LEROY SOMER

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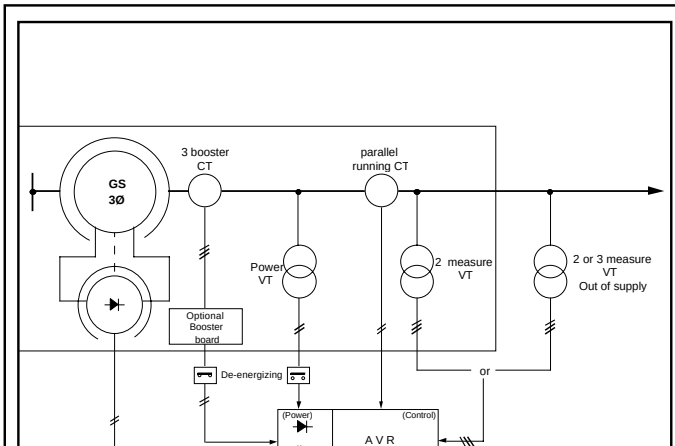

AUTOMATIC VOLTAGE REGULATOR
R610

Instruction manual

AVR
MODEL R610

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NOTE

THE ELECTRICAL CONNECTION DIAGRAM ARE ONLY GIVEN AS AN INDICATION. PLEASE REFER TO THE SPECIFIC DIAGRAMS OF YOUR ALTERNATOR

WARNING

TO PREVENT PERSONNAL INJURY OR EQUIPMENT DAMAGE, ONLY QUALIFIED TECHNICIANS/OPERATORS SHOULD INSTALL AND OPERATE THIS DEVICE

CAUTION

MEGGERS AND HIGH POTENTIAL TEST EQUIPMENT MUST NOT BE USED. INCORRECT USED OF SUCH EQUIPMENT COULD DAMAGE THE SEMICONDUCTORS CONTAINED IN THE AVR

AVR MODEL R610 CARDS REFERENCE

DESIGNATION	N° printed circuit board	N° complete card	N° instruction manual	REMARKS
Wired empty rack		C51950255	NT1950255/a-03/96	SHUNT (+booster)
				PMG or AREP
Complete Generator 1-2F board		C51950230	NT1950230/a-03/96	100 / 120V - 50 / 60Hz
Complete Generator 1-2F board		C51950232	NT1950230/a-03/96	400 / 450V - 50 / 60Hz
Complete Generator 3F board		C51950233	NT1950233/a-03/96	Gen:110V; Mains:110V
Complete Generator 3F board		C51950235	NT1950233/a-03/96	Gen:400V; Mains:400V
Complete Generator 3F board		C51950234	NT1950233/a-03/96	Gen:400V; Mains:110V
Rack supply	CP1950040	C51950040	NT1950042/a-11/92	
Sensing	CP1950050	C51950050	NT1950052/a-11/92	
PID, limitation	CP1950060	C51950060	NT1950062/a-11/92	
Driver	CP1950070	C51950070	NT1950072/b-11/93	
CosØ, KVAR	CP1950080	C51950080	NT1950082/a-02/93	
Limit Istator	CP1950090	C51950091	NT1950090/a-11/92	
Manual mode 2	CP1950100	C51950102	NT1950100/a-02/93	
Digital U / P.F potentiometer	CP1950110	C51950111	NT1950110/a-01/94	
Mains P.F régulation	CP1950120	C51950121	NT1950120/a-04/94	
Rotating diodes failure detector	CP1950130	C51950131	NT1950130/a-06/96	Available 09/96

= Necessary

= Optionnal

NOTE :
- 1F = Solo or parallel operation between machines (Voltage regulation + reactive load sharing (droop))
- 2F = 1F + parallel operation with the mains (P.F or KVAR regulation)
- 3F = 2F + automatic voltage matching between the generator and the mains. (For synchronizing)

IMPORTANT : The informations given on this sheet will be used to order spare parts. Take care of it.

AVR MODEL R610 GENERAL DESCRIPTION

1) APPLICATION

- The AVR model R600 can be used with brusless self-excited type generators, "SHUNT", "SHUNT with BOOSTER" or "SHUNT with PMG" excitation. In case of "SHUNT with BOOSTER the booster current is totally monitored by the AVR.
- The AVR is able to ensure, depending of its constitution, solo operation, parallel operation between equivalent generators or parallel operation with the mains with cosØ or KVAR regulation.

2) DESCRIPTION

- The AVR model R610 is composed of electronic cards wich are included in a half rack 19" .
- An empty slot located on the left of the rack allows future optional cards to be added without any internal wiring modification.
- The rear flat cable (BUS 64 points) is given more long as it can be connected to an optional interface terminal block wich gives all the internal test points or in the future the possibility to connect another rack if the cards number will become too important.

3) INTERCONNECTIONS

- External interconnections are located on the top of the rack in form of two terminal blocks:
- A power / voltage terminal block (16 terminals, two with fuses)
- A command / control terminal block (24 terminals)
- A conventional wiring connect this terminal blocks to the power block fitted on a heatsink and also to the "generator I/O" and "mains I/O" to give an interface with the flat cable BUS 64 points.
- In the same manner a 8 points connector connects directly the driver card to the power block.

4) OPTIONAL CARDS

- Basically the AVR allows voltage regulation with reactive sharing when paralleling with other machines.

The following cards can be plugged into the AVR without internal wiring modification :

- CosØ / KVAR regulation (2F) (// with the mains)

- Voltage equalization with the mains (3F) (Synchro)

Only one is possible with the following cards

- Voltage and P.F digital potantiometers

- Manual operation

- Istator limitation

- Mains P.F or KVAR regulation from 4-20mA sensor

5) SPECIFICATIONS :

- Sensing voltage
  : 100/110Vac 50Hz
  : 120/130Vac 60Hz
  : 380/420Vac 50Hz
  : 430/450Vac 60Hz

- Power supply
  : Depend of generator(Adaptation by transformer). Maximum 180Vac 50/60Hz
  : PMG possible maximum 150Vac 3Ø 50/150Hz

- Field output
  : 8 Amperes nominal, 20Amp maximum during 10s on 6Ω minimum

- Accuracy
  : +/-1% of the means of the three phases on linear load and without droop

- Voltage setting range
  : +/-5% of the nominal voltage by means of external optionnal potentiometer .

- Droop setting range
  : - 7% of the nominal voltage at cosØ =0

- Under-frequency protection
  : Adjustable threshold and slope from V/Hz to 2V/Hz

- Field ceiling
  : 110% of If nominal permanently, unlocked in case of voltage decrease

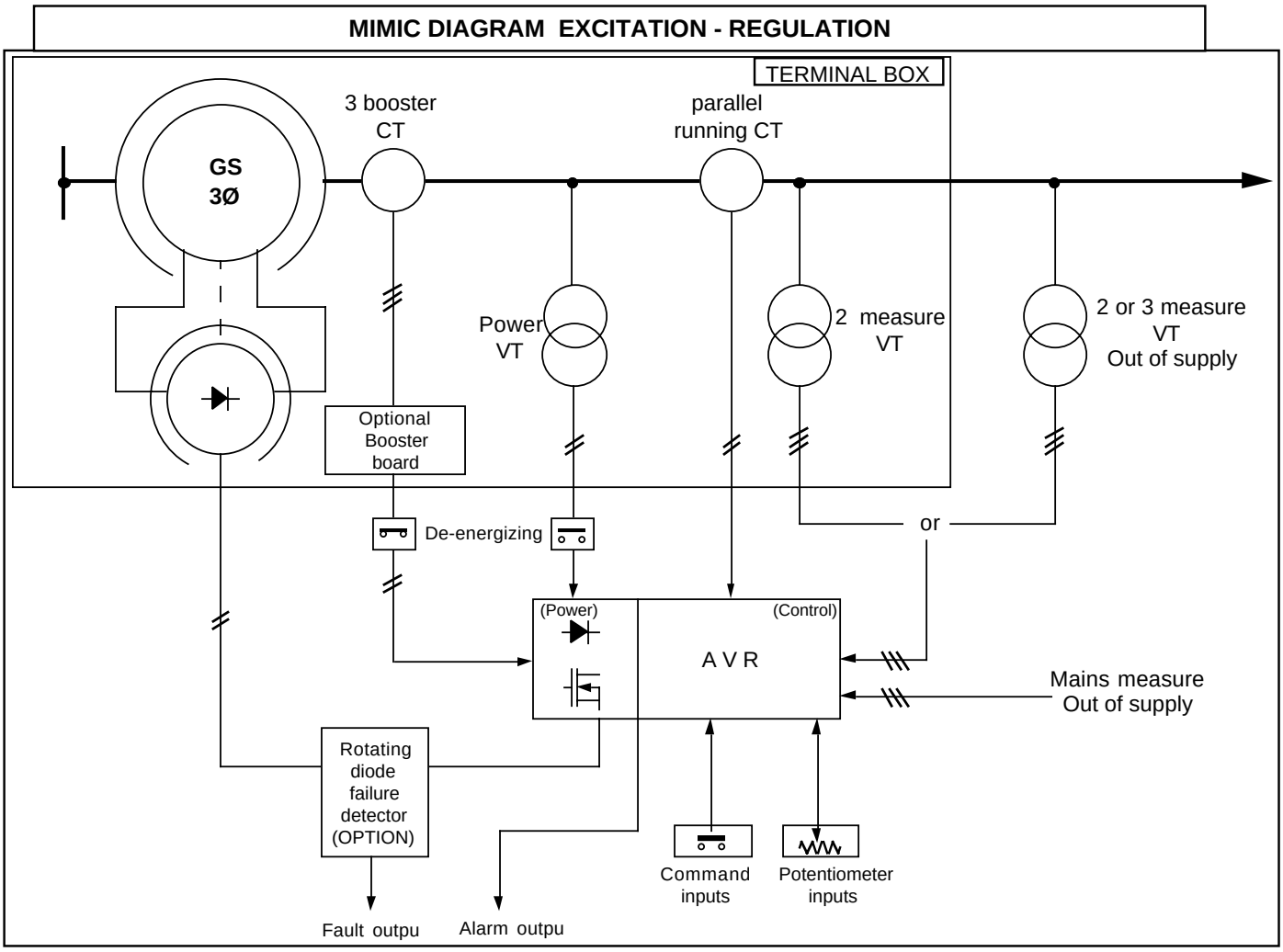
- Protection
  : Heatsink overheating, exciter short-circuit

- Alarm output
  : Heatsink overheating, too much ceiling unlocked time

- Environnement
  : Maximum ambiant temperature -10°C to +50°C
  : Fitting in control panel without excessive vibrations

6) SCHEMATICS AND DRAWINGS

- Following schematics give all the usual informations on the interconnexions between the terminal block, the I/O connectors and the power block.



VOLTAGE / POWER TERMINAL BLOCK

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
GROUND	U GENERATOR	V GENERATOR	W GENERATOR	+ Field flashing	+ Field	- Field	+ Booster	- Booster	// CT	// CT	U MAINS	V MAINS	W MAINS	Power supply (Fused)	Power supply	Power supply (Fused)

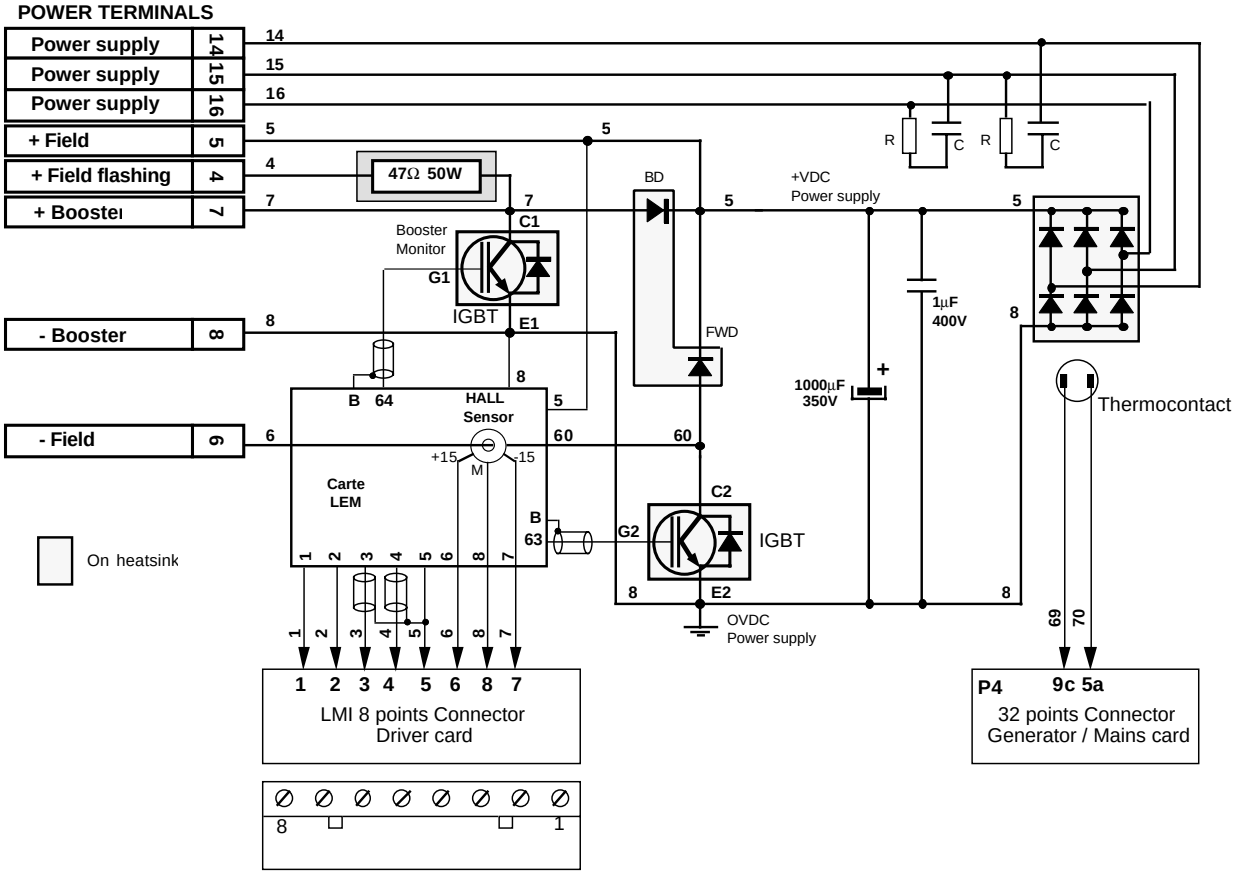
COMMAND / CONTROL TERMINAL BLOCK

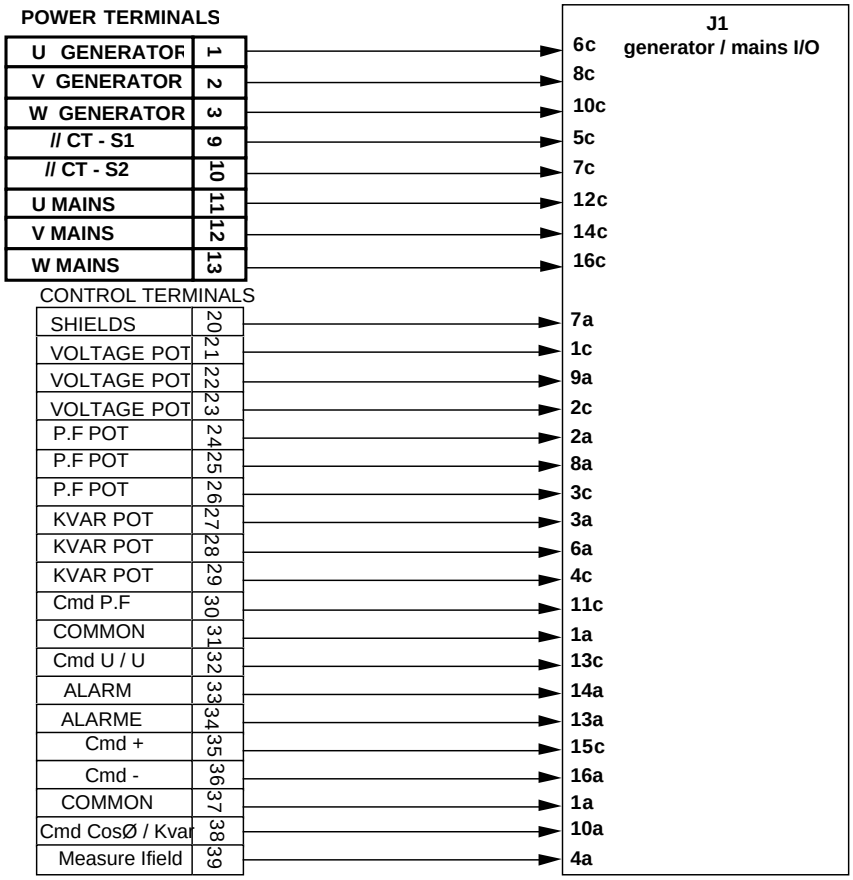
20	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SHIELD	SHIELD	VOLTAGE POT	VOLTAGE POT	VOLTAGE POT	P.F POT	P.F POT	P.F POT	KVAR POT	KVAR POT	KVAR POT	Cmd P.F	COMMON	Cmd U/U	ALARM	ALARM	CMD +U	CMD -U	COMMON	Cmd COSØ / KVAR	Measure Ifield	

TERM N°	VOLTAGE / POWER TERMINAL BLOCK	0F	1F	2F	3F
1	Phase 1 (U) machine (measure)	N	N	N	N
2	Phase 2 (V) machine (measure)	N	N	N	N
3	Phase 3 (W) machine (measure)	N	N	N	N
4	+ fiel flashing or pre-excitation input (optional)	O	O	O	O
5	+ field output	N	N	N	N
6	- field output	N	N	N	N
7	+ booster input	O	O	O	O
8	- booster input	O	O	O	O
9	Paralleling CT phase 2 (V) S1		N	N	N
10	Paralleling CT phase 2 (V) S2		N	N	N
11	Phase 1 (U) mains (measure)				N
12	Phase 2 (V) mains (measure)				N
13	Phase 3 (W) mains (measure)				N
14	Power supply input (fused)	N	N	N	N
15	Power supply input	N	N	N	N
16	Power supply input (fused)	N	N	N	N
17					
18					
19					
	COMMAND / CONTROL TERMINAL BLOCK				
20,2	Potentiometer shield (2 terminals)	O	O	O	O
21	External voltage potentiometer maximum CW)	O	O	O	O
22	External voltage potentiometer (10KΩ-2W) (cursor)	O	O	O	O
23	External voltage potentiometer (minimum CCW)	O	O	O	O
24	External cosØ potentiometer maximum CW)			O	O
25	External cosØ potentiometer (10KΩ-2W) (cursor)			O	O
26	External cosØ potentiometer (minimum CCW)			O	O
27	External KVAR potentiometer maximum CW)			O	O
28	External KVAR potentiometer (10KΩ-2W) (cursor)			O	O
29	External KVAR potentiometer (minimum CCW)			O	O
30	cosØ regulation command input (/ terminal 31)			N	N
31	Common			N	N
32	Voltage equalization command input (/ terminal 31)				N
33	Overheating or ceiling unlocked time alarm output (NO)	O	O	O	O
34	Overheating or ceiling unlocked time alarm (common)	O	O	O	O
35	Upper command voltage and P.F (/ terminal 37)	O	O	O	O
36	Lower command voltage and P.F (/ terminal 37)	O	O	O	O
37	Common	O	O	O	O
38	CosØ / KVAR selection command input (/ terminal 37)			O	O
39	Fied current measurement output (+Vdc / terminal 20)	O	O	O	O
40	Reserve				

O = Optional
N = Neccessary
Nothing = Not applicable

O = Optional
N = Neccessary
Nothing = Not applicable

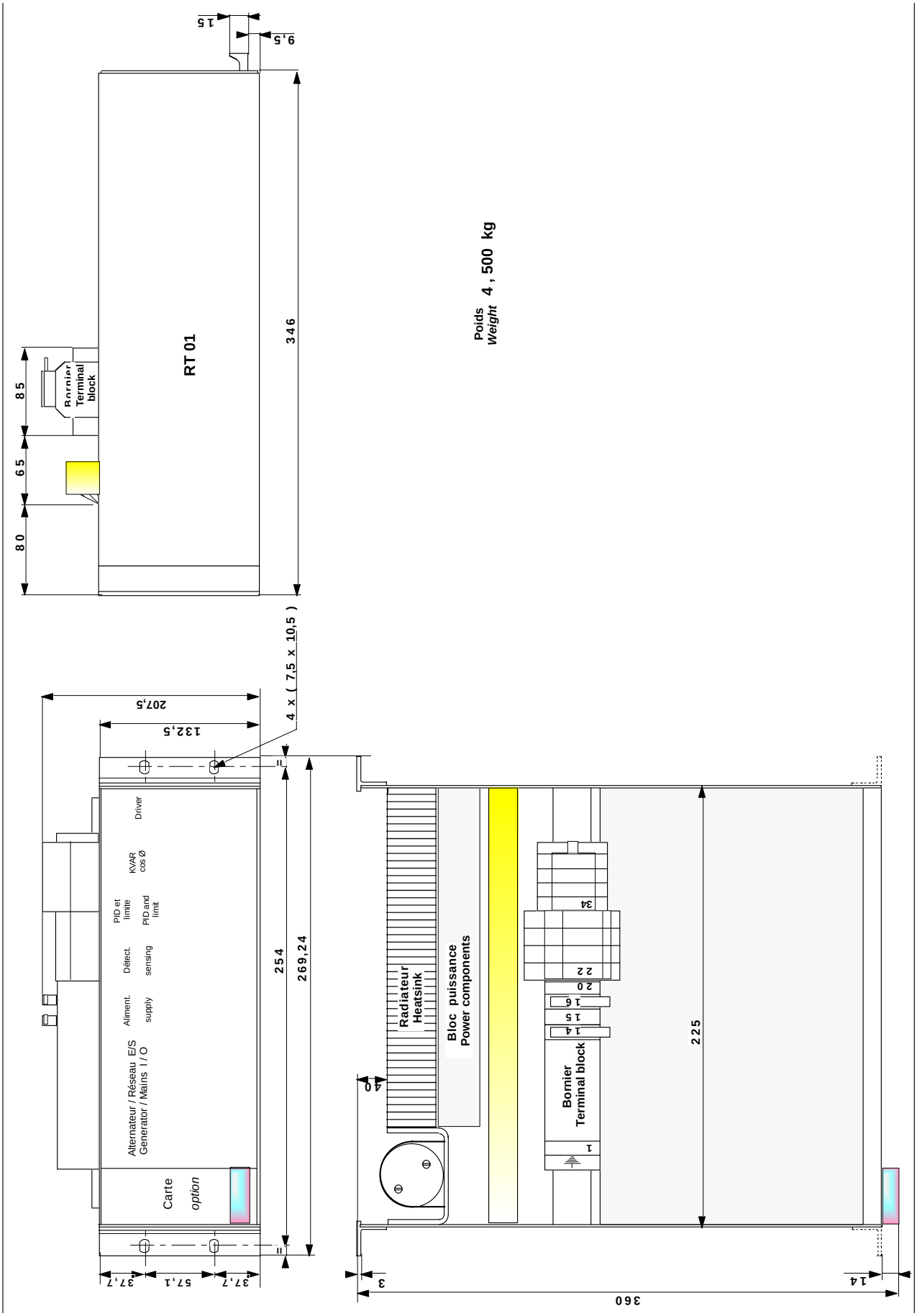

POWER TERMINALS
Power supply 14
Power supply 15
Power supply 16
+ Field 5
+ Field flashing 4
+ Booster 7
- Booster 8
- Field 6
47Ω 50W
Booster Monitor
G1
C1
IGBT
E1
B 64
HALL Sensor
Carte LEM
+15
M
-15
BD
FWD
C2
G2
B 63
IGBT
E2
OVDC Power supply
+VDC Power supply
R
C
1µF 400V
1000µF 350V
Thermocontact
On heatsink
LMI 8 points Connector Driver card
P4 9c 5a
32 points Connector Generator / Mains card


POWER TERMINALS
U GENERATOR 1
V GENERATOR 2
W GENERATOR 3
// CT - S1 9
// CT - S2 10
U MAINS 11
V MAINS 12
W MAINS 13
CONTROL TERMINALS
SHIELDS 20
VOLTAGE POT 21
VOLTAGE POT 22
VOLTAGE POT 23
P.F POT 24
P.F POT 25
P.F POT 26
KVAR POT 27
KVAR POT 28
KVAR POT 29
Cmd P.F 30
COMMON 31
Cmd U / U 32
ALARM 33
ALARME 34
Cmd + 35
Cmd - 36
COMMON 37
Cmd CosØ / Kvar 38
Measure Ifield 39
J1
generator / mains I/O
6c
8c
10c
5c
7c
12c
14c
16c
7a
1c
9a
2c
2a
8a
3c
3a
6a
4c
11c
1a
13c
14a
13a
15c
16a
1a
10a
4a

- The following tables give interconnections between each card and the 64 points flat cable.
- Grey cases give signals origine .
- Other cases where they go.
- On the left we have two numbers :
    - First the connector numering
    - Second test block terminal number.
- On the right we have a recapitulative of all the informations wich can be found on the test terminal block.

PIN	PIN	Gen/Mains I/O	Supply	Sensing	PID, limit	CosØ,KVAR	Pot digital U	Manu mode	Driver	test output
1c	1	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc
1a	2	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc	+Vcc
2c	3	+Vdc alim	+Vdc alim							+Vdc alim
2a	4	+Vdc alim	+Vdc alim							+Vdc alim
3c	5	-Vdc alim	-Vdc alim							-Vdc alim
3a	6	-Vdc alim	-Vdc alim							-Vdc alim
4c	7	Vac puiss 1						Vac puiss 1	Vac puiss 1	Vac puiss 1
4a	8	Vac puiss 2							Vac puiss 2	Vac puiss 2
5c	9	GND	GND	GND	GND	GND	GND	GND	GND	GND
5a	10	Vac-dr1								Vac-dr1
6c	11	Vac-dr2								Vac-dr2
6a	12	Vac-dr3								Vac-dr3
7c	13	GND	GND	GND	GND	GND	GND	GND	GND	GND
7a	14	Vac-dm1		Vac-dm1						Vac-dm1
8c	15	Vac-dm2		Vac-dm2		Vac-dm2				Vac-dm2
8a	16	Vac-dm3		Vac-dm3						Vac-dm3
9c	17				V-10%			V-10%	V-10%	V-10%
9a	18	TI//		TI//		TI//				TI//
10c	19					Déphasage				Déphasage
10a	20	Ures			Ures					Ures
11c	21			Um	Um					Um
11a	22			Uref	Uref					Uref
12c	23				Correct PID			Correct PID		Correct PID
12a	24					IsinØ				IsinØ
13c	25				Uregl		Uregl			Uregl
13a	26				Statisme D	Statisme D				Statisme D
14c	27				cosØ, KVAR	cosØ, KVAR				cosØ,KVAR
14a	28				IcosØ	IcosØ				IcosØ
15c	29				Sauto		Sauto	Sauto	Sauto	Sauto
15a	30							Smanu	Smanu	Smanu
16c	31						cde Iexc	cde Iexc	cde Iexc	cde Iexc
16a	32	GND	GND	GND	GND	GND	GND	GND	GND	GND

PIN	PIN	Gen/Mains I/O	Supply	Sensing	PID, limit	CosØ, KVAR	Pot dig U	Manu mode	Driver puiss	test output
17c	33	GND	GND	GND	GND	GND	GND	GND	GND	GND
17a	34	Mes Iexc							Mes Iexc	Mes Iexc
18c	35	synchro							Perte synchro	Perte synchro
18a	36	I limit							I limit	I limit
19c	37	GND	GND	GND	GND	GND	GND	GND	GND	GND
19a	38	Fin rampe			Fin rampe				Fin rampe	Fin rampe
20c	39	U cosØ				U cosØ	U cosØ			U cosØ
20a	40	P.F/KVAR				P.F/KVAR	P.F/KVAR			P.F/KVAR
21c	41	U KVAR				U KVAR	U KVAR			U KVAR
21a	42	Pot tension			Pot tension					Pot tension
22c	43	U tension			U tension					U tension
22a	44	+Iexc								+Iexc
23c	45	-Iexc								-Iexc
23a	46	+Uauto					+Uauto			+Uauto
24c	47	-Uauto					-Uauto			-Uauto
24a	48	Cde reg cosØ			Cde reg cosØ					Cde reg cosØ
25c	49	Cde U=U			Cde U=U					Cde U=U
25a	50	cde auto/manu						cde auto/manu	cde auto/manu	cde auto/manu
26c	51	Défaut T°C							Défaut T°C	Défaut T°C
26a	52									reserve
27c	53							Cde U		Cde U
27a	54									reserve
28c	55									reserve
28a	56									reserve
29c	57									reserve
29a	58									reserve
30c	59									Max pot Iexc
30a	60						Max pot			Max pot U/P.F
31c	61									reserve
31a	62	Alarm							Alarm	Alarm
32c	63	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc
32a	64	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc	-Vcc


15
9,5
RT 01
346
Bornier
Terminal block
85
65
80
Poids
Weight
4 , 500 kg
4 x (7,5 x 10,5)
207,5
132,5
254
269,24
Alternateur / Réseau E/S
Generator / Mains I / O
Aliment.
supply
Détect.
sensing
PID et limite
PID and limit
KVAR cos Ø
Driver
Carte option
37,7
57,1
37,7
Radiateur
Heatsink
Bloc puissance
Power components
40
225
34
22
20
16
15
14
Bornier
Terminal block
1
3
14
360

AVR MODEL R610 — GENERATOR / MAINS I / O (1F / 2F)

1) FUNCTIONAL

- This unit is mainly an interface between external signals and low power electronics.

- It is composed by :

- The adaptation three phases transformer between generator input voltages (1F,2F) and measurement circuits.
For 2F a P.F / KVAR card must be fitted in the AVR

- The burden resistor of parallel CT.
- The adaptation transformer between input voltage and low power electronic supplies.
- The interface input relays between command / control terminals and internal circuits.
- The interface between 64pts BUS and the analogic input / output terminals

2) ADJUSTMENTS

- None

3) INPUT / OUTPUT

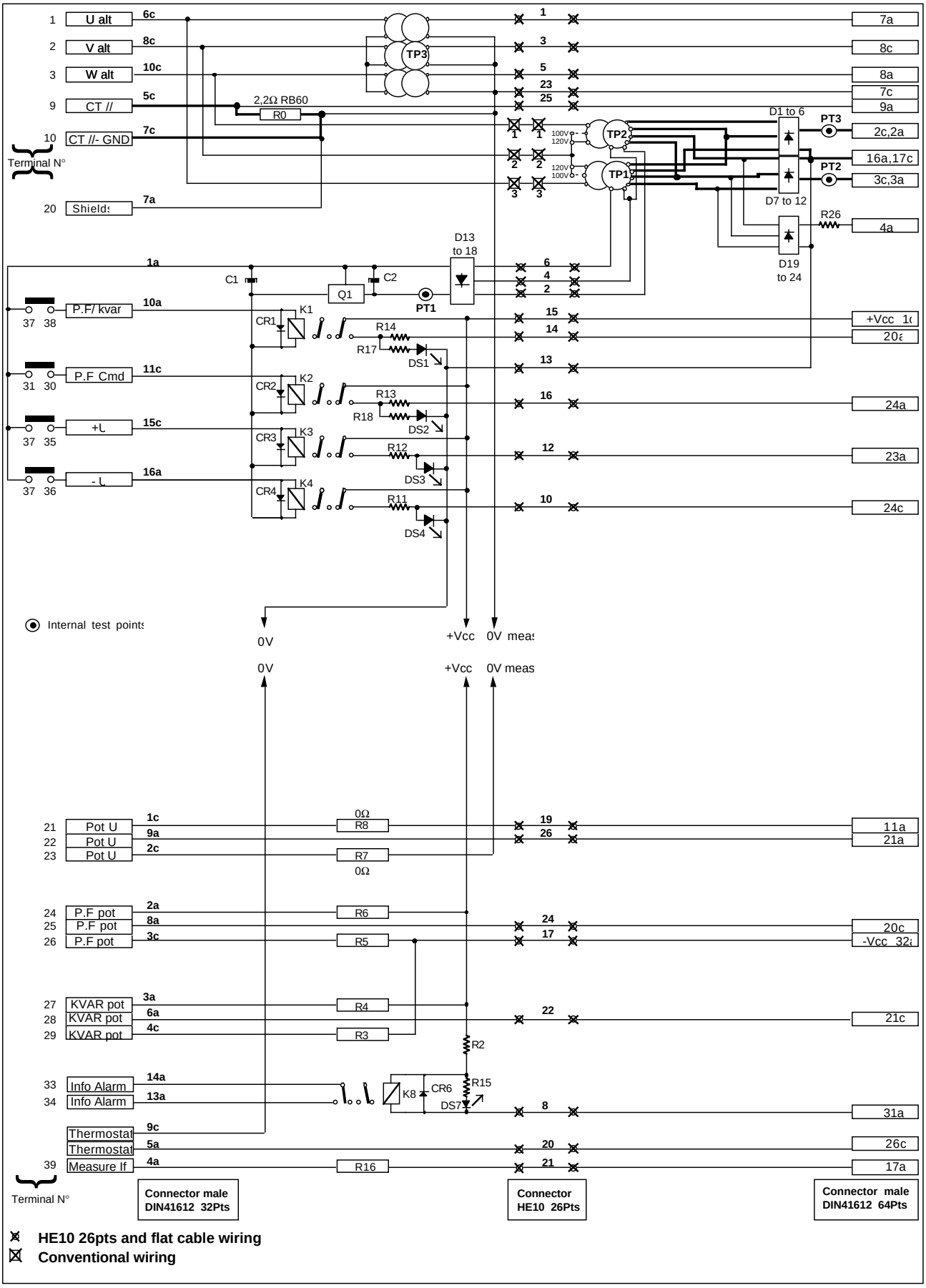
- See following table

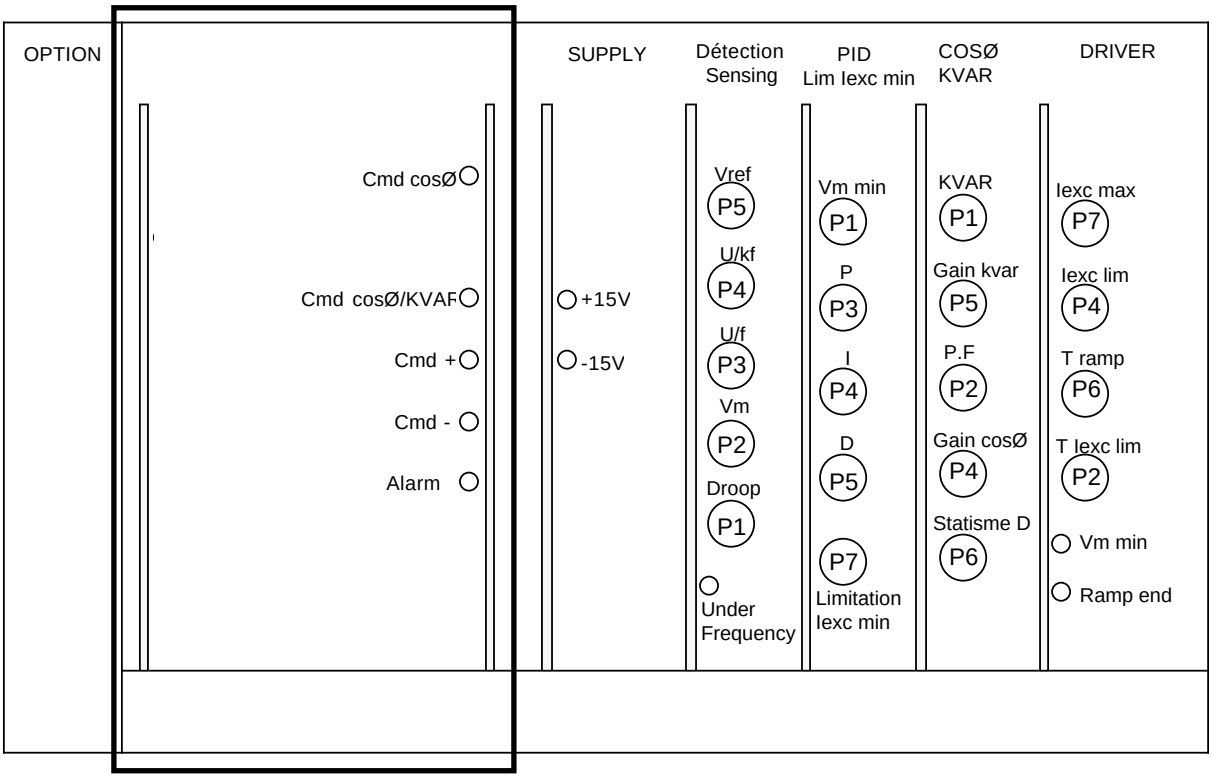
INPUT TERMINAL	Connector 32 PTS	Type I / O	Interface	Connector 26 PTS	Connector BUS 64 PTS
1	6c	measure	transfo 3Ø TP3	1	7a
1	6c	supply	transfo TP2		
2	8c	measure	transfo 3Ø TP3	3	8c
2	8c	supply	transfo TP1/2		
3	10c	measure	transfo 3Ø 3	5	8a
3	10c	supply	transfo TP1		
9	5c	measure	resistance RTI	25	9a
10	7c	measure	GND	23	7c
20	7a	shield	GND	23	7c
21	1c	signal	resistance	19	11a
22	9a	signal	direct	26	21a
23	2c	signal	resistance	23	7c
24	2a	signal	resistance	15	1c
25	8a	signal	direct	24	20c
26	3c	signal	resistance	17	32a
27	3a	signal	resistance	15	1c
28	6a	signal	direct	22	21c
29	4c	signal	resistance	17	32a
30	11c	cmd input	relay	16	24a
31	1a	common			
33	14a	cmd output	relay	8	31a
34	13a	cmd output	relay		31a
35	15c	cmd input	relay	12	23a
36	16a	cmd input	relay	10	24c
37	1a				
38	10a	cmd input	relay	14	20a
39	4a	signal	resistance	21	17a
40					

VOLTAGE INPUTS :

Reference	Generator sensing voltage
C5 195 0230	100V to 120V 50/60Hz
C5 195 0232	400V to 450V 50/60Hz

AVR MODEL R610 — GENERATOR / MAINS I / O (1F / 2F)





R610 potentiometers position. For adjustments, refer to specific card technical manual

AVR MODEL R610 — SUPPLY CARD

1) FUNCTIONAL

- This card, from not regulated symetrical voltage, generates +15Vdc and -15Vdc voltages with 0V common to both named +Vcc for +15V and Vdd for -15V in the following.

- The non régulated voltages are first filtered (C01, C02), pre-régulated to 20dc with ballast stages Q01 et Q02 and finally decreased to15V by means of RG01 et RG02 régulators.

- Its permanent current capability is 0,5 Amp on both polarity.

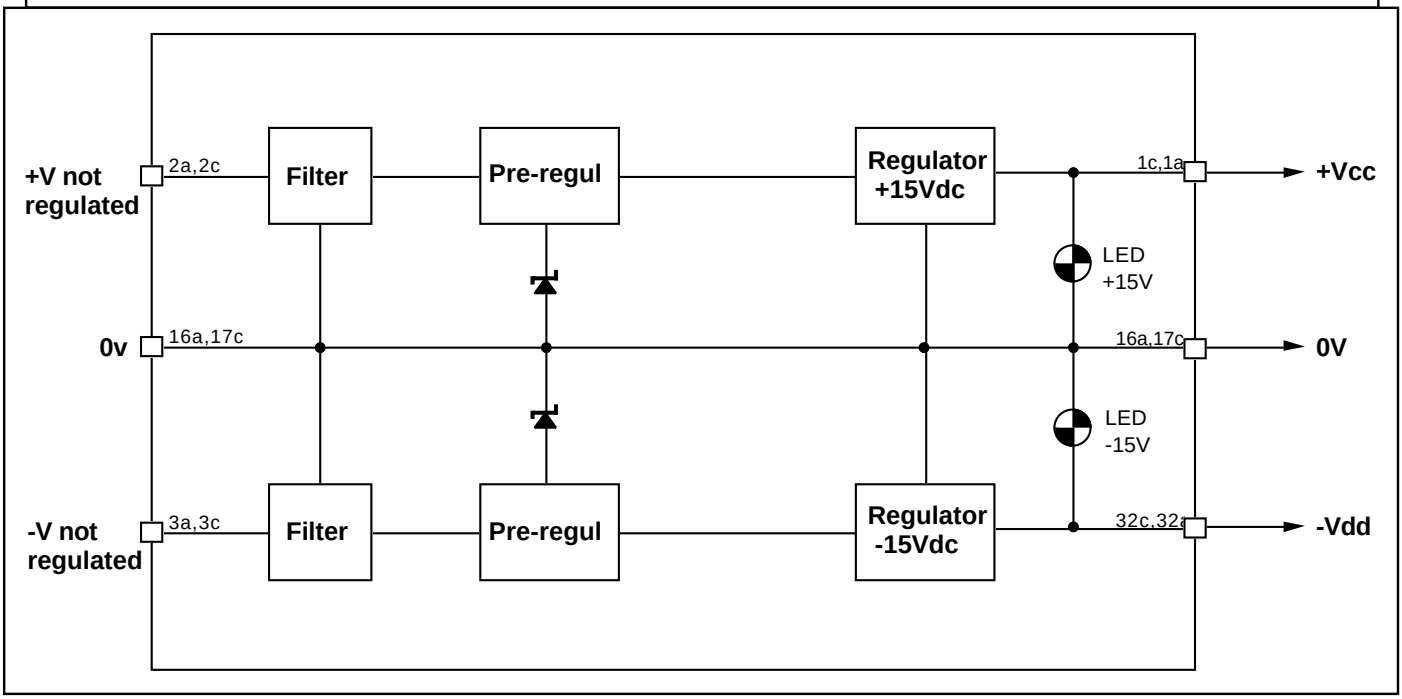
2) ADJUSTMENTS

- None

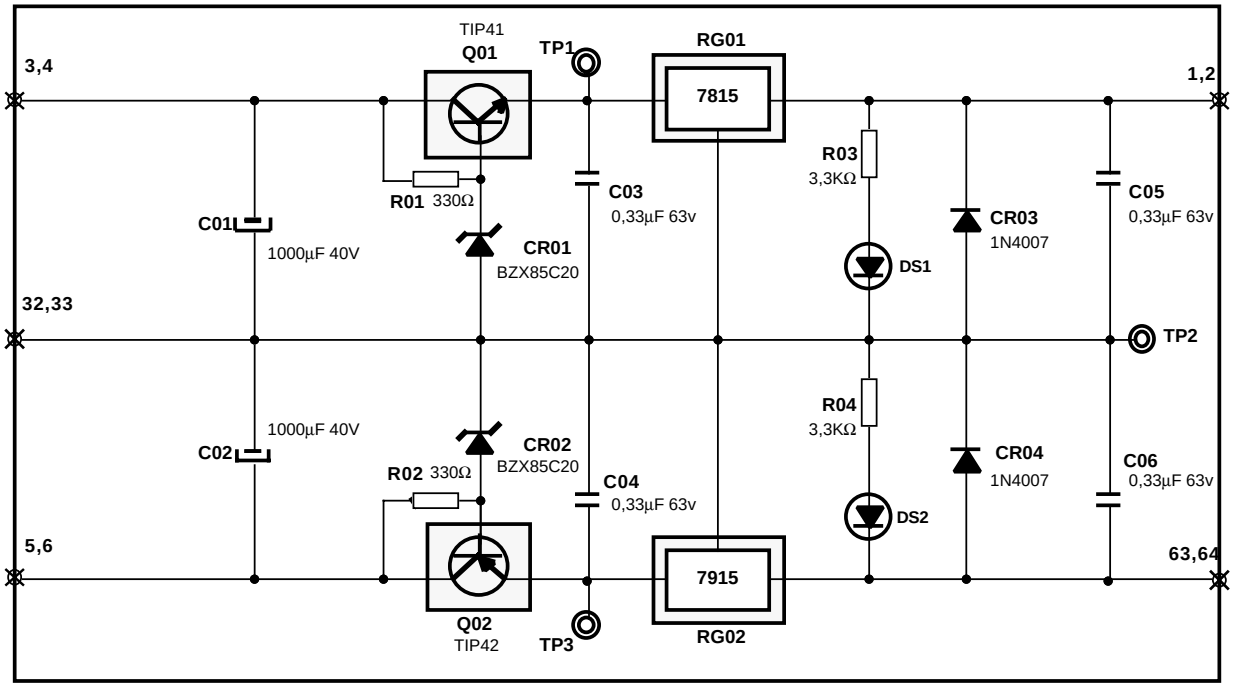
3) INPUTS / OUTPUTS

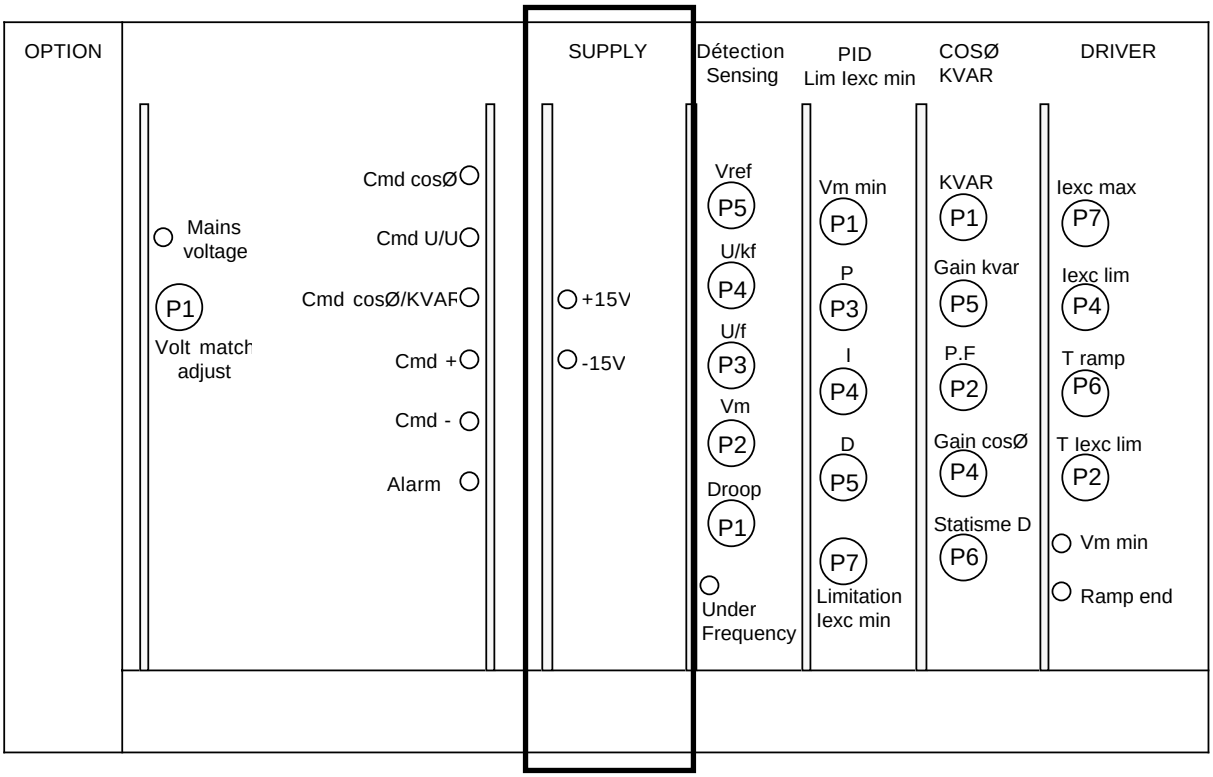
- 2a, 2c : Input +30Vdc not regulated
- 3a,3c : Input -30Vdc not regulated
- 1a,1c : Output +15Vdc regulated (Vcc)
- 32a,32c : Output -15Vdc regulated (Vdd)
- 16a,17c : Common electronic ground

MIMIC DIAGRAM OF ELECTRONIC SUPPLY CARD



AVR MODEL R610 SUPPLY CARD





AVR MODEL R610 — SENSING CARD

1) FUNCTIONAL

- This card elaborates from the three phases voltage image of the generator given by the "ALTERNATOR I/O" :

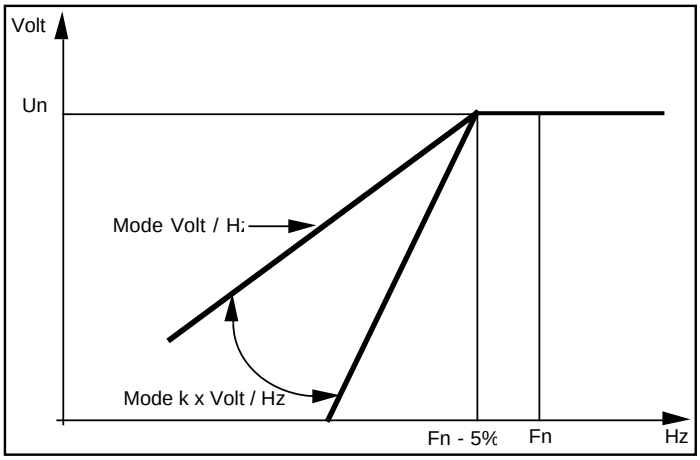
-A rectified, calibrated, filtered voltage Vm proportional to the stator voltage of the generator. Vm could be affected by droop depending of adjustment.

- A voltage function of the generator frequency, a part of which gives the reference set point named Vref.

- Vref is a constant above the underfrequency threshold set point (signaled by LED) and decreases below this threshold following a function depending of the position of the strap CV1:

- In fixed V/Hz mode

-In adjustable kVolt / Hz (see curve below)



2) ADJUSTMENTS

- P1 : Reactive droop adjust for parallel operation between equivalent machine.

- P2 : Vm adjust for nominal voltage. (9Vdc at Un)

- P3 : Underfrequency threshold adjust (normally Fn - 5%) signaled by LED.

- P4 : Underfrequency slope adjust (k) in kVolt / Hz mode

- P5 : Voltage set point Vref for the nominal voltage (9Vdc at Un and Fn)

3) INPUTS / OUTPUTS

- 7a, 8a, 8c : Voltage inputs image of the generator (3 x 21Vac between each and the GND)

- 9a : Current input image of the generator stator current (1Vac pour In)

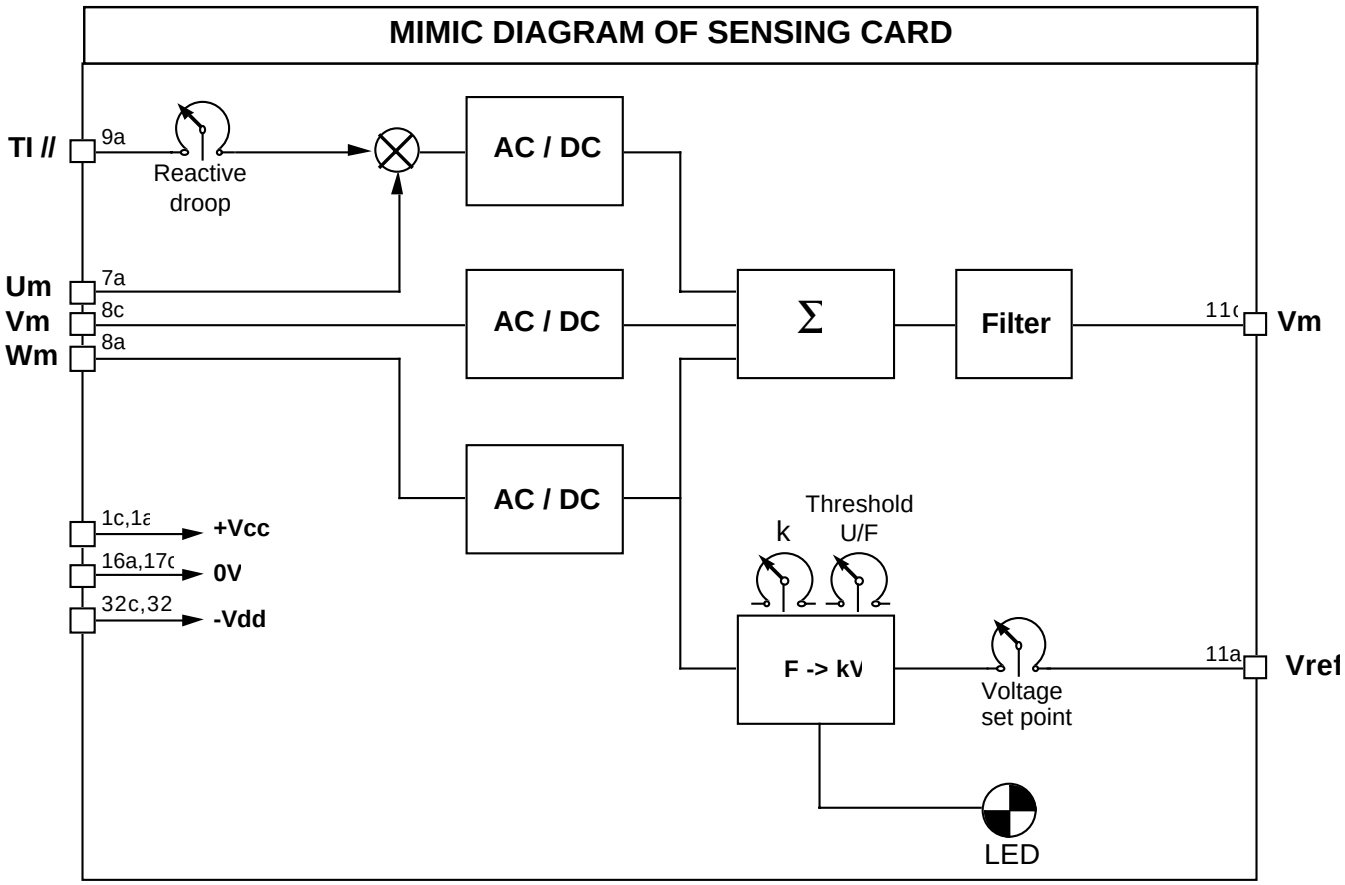
- 1a,1c : +15Vdc regulated (Vcc)

- 32a,32c : -15Vdc regulated (Vdd)

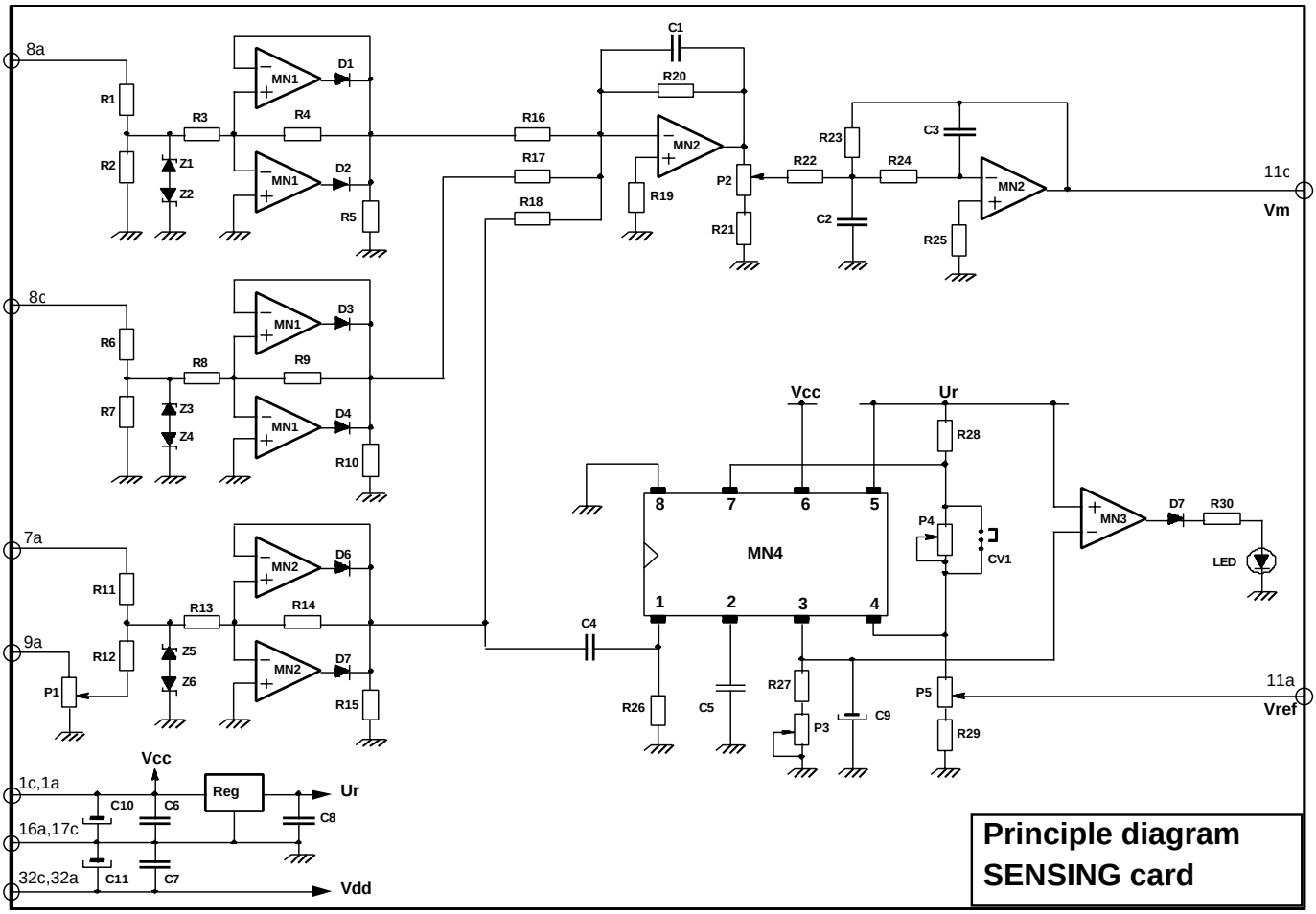
- 16a,17c : Common ground (GND or 0V)

- 11c : Voltage output image of the generator (Vm) 9Vdc at Un

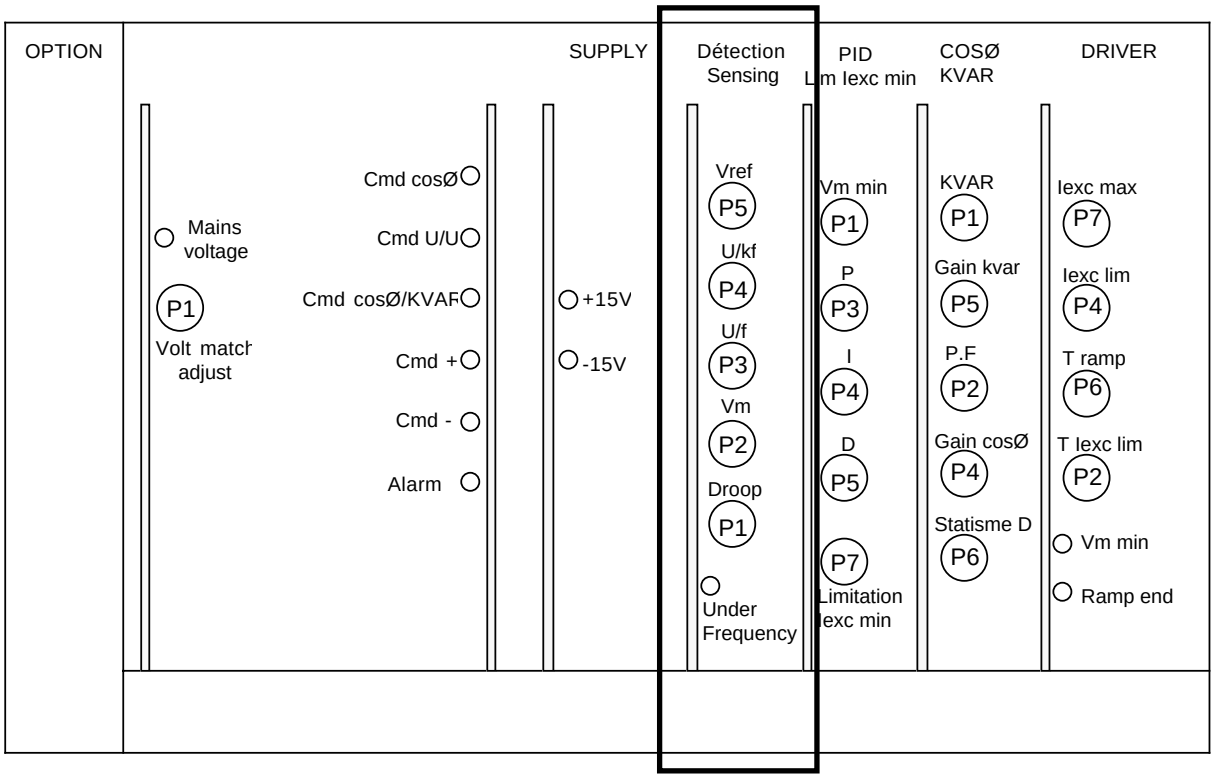
- 11a : Voltage set point output (Vref) 9Vdc at Un and Fn



AVR MODEL R610 SENSING CARD



Principle diagram SENSING card



AVR MODEL R610 — PID, LIMIT CARD

1) FUNCTIONAL

- This card, from Vm (machine voltage image), Vref (voltage set point) and complementary informations given in the following, elaborates the voltage command of the power driver card, which is the field current set point.

- Three operating modes are possible, depending of external informations :

- Solo operation or parallel operation between equivalent machines (1 Fonction)
(This is the normal mode)

- Parallel operation with the mains with power factor (COSØ) or KVAR regulation (2 Fonction)
(Only if COSØ / KVAR card is fitted)

- Operation in voltage equalization mode between machine and mains before coupling (3 Fonction)
(Only if "MAINS I / O" CARD is fitted)

1F : Machine image Vmis compared with the sum of Vref, Pext, etc voltages depending of used options and the resultant voltage (error voltage) feeds the PID.

2F : When cosØ cmd input is activated (+Vcc), the machine voltage Vm is compared to the voltage given from the cosØ/KVAR card and the result (error voltage) feeds the PID.

3F : When U/U cmd input is activated (+Vcc), the machine voltage Vm is compared to the voltage given from the "MAINS I / O" card and the result (error voltage) feeds the PID.

A compensation external input, given for specific applications is added to the error voltage and the resultant voltage is the real PID input. Each branch (P, I, D) of the PID, independently adjustable from the others, set the time constants of the AVR in regard to the generator. The integrator branch can be short-circuited, for example when starting-up.

These three outputs are added, limited to 10Vdc and then give the field current set voltage of the "automatic channel" which is the driver card input.
The minimum value of this signal can be limitated to avoid total loss of excitation of the generator. In case of parallel operation with the mains (cosØ/KVAR card), this limitation is a function of the active power supply by the generator, this information is given by the COSØ / KVAR card.

A separate stage detect if the generator voltage is below an adjustable value to unlock the normal field ceiling voltage from 110% of nominal to 160% (adjustable).

2) ADJUSTMENTS

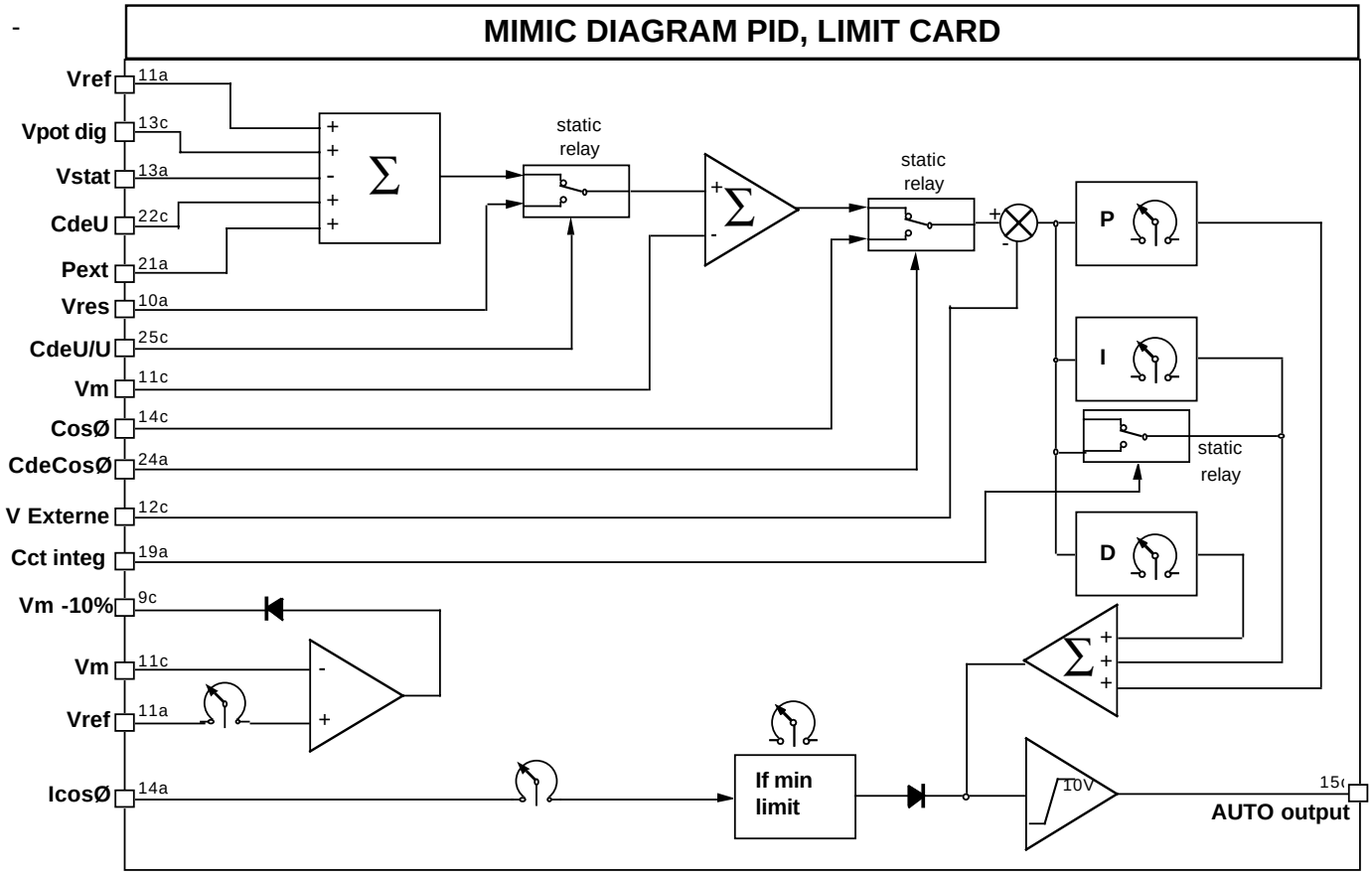
- P1 : Ceiling unlocked voltage threshold adjust (normally 90% Un).
- P2 : Proportionnal branch gain adjust (large signal)
- P3 : Proportionnal branch gain adjust
- P4: Integrative branch time constant adjust
- P5 : Derivative branch gain adjust
- P6 : Derivative branch time constant adjust
- P7 : Minimum field limitation adjust
- P8 : Minimum field limitation, active power correction adjust

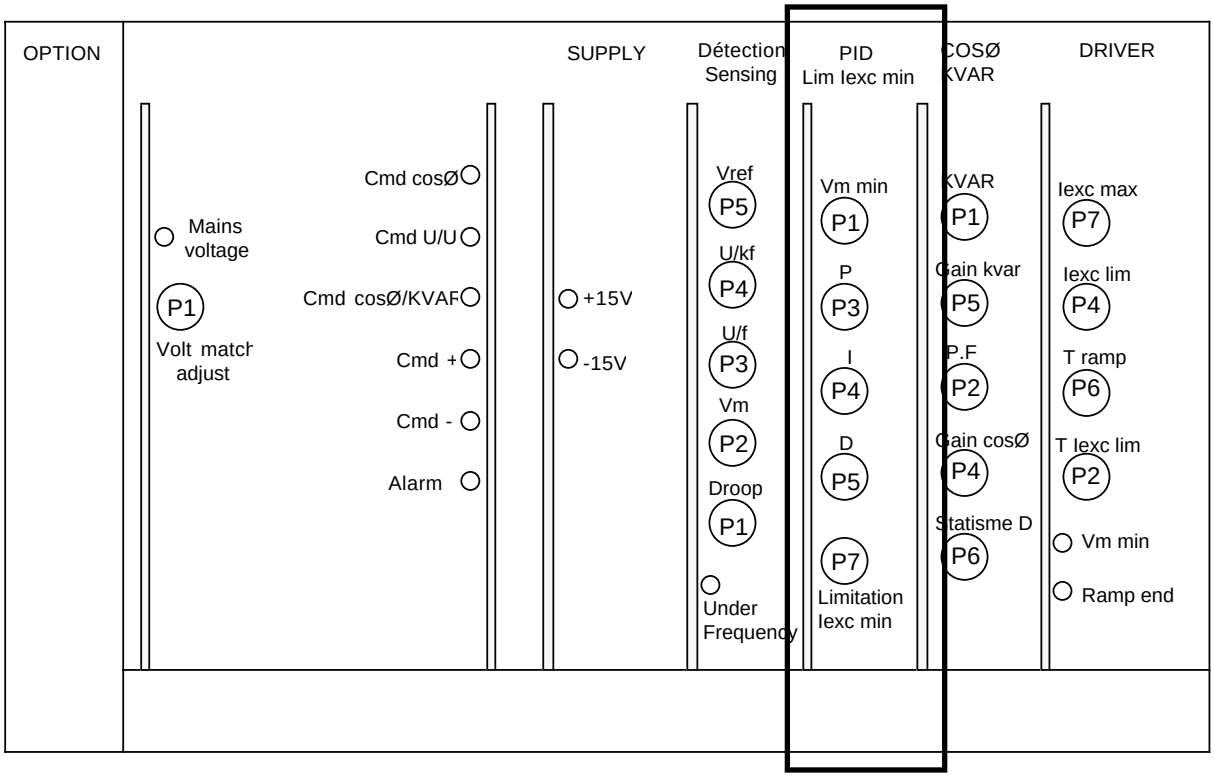
3) INPUTS / OUTPUTS

- 11a : Voltage reference set point input. Vref
- 13c : Added signal to voltage reference set point input (option)
- 22c : Added signal to voltage reference set point input (external voltage option)
- 21a : Added signal to voltage reference set point input (external potentiometer option)
- 13a : Added signal to voltage reference set point input (differential droop option; with cosØ/KVAR card)
- 19a : Integrator short-circuit command input
- 10a : Mains image voltage input (3F) (with "MAINS I / O" card only)
- 14c : CosØ error voltage input (2F) (with cosØ/KVAR card)
- 25c : Voltage equalization command input (3F) (with "MAINS I / O" card only)
- 24a : CosØ regulation command input (2F) (with cosØ/KVAR card)
- 1a,1c : +15Vdc regulated (Vcc)
- 32a,32c: -15Vdc regulated (Vdd)
- 16a,17c: Common electronic ground
- 14a : Minimum field limitation, active power correction input
- 15c : Field current voltage control output "AUTO" channel

-

MIMIC DIAGRAM PID, LIMIT CARD





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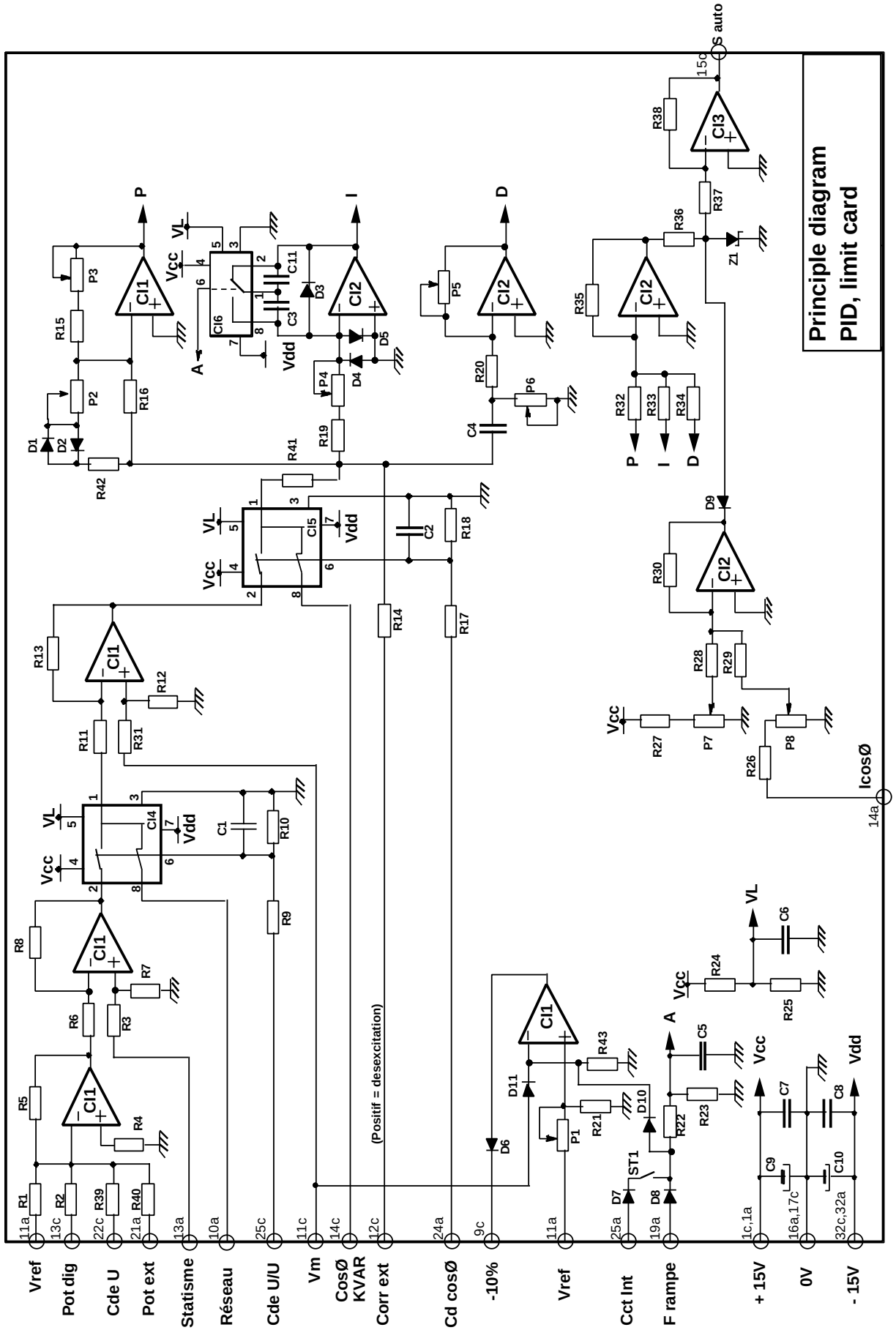

Principle diagram
PID, limit card
S auto
15c
P
I
D
Cl1
Cl2
Cl3
Cl4
Cl5
Cl6
Vcc
VL
Vdd
A
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
R39
R40
R41
R42
R43
P1
P2
P3
P4
P5
P6
P7
P8
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
Z1
ST1
IcosØ
14a
(Positif = desexcitation)
Vref
Pot dig
Cde U
Pot ext
Statisme
Réseau
Cde U/U
Vm
CosØ KVAR
Corr ext
Cd cosØ
-10%
Vref
Cct Int
F rampe
+ 15V
0V
- 15V
11a
13c
22c
21a
13a
10a
25c
11c
14c
12c
24a
9c
11a
25a
19a
1c,1a
16a,17c
32c,32a

AVR MODEL R610 DRIVER CARD

1) FUNCTIONAL

This card controls from "AUTO" and "MANU" voltage reference and some additional informations detailed in the following, the exciter field current supply by the regulator and the booster (if used).

- Three operating mode are possible, depending of external informations :
  - Normal mode with 110% ceiling of If nominal.
  - Ceiling unlocked mode (160% minimum Ifield nominal) depending of the command input from the PID card with limited delay and alarm output in case of sustained undervoltage.
  - Maximum ceiling mode if the synchronisation voltage desappears (machine short-circuit) with limited (adjustable) field current.
  - The "AUTO" or "MANU" reference voltage depending of the associated command input and also of the active limitations, is compared to the field current measurement and gives the error voltage which is after integration, compared to a sawtooth feed by the synchronisation voltage. The output of this stage is a variable duty cycle signal which controls the power transistors throught isolating optocouplors.

- This card can be supplied in three manners :
  - From the general supply of the rack in normal operation
  - Throught an isolated supply taken from the field voltage during start-up or generator short-circuit. (Rack supply not present)
  - Directly from the field voltage for power transistor command.

The permanent limitation (110% de Iexc nominal) can be modified by the following conditions:

- Field ceiling unlocking on machine undervoltage condition. It inccreases from 110% (normal operation) to a minimum of 160% of the nominal field current during an adjustable time delay and then go back to 110%. An alarm is activated if this undervoltage is sustained afterward.
- Field ceiling unlocking on synchronisation voltage abcence. It increases to the maximum given by the setting of P7.
- Field ceiling limitation caused by power heatsink overheating. On thermocontact action the ceiling is reduced to a value given by the setting of P8.

A separate circuit monitors the instantaneous current of the power transistor and reduces immediatly the command signal if its value increases above a fixed value. (Exciter or wiring short-circuit protection).

2) ADJUSTMENTS

- P1 : Integrator time constant adjust.
- P2 : Unlocked ceiling time delay adjust. (generally 5s)
- P3 : Alarm time delay adjust after ceiling unlock.
- P4 : Permanent ceiling value adjust (generally 1,1If nominal)
- P5 : HALL sensor range adjust.
- P6 : Initial ramp-up adjust
- P7 : Maximum field current adjust (machine short-circuit)
- P8 : Maximum fieeld current in case of heatsink overheating.

3) INPUTS / OUTPUTS

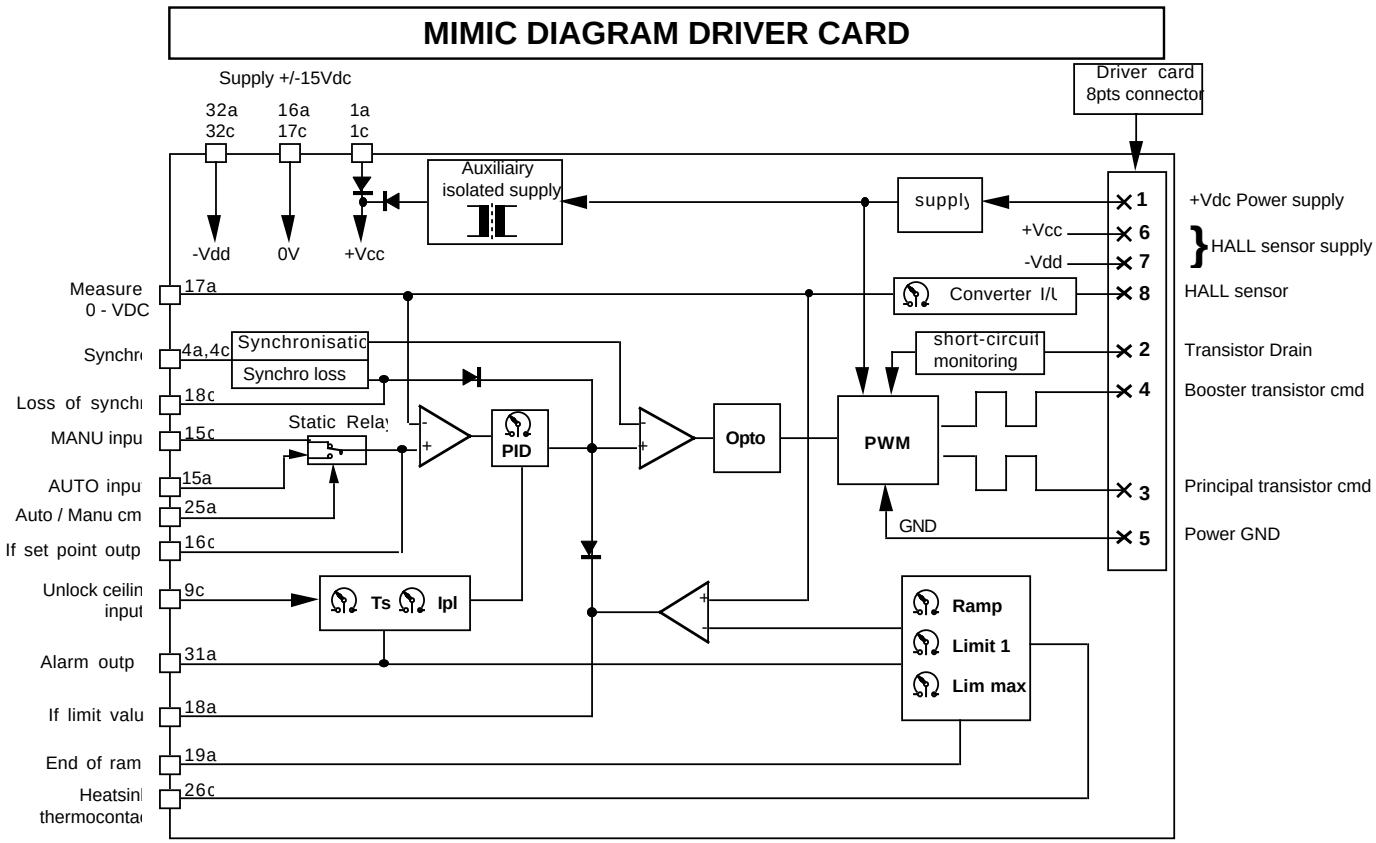
Flat cable (BUS 64points)

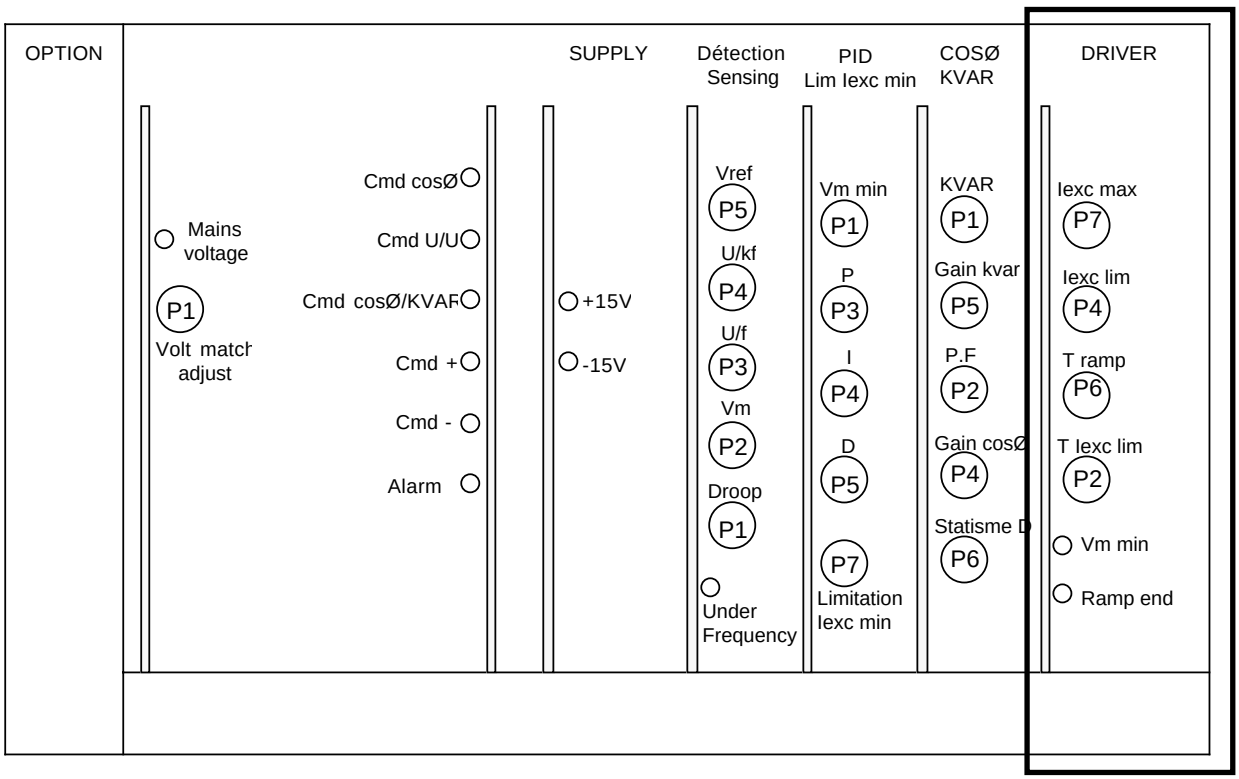
- 15c : If reference set point input "AUTO" channel
- 15a : If reference set point input "MANU" channel
- 25a : "AUTO / MANU" command input (0V = "AUTO")
- 9c : Unlocking ceiling command input
- 4a, 4c : Synchronisation voltage input
- 26c : Heatsink thermocontact input
- 1a,1c : +15Vdc regulated (Vcc)
- 32a,32c: -15Vdc regulated (Vdd)
- 16a,17c: Common ground (GND or 0V)
- 17a : Field current measure output
- 19a : End of ramp-up output signal
- 31a : Alarm output

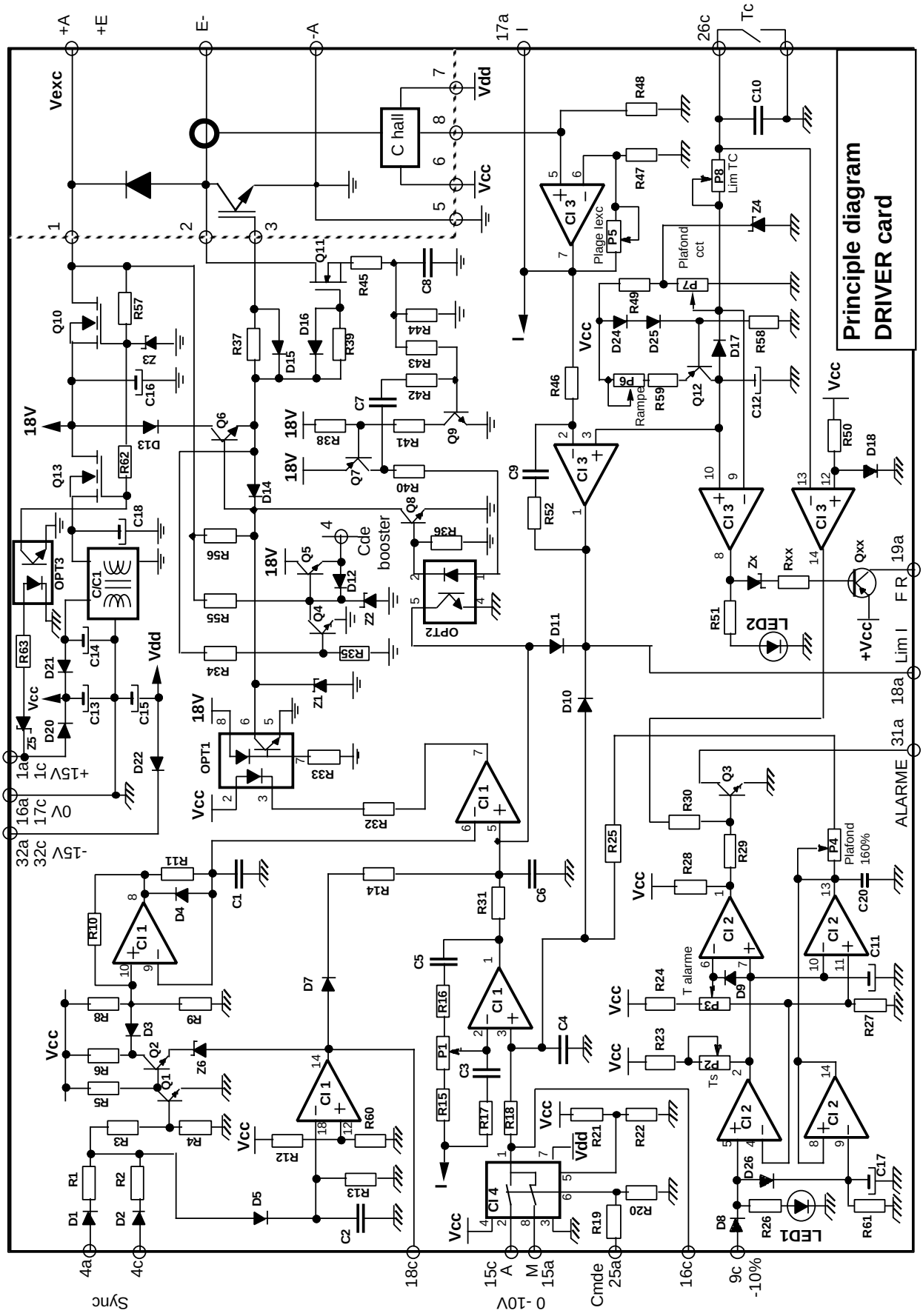
Card connector (8 points)

- 1 : Field voltage
- 2 : Main transistor drain
- 3 : Main transistor gate
- 4 : Booster transistor gate
- 5 : Power ground
- 6 : +Vcc HALL sensor
- 7 : -Vcc HALL sensor
- 8 : HALL sensor measure output

MIMIC DIAGRAM DRIVER CARD






Principle diagram
DRIVER card
+A
+E
E-
-A
17a
I
26c
Tc
Vexc
C hall
Vdd
Vcc
Q11
R45
C8
R48
C10
R47
P8
Lim TC
Z4
P5
Plage Iexc
Plafond cct
P7
R49
D24
D25
D17
R58
R46
P6
Rampe
R59
Q12
C12
R50
D18
C9
R52
R57
Q10
Z3
C16
R37
D15
D16
R39
R44
R43
R42
C7
R38
R41
Q9
Q6
18V
D13
R62
Q13
C18
D14
R40
Q7
Q8
R36
Cde booster
OPT2
R56
R55
Q5
Q4
D12
Z2
R35
R34
Z1
OPT3
C/C1
R63
C14
D21
C13
C15
D22
D20
Z5
OPT1
R33
R32
D11
D10
R51
LED2
Zx
Rxx
Qxx
+Vcc
Lim I
F R
19a
18a
31a
ALARME
1a
1c
+15V
16a
17c
0V
32a
32c
-15V
R11
C1
D4
R10
R14
R31
C6
R25
R30
Q3
R28
R29
P4
Plafond 160%
C20
C11
R27
R24
T alarme
P3
D9
R23
P2
Ts
R8
R9
D3
Q2
Q1
Z6
R6
R5
R3
R4
R1
R2
D1
D2
D5
R12
R60
R13
C2
D7
C5
R16
P1
C3
R15
R17
R18
C4
R21
R22
R20
R19
D26
D8
R26
LED1
C17
R61
4a
4c
Sync
18c
15c
A
M
15a
0 -10V
Cmde
25a
16c
9c
-10%

AVR MODEL R610 — COSØ - KVAR OPTIONAL CARD

1) FUNCTIONAL

This option allows the parallel operation coupling with the mains with P.F or KVAR regulation (also called 2F)

This card elaborates from generator current and voltage informations, the following signals:

- An image of the reactive current of the generator named (KVAR) used for KVAR regulation.
- An image of the phase shift between the voltage and the current of the generator named (Ø) used for cosØ (PF) regulation.
- An image of the active current of the generator named (KW) used for compensate the minimum Ifield limit of the PID card.

- The principle of measurement is to sample and hold the instantaneous value of the current when the instantaneous voltage reaches zero on positive slope.
- First the current image of the stator current is filtered and used directly for KVAR measure. Then it is derivated and used for KW measure. And then it is amplified to obtain square waves and integrated to give a sawtooth used to Ø measure.
- The voltage image is phase-shifted to compensate the phase shift of the current input filter and after amplification is fed to a monostable which gives the pulse signal (about 100µs) used by all the sample and hold circuits.

- KVAR and Ø values are compared with an internal and external (if used) setting and the difference is send to the PID card as an error signal. An external contact control an analog switch to select what information between KVAR and Ø will be regulated.

- Three informations (Ø, ΔØ, ΔKVAR) can be used as an alternative droop for solo operation.
- Ø gives no droop at cosØ=1 and the voltage decreases at lagging PF.
- ΔØ gives no droop at the cosØ setting and the voltage decreases at more lagging PF and opposite for more leading PF.
- ΔKVAR gives no droop at the KVAR value setting and the voltage decreases with more KVAR and increases if less.
- The selection between these is made by mean of jumper (CAV) on the card. (internal)

2) ADJUSTMENTS

- P1 : KVAR internal setting.
- P2 : PF (cosØ) internal setting.
- P3 : Voltage phase shifter (internal)
- P4 : PF (cosØ) gain setting
- P5 : KVAR gain setting.
- P6 : Différential droop setting
- P7 : Pulse width setting (internal)

- Jumper CAV : Selection of droop type

No : Reactive droop adjusted by P1 (sensing card)
CAV1 : No droop for cosØ=1 and droop if lagging.
CAV2 : No droop for KVAR setting (P1), voltage decreases if more KVAR (lagging) and opposite if less.
CAV3 : No droop for PF setting (P2), voltage decreases if more lagging and opposite if less or leading.

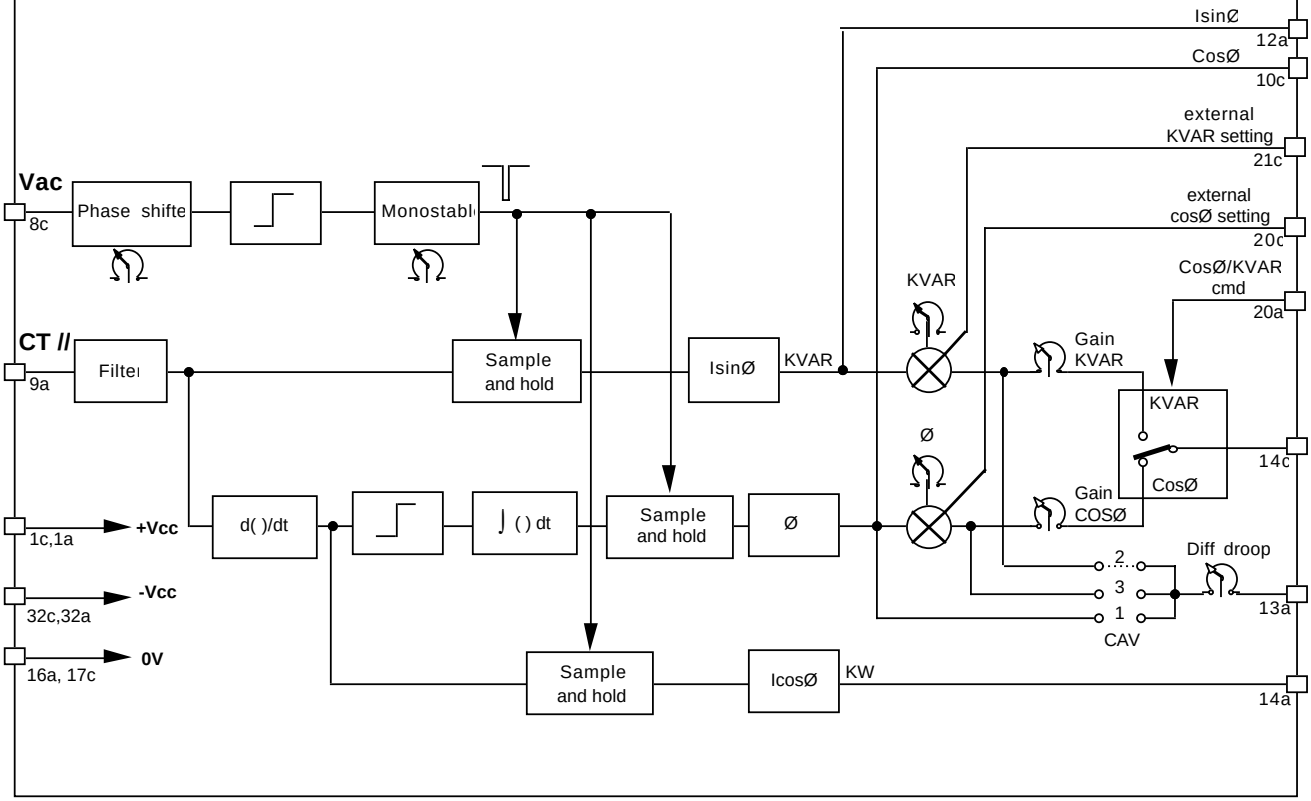
Nota : If the droop is used from this card, potentiometer P1 of the sensing card must be set to zero.

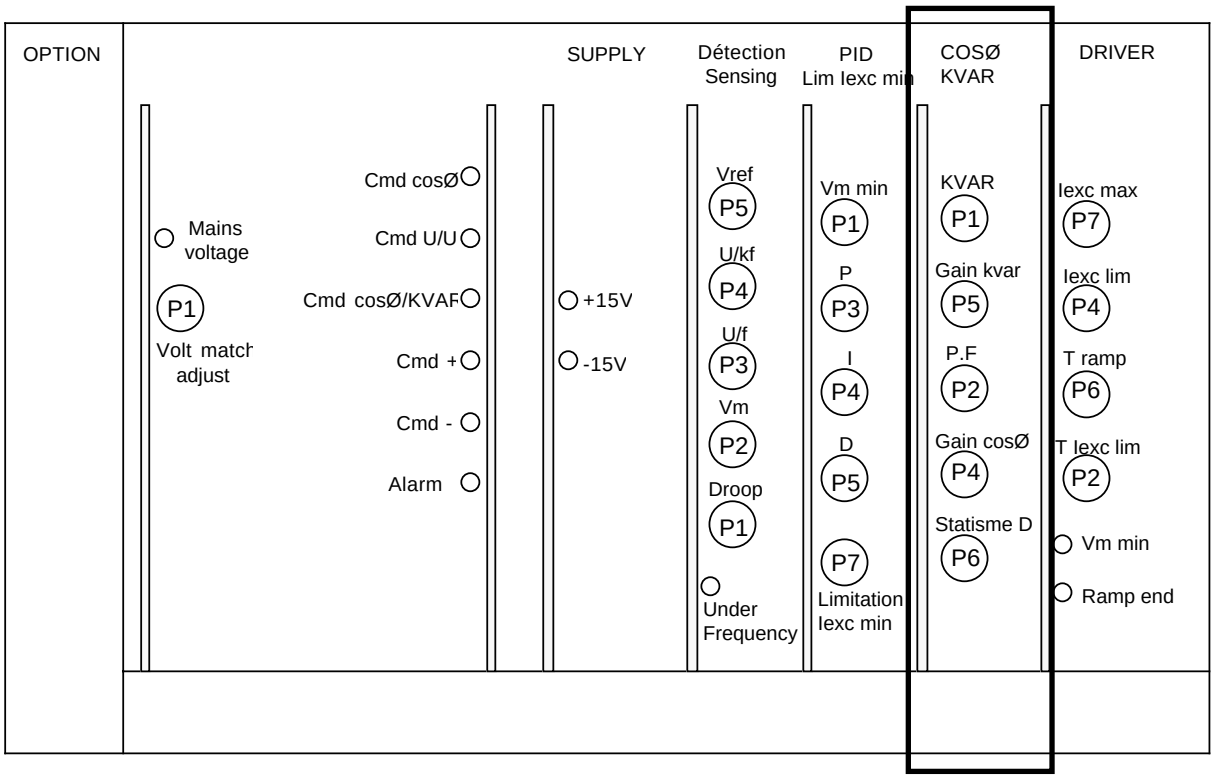
3) INPUTS / OUTPUTS

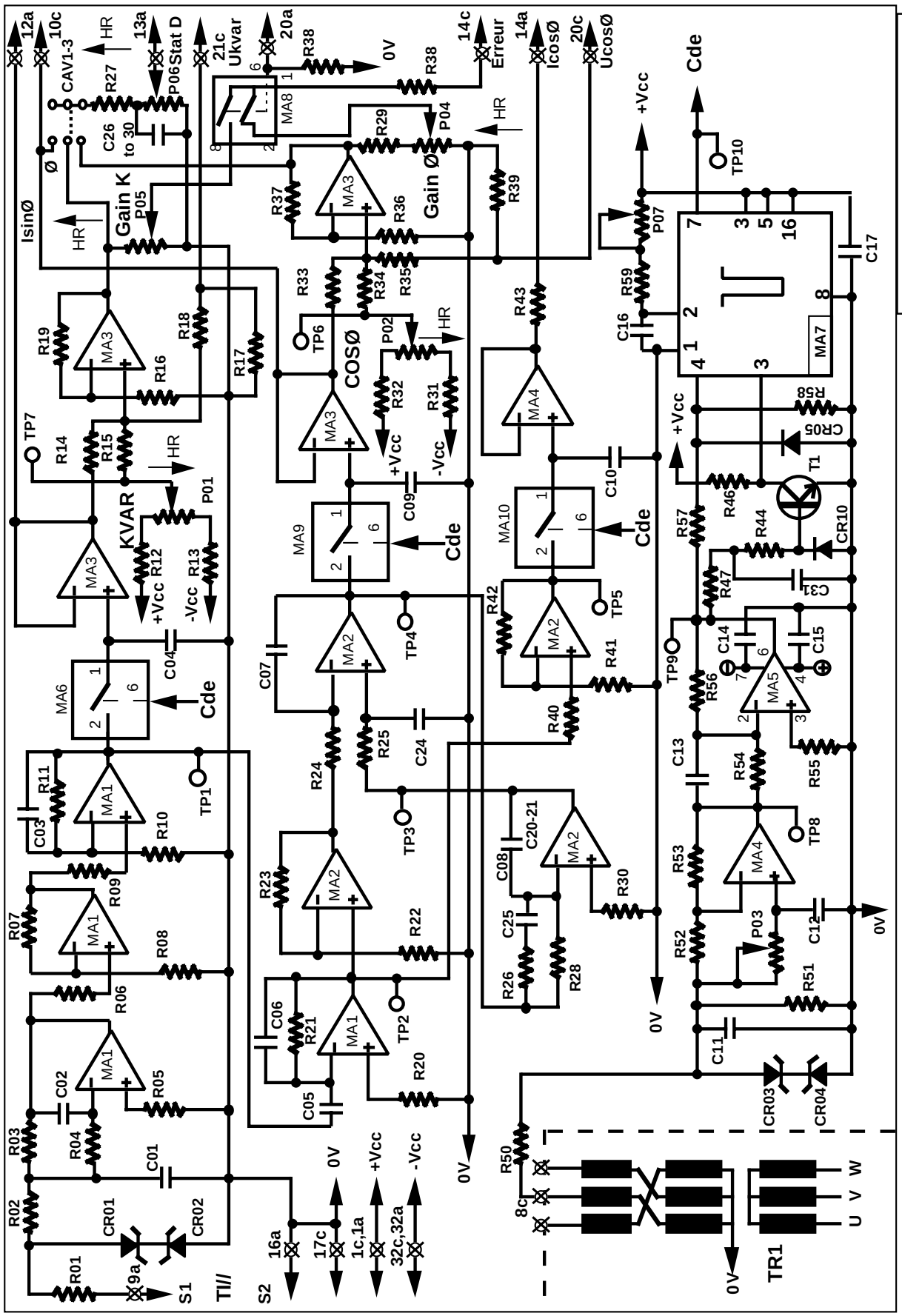
Flat cable (BUS 64points)

- 8c : Generator voltage image input
- 9a : Generator current image input
- 20a : Command input "cosØ / KVAR" (0V = "cosØ")
- 21c : External KVAR setting input
- 20c : External cosØ setting input
- 1a,1c : +15Vdc supply (Vcc)
- 32a,32c: -15Vdc supply (Vdd)
- 16a,17c: Common electronic ground
- 14c : Error signal output to PID card
- 13a : Droop signal output to sensing card
- 14a : KW signal output to PID card
- 12a : KVAR signal output
- 10c : Ø signal output

MIMIC DIAGRAM COSØ - KVAR CARD






principle diagram
COSØ - KVAR card
12a
10c
CAV1-3
HR
13a
P06
Stat D
21c
Ukvar
20a
R38
0V
14c
Erreur
14a
IcosØ
20c
UcosØ
+Vcc
Cde
TP10
C17
MA7
R59
P07
R58
CR05
T1
R46
R44
CR10
R57
C31
R47
C14
C15
R56
MA5
R54
R55
C13
TP8
R53
MA4
P03
C12
R52
R51
C11
CR03
CR04
R50
8c
U V W
TR1
0V
R27
P05
Gain K
R29
P04
Gain Ø
R39
R37
MA3
R36
R33
R34
R35
TP6
COSØ
P02
R32
R31
-Vcc
C09
MA9
MA10
C10
R43
MA4
C16
R19
R18
R17
R16
TP7
R14
R15
P01
KVAR
R12
R13
C04
MA6
C07
MA2
TP4
R42
TP5
R41
R40
TP9
R25
C24
R24
TP3
C20-21
C08
R30
R23
R22
C25
R26
R28
C06
R21
TP2
R20
C05
R11
C03
MA1
TP1
R10
R09
R07
R08
R06
C02
R05
R03
R04
C01
R02
CR01
CR02
R01
9a
S1
TI//
S2
16a
17c
1c,1a
32c,32a
0V
+Vcc
-Vcc

AVR MODEL R610 — GENERATOR / MAINS I / O (3F) OPTIONAL

1) FUNCTIONAL

This option allows the automatic matching of the mains and generator voltage during synchronizing (also called 3F)

- This unit is mainly an interface between external signals and low power electronics.

- It is composed by :

- The adaptation three phases transformer between input voltages (generator (1F,2F) and mains (3Fonly) and measurement circuits.
- The burden resistor of parallel CT.
- The adaptation transformer between input voltage and low power electronic supplies.
- The interface input relays between command / control terminals and internal circuits.
- The interface between 64pts BUS and the analogic input / output terminals

2) ADJUSTMENTS

- Voltage matching adjustment (P1) (3Fonly)

3) INPUT / OUTPUT

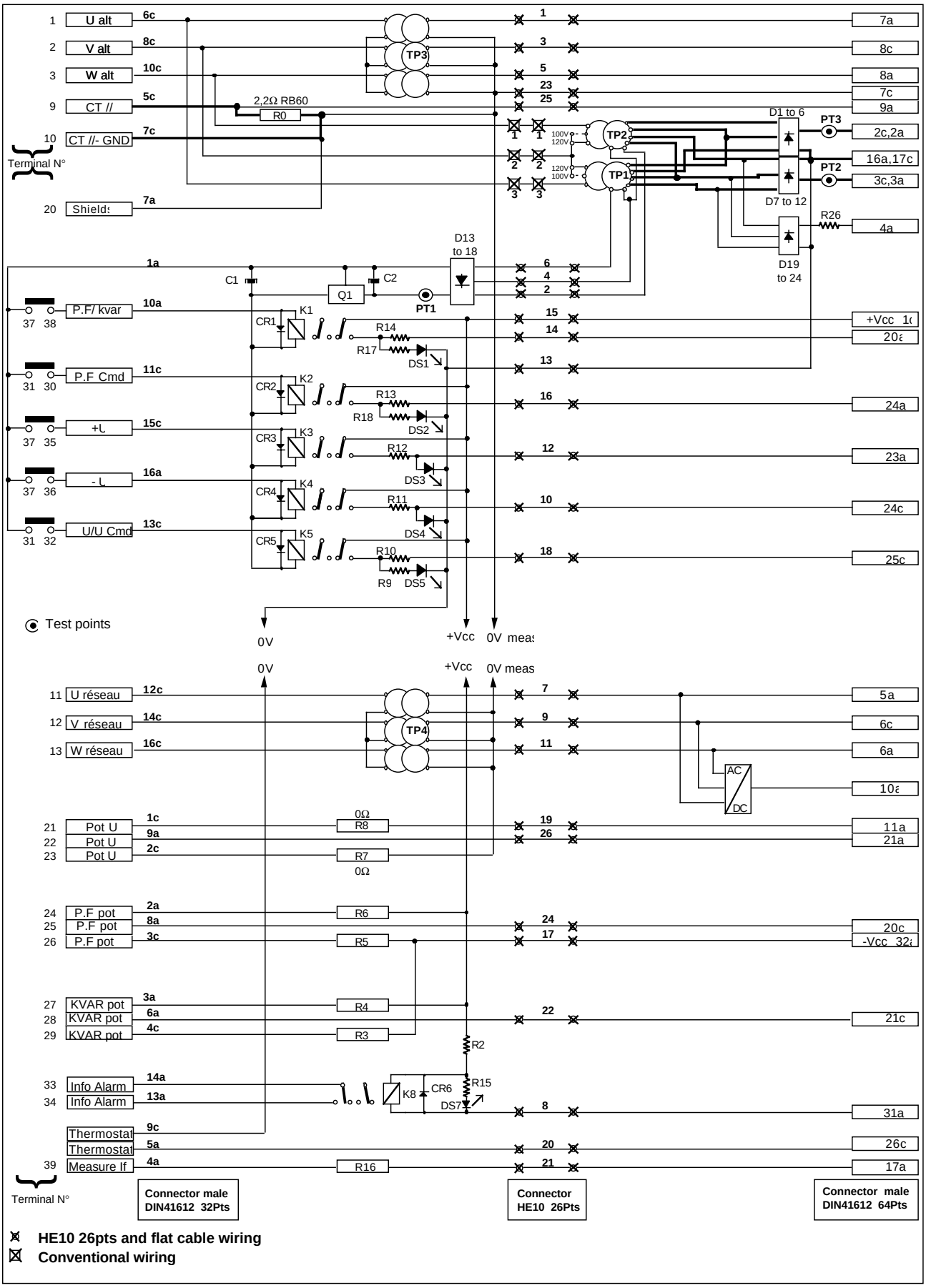
- See following table

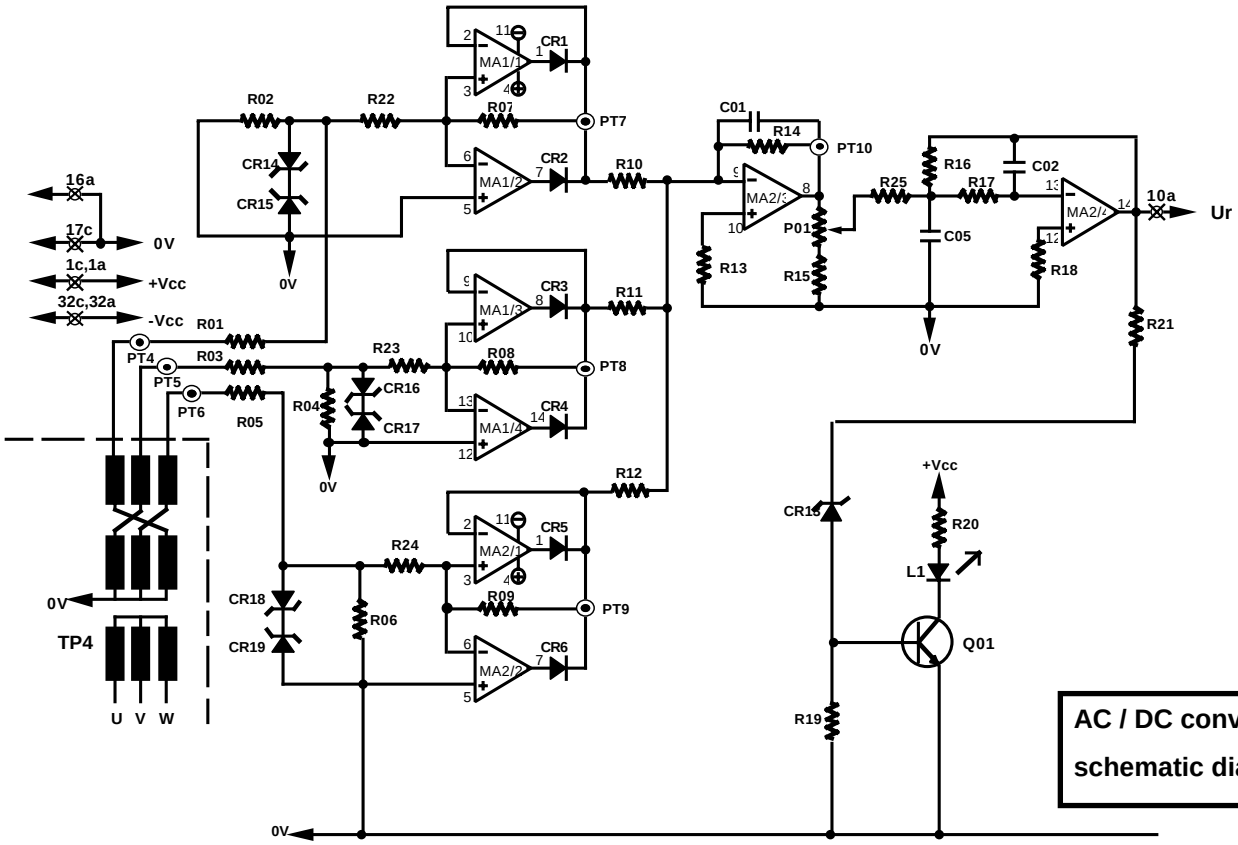
INPUT TERMINAL	Connector 32 PTS	Type I / O	Interface	Connector 26 PTS	Connector BUS 64 PTS
1	6c	measure	transfo 3Ø TP3	1	7a
1	6c	supply	transfo TP2		
2	8c	measure	transfo 3Ø TP3	3	8c
2	8c	supply	transfo TP1/2		
3	10c	measure	transfo 3Ø 3	5	8a
3	10c	supply	transfo TP1		
9	5c	measure	resistance RTI	25	9a
10	7c	measure	GND	23	7c
11	12c	measure	transfo 3Ø TP4	7	5a
12	14c	measure	transfo 3Ø TP4	9	6c
13	16c	measure	transfo 3Ø TP4	11	6a
20	7a	shield	GND	23	7c
21	1c	signal	resistance	19	11a
22	9a	signal	direct	26	21a
23	2c	signal	resistance	23	7c
24	2a	signal	resistance	15	1c
25	8a	signal	direct	24	20c
26	3c	signal	resistance	17	32a
27	3a	signal	resistance	15	1c
28	6a	signal	direct	22	21c
29	4c	signal	resistance	17	32a
30	11c	cmd input	relay	16	24a
31	1a				
32	13c	cmd input	relay	18	25c
33	14a	cmd output	relay	8	31a
34	13a	cmd output	relay		31a
35	15c	cmd input	relay	12	23a
36	16a	cmd input	relay	10	24c
37	1a				
38	10a	cmd input	relay	14	20a
39	4a	signal	resistance	21	17a
40					

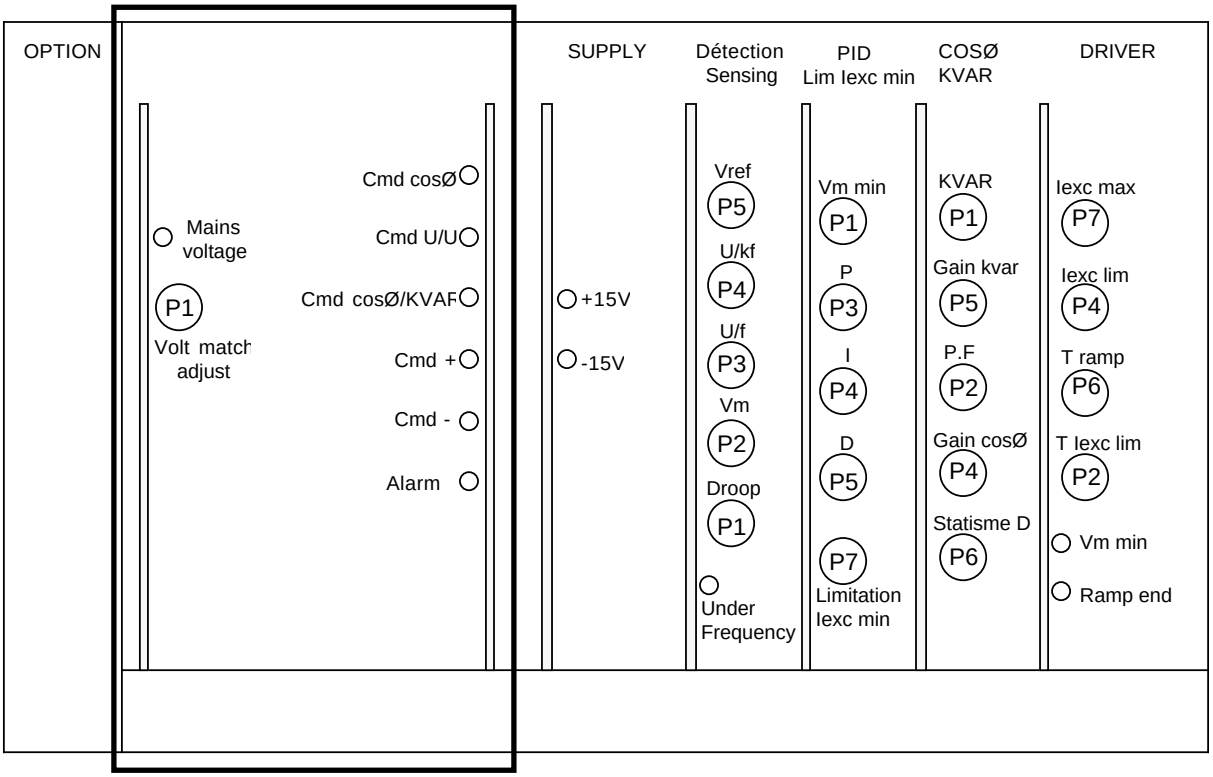
VOLTAGE INPUTS :

Reference	Generator sensing voltage	Mains sensing voltage
C5 195 0233	100V to 120V 50/60Hz	100V to 120V 50/60Hz
C5 195 0235	400V to 450V 50/60Hz	400V to 450V 50/60Hz
C5 195 0234	400V to 450V 50/60Hz	100V to 120V 50/60Hz

AVR MODEL R610 — GENERATOR / MAINS I / O (3F) OPTIONAL







R610 potentiometers position. For adjustments, refer to specific card technical manual

AVR MODEL R600 — Digital pot U / P.F OPTIONAL CARD

1) FUNCTIONAL

This card replace two conventional motorized potentiometers:

- One for the remote voltage setting.
- One for power factor or reactive current setting.

- Switch between the two modes is made by the external P.F regulation order (terminals 33,34) and switch between P.F and KVAR setting is made by the external order (terminals 48,53)
- Each last position is memorized when the control is switched or when the machine is stopped.

- Jumps (SW1 and SW2) allow the choice between unipolar or bipolar voltage output and the range is adjusted by means of potentiometers P02 and P03.

- Jumps SW3 and SW4 must be open for normal operation and are only used for special applications.

- Speed of all adjustments is controled by potentiometer P01.

- Two LED's (L1,L2) indicate the command orders + or - and four other LED's (L3,L4 and L5,L6) indicates the maximum and minimum position of voltage and P.F settings

-NOTE: When this card fitted, the internal voltage setting (P05 on sensing card) must be used to give the center position of the range (if bipolar range) or the minimum setting in case of unipolar range (idem for P.F and Kvar internal setting on P.F card). An external setting potentiometer must not be used , the settings are made only by mean of push-buttons on terminals 42,43,44.

2) ADJUSTMENTS

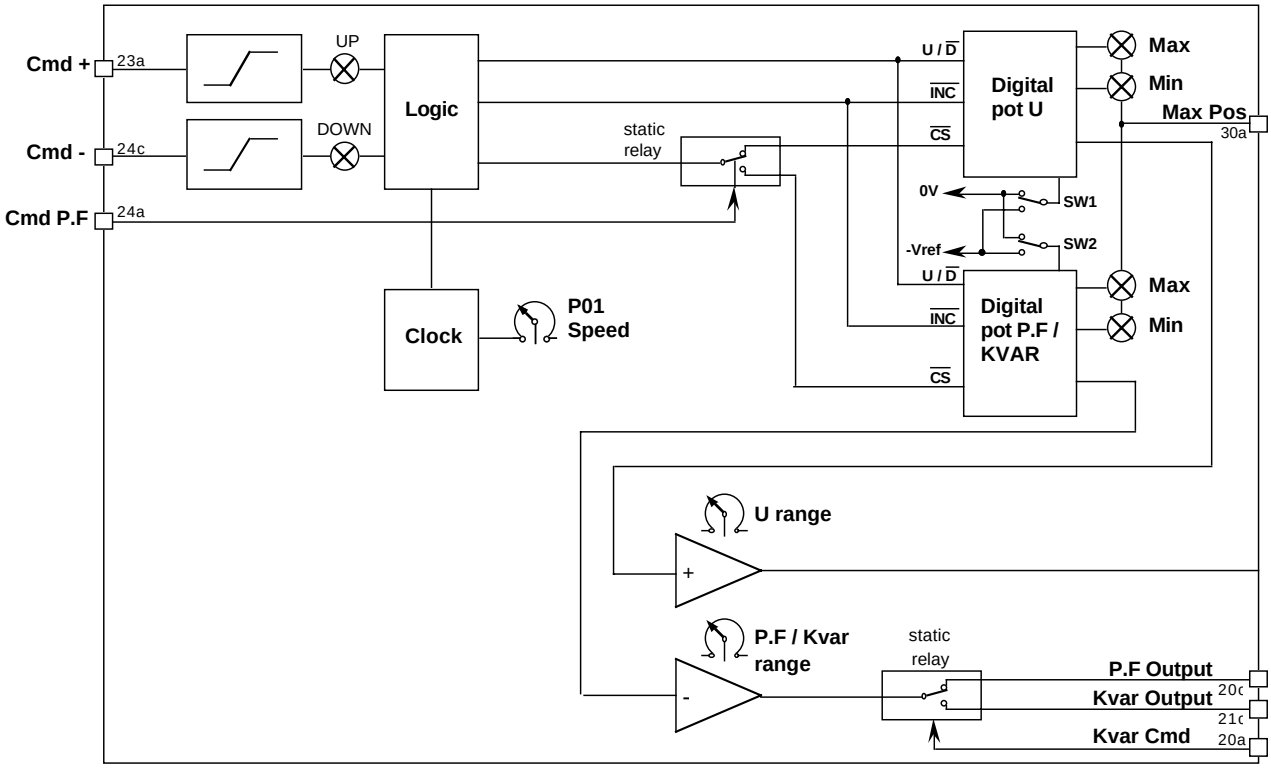
- P1 : Clock speed (total range time)
- P2 : Voltage range value
- P3 : P.F or KVAR range value
- SW1 : Voltage range polarity (0/+ or +/-)
- SW2 : P.F or KVAR range polarity (0/+ or +/-)

3) INPUTS / OUTPUTS

Flat cable (BUS 64points)

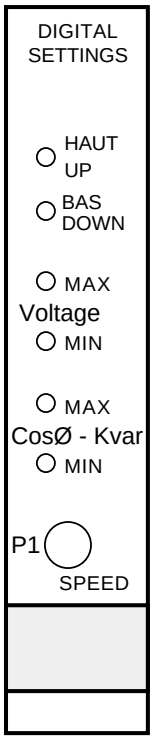
- 24c : Cmd lower
- 23a : Cmd upper
- 16c : If reference set point input
- 15c : If reference set point input "AUTO" channel
- 24a : External P.F regulation order
- 20a : External P.F or KVAR regulation order
- 13c : Voltage setting output to PID card
- 20c,21c: P.F or KVAR setting output to P.F card
- 30a : Maximum position of settings
- 1a,1c : +15Vdc regulated (Vcc)
- 32a,32c: -15Vdc regulated (Vdd)
- 16a,17c: Common ground (GND or 0V)

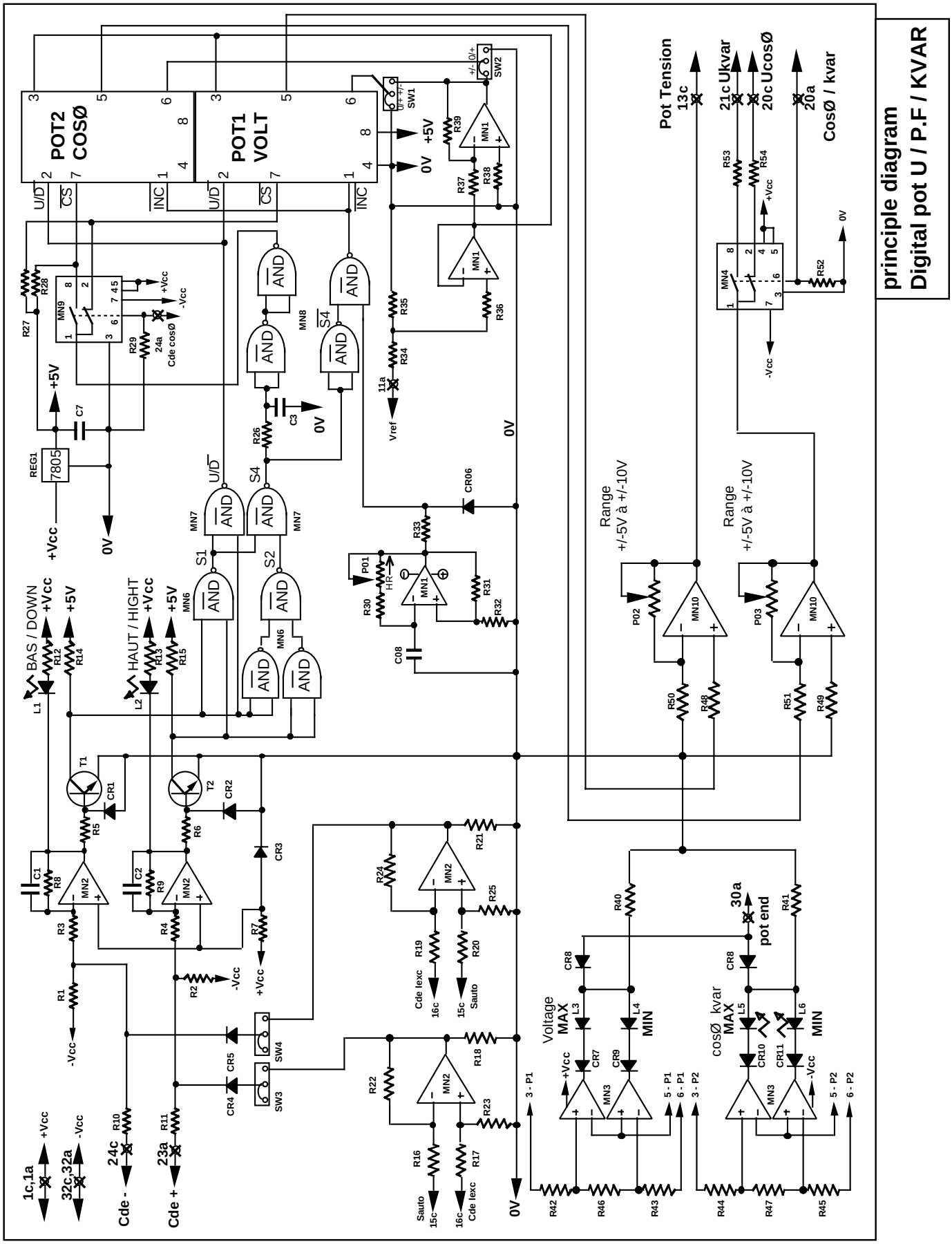
Digital pot U / P.F CARD MIMIC DIAGRAM



FRONT VIEW

Digital pot U / P.F




principle diagram
Digital pot U / P.F / KVAR
POT2 COSØ
POT1 VOLT
Pot Tension 13c
21c Ukvar
20c UcosØ
20a CosØ / kvar
Range +/-5V à +/-10V
Range +/-5V à +/-10V
BAS / DOWN
HAUT / HIGHT
Voltage MAX
MIN
cosØ kvar MAX
MIN
30a pot end
Vref
Cde cosØ
Cde Iexc
Sauto
Cde - 24c
Cde + 23a
1c,1a
32c,32a
+Vcc
-Vcc
+5V
0V

1) FUNCTIONAL

This card elaborates from internal setting (PO2) and external setting informations, the Ifield command signal given to "MANU" channel of the driver card.

- The Ifield output signal is limited or reduced if the generator voltage exceeds the limitation value sets by the potentiometer P01 (trip of the main breaker on load for example).

- This case of operation is indicated by the LED "LIMIT" and the Ifield setting must be decreased to a point under control.

- On MANU operation, the difference between MANU output and AUTO channel output gives a compensation signal which is used to compensate the PID to have always the MANU and AUTO channels outputs identical. With this circuit a smooth switching between MANU to AUTO is possible and operation will go back to the AUTO channel own settings.

- The ceiling can be unlocked on this operation, that is why it can be necessary to wait some seconds after the switching to return on MANU operation.

- On AUTO operation, these two channels are also monitored and the difference is indicated by three LEDs.

- HIGH says that MANU channel is higher than AUTO
- LOW says that MANU channel is lower than AUTO

- OK says that MANU and AUTO channels are identical and smooth AUTO ---> MANU switching is possible.

NOTE :

For the R610, the switching between AUTO <--> MANU is only possible by the switch command in front of the card, and the setting by the front potentiometer. It is not possible to use remote command or control.

2) ADJUSTMENTS

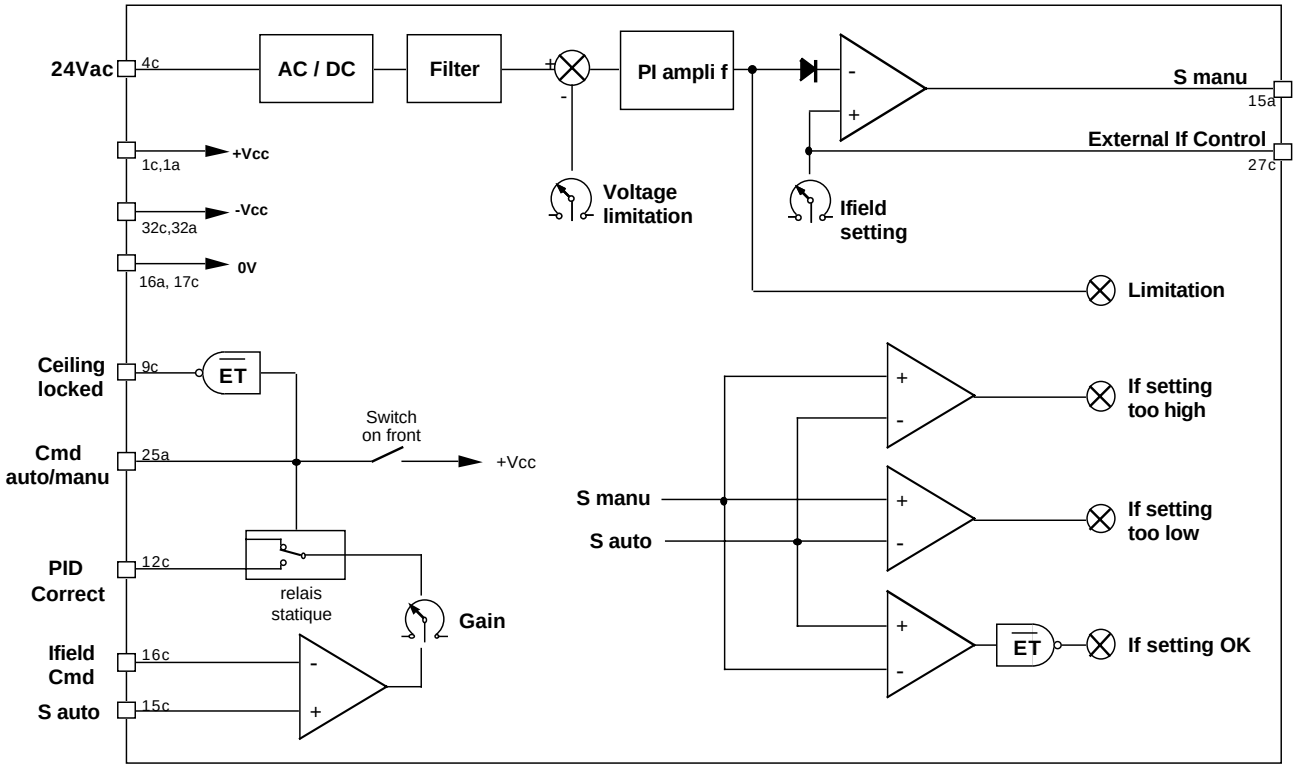
- P1 : Voltage limitation setting
- P2 : Internal Ifield value setting
- P3 : PID compensation gain setting
- P4 : Internal compensation setting

3) INPUTS / OUTPUTS

Flat cable (BUS 64points)

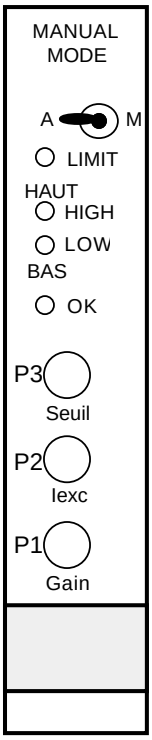
- 4c : 24Vac input image of the generator from "generator I/O" card
- 25a : "AUTO / MANU" command input (0V = "AUTO")
- 16c : If reference set point input
- 15c : If reference set point input "AUTO" channel
- 27c : External Ifield setting input
- 1a,1c : +15Vdc regulated (Vcc)
- 32a,32c: -15Vdc regulated (Vdd)
- 16a,17c: Common ground (GND or 0V)
- 15a : If set point output "MANU" channel
- 12c : PID compensation output
- 9c : Ceiling locked output

MANUAL MODE 2 CARD MIMIC DIAGRAM

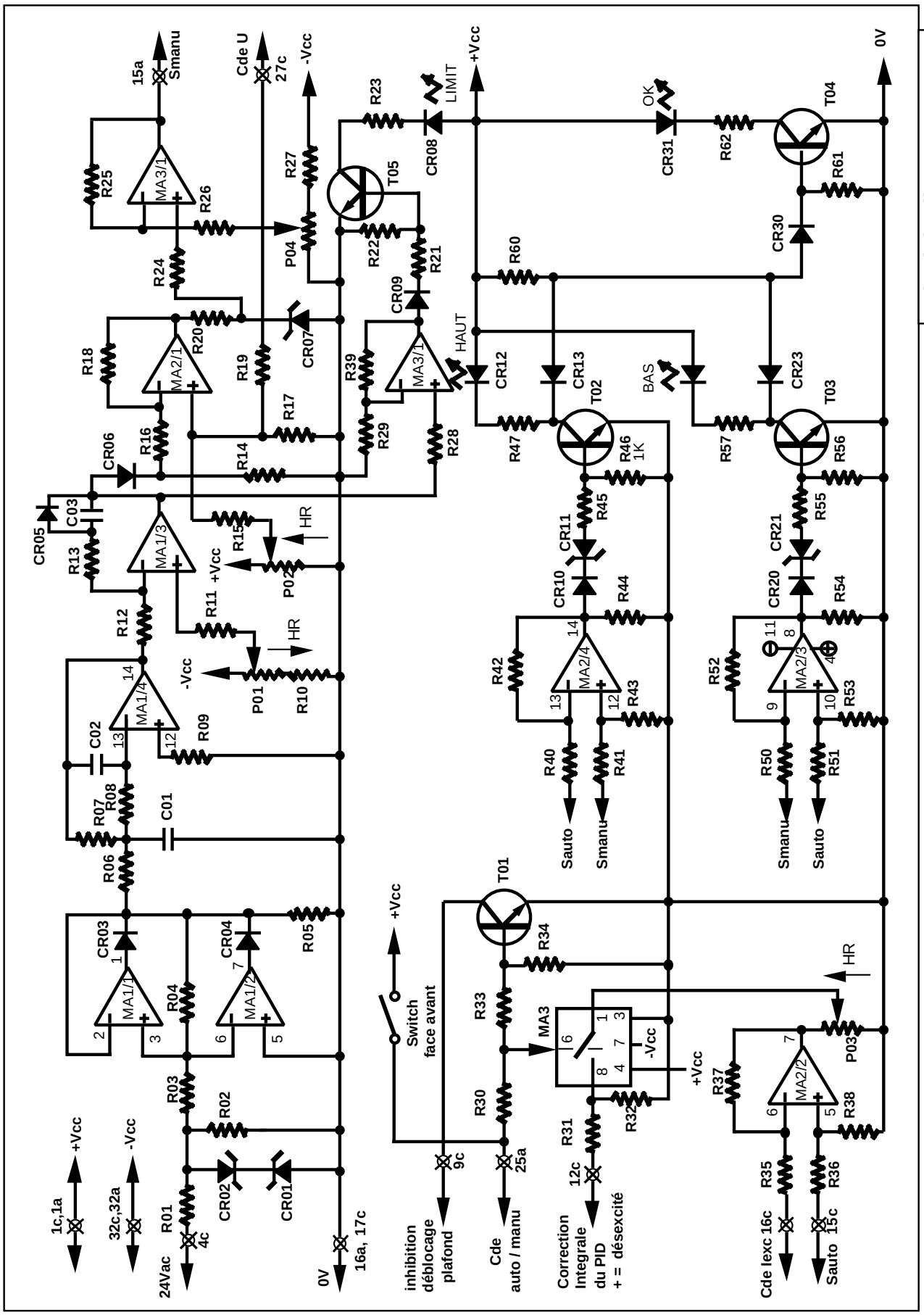


FRONT VIEW

Manual mode



principle diagram
Manual mode 2 card



AVR MODEL R600 — Mains P.F Regulation OPTIONAL CARD

1) DESCRIPTION

This card is used when the P.F or KVAR regulation is wanted not at the generator terminals but at the mains input. For this a P.F or KVAR sensor with 4-20mA output is necessary and it must be located at the place where the regulation must be made.

2) FONCTIONAL

This card elaborates from setting informations and 4-20mA signal image of P.F (or KVAR) of the mains, the error-voltage dending to the PID of the PID card.

- The error signal have an ajustable gain and can be inversed depending of the 4-20mA sensor output.
- This kind of operation is indicated by the LED "L3" and by a contact (potential free) on the front connector.
- This operation is selected by mean of a contact on front connectort and will be active on coupling when contact between terminals 33,34 of main terminals will be closed. If the contact on front connector remains open, the regulation (P.For KVAR) will be made at the generator output, if it is closed, this is the 4-20mA information wich is regulate function of the internal settings (P2 or channel 2 4-20mA) or/and external by the front connector.

-If during operation, the measuring 4-20mA signal deseappears, control is automatically return to regulation on the generator output side and this failure is indicated by LED L1 ou L2 and by a contact on front connector .

- A second channel can be used as set point of the first channel or as a remote adjustment of voltage, P.F or KVAR on generator side. As on channel 1 if the 4-20mA deseappears, output is inhibited and indicated by LED L2.
- A field current limitation is given, active when a contact (front connector) is closed and indicated by LED L4. The limitatio is adjusted by P7 (Limit 2 set) and can be set between a maximum value preset by P7 on driver card and a minimum value preset by P8 on driver card.

- An signaling contact on the front connector gives (if they are used) the indication that one or more of the digital potentiometers are at maximum position .

3) ADJUSTMENTS

Potentiometers

- P1 : Channel 1 range adjustment
- P2 : Reference set point channel 1
- P3 : Gain channel 1
- P4 : Channel 2 range adjustment
- P5 : Reference set point channel 2
- P6 : Gain channel 2
- P7 : Limit 2l adjustment

Jumpers

- CV1 A : Channel 1 used
- CV1 B : Channel 1 not used
- CV2 A : Channel 1 used
- CV2 B : Channel 2 not used
- CV3 A : Non inverting error channel 1
- CV3 B : Inverting error channel 1
- CV4 A : Non inverting error channel 2
- CV4 B : Inverting error channel 2
- CV5 A : Channel 1 in 4-20mA regulation channel 1
- CV5 B : Channel 1 in voltage setting
- CV5 C : Channel 1 in generator P.F setting
- CV5 D : Channel 1 in generator KVAR setting
- CV6 A : Channel 2 in 4-20mA regulation channel 2
- CV6 B : Channel 2 in voltage setting
- CV6 C : Channel 2 in generator P.F setting
- CV6 D : Channel 2 in generator KVAR setting
- CV6 E : Channel 2 in channel 1 setting

4) INPUTS / OUTPUTS

Flat cable (BUS 64points)

- 12c : Error output to PID
- 21a : Output to voltage setting
- 20c : Output to generator P.F setting
- 21c : Output to generator KVAR setting
- 30a, c : Digital pot at maximum position
- 1a,1c : Supply +15Vdc regulated (Vcc)
- 32a,32c: Supply -15Vdc regulated (Vdd)
- 16a,17c: Common ground
- 23a : Cmd + U or + P.F
- 24c : Cmd - U or - P.F
- 14c : Output of generator side P.F card
- 24a : P.F regulation order
- 26c : Limitation 2 output to driver card

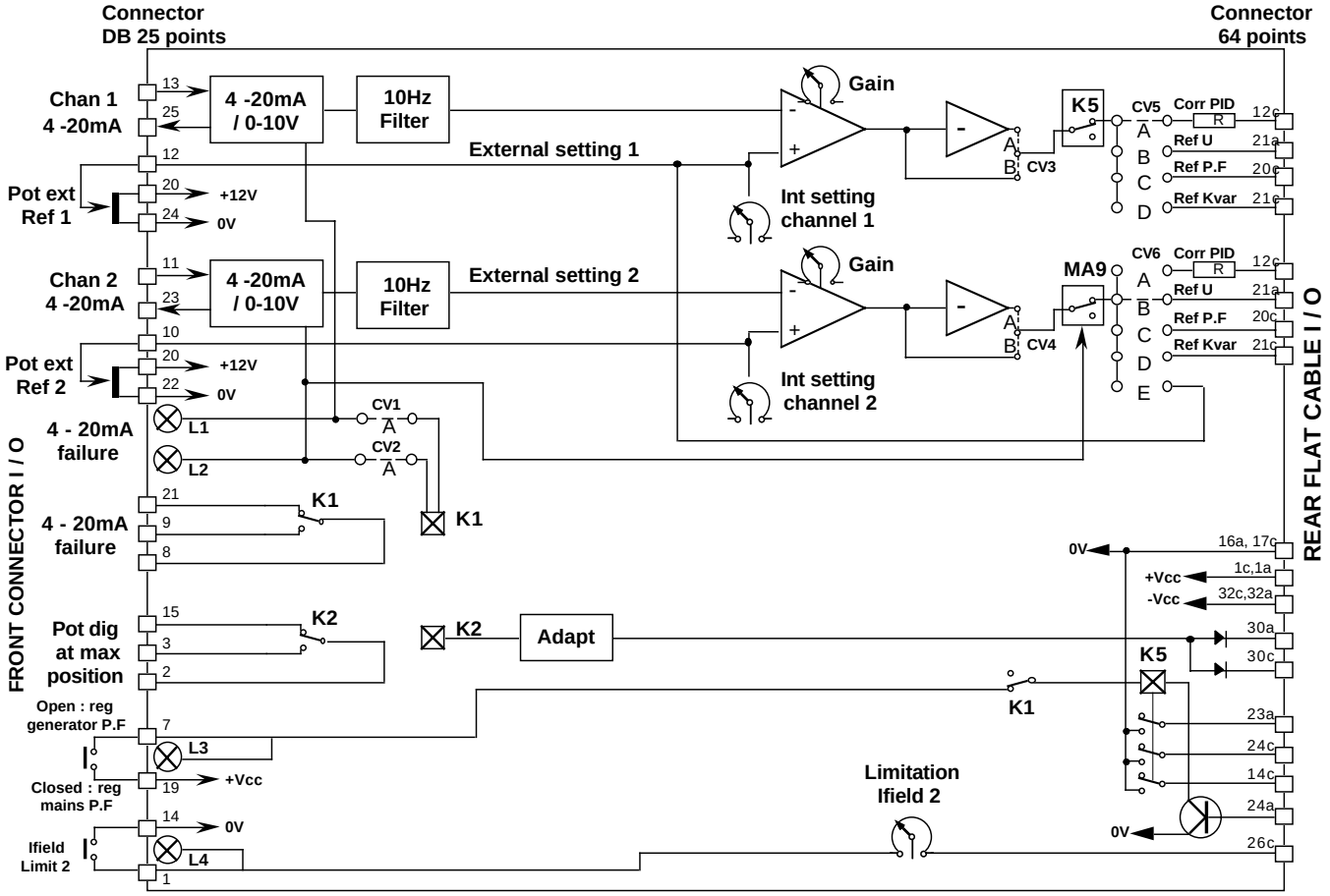
Front connector (DB25 points)

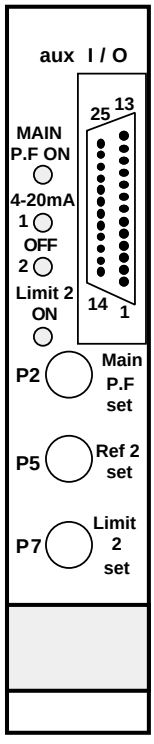
- 13 : + 4-20mA input channel 1
- 25 : 4-20mA output channel 1
- 20 : 12V to external setting potentiometer ch 1
- 12 : External setting potentiometer cursor ch 1
- 24 : Ground to external setting potentiometer
- 11 : + 4-20mA input channel 2
- 23 : 4-20mA output channel 2
- 20 : 12V to external setting potentiometer (ch 2)
- 10 : External setting potentiometer cursor ch 2
- 22 : Ground to external setting potentiomete
- 9 : 4-20mA failure (NO)
- 21 : 4-20mA failure (NF)
- 8 : 4-20mA failure (Commun)
- 3 : Digital pot at max position (NO)
- 15 : Digital pot at max position (NF)
- 2 : Digital pot at max position (Common)
- 7,19 : Contact regulation ch 1 active (mains P.F)
- 14,1 : Contact limitation 2 active

LED

- L1, L2 : 4-20mA failure channel 1 or 2
- L3 : Channel 1 active
- L4 : Ifield limitation 2 active

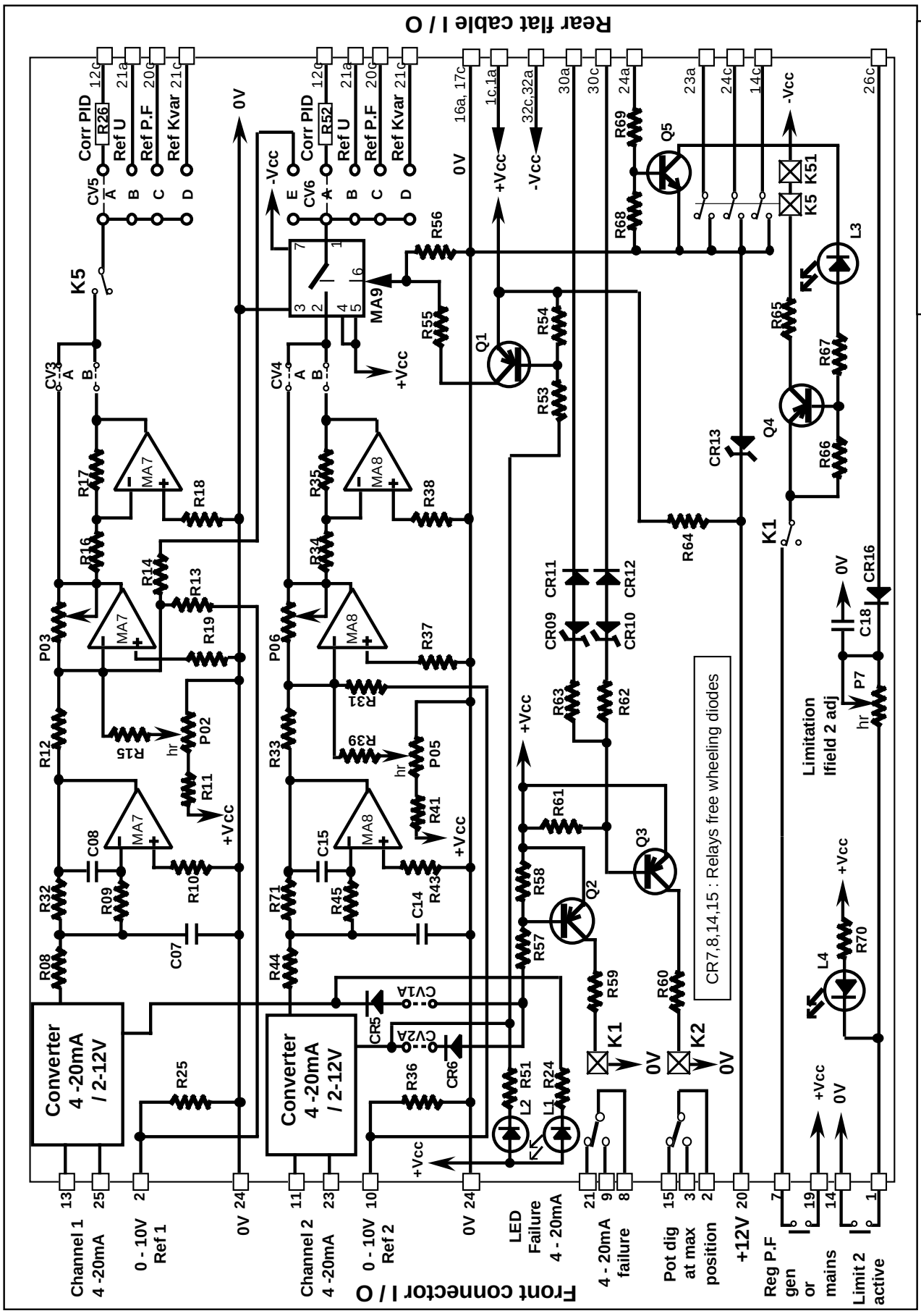
MAINS P.F REGULATION CARD MIMIC DIAGRAM





FRONT VIEW

MAINS P.F REG



Principle diagram
mains P.F reg card

AVR MODEL R600 — LIMIT Istator OPTIONAL CARD

1) FUNCTIONAL

- A voltage, image of the stator current of the machine, fed from the "ALTERNATOR I / O" card is rectified, filtered and compared to a reference voltage. The error signal gives a voltage correction which is added to the main PID input to maintain the stator current equal to the adjusted value.

- The reference voltage is applied with an initial ramp ajustable from 0,5 to about 4s.

- A front LED signals stator current limitation operation.

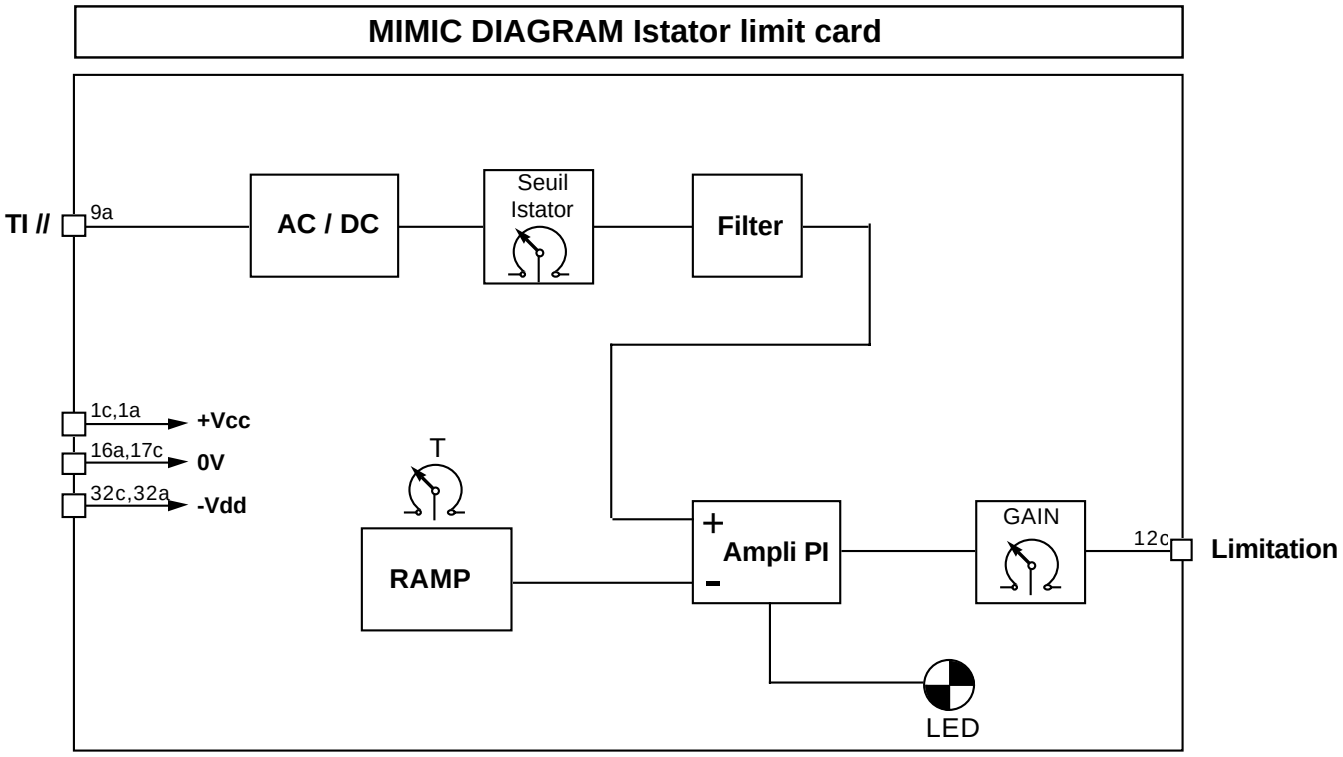
- When this card is used for soft-start operation, the AVR power transformer must be fed from a separate source during the start operation and can be switched on the generator output when the voltage have reached the nominal value. The switching must be as fast as possible (by relay , not by manual switch)

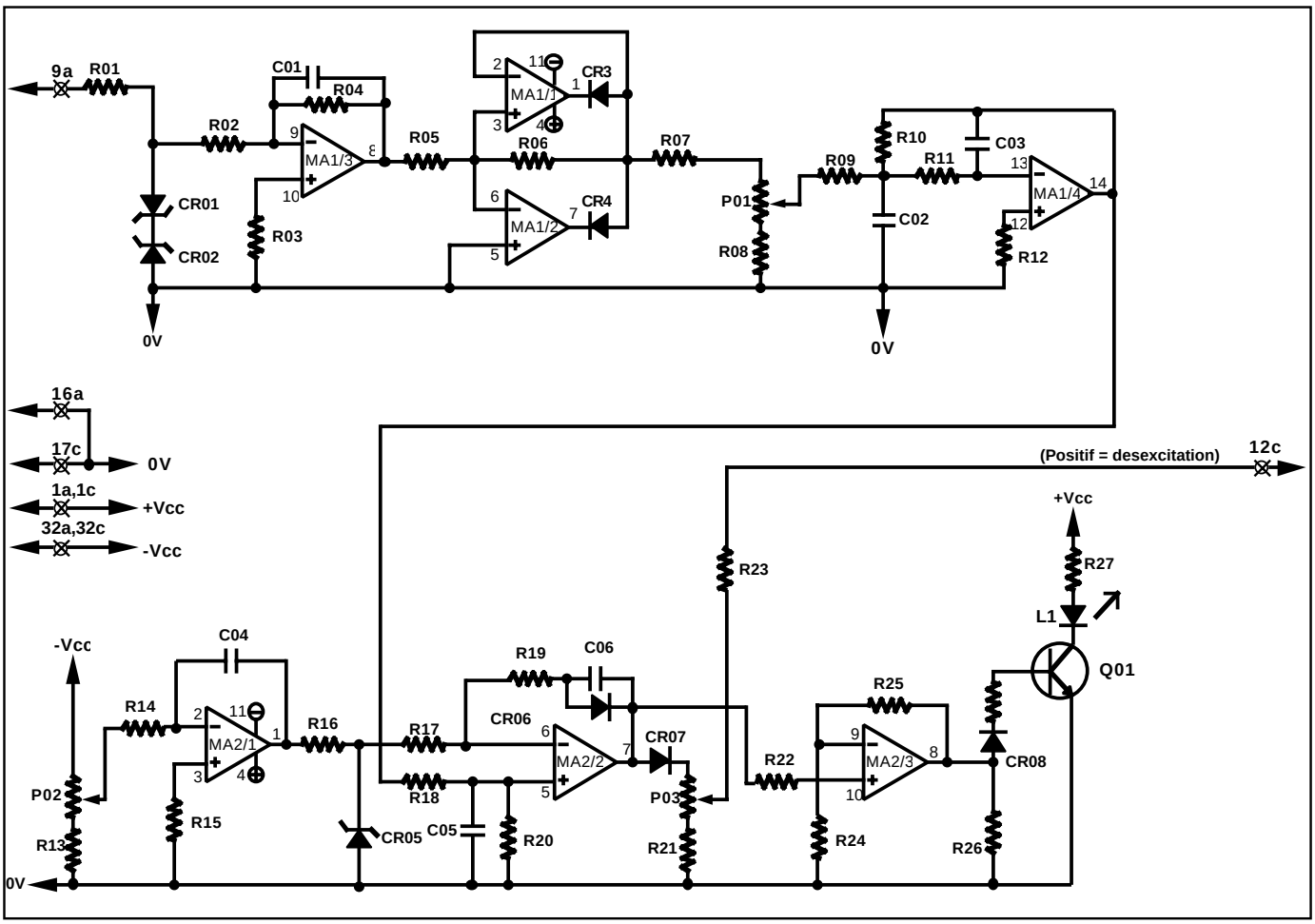
2) REGLAGES

- P1 : Stator current limit adjust. (about 2In to 4In)
- P2 : Ramp-up time adjust. (0,5 à 4s environ)
- P3 : Output signal gain

3) INPUTS /OUTPUTS

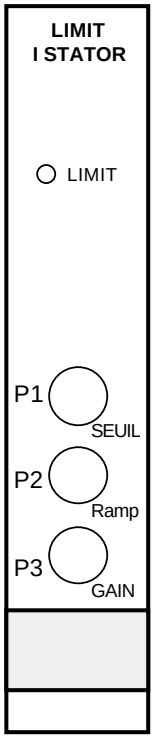
- 9a : Stator current image input (1Vac for In)
- 1a,1c : +15Vdc regulated (Vcc)
- 32a,32c : -15Vdc regulated (Vdd)
- 16a,17c : Common ground (GND or 0V)
- 12c : Voltage correction output to PID.





FRONT VIEW

Lim Istator card



CAUTION

Never energize the AVR when the driver card is removed. An overvoltage can appear and the power transistor can be damaged

1) STARTING WITH MANUAL MODE CARD

- For initial start-up, the best is to use the manual mode for testing the sensing wires between the generator and the AVR.

- For this it is necessary to have a manual mode card plugged in the AVR. If not, see directly §2.

- Switch the manual card on ON (switch in front of card).

- Set the potentiometer P2 on manual card maximum CCW, start the prime mover up to the nominal speed.

- Turn slowly the potentiometer CW to obtain the nominal voltage.

- Check the presence and the value of the three phases at the AVR terminal block (terminals 1, 2, 3)

- Set the voltage to 5% above the nominal voltage.

- Check that the voltage between terminal 39 and 20 of the AVR terminal block is about one volt.

- If yes, switch off the manual operation in the front of manual card.

- The voltage must reach the nominal value.

- Go to §3

2) STARTING WITHOUT MANUAL MODE CARD

- Start the prime mover up to the nominal speed..

- If the voltage does not appear, check wires between AVR and the generator field (terminals 5 and 6 of AVR),and the also the wires between AVR and power transformer (terminals 14,15 (and 16 if used) of AVR. Check also the fuse inside the terminal 14,16 of AVR terminal block.

- If the voltage is too hight, check that the sensing voltages at the terminals 1, 2, 3 of the AVR terminal block are present.

- Adjust the nominal voltage with Vref (P5) of the sensing card for the middle position of the external voltage potentiometer (if used).

3) DE-ENERGIZING (optional)

- External contacts E01 and E02 must be used.

- E01 must be serie with terminal 14,15 of AVR (power input) and is opened for de-energizing.

- E02 must short-circuit the booster output (if used) (terminals 7 and 8 of AVR) and is closed for de-energizing.

4) ADJUSTMENTS

- Refer also to card descriptions.

- The AVR is normally preset in factory.

- The nominal voltage can be set by Vref (P5) on sensing card. Fine adjustment can be made by an external voltage potentiometer (10KΩ), (terminals 21,22,23)

-If an adjustment must be moved, note carefully the original setting for resetting in case of problems.

- If the strap V/Hz of sensing card is on kV/Hz position, the original setting is V/Hz and can be changed between V/Hz and 2V/Hz by potentiometer P4.

-The stability is adjusted with the machine in factory . If necessary, the response time can be changed by the setting of potentiometer P4 of PID card.

- Other settings are difficult to adjust without specific electronics equipments. It is better to not change them.

5) FIELD FLASHING

- Generally, field flashing is not necessary, but in some cases like long stop time or fault trip, it can be possible that the voltage does not appear naturally.
In this case, connect a 12Vdc to 24Vdc voltage source to the terminals 4 and 8 of AVR terminal block, + to 4 for a short time and remove it when the voltage increases.

6) PARALLEL OPERATION(1F)

- The generator voltages must be as equal as possible.

- Same for the droop. If it is not possible to measure it, set the potentiometers P1 of the sensing cards all in the same position. (middle set for example).
If the droop setting is made from cosØ/KVAR card (when used), see notice NT 1950080.

- The reactive currents (KVAR) must be shared, immediatly after coupling, even the KW are not shared.

- If, immediatly after coupling, the current increases abnormally, check if the parallel CT wires are not reversed. (9 et 10 of AVR terminal block)

- If the coupling is OK but if when the load increases, the cosØ or the current have an abnormal value, check that the sensing phases at the input of the AVR are right connected. (U, V, W respectively to the terminals 1, 2, 3 if clockwise rotation or W, V, U, if counter clockwise rotation)

7) PARALLEL WITH THE MAINS (2F)

- The generator and mains voltages must be as equal as possible. (see GENERATOR/ MAIN I/O card manual). **The contact between terminals 30, 31** of AVR terminal block **must be closed at the same time as the coupling** and will remain closed as long as the generator is connected to the mains.
It will be open when parallel between generators.

- If, immediatly after coupling, the current increases abnormally, check if the parallel CT wires are not reversed. (9 et 10 of AVR terminal block)
- If the coupling is OK but if when the load increases, the cosØ or the current have an abnormal value, check that the sensing phases at the input of the AVR are right connected. (U, V, W respectively to the terminals 1, 2, 3 if clockwise rotation or W, V, U, if counter clockwise rotation)

- The PF value is normally factory set to 0.9 . It can be adjust by mean of potentiometer P2 on cosØ/KVAR card or by mean of an external potentiometer (10KΩ-1W) connected to AVR terminal block (24,25,26)

- If the KVAR regulation is required terminals 37 and 38 must be short-circuited and the KVAR can be set by mean of potentiometer P1 on cosØ/KVAR card or by mean of an external potentiometer (10KΩ-1W) connected to AVR terminal block (27,28,29)

-For droop setting, see notice NT 1950080.

8) VOLTAGE EQUALISATION (3F)

- The following procedure must be made one time to take account of the mains transformer primary/secondary ratio.
- At no load and mains voltage present at terminals 11,12,13 of the AVR terminal block.
- Short circuit terminals 31,32 of the AVR terminal block
- Adjust P1 of MAIN I/O card to have generator and mains voltage as equal as possible.
- Remove the strap between terminals 31,32 of the AVR terminal block.
- The initial setting is made.
In normal operation the contact between terminals 31,32 of the AVR terminal block must be closed with synchronizer operation and can be opened after coupling.

9) MANUAL OPERATION (if used)

-If a manual mode card is used, it is possible to control directly the field current of the generator.

- In automatic mode, adjust the potentiometer P2 on manual mode card to have the LEDs "HIGHT" and "LOW" off and the LED OK ligthing. At this time the manual setting is equal to the automatic channel control.

- Switch on front of manual card on position "ON" gives control to the manual channel and the field current is adjusted by potentiometer P2.

- This mode can be used when initial start-up of the generator, to make test after problems or when operating with the mains. It cannot be used when solo operation because it is not possible to follow the load variations.

- When coupling with the mains on load, if trip of the generator occurs, an overvoltage may occurs due to the fact that the field current setting is too hight regarding the load of the generator. On this case, an internal circuit of the card decreases the field current to limit the overvoltage approximatively to 110% of nominal, the voltage in this case can be unstable but protect faster the equipments. LED "LIMIT" on front of the card will light. The setting of field current must be reset manually to the no load value and the LED "LIMIT" will switch off.

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