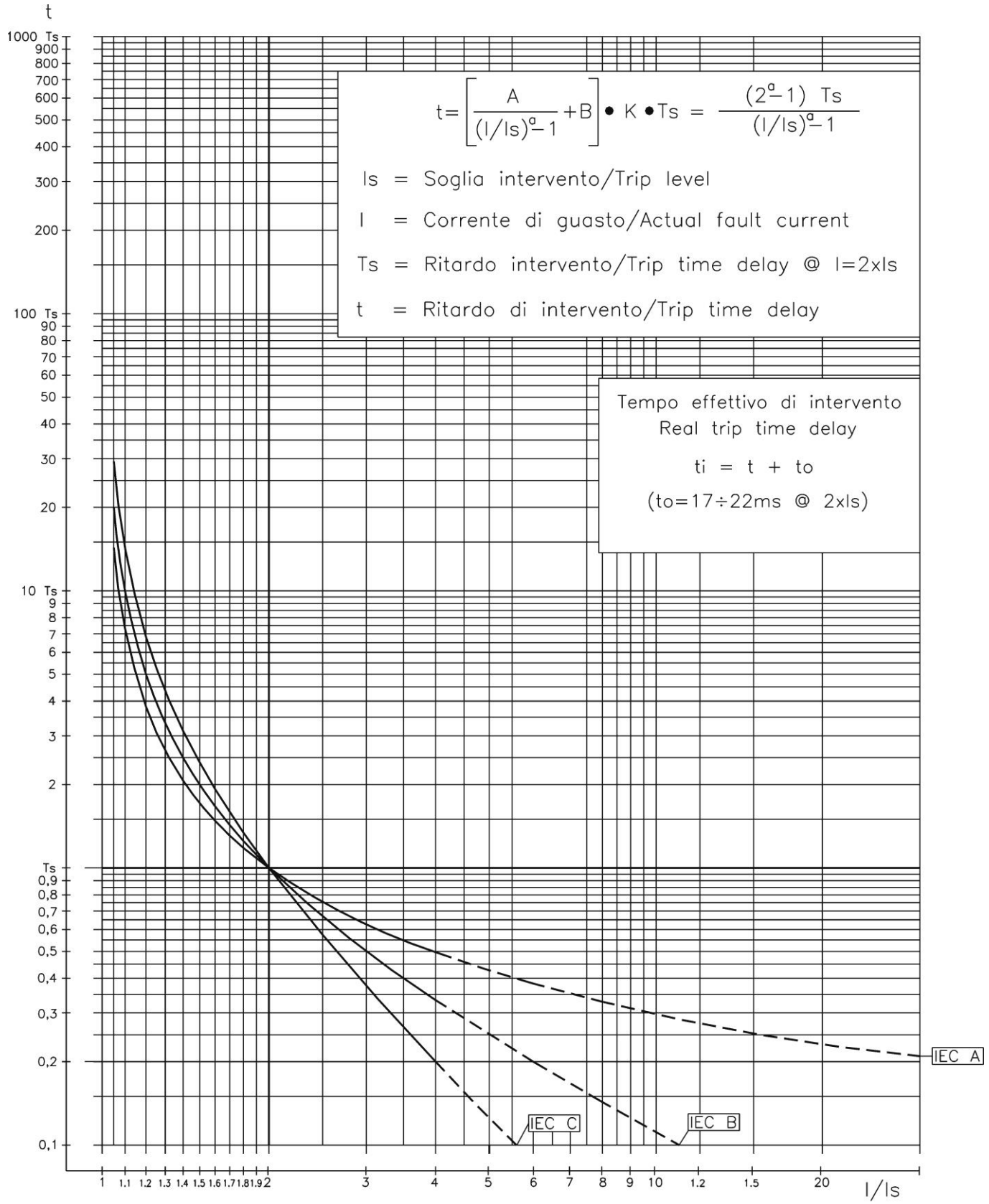
tr = Operation time of the output relay on pick-up.

The parameters "**A**" and "**a**" have different values for the different Time Current Curves.

Curve Name	Curve Identifier	A	B	a
IEC A Inverse	A	0.14	0	0.02
IEC B Very Inverse	B	13.5	0	1
IEC C Extremely Inverse	C	80	0	2

The maximum measuring current is "3xIn" for phase elements.

2.3.5 - Time Current Curves IEC



Curve Type	A	B	K	a
IEC A	0.14	0	0.336632	0.02
IEC B	13.5	0	0.666667	1
IEC C	80	0	1.2375	2

Max. "I" Phase = 3xIn

2.3.6 - Functions and Settings **(Function)**

2.3.6.1 - **1I> (1F51)** - First overcurrent protection element (MC22-TH)

FuncEnab	→		Disable		[Disable / Enable]			
Options	→	**TCC**	D		[D / A / B / C]			
TripLev	→	**1I>**	1.5	**In**	(0.10 ÷ 2.00)	step	0.01	In
Timers	→	**t1I>**	60	**s**	(0.01 ÷ 60.00)	step	0.01	s

- ❑ **FuncEnab** : If disable the function is disactivated
- ❑ **TCC** : Time current curves
  - **D** = Independent Definite Time
  - **A** = IEC A Inverse
  - **B** = IEC B Very Inverse
  - **C** = IEC C Extremely Inverse
- ❑ **1I>** : Minimum phase current pick-up level
- ❑ **t1I>** : Trip time delay

Trip when : Level "1I>" exceeded for time "t1I>"

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

Reset when : Returns in normal condition

2.3.6.2 - **2I> (2F51)** - Second overcurrent protection element (MC22-TH)

FuncEnab	→		Disable		[Disable / Enable]			
Options	→		No Param		No Parameters			
TripLev	→	**2I>**	1.75	**In**	(0.10 ÷ 3.00)	step	0.01	In
Timers	→	**t2I>**	5.00	**s**	(0.05 ÷ 60.00)	step	0.01	s

- ❑ **FuncEnab** : If disable the function is disactivated
- ❑ **2I>** : Minimum phase current pick-up level
- ❑ **t2I>** : Trip time delay

Trip when : Level "2I>" exceeded for time "t2I>"

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

Reset when : Returns in normal condition

*2.3.6.3 - **3I> (3F51)** - Third overcurrent protection element (DRP-TH)*

FuncEnab	→		No Param		No Parameters			
Options	→		No Param		No Parameters			
TripLev	→	***3I>***	2.00	**In**	(1.00 ÷ 3.00)	step	0.01	In
Timers	→	***t3I>***	0.00	**s**	(0.00 ÷ 60.00)	step	0.01	s

- ***FuncEnab*** : If disable the function is disactivated
- **3I>** : Minimum phase current pick-up level
- **t3I>** : Trip time delay

Trip when : Level “3I>” exceeded for time “t3I>”

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

Reset when : Returns in normal condition

*2.2.6.4 - **U> (F59)** – Overvoltage element (MC22-TH)*

FuncEnab	→		Disable		[Disable / Enable]			
Options	→		No Param		No Parameters			
TripLev	→	***U>***	1.20	**Un**	(0.70 ÷ 1.50)	step	0.1	Un
Timers	→	***tU>***	3.00	**s**	(0.01 ÷ 600)	step	0.01	s

- ***FuncEnab*** : If disable the function is disactivated
- **U>** : Trip level protection
- **tU>** : Trip time delay

Trip when : Level “U>” exceeded for time “tU>”

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

Reset when : Returns in normal condition

*2.2.6.5 - **U< (F27)** – Undervoltage element (MC22-TH)*

FuncEnab	→		Disable		[Disable / Enable]			
Options	→		No Param		No Parameters			
TripLev	→	***U<***	0.80	**Un**	(0.80 ÷ 1.10)	step	0.1	Un
Timers	→	***tU<***	0.03	**s**	(0.01 ÷ 600)	step	0.01	s

- ***FuncEnab*** : If disable the function is disactivated
- **U<** : Trip level protection
- **tU<** : Trip time delay

Trip when : Level “U<” exceeded for time “tU<”

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

Reset when : Returns in normal condition

2.2.6.6 - ***U2> (F46)*** – *Phase Sequence (MC22-TH)*

FuncEnab	→		Disable		[Disable / Enable]			
Options	→		No Param		No Parameters			
TripLev	→	***U2>***	0.20	**Un**	(0.20 ÷ 1.00)	step	0.1	Un
Timers	→	***tU2>***	0.10	**s**	(0.01 ÷ 600)	step	0.01	s

- ***FuncEnab*** : If disable the function is disactivated
- **U2>** : Trip level protection
- **tU2>** : Trip time delay

Trip when : Level “U2>” exceeded for time “tU2>”

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

Reset when : Returns in normal condition

*2.2.6.7 – **PID-V** – (Setting) (MC22-TH)*

FuncEnab	→		Enable		[Disable / Enable]		
Options	→	***S/F***	Field		[SCADA / Field / InpSel]		
TripLev	→	**K_P**	1.00		(0.00 ÷ 200)	step 0.01	
	→	**K_I**	1.00		(0.00 ÷ 99.99)	step 0.01	
	→	**K_D**	0.00		(0.00 ÷ 99.99)	step 0.01	
Timers	→	***rRmpV***	5.00	**s**	(0.08 ÷ 60)	step 0.01	s
	→	***fRmpV***	0.10	**s**	(0.01 ÷ 0.10)	step 0.01	s

❑	**S/F**	:	[SCADA] =	Reference input from SCADA
			[Field] =	Reference input from FIELD
			[InpSel] =	Reference input selected by digital input (see § digital input)
❑	**K_P**	:	Proportional gain	
❑	**K_I**	:	Integrative gain	
❑	**K_D**	:	Derivative gain	
❑	**rRmpV**	:	Rise time voltage ramp	
❑	**fRmpV**	:	Fall time voltage ramp	

*2.2.6.8 – **PID-I** – (Setting) (MC22-TH)*

FuncEnab	→		Enable		[Disable / Enable]		
Options	→	***S/F***	Field		[SCADA / Field / InpSel]		
TripLev	→	**K_P**	1.00		(0.00 ÷ 200)	step 0.01	
	→	**K_I**	1.00		(0.00 ÷ 99.99)	step 0.01	
	→	**K_D**	0.00		(0.00 ÷ 99.99)	step 0.01	
Timers	→	***rRmpV***	5.00	**s**	(0.08 ÷ 60)	step 0.01	s
	→	***fRmpV***	0.10	**s**	(0.01 ÷ 0.10)	step 0.01	s

❑	**S/F**	:	[SCADA]	=	Reference input from SCADA
			[Field]	=	Reference input from FIELD
			[InpSel]	=	Reference input selected by digital input (see § digital input)
❑	**K_P**	:	Proportional gain		
❑	**K_I**	:	Integrative gain		
❑	**K_D**	:	Derivative gain		
❑	**rRmpV**	:	Rise time voltage ramp		
❑	**fRmpV**	:	Fall time voltage ramp		

*2.2.6.9 – **Step** – (Regulation step handle) (MC22-TH)*

FuncEnab	→		Disable		[Disable / Enable]			
Options	→	***QFL***	NoIFR		[NoIFR / IFR]			
TripLev	→	***s2s1***	0.80	Vn	(0.00 ÷ 2.00)	step	0.01	Vn
	→	***s1s2***	0.70	Vn	(0.00 ÷ 2.00)	step	0.01	Vn
	→	***s3s2***	0.50	Vn	(0.00 ÷ 2.00)	step	0.01	Vn
	→	***s2s3***	0.40	Vn	(0.00 ÷ 2.00)	step	0.01	Vn
Timers	→	***ts2s1***	5.00	s	(0.00 ÷ 120.00)	step	1	s
	→	***ts1s2***	5.00	s	(0.00 ÷ 120.00)	step	1	s
	→	***ts3s2***	10.00	s	(0.00 ÷ 120.00)	step	1	s
	→	***ts2s3***	10.00	s	(0.00 ÷ 120.00)	step	1	s
	→	***tQOp***	2.00	s	(0.10 ÷ 10.00)	step	0.1	s
	→	***tQCL***	2.00	s	(0.10 ÷ 10.00)	step	0.1	s

❑	***FuncEnab***	:	If disable the function is disactivated
❑	***QFL***	:	Q1-Q4 behavior on failure: [NoIRF] = Don't cause internal relay fault [IRF] = cause internal relay fault
❑	***s2s1***	:	Step 2 to Step 1 Level to rising Voltage
❑	***s1s2***	:	Step 1 to Step 2 Level to descend Voltage
❑	***s3s2***	:	Step 3 to Step 2 Level to rising Voltage
❑	***s2s3***	:	Step 2 to Step 3 Level to descend Voltage
❑	***ts2s1***	:	Start time Step 2 to Step 1 Level to rising Voltage
❑	***ts1s2***	:	Start time Step 1 to Step 2 Level to descend Voltage
❑	***ts3s2***	:	Start time Step 3 to Step 2 Level to rising Voltage
❑	***ts2s3***	:	Start time Step 2 to Step 3 Level to descend Voltage
❑	***tQOp***	:	Control time Open command Q1(Q4)
❑	***tQCL***	:	Control time Close command Q1 (Q4)

Hidden Parameters (reserved for service installation)

→	***Q1-Q4 (default) init step***	Step 1	[Step 1 / Step 2 / Step 3]
→	***Q1-Q4 command behavior***		[Exit on correct Q1(4) position / Wait control time expiration]

*2.2.6.10 - **Fan** - (Fan Control) (MC22-TH)*

FuncEnab	→		Disable		[Disable / Enable]			
Options	→		No Param		No Parameters			
TripLev	→		No Param		No Parameters			
Timers	→	***tFan***	60.00	**s**	(60 ÷ 600)	step	10	s

- ❑ ***FuncEnab*** : If disable the function is disactivated
- ❑ ***tFan*** : Time for turn-off fan after stop command

This function command the start of the FAN each time the regulator is started and the stop of the FAN that is delayed of the time “tFan” after the regulator is stopped.

*2.2.6.11 - **Test** - (Test) (MC22-TH)*

FuncEnab	→		No Param		No Parameters			
Options	→	**Tst**	Disable		[Disable / Ref. / TrigAng]			
TripLev	→	**L_RifI**	0.00	**%**	(0.00 ÷ 100.00)	step	1	%
	→	**L_RifV**	0.00	**%**	(0.00 ÷ 100.00)	step	1	%
	→	**Ang.T**	0.00	**dg**	(0.00 ÷ 359.99)	step	0.01	dg
Timers	→		No Param		No Parameters			

- ❑ **Tst** (Test Mode) :
  - *Disable* : In this case the “Test” is disabled and apparatus work normally, receiving the signal reference via serial communication from the field.
  - *Rif* : 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 (FriemCom) setting the parameter “L_Rif”.
  - *TrigAng* : 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 “TrigAng”, adjusted through keyboard of the relay or via serial communication (FriemCom).
- ❑ **L_RifI** : Current Local reference
- ❑ **L_RifV** : Voltage Local reference
- ❑ **Ang.T** : Arbitrary angle Test

*2.2.6.12 - **Osc** - Oscillographic Recording (MC22-TH)*

FuncEnab	→		Disable		[Disable / Enable]			
Options	→	**Trg**	Trip		[Disable / Start / Trip / Ext.Inp. / DRPStar]			
TripLev	→		No Param		No Parameters			
Timers	→	**tPre**	5.00	**s**	(5.00 ÷ 15.00)	step	1	s
	→	**tPost**	10.00	**s**	(10.00 ÷ 55.00)	step	0.1	s

❑	**FuncEnab**	:	If disable the function is disactivated		
❑	**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 the Digital Input D3 (dry contact) is closed
			DRPStar	=	Trigger on regulator start
❑	**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 60 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 (4 x 15 sec).

Any new event beyond the 60 sec capacity of the memory, cancel and overwrites the former records (FIFO Memory).

*2.2.6.13 - **LoadP** – Load Profile (MC22-TH)*

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 disactivated
- **tLP** : Scan time

Every time that comes measured a value of current (> 2%) comes activated with a time of programmable scansion “tLP”, the recording of the load profile.

*2.2.6.14 - **I.R.F.** - Internal Relay Failure (MC22-TH)*

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).

*2.2.6.15 - **LCD** – Display and Buzzer operation (MC22-TH)*

FuncEnab	→		No Param	No Parameters
Options	→	***Key***	BeepON	[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.

*2.2.6.16 - **Comm** – Communication Parameters (MC22-TH)*

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

*2.2.6.17 – **VEST** – Enable to Start DRP-2DS*

FuncEnab	→		No Param		No Parameters			
Options	→		No Param		No Parameters			
Trip Level	→	**Vb>**	0.5		(0.5 ÷ 1.5)	step	0.01	Vn
	→	***Vb<***	0.2		(0.2 ÷ 1)	step	0.01	Vn
Timers	→	**tVb**	0	**s**	(0 ÷ 100.00)	step	0.1	s

- **Vb>** : Level
- **Vb<** : Level
- **tVb** : Time delay

Enable when : [Vb<] < VBF < [Vb>] after time [tVb] and activate logic output "tVb>".

2.2.6.18 – **I<** – Output current = 0 *(Hidden Parameters - Reserved for service installation) (DRP-TH)*

FuncEnab	→		No Param		No Parameters			
Options	→		No Param		No Parameters			
TripLev	→	***I<***	0.03	**In**	(0.03 ÷ 1.00)	step	0.01	In
Timers	→	***tI<***	0.05	**s**	(0.05 ÷ 40.00)	step	0.01	s

- ***I<*** : Level for zero current
- ***tI<*** : Acknowledgement delay time

When the function is tripped : *Signalization* = Via serial communication or output relay

Reset when : Returns in normal condition

2.2.6.19 – **FBI** – Current Feedback - *(Hidden Parameters - Reserved for service installation)*

Options	→	***FBI***	Input_4	[Input_4 / Input_5 / Input_6 / Input_7 / Input_8 / Input_9 / Idc]

- ***FBI*** :
  - Input_4 = Feedback from input 4
  - Input_5 = Feedback from input 5
  - Input_6 = Feedback from input 6
  - Input_7 = Feedback from input 7
  - Input_8 = Feedback from input 8
  - Input_9 = Feedback from input 9
  - Idc = Feedback from input Idc

2.2.6.20 – **FBV** – Voltage Feedback - *(Hidden Parameters - Reserved for service installation)*

Options	→	***FBV***	Input_4	[Input_4 / Input_5 / Input_6 / Input_7 / Input_8 / Input_9]

- ***FBV*** :
  - Input_4 = Feedback from input 4
  - Input_5 = Feedback from input 5
  - Input_6 = Feedback from input 6
  - Input_7 = Feedback from input 7
  - Input_8 = Feedback from input 8
  - Input_9 = Feedback from input 9

2.2.6.21 – **IP** – "Select Input for Protection" *(Hidden Parameters - Reserved for service installation)*

Options	→ **IP**	Input_4	[Input_4 / Input_5 / Input_6 / Input_7 / Input_8 / Input_9 / Idc]

- ❑ **IP** : Input_4 = Feedback from input 4
  Input_5 = Feedback from input 5
  Input_6 = Feedback from input 6
  Input_7 = Feedback from input 7
  Input_8 = Feedback from input 8
  Input_9 = Feedback from input 9
  Idc = Idc

2.2.6.22 – **BrM** – Bridge mode *(Hidden Parameters - Reserved for service installation)*

Options	→ **BrM**	Bridge	[Bridge / Double Star]

- ❑ **BrM** : Bridge = For 3-Phase rectifier
  Double Star = For 6-Phase rectifier

2.2.6.23 – **Ass** – Lack of pulse *(Hidden Parameters - Reserved for service installation)*

FuncEnab	→	No Param	No Parameters
Options	→	No Param	No Parameters
TripLev	→ **NotU**	Reserved	
Timers	→	No Param	No Parameters

When the function is tripped : *Signalization* = Led "Trip" is illuminated and displayed "Ass" on display.

Reset when : Returns in normal condition

2.2.6.24 – **OpMd** – Operation Mode *(Hidden Parameters - Reserved for service installation)*

Options	→	**OpMd**	Master Mode		[Master Mode DRP6 / Master/Slave Mode DRP6+6]			
	→	***Idc***	5		(1 ÷ 10)			
	→	***IFB***	5		(1 ÷ 10)			
	→	***VFB***	5		(1 ÷ 10)			
Timers	→	**tVca**	0.2	s	(0.00 ÷ 2.00)	step	0.01	s

❑ **OpMd**	:	Operative Mode
❑ ***Idc***	:	Number of Average of Idc
❑ ***IFB***	:	Number of Average of IFB
❑ ***VFB***	:	Number of Average of VFB
❑ **tVca**	:	Trip time delay Vca Failure

2.2.6.25 – **DCBSC** – DC Bus Short circuit *(Hidden Parameters – Reserved for service installation)* *(DRP-TH)*

FuncEnab	→		No Param		No Parameters			
Options	→	**DCBSC**	0	Vn	(0.00 ÷ 1.00)	step	0.01	Vn
Timers	→	**tDCB**	0	s	(0.00 ÷ 10.00)	step	0.01	s
	→	**tMin**	0	s	(0.00 ÷ 2.00)	step	0.01	s

❑ **DCBSC**	:	DC Bus Short circuit Level
❑ **tDCB**	:	Time DC Bus short circuit
❑ **tMin**	:	Minimum time DC Bus short circuit Logical output signal

Trip when	:	Level “DCBSC” exceeded for time “tDCB”		
When the function is tripped	:	*Regulator*	=	Is Blocked
		Signalization	=	Led “Trip” is illuminated
		Last Trip	=	Is recorded
Reset when	:	Returns in normal condition		

2.2.6.26 – **VFB>** – V Feedback overvoltage *(Hidden Parameters - Reserved for service installation) (DRP-6TH)*

FuncEnab	→		Disable		[Disable / Enable]			
Options	→	**VFB>**	0.50	**Vn**	(0.50 ÷ 1.50)	step	0.01	Vn
Trip Level	→	**OpMd**	Master Mode		[Master Mode DRP6 / Master/Slave Mode DRP6+6]			
	→	***Idc***	5		(1 ÷ 10)			
	→	***IFB***	5		(1 ÷ 10)			
Timers	→	**tVFB>**	0	**s**	(0.00 ÷ 10.00)	step	0.01	s

- ❑ **VFB>** : Overvoltage Level V Feedback
- ❑ **tVFB>** : Trip time overvoltage V Feedback

Trip when : Level “VFB>” exceeded for time “tVFB>”

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

Reset when : Returns in normal condition

2.2.6.27 – **VFB<** – V Feedback undervoltage *(Hidden Parameters - Reserved for service installation) (DRP-6TH)*

FuncEnab	→		Disable		[Disable / Enable]			
Options	→	**VFB<**	0.20	**Vn**	(0.20 ÷ 1.00)	step	0.01	Vn
TripLev	→		No Param		No Parameters			
Timers	→	**tVFB<**	0	**s**	(0.00 ÷ 10.00)	step	0.01	s
	→	**tStrt**	0	**s**	(0.00 ÷ 100.00)	step	0.1	s
	→	**tMin**	0	**s**	(0.00 ÷ 2.00)	step	0.1	s

- ❑ **VFB<** : Undervoltage Level V Feedback
- ❑ **tVFB<** : Trip time Undervoltage V Feedback
- ❑ **tStrt** : Time Lock VFB< on start command
- ❑ **tMin** : Minimum time VFB Undervoltage Logical output signal

Trip when : Level “VFB<” exceeded for time “tVFB<”

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

Reset when : Returns in normal condition

3. Output Relays

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 Relay 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).

Available in the Regulator - MC22-TH (Board 0)		
R1	:	Lack of pulse
R2	:	Fan
R3	:	Protection Trip

Available in the UX10-4 Expansion Module (Board 3) (Only for DRP-6+6T version)		
1.R1	:	Q3
1.R2	:	Q4
1.R3	:	Q1
1.R4	:	Q2

4. Digital Input

Available in the - MC22-TH (Board 0)				
0.D1	(terminals 22 - 19)	:	*Close* select current reference from field *Open* select current reference from Scada	The Digital Input is activated when its terminals are shorted by a dry contact (R≤3kΩ).
0.D2	(terminals 22 - 21)	:	*Close* select voltage reference from field *Open* select voltage reference from Scada	
0.D3	(terminals 22 - 20)	:	Trigger Oscillographic recording (see § Osc). Note: the input is active when the contact is close.	

Available in the DRP-TH (Board 1)				
D1	(terminals 177 - 179)	:	Start/Stop	The Digital Input is activated when its terminals are shorted by a dry contact (R≤3kΩ).
D2	(terminals 177 - 178)	:	Reserved don't connect	

Available in the DRP-TH (Board 2) (Only for DRP-6+6T version)				
D1	(terminals 277 - 279)	:	Reserved don't connect	The Digital Input is activated when its terminals are shorted by a dry contact (R≤3kΩ).
D2	(terminals 277 - 278)	:	DRP-6+6T mode – must be shorted	

Available in the UX10-4 Expansion Module (Board 3) (Only for DRP-6+6T version)					
1.D1	Digital Input "D1"	(terminals 352 – 362)	Fuse 1	(+24V)	By the interface program "FRIEMCom" it is possible to Activate/Deactivate the functions.
1.D2	Digital Input "D2"	(terminals 353 – 363)	Fuse 2	(+24V)	
1.D3	Digital Input "D3"	(terminals 354 – 364)	TH Inductance	(+24V)	
1.D4	Digital Input "D4"	(terminals 355 – 365)	Q3	(+24V)	
1.D5	Digital Input "D5"	(terminals 356 – 366)	Q4	(+24V)	
1.D6	Digital Input "D6"	(terminals 372 – 382)	TH Transformer	(+24V)	
1.D7	Digital Input "D7"	(terminals 373 – 383)	TH Heatsink	(+24V)	
1.D8	Digital Input "D8"	(terminals 374 – 384)	Q1	(+24V)	
1.D9	Digital Input "D9"	(terminals 375 – 385)	Q2	(+24V)	
1.D10	Digital Input "D10"	(terminals 376 – 386)	BusBar Grounded	(+24V)	

Note: +24V = external supply Digital Inputs.

5. Self-Diagnostic

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

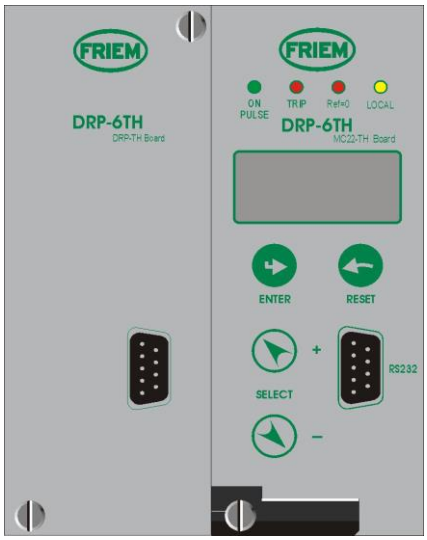
- A/D conversion
- Checksum of the settings stored into E^2Prom.
- DSP general operation (Power, Routines, etc.)
- Lamp test (only on manual test).
- Canbus supervision

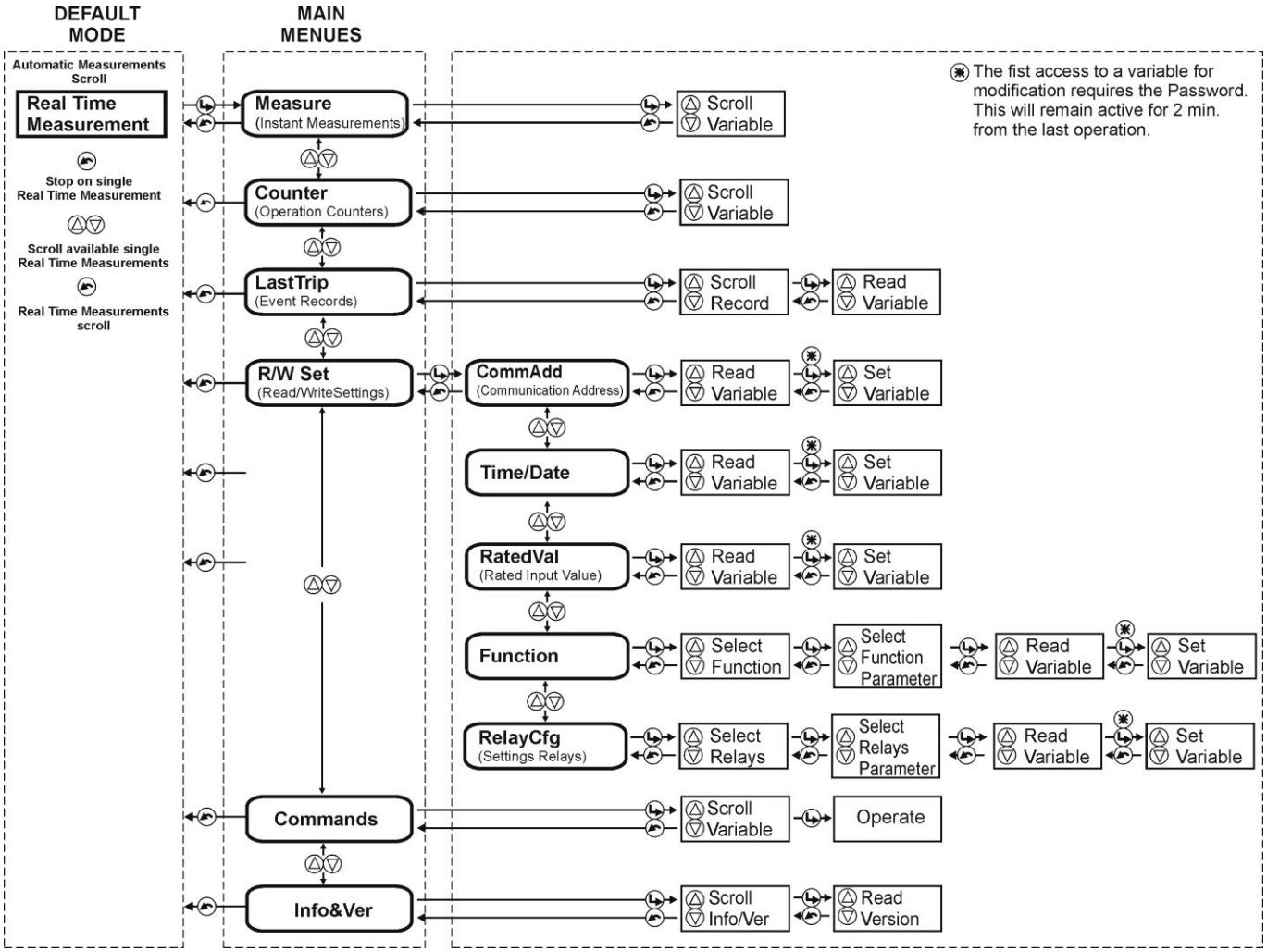
Any time Power is switched on, a complete test is run; then, during normal operation, the test runs continuously and the checksum is done any time a parameter is stored into E^2Prom.
If during the test any Relay Internal Failure (I.R.F) is detected:

- If " I.R.F. " is programmed to " Trip ", the programmed output relay is activated, the same as on tripping of any protection function. It 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.

6. Regulator Management

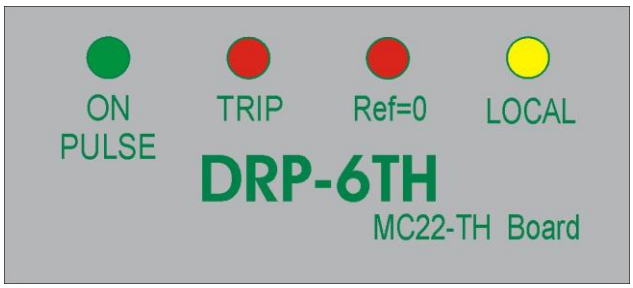
The regulator can be totally managed locally, either by the RS232 communication port or by the 4 key buttons and the LCD display, or remotely via the communication bus RS485 connected to the rear terminal blocks. The 2 line x 8 characters LCD display shows the available information.
Key buttons operate 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.
b)	Red LED	**Ref=0**	❑ Off	:	Reference ≠ 0
			❑ Flashing	:	----------
			❑ Illuminated	:	Reference = 0
d)	Yellow LED	**LOCAL**	❑ Off	:	From SCADA or Analog Input
			❑ Flashing	:	----------
			❑ Illuminated	:	LOCAL Reference

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 (MC22-TH)

This port is accessible via the terminals 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 / IEC60870-5-103.
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

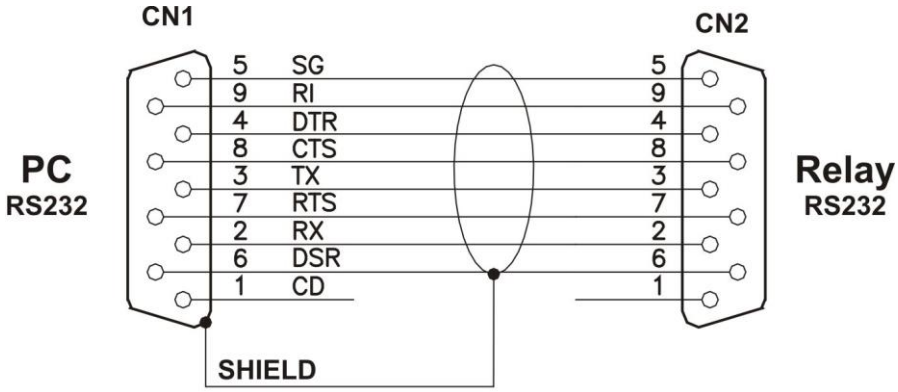
Note: any change of this setting becomes valid at the next power on.

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.

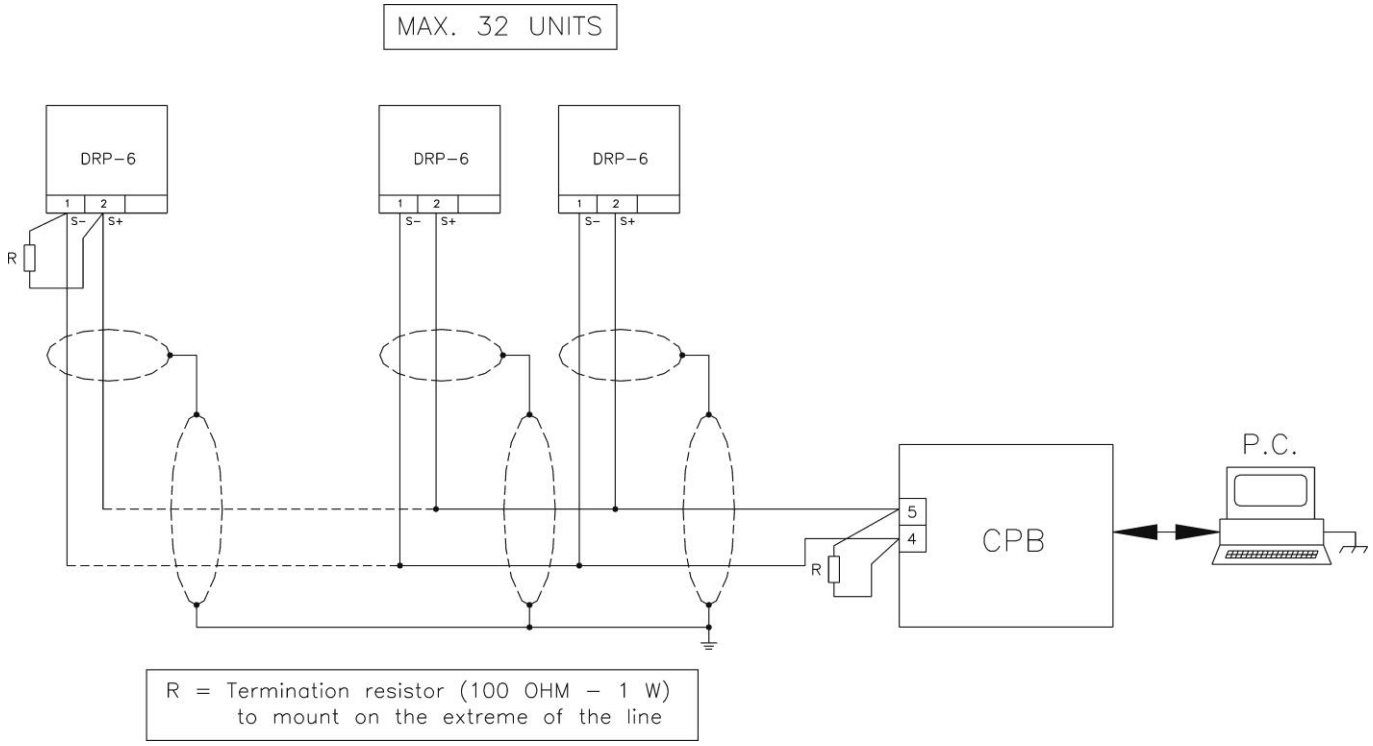
9.2 - Communication Port on Front Face Panel – MC22-TH & DRP-TH

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
VA	=	0 – 65535	**V**	AC Voltage phase A
VB	=	0 – 65535	**V**	AC Voltage phase B
VC	=	0 – 65535	**V**	AC Voltage phase C
Idc	=	0 – 650	**kA**	DC current feedback measured by CTs (*)
IfR	=	0 – 650	**kA**	Current Reference set point from Field (on input 3)
VfR	=	0 – 65535	**V**	Voltage Reference set point from Field (on input 2)
sIR	=	0 – 325	**%**	Current Reference set point from SCADA (serial communication)
sVR	=	0 – 325	**%**	Voltage Reference set point from SCADA (serial communication)
IFB	=	0 – 650	**kA**	DC Load Current (Feedback measured by transducer on input)
VFB	=	0 – 65535	**V**	DC Load Voltage (Feedback measured by transducer on input)
V1	=	0 – 65535	**%**	AC Direct voltage sequence
V2	=	0 – 65535	**%**	AC Inverse voltage sequence
aT	=	180 – 70	**dg**	Trigger shot angle

(*) Idc – Is the load current (DC) calculated, measured by CTs connected on the input of the rectifier.

10.2 - Measure (Instantaneous Measurements)

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

- " **R**eal **T**ime **M**eas " ↳
- " Meas " ↳
- " 1st Measurement △▽ other measurements
- ↶ to go back to " Meas "

Display				Description
VA	=	0 – 65535	**V**	AC Voltage phase A
VB	=	0 – 65535	**V**	AC Voltage phase B
VC	=	0 – 65535	**V**	AC Voltage phase C
Idc	=	0 – 650	**kA**	DC current feedback measured by CTs
IfR	=	0 – 650	**kA**	Current Reference set point from Field (on input 3)
VfR	=	0 – 65535	**V**	Voltage Reference set point from Field (on input 2)
sIR	=	0 – 325	**%**	Current Reference set point from SCADA (serial communication)
sVR	=	0 – 325	**%**	Voltage Reference set point from SCADA (serial communication)
IFB	=	0 – 650	**kA**	DC Load Current (Feedback measured by transducer on input)
VFB	=	0 – 65535	**V**	DC Load Voltage (Feedback measured by transducer on input)
V1	=	0 – 65535	**%**	AC Direct voltage sequence
V2	=	0 – 65535	**%**	AC Inverse voltage sequence
aT	=	180 – 70	**dg**	Trigger shot angle

10.3 - Counter (Operation Counters)

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

- " **R**eal **T**ime **M**eas " →
- "Counter " →
- " 1st counters △▽ other counters
- ↶ to go back to "Counter "

Display			Description	
1I>	=	0 – 65535	Number of 1st Overcurrent	(time delayed) trip
2I>	=	0 – 65535	Number of 2nd Overcurrent	(time delayed) trip
3I>	=	0 – 65535	Number of 3rd Overcurrent	(time delayed) trip
I<	=	0 – 65535	Number of Undercurrent	
U>	=	0 – 65535	Number of Overvoltage	(time delayed) trip
U<	=	0 – 65535	Number of Undervoltage	(time delayed) trip
U2>	=	0 – 65535	Number of Negative Sequence	
IRF	=	0 – 65535	Number of Internal Relay Faults	
HR	=	0 – 65535	Number of HW recovery operations	
Ass	=	0 – 65535	Lack of synch.	
DcB	=	0 – 65535	DC Bus Short circuit	
VFB	=	0 – 65535	V Feedback Under/Over voltage	

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:
				- **1I>** = 1st Overcurrent element - **2I>** = 2nd Overcurrent element - **3I>** = 3rd Overcurrent element - **U>** = Overvoltage element - **U2>** = Phase Sequence element - **U<** = Undervoltage element - **IRF** = Internal Relay Faults - **Ass** = Lack of synch. - **DCBSC** = DC Bus Short circuit - **VFB>** = V Feedback overvoltage - **VBF<** = V Feedback undervoltage
Date	:	YYYY/MM/GG		Date: Year/Month/Day
Time	:	hh:mm:ss:cc		Time: hours/minutes/second/hundredths of seconds
VA	=	0 – 65535	**V**	Voltage phase A
VB	=	0 – 65535	**V**	Voltage phase B
VC	=	0 – 65535	**V**	Voltage phase C
Idc	=	0 – 650	**kA**	DC current feedback measured by CTs
IFB	=	0 – 650	**kA**	Current Feedback
VFB	=	0 – 65535	**V**	Voltage Feedback

- ↶ 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
I1	1	**kA**	Rated Primary current of phase C.T.	1 - 400	0.01	A
I2	5	**A**	Rated Secondary current of phase C.T.	1 - 5	1/5	A
In	1	**kA**	Reference primary current of the relay	1 - 400	0.01	A
V1	10	**kV**	Rated Primary voltage of phase V.T.	0.05 - 500	0.01	kV
V2	500	**V**	Rated Secondary voltage of phase V.T.	50 - 115	0.01	V
Freq	50	**Hz**	System rated frequency	50 - 60	10	Hz

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
  - FuncEnab
  - Options
  - TripLev
  - Timers
- ↳ 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!

Function	Display Type		Variable	Default Setting	Unit	Description	Setting Range	Step
Password		=	0000-9999	1111	-	Password for programming enable (see § Password)		
1I>	FuncEnab	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	TCC	D		Time current curves	D,A,B,C	-
	TripLev	→	1I>	1.5	In	Trip level	0.10 – 2.00	0.01
	Timers	→	t1I>	60	s	Trip time delay	0.01 – 60.00	0.01
2I>	FuncEnab	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	2I>	1.75	In	Trip level	0.10 – 3.00	0.01
	Timers	→	t2I>	5.00	s	Trip time delay	0.05 – 60.00	0.01
3I>	FuncEnab	→	No Param			No Parameters		
	Options	→	Res	MAN		Reset: "MAN" = Manual - "AUT" = Automatic	MAN/AUT	-
	TripLev	→	3I>	2.00	In	Trip level	1.00 – 3.00	0.01
	Timers	→	t3I>	0.00	s	Trip time delay	0.00 – 60.00	0.01
U>	FuncEnab	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	U>	1.20	Un	Trip level	0.70 - 1.50	0.1
	Timers	→	tU>	3.00	s	Trip time delay	0.01 – 600	0.01
U<	FuncEnab	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	U<	0.80	Un	Trip level	0.80 - 1.10	0.1
	Timers	→	tU<	0.03	s	Trip time delay	0.01 – 600	0.01
U2>	FuncEnab	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	U2>	0.20	Un	Trip level	0.20 - 1.00	0.1
	Timers	→	tU2>	0.10	s	Trip time delay	0.01 – 600	0.01
PID-V	FuncEnab	→	Enable			Enable or Disable function	Disable/Enable	-
	Options	→	S/F	Field		Reference form SCADA or Field	SCADA/Field/InSel	-
	TripLev	→	K_P	1.00	-	Proportional gain	0.00 – 200	0.01
			K_I	0.00	-	Integrative gain	0.00 - 99.99	0.01
			K_D	0.00	-	Derivative gain	0.00 - 99.99	0.01
	Timers	→	rRmpV	5.00	s	Rise time voltage ramp	0.08 – 60	0.01
			fRmpV	0.10	s	Fall time voltage ramp	0.01 - 0.10	0.01
PID-I	FuncEnab	→	Enable			Enable or Disable function	Disable/Enable	-
	Options	→	S/F	Field		Reference form SCADA or Field	SCADA/Field/InSel	-
	TripLev	→	K_P	1.00	-	Proportional gain	0.00 - 200	0.01
			K_I	1.00	-	Integrative gain	0.00 - 99.99	0.01
			K_D	0.00	-	Derivative gain	0.00 - 99.99	0.01
	Timers	→	rRmpV	5.00	s	Rise time voltage ramp	0.08 - 60	0.01
			fRmpV	0.10	s	Fall time voltage ramp	0.01 - 0.10	0.01

Step	**FuncEnab**	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	**QFL**	NoIFR		Q1-Q4 behavior on failure	NoIFR / IFR	-
	TripLev	→	***s2s1***	0.80	**Vn**	Step 2 to Step 1 Level to rising Voltage	0.00 – 2.00	0.01
			s1s2	0.70	**Vn**	Step 1 to Step 2 Level to descend Voltage	0.00 – 2.00	0.01
			s3s2	0.50	**Vn**	Step 3 to Step 2 Level to rising Voltage	0.00 – 2.00	0.01
			s2s3	0.40	**Vn**	Step 2 to Step 3 Level to descend Voltage	0.00 – 2.00	0.01
	Timers	→	***ts2s1***	5.00	**s**	Start time Step 2 to Step 1 Lev. to rising Volt.	0.00 – 120.00	1
			ts1s2	5.00	**s**	Start time Step 1 to Step 2 Lev. to desc.Volt.	0.00 – 120.00	1
			ts3s2	10.0	**s**	Start time Step 3 to Step 2 Lev. to rising Volt.	0.00 – 120.00	1
			ts2s3	10.0	**s**	Start time Step 2 to Step 3 Lev. to desc. Volt.	0.00 – 120.00	1
			tQOp	2.00	**s**	Control time Open command Q1(Q4)	0.10 – 10.00	0.1
			tQCL	2.00	**s**	Control time Close command Q1 (Q4)	0.10 – 10.00	0.1
Fan	**FuncEnab**	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	No Param			No Parameters		
	Timers	→	**tFan**	60.00	**s**	Time for turn-off fan after stop command	60 - 600	10
Test	**FuncEnab**	→	No Param			No Parameters		
	Options	→	**Tst**	Disable		Test Mode	Disab/Rif/TrigAng	-
	TripLev	→	**L_Rifl**	0.00	**%**	Current Local reference	0.00 - 100	0.01
			L_RifV	0.00	**%**	Voltage Local reference	0.00 - 100	0.01
			Ang.T	0.00	**g**	Test arbitrary angle	0.00-359.99	0.01
	Timers	→	No Param			No Parameters		
Osc	**FuncEnab**	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	**Trg**	Disable		select command for Trigger (start recording):	Disable Start Trip Ext.Imp.	-
	TripLev	→	No Param			No Parameters		
	Timers	→	**tPre**	5	**s**	Recording time before Trigger	5 – 15	1
		→	**tPost**	10	**s**	Recording time after Trigger	0.10 – 1.50	0.1
LoadP	**FuncEnab**	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	No Param			No Parameters		
	Timers	→	**tLP**	1.00	**m**	Scan time	1.00 – 650	1
IRF	**FuncEnab**	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	**Opz**	NoTrip		Internal Failure Trip=Trip; NoTrip=No Trip	Trip-NoTrip	-
	TripLev	→	No Param			No Parameters		
	Timers	→	No Param			No Parameters		
VEST	**FuncEnab**	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	No Param			No Parameters		
	TripLev	→	**Vb>**	0.5	**Vn**	Level	0.5 – 1.5	0.01
		→	**Vb<**	0.2	**Vn**	Level	0.2 - 1	0.01
	Timers	→	**tVb**	0	**s**	Time delay	1.00 – 650	1
LCD	**FuncEnab**	→	No Param			No Parameters		
	Options	→	**Key**	BeepON		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) ***Note**: any change of this setting became valid at the next power on*	8,n,1 8,o,1 8,e,1	-
			RPr	Modbus		Remote Protocol	-	-
	TripLev	→	No Parameters					
	Timers	→	No Parameters					

Settings can also be programmed via the serial communication ports.

(Hidden Parameters - Reserved for service installation)

Display						Description	Setting Range	Step
Function	Type		Variable	Default Setting	Unit			
I<	FuncEnab	→	No Param			No Parameters		
	Options	→	No Param			No Parameters		
	TripLev	→	I<	0.03	In	Trip level	0.03 – 1.00	0.01
	Timers	→	tI<	0.05	s	Trip time delay	0.05 – 40.00	0.01
Ass	FuncEnab	→	No Param			No Parameters		
	Options	→	No Param			No Parameters		
	TripLev	→	NotU	*Reserved*				
	Timers	→	No Param			No Parameters		
FBI	Options	→	FBI	Input_4		[Input_4 / Input_5 / Input_6 / Input_7 / Input_8 / Input_9 / Idc]		
FBV	Options	→	FBV	Input_4		[Input_4 / Input_5 / Input_6 / Input_7 / Input_8 / Input_9]		
IP	Options	→	FBI	Input_4		[Input_4 / Input_5 / Input_6 / Input_7 / Input_8 / Input_9 / Idc]		
BrM	Options	→	BrM	Bridge		[Bridge / Double star]		
OpMd	FuncEnab	→	No Param			No Parameters		
	Options	→	OpMd	Master Mode		Operation Mode: - Master Mode DRP-6 - Master/Slave Mode DRP-6+6	-	-
		→	Idc	0		Number Average of Icc	1 - 10	1
		→	IFB	0		Number Average of IFB	1 - 10	1
		→	VFB	0		Number Average of VFB	1 - 10	1
	TripLev	→	No Param			No Parameters		
	Timers	→	tVca	0.20	s	Trip time delay Vca Failure	0.00 – 2.00	0.01
DCBSC	FuncEnab	→	No Param			No Parameters		
	Options	→	DCBSC	0	Vn	DC Bus Short circuit Level	0.00 – 1.00	0.01
	TripLev	→	No Param			No Parameters		
	Timers	→	tDCB	0	s	Time DC Bus short circuit	0.00 – 10.00	0.01
			tMin	0	s	Minimum time DC Bus short circuit Logical output signal	0.00 - 2.00	0.01
VFB>	FuncEnab	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	VFB>	0.50	Vn	Overvoltage Level V Feedback	0.50 – 1.50	0.01
	TripLev	→	No Param			No Parameters		
	Timers	→	tVFB>	0	s	Trip time overvoltage V Feedback	0.00 - 10.00	0.01
VFB<	FuncEnab	→	Disable			Enable or Disable function	Disable/Enable	-
	Options	→	VFB<	0.20	Vn	Undervoltage Level V Feedback	0.20 – 1.00	0.01
	TripLev	→	No Param			No Parameters		
	Timers	→	tVFB<	0	s	Trip time Undervoltage V Feedback	0.00 - 10.00	0.01
			tStrt	0	s	Time Lock VFB< on start command	0.00 – 100.00	0.1
			tMin	0	s	Minimum time VFB Undervoltage Logical output signal	0.00 – 2.00	0.1

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 than 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".

Available in the MC22-TH Module

Display				Description	Setting Range	Step
Relay	Type		Default Value			
Relay1 (0.R1)	**Link**	→	**BlcDRPm**	Association of functions to output relay R1	See Table 1	-
	OpMode	→	**N.D.**	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-
Relay2 (0.R2)	**Link**	→	**Fan_On**	Association of functions to output relay R2	See Table 1	-
	OpMode	→	**N.D.**	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-
Relay3 (0.R3)	**Link**	→	**t1I>, t2I>, t3I>, tU>, tU2>, tU<.**	Association of functions to output relay R3	See Table 1	-
	OpMode	→	**N.D.**	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-

Available in the UX10-4 Module (Board 3) (Only for DRP-6+6T version)

Display				Description	Setting Range	Step
Relay	Type		Default Value			
1.R1	**Link**	→	**Q3**	Association of functions to output relay 1.R1	See Table 1	-
	OpMode	→	**N.D.**	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-
1.R2	**Link**	→	**Q4**	Association of functions to output relay 1.R2	See Table 1	-
	OpMode	→	**N.D.**	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-
1.R3	**Link**	→	**Q1**	Association of functions to output relay 1.R3	See Table 1	-
	OpMode	→	**N.D.**	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-
1.R4	**Link**	→	**Q2**	Association of functions to output relay 1.R3	See Table 1	-
	OpMode	→	**N.D.**	N.D. (Normally Deenergized) N.E. (Normally Energized)	N.D./N.E.	-

Table 1

1I>	*Start – First Overcurrent protection level*	*(instantaneous)*
t1I>	*Trip – First Overcurrent protection level*	*(time delayed)*
2I>	*Start – Second Overcurrent protection level*	*(instantaneous)*
t2I>	*Trip – Second Overcurrent protection level*	*(time delayed)*
3I>	*Start – Third Overcurrent protection level*	*(instantaneous)*
t3I>	*Trip – Third Overcurrent protection level*	*(time delayed)*
I<	*Start – Undercurrent protection level*	*(instantaneous)*
tI<	*Trip – Undercurrent protection level*	*(time delayed)*
U>	*Start – Overvoltage protection level*	*(instantaneous)*
tU>	*Trip – Overvoltage protection level*	*(time delayed)*
U2>	*Start – Phase sequence*	*(instantaneous)*
tU2>	*Trip – Phase sequence*	*(time delayed)*
U<	*Start – Undervoltage protection level*	*(instantaneous)*
tU<	*Trip – Undervoltage protection level*	*(time delayed)*
SAT>1	PID-V saturation >	
SAT<1	PID-V saturation <	
SAT>2	PID-I saturation >	
SAT<2	PID-I saturation <	
Q1	Command Q1 contactor	
Q2	Command Q2 contactor	
Q3	Command Q3 contactor	
Q4	Command Q4 contactor	
St-s2s1	Start step 2 to step 1	
Tr-s2s1	Trip step 2 to step 1	
St-s1s2	Start step 1 to step 2	
Tr-s1s2	Trip step 1 to step 2	
St-s3s2	Start step 3 to step 2	
Tr-s3s2	Trip step 3 to step 2	
St-s2s3	Start step 2 to step 3	
Tr-s2s3	Trip step 2 to step 3	
Step1	Step 1 (Vfb > 2400)	
Step2	Step 2 (Vfb > 1800)	
Step3	Step 3 (Vfb > 600)	
Fan_On	Fan command	
BlcDRPm	DRP pulse block (Lack of Pulse)	required (I>,I>>,faults, external alarms)
VcaFail	Vca Failure	
RegAct	Regulation Active	On when pulse is active
tRegAct	Time delay for Regulation Active	
InpPID1s-f	Input PID-V from field	
InpPID2s-f	Input PID-I from field	
FailDRP	Failure DRP	
Test	Test	
IRF	Internal Regulator Fault	
HwRecov	Hardware Recovery	
AssSyn	Start - Lack Synchronism	
tAssSyn	Trip - Lack Synchronism	
GenStart	General Starts	
GenTrip	General Trip	
DCBSC	DC Bus Short circuit	
tVb>	Enable start DRP-2DS	
VFB<>	Under/Over Feedback	
GenTripF	General Trip Frozed	
AnTrasnd	Transducer Fail	

10.7 - Commands

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

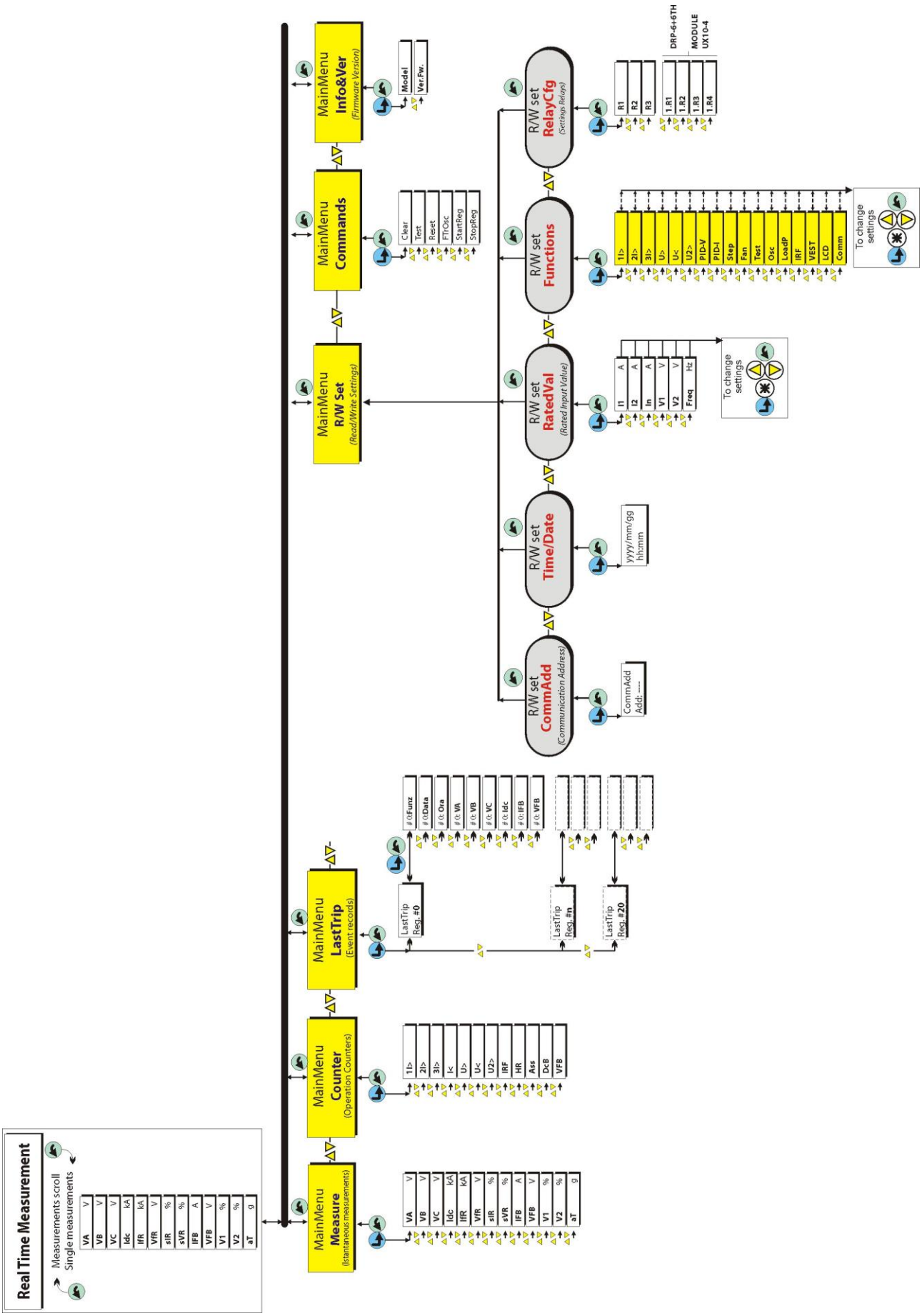
Display		Description
Clear	:	Erase memory of Trip Counters, Event Records.
Test	:	Starts a relay diagnostic test
Reset	:	Reset after trip
FTrOsc	:	Force Oscillographic Trigger
StartReg	:	Start Regulation
StopReg	:	Stop Regulation
Zero_Idc	:	Reset of Idc current measurement
Restart	:	Restart DRP can protocol (Hidden Parameters - Reserved for service installation)
User	:	User Select Q1-Q4 step (Hidden Parameters - Reserved for service installation)

10.8 - Info&Ver

The menu displays the Relay Model and the Firmware Version

- " **R**eal **T**ime **M**eas " ↳
- △▽ " Info/Ver ",
- △▽ " Model XXXXXX ", Model Relay
- △▽ " RelayVrs ###.#.#*X* ", Firmware Version
- ↶ to go back to " Info&Ver ".
- ↶ to go back to " **R**eal **T**ime **M**eas "

11. Keyboard Operational Diagram



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 1st digit (1-9) ↳ to validate
- △▽ to select 2nd digit (1-9) ↳ to validate
- △▽ to select 3rd digit (1-9) ↳ to validate
- △▽ to select 4th 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 (RT Meas).
Once the Password has been entered, a “ # “ appears before the variable that can be modified.

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

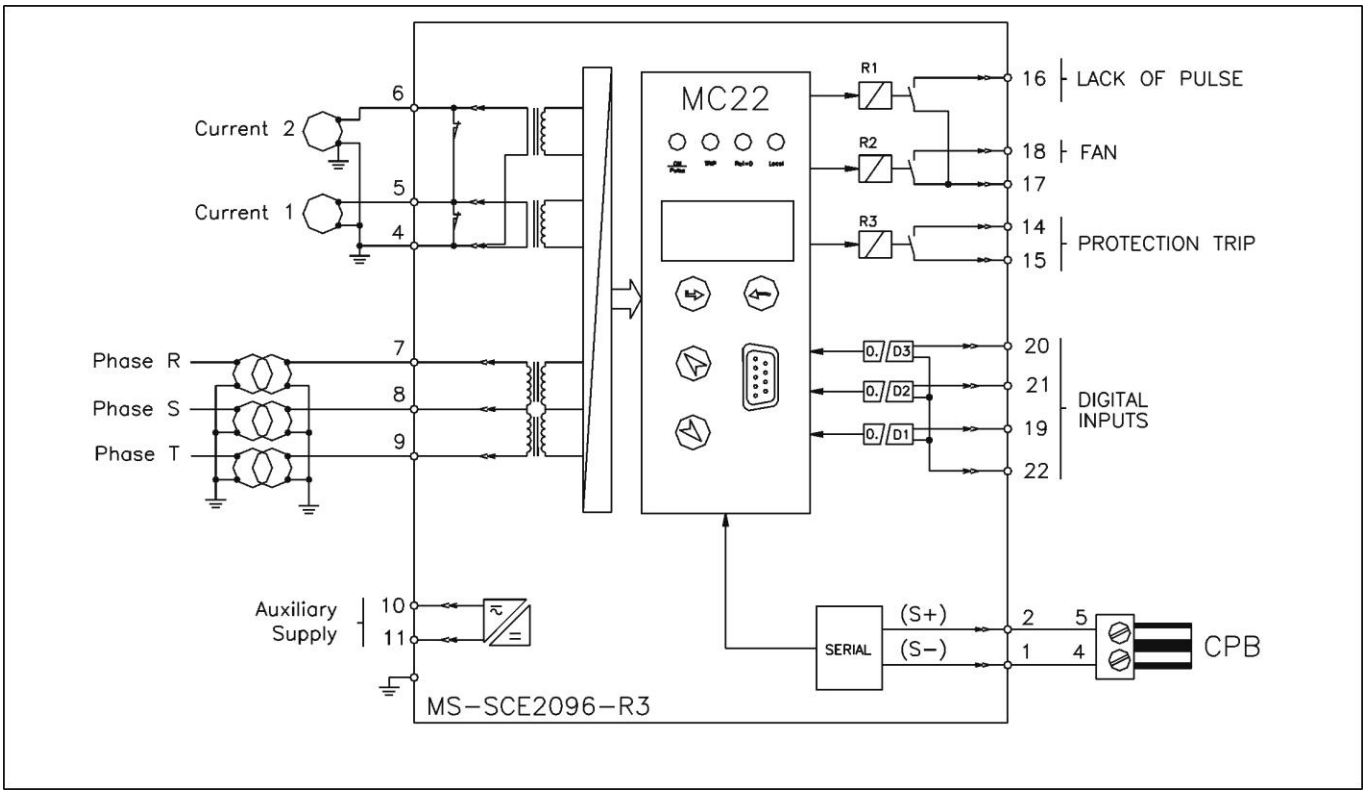
13. Maintenance

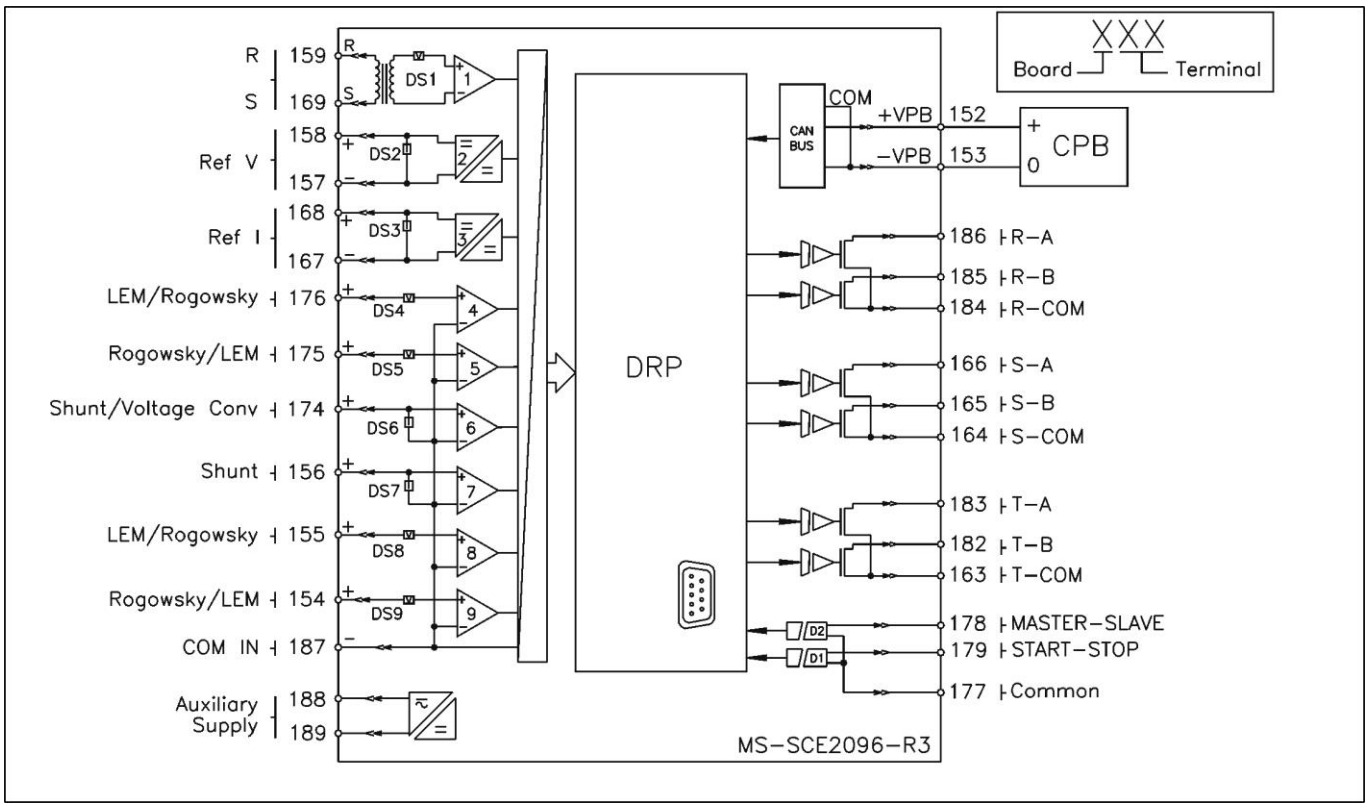
No maintenance is required. In case of malfunctioning please contact FRIEM Service or the local Authorised Dealer mentioning the relay's Serial No reported in the label on relays enclosure.

14. Power Frequency Insulation Test

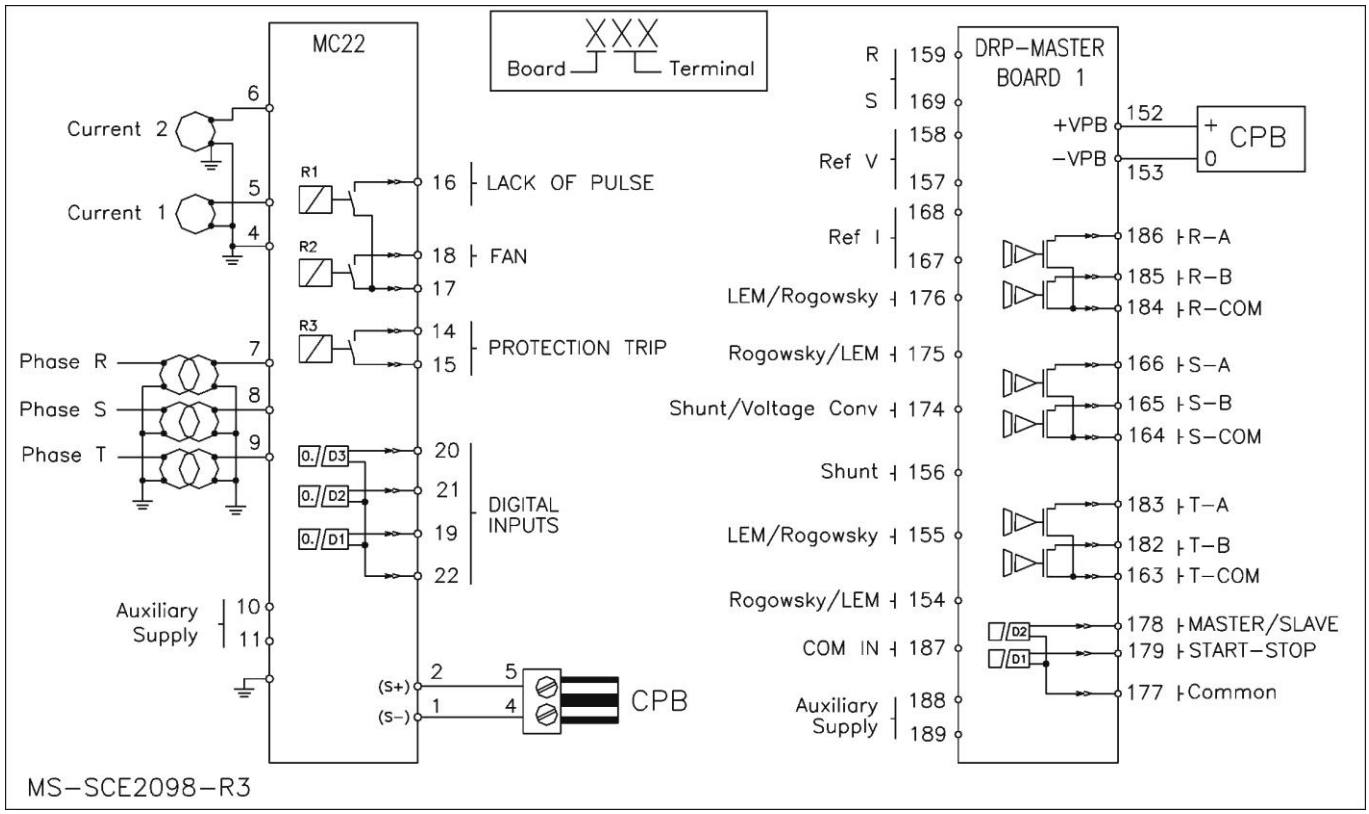
Every relay individually undergoes a factory insulation test according to IEC255-5 standard at 2 kV, 50 Hz 1min. Insulation test should not be repeated as it unusefully stresses the dielectrics.
When doing the insulation test, the terminals relevant to serial output, digital inputs and RTD input must 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.

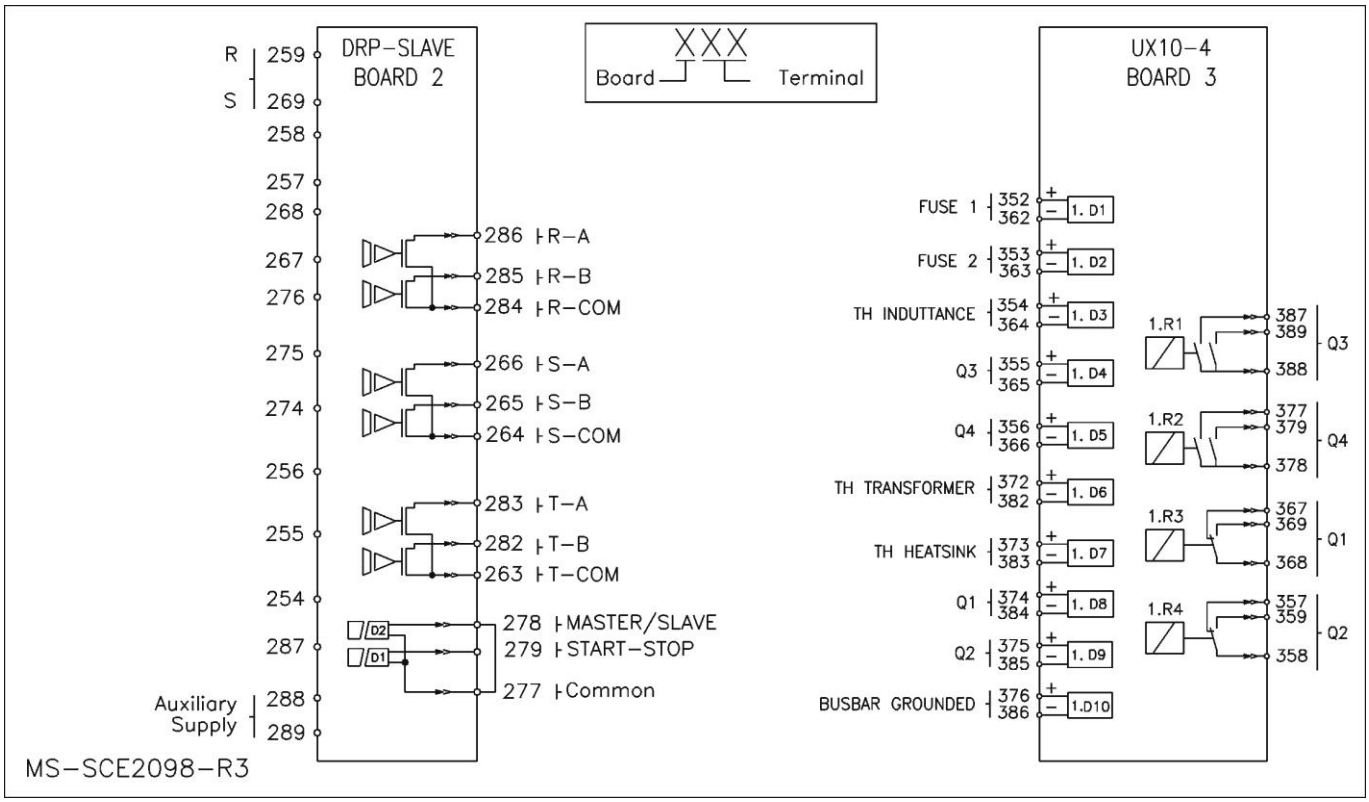
15. DRP-6 - Wiring Diagram



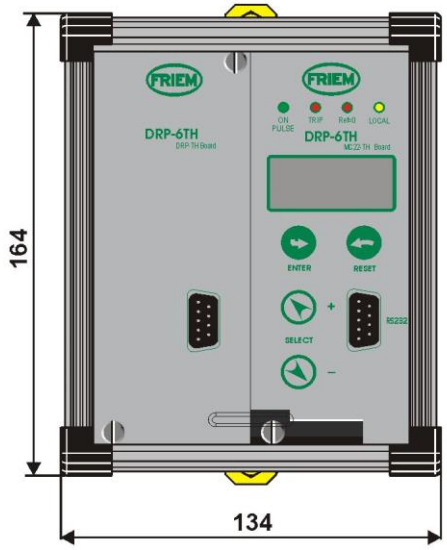


*15.1 – **DRP-6+6** - Wiring Diagram*

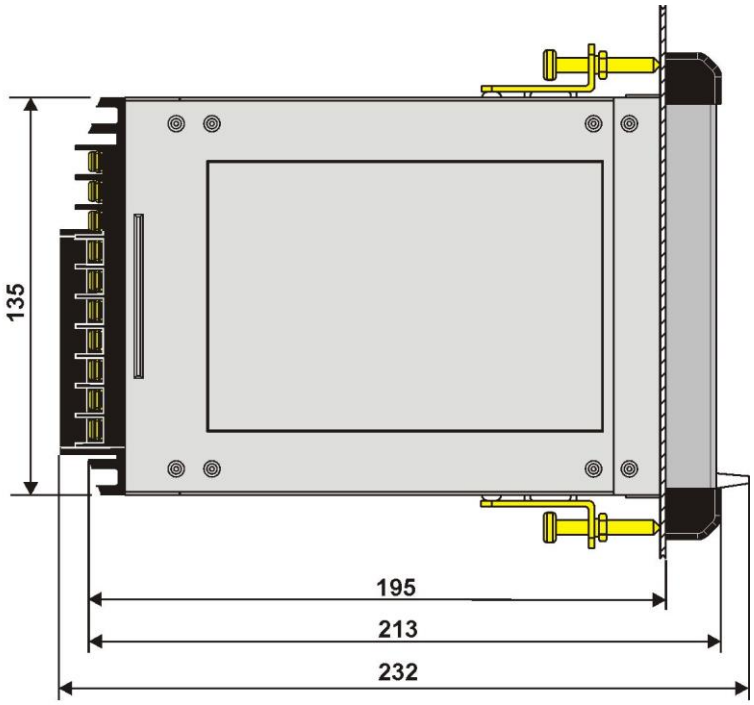


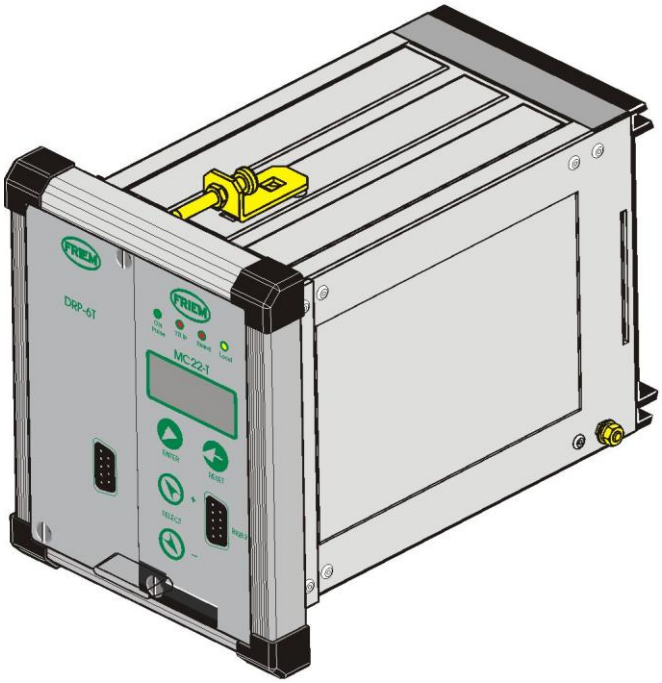


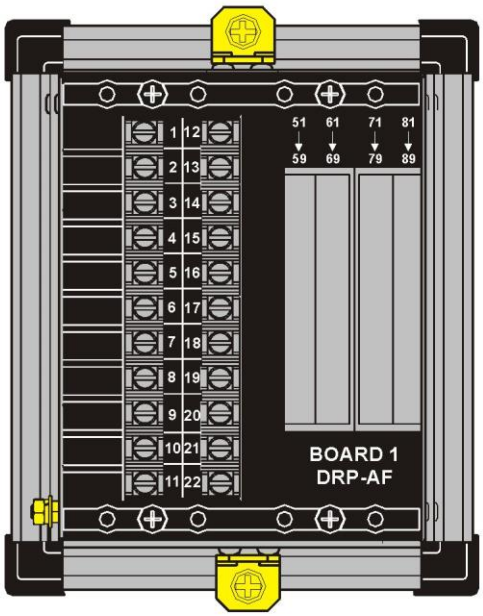
16. DRP-6TH - Overall Dimensions (mm)



PANEL CUT-OUT
115x137 (LxH)

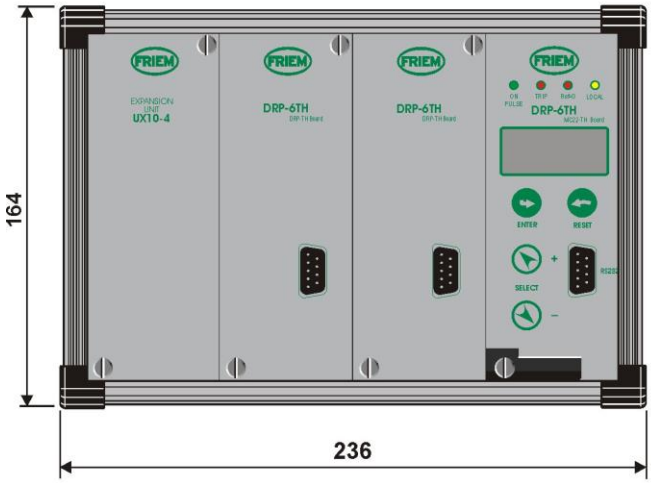




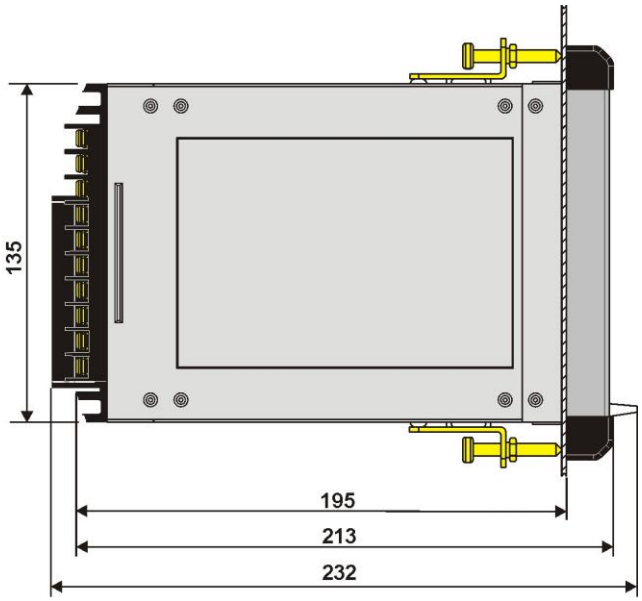


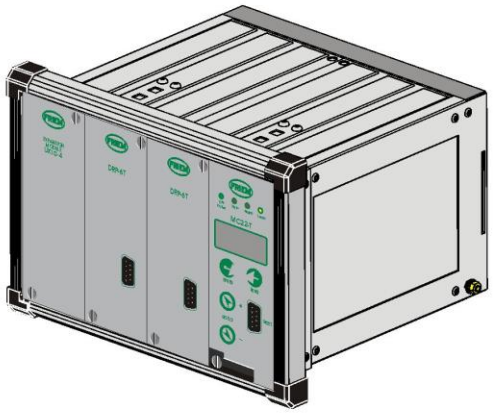
VIEW OR REAR - TERMINAL CONNECTION

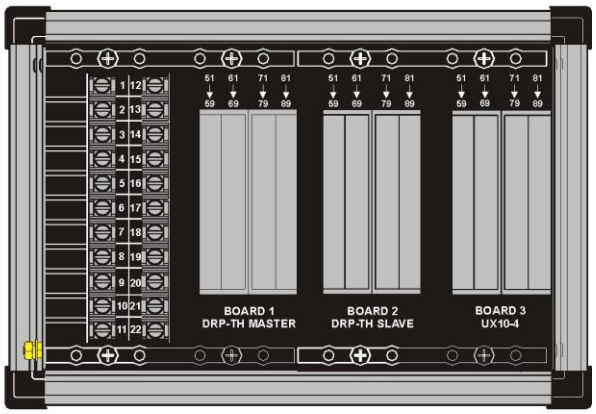
*16.1 – **DRP-6+6T** – Overall Dimensions (mm)*



PANEL
CUT-OUT
217x137 (LxH)







VIEW OR REAR - TERMINAL CONNECTION

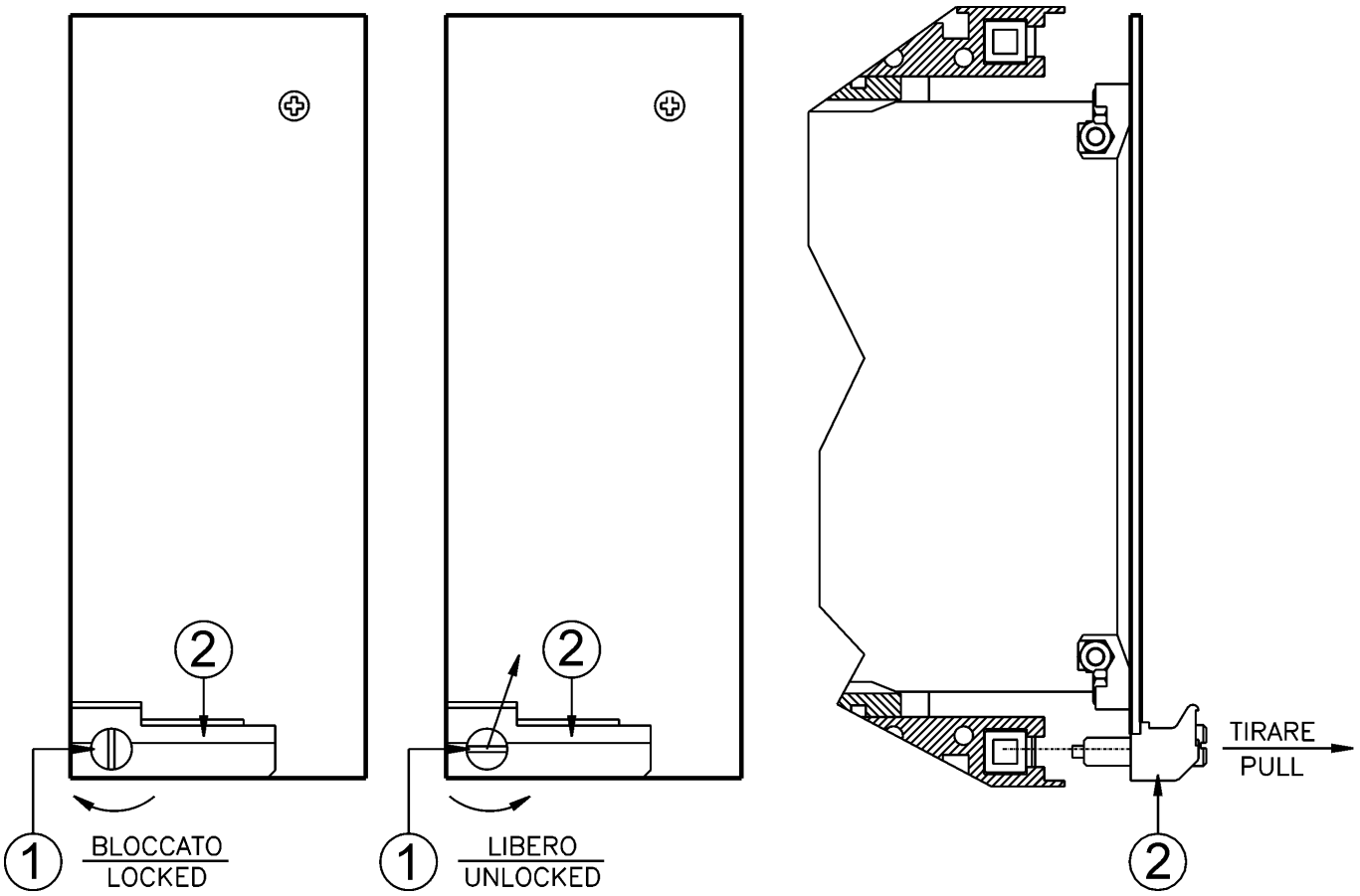
17. Direction for Pcb's Draw-Out and Plug-In

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	level 3	80-2000MHz	10V/m
		ENV50204		900MHz/200Hz	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		<1% F.s. for regulation <2% F.s. for measure			
		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