CTRD

CTRD

User's Manual

Version 2.4

TDE MACNO

MACTRD0010I0

SUMMARY

1.1 WARNINGS

- **Before installation and use of an equipment read carefully the handbook.**
- **Responsability for inappropriate use of the equipment different from those prescribed in the handbook, are declined.**
- **No modification or operation not prescribed in the handbook are permitted without the constructor's explicit authorisation and must be executed only by qualified personnel. In case of not respect, constructor declines any responsibility on consequences and guarantee is no more valid.**
- **Starting and installation are allowed only to qualified personnel who is responsible of the respect of the safety rules in force.**
- **The drive, if not provided with the suitable filter and connected to public residential low tension, can cause interferences to radio frequences.**
- **In the specific case of duty, the prevention of accident valid rules have to be respected. Installation, harness and opening of the equipment and converter must be done only in lack of tension.**
- **Equipment and converters must be installed in a contact-proof case with an IP protection degree in accordance to valid rules.**
- **Lay the equipment in a way to easy maintenance, avoiding any interference among the components in movement.**
- **Make sure that a sufficient ventilation is guaranteed in order to drain the converter's dripping.**
- **In case of fire near the equipment, do not use extinguishing means containing water.**
- **Avoid in any case intrusion of water or other fluids into the equipment.**
- **Any kind of operation inside the equipments must be made in lack of tension. Due to the presence of capacitors, wait al least 5 minutes before entering for operations.**

2. CHARACTERISTICS

The TDE thyristor drives are static converters completely digital for speed control and torque of c.c. independent wound motors. A 16 bit microprocessor generates all converter functions, from ramp onto regulations and visualizations. The control algorithm is based on a model of the ensemble converter-motor which guarantees a particularly quick state dynamic. It is possible to change the parameters of the drivers by: a serial optoinsulated line managed by a P.C., an apposite terminal or keypad on board. The PC permits to save the parameters on a disk, as well they transfer to other drivers. All parameters are reachable by a multi-level menu. The units are supplied with internal default parameters
The most modern technology increases the converter performance.

2.1 General information

- Autotest after feeding and a continuous alarm control during operations
- Automatic frequency matching in the field 45-65 Hz.
- Alarm with indication of the first out on the keypad on board.
- Adjustment of parameters and indication of signals on: PC, keypad, terminal which can be eventually inserted on door front.
- Visual control of inputs and outputs.
- Sequences of I/O controlled by microprocessor (insertion contactor, enable and disable of drive).
- Easy and precise reproduction of the values stored in the unit.
- Short setting at work: all parameters related to the current ring are automatically set during self-calibration.
- Setting of parameters even on running.
- Programmable ramp on the four quadrants with rounding.
- Two internal JOG references.
- Functions or configuration of auxiliary analogic inputs changeable.
- Possibility to change control functions.
- Speed reaction from tachometer dynamo or encoder.
- Control by profibus interface (optional).

2.2 Inputs - outputs

- Main speed reference:
  - from analogic signal,
  - from P.C. or terminal with digital set on RS232 line,
  - from P.C. by digital set on RS485 line,
  - from keypad on board
- Analogic input for additional speed signal and 2 inputs for current reference or limit.
- Speed reaction from tachometer or encoder.
- Independent connection for encoder with settable 5-18v feeding.
- 11 active opto-insulated inputs with 24V (LED turned on).
- 2 immediate shutdown inputs, consent to running and radiator overheating, and a delayed alarm for lack of excitation.
- 4 signal analogic outputs: tachometric, current, reference for excitation governor, plus one that can be freely set.
- 8 opto-insulated digital outputs with signaling LEDS.
- Selectable work ways by programming.

2.3 Protections

- Test on memories at feeding insertion.
- Control on exceeding of I^2t (protection against motor overheating).
- Control on feeding failure, out of tolerance connection and phase failure, sequence phases, over-speed, lack of speed reaction or overcurrent on thyristors.
- Control on thyristors conduction with alarm for lack in conduction.
- Failure indication with evidence of the first out.

2.4 SIZES AND DIMENSIONS CONVERTERS

CURRENT	UNIDIRECTIONAL	BIDIRECTIONAL	VENTILATED	SIZE	HxLxP
30A	CTRD-XX-030-U	CTRD-XX-030-B			350x225x190
50A	CTRD-XX-050-U	CTRD-XX-050-B		S	
80A	CTRD-XX-080-U	CTRD-XX-080-B			
140A	CTRD-XX-140-U	CTRD-XX-140-B	•	M	
200A	CTRD-XX-200-U	CTRD-XX-200-B	•		400x225x240
280A	CTRD-XX-280-U	CTRD-XX-280-B	•		
360A	CTRD-XX-360-U	CTRD-XX-360-B	•		
*450A	CTRD-XX-450-U	CTRD-XX-450-B	••	L	650x225x290
*600A	CTRD-XX-600-U	CTRD-XX-600-B	••		
*800A	CTRD-XX-800-U	CTRD-XX-800-B	••	X	750x305x300
*1000A	CTRD-XX-1000-U	CTRD-XX-1000-B	••		

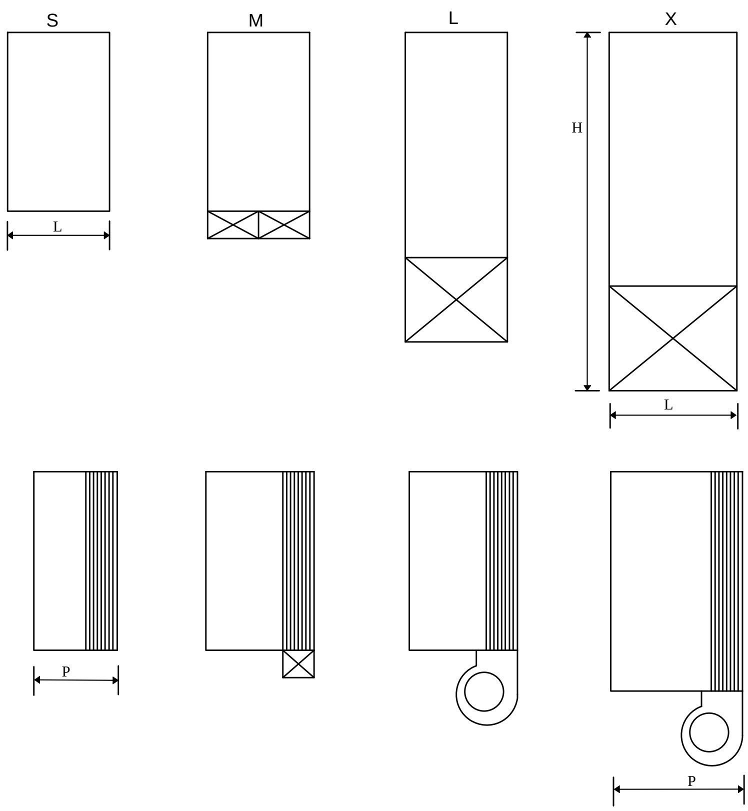
* External bridge rectifier for field

Where : **XX = 12 per thyristors at 1200V**

XX = 16 per thyristors at 1600V

• = Fans internally fed

•• = Fans externally fed



3. POWER: CONNECTION AND DIMENSION FUSES

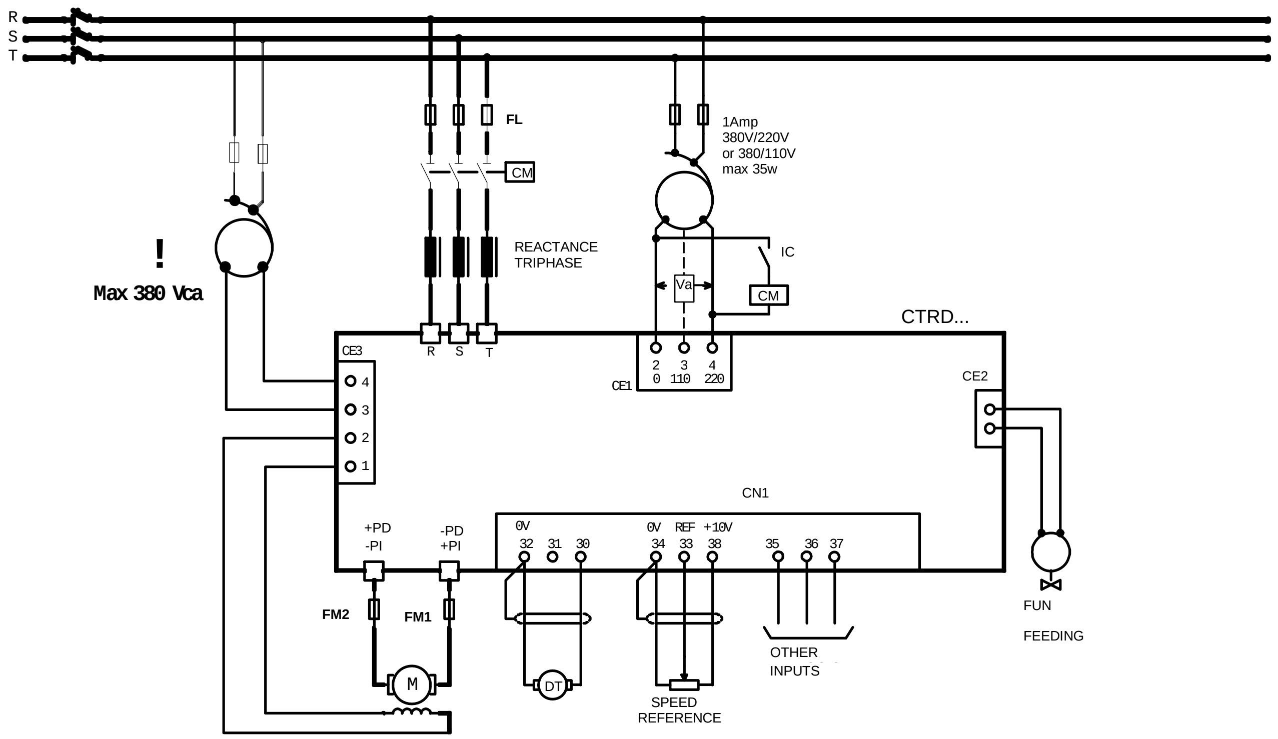
CM Power contactor:
(for possible sequence schemas see page 11)

FL-FM Line and motor fuses (FM necessary only for bidirectional converters)

Vac Field tension: 380Vac max (not for 450 – 1000A)

Vp Power tension: 220V ≤ Vac ≤ 415V

Va Tension for regulation feeding: 110V ≤ Vac ≤ 250V (max 35w)

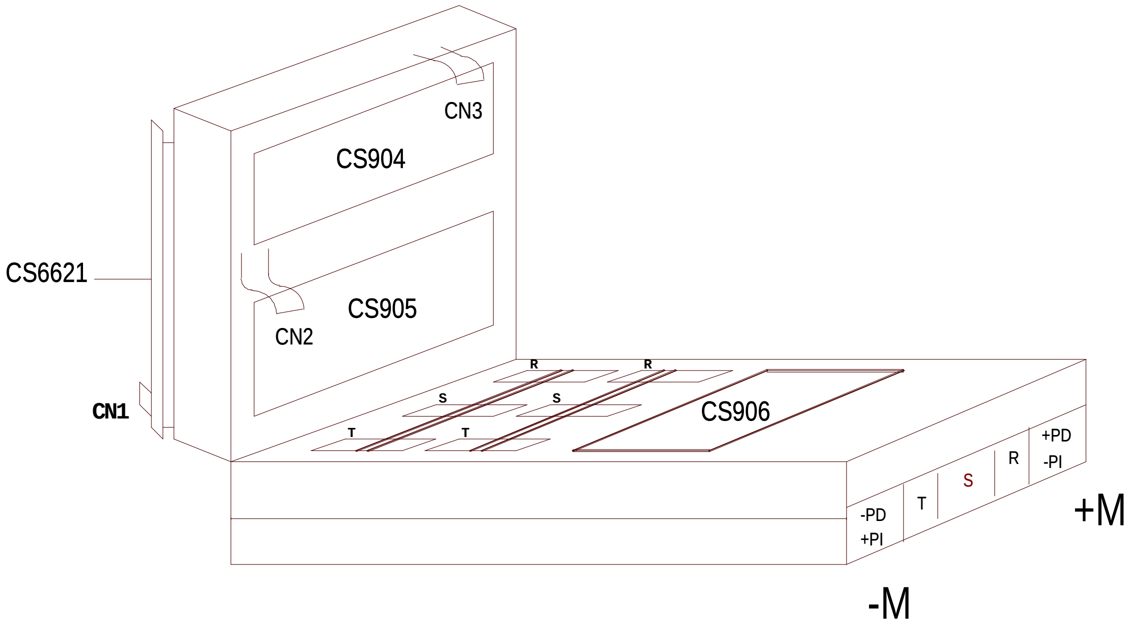


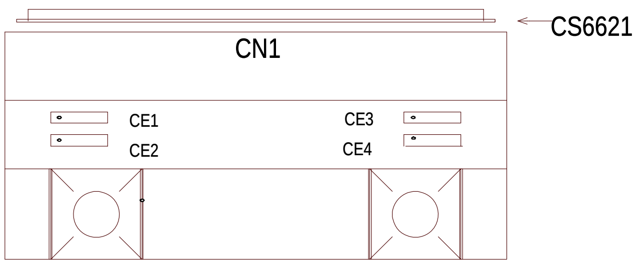
3.1 Fuses CTRD (fl-fm1-fm2) sizes

SIZE CTRD	LIMIT (Amp)	THYRISTOR	I²T(A²S)	FUSE FM-FM1 (Amp)	RANGE ZILOX
30	34,5	SKKT27/XXE TT25NXXK	800 1.060	50 50	DIN00/ DIN000 DIN00/ DIN000
50	57,5	SKKT57/XXE TT56NXXK	8.000 9.100	100 100	DIN00/ DIN000 DIN00/ DIN-000
80	92	SKKT57/XXE	8.000	100 100	DIN-000
		TT56NXXK	9.100	125A 125A	DIN-00
140	161	TT66NXXK	9.800	160	DIN-00
200	230	TT105NXXK	24.000	250 250	DIN-00 DIN1*
280	322	TT142NXXK	84.000	350 400	DIN-00 DIN1*
360	414	TT162NXXK	97.000	400	DIN-00

450	517	TT210NXXK SKKT250/XXE	218.000 320.000	500 500	DIN-00 SIZE 3
600	690	TT285NXXK	320.000	700	
800	920	TT425NXXK	781.000	900	
1000	1050	TT500NXXK	1.051.000	1100	

3.2 General map

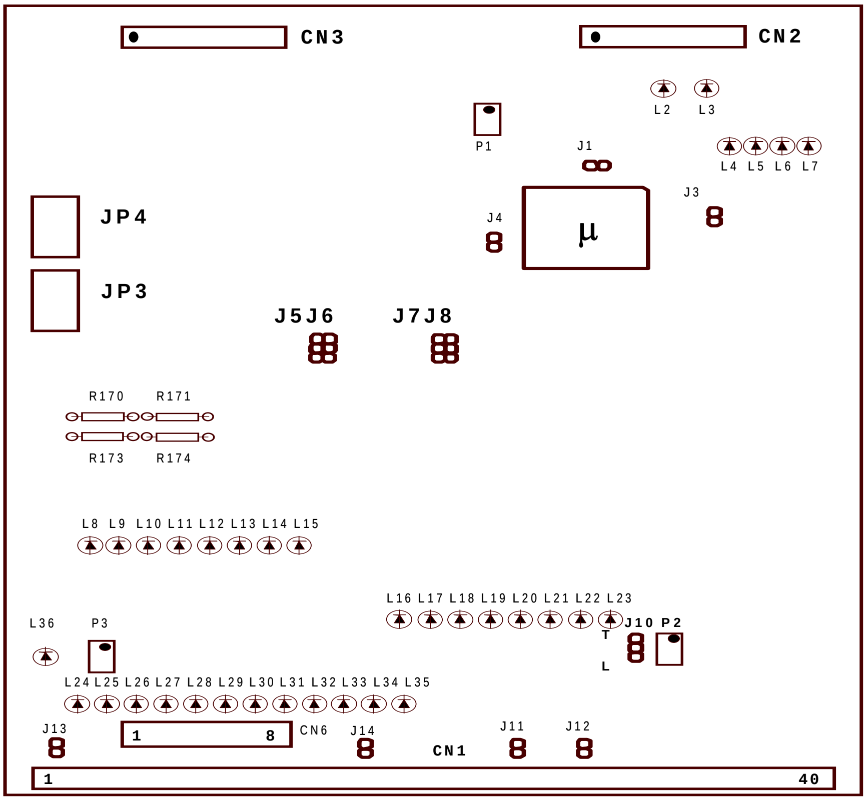




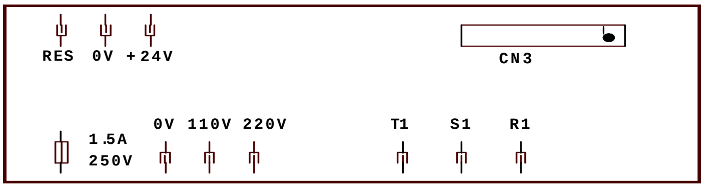
Back of converter

CE1 = regulation board supply: 110 or 220vac max 35w
CE2 = not used
CE3 = field supply
CE4 = fun supply (until 360A)

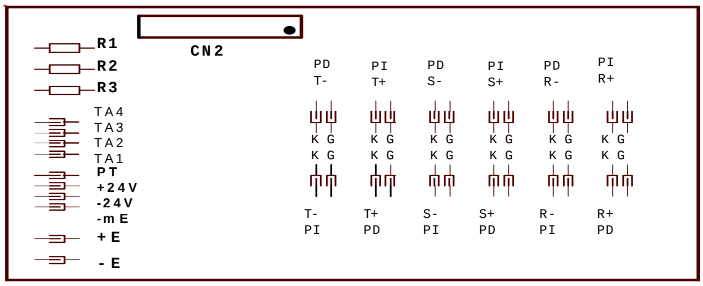
CS6621 REGULATION BOARD



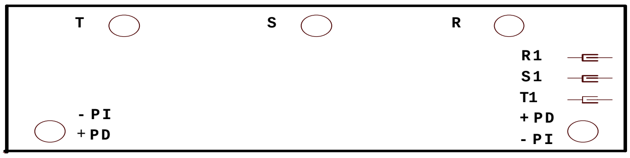
CS904 FEEDER SWITCHING AND SYNCHRONISM



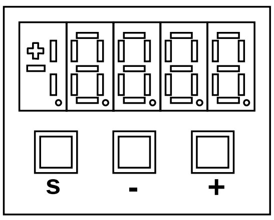
CS905 IGNITERS AND SIZE IN CURRENT

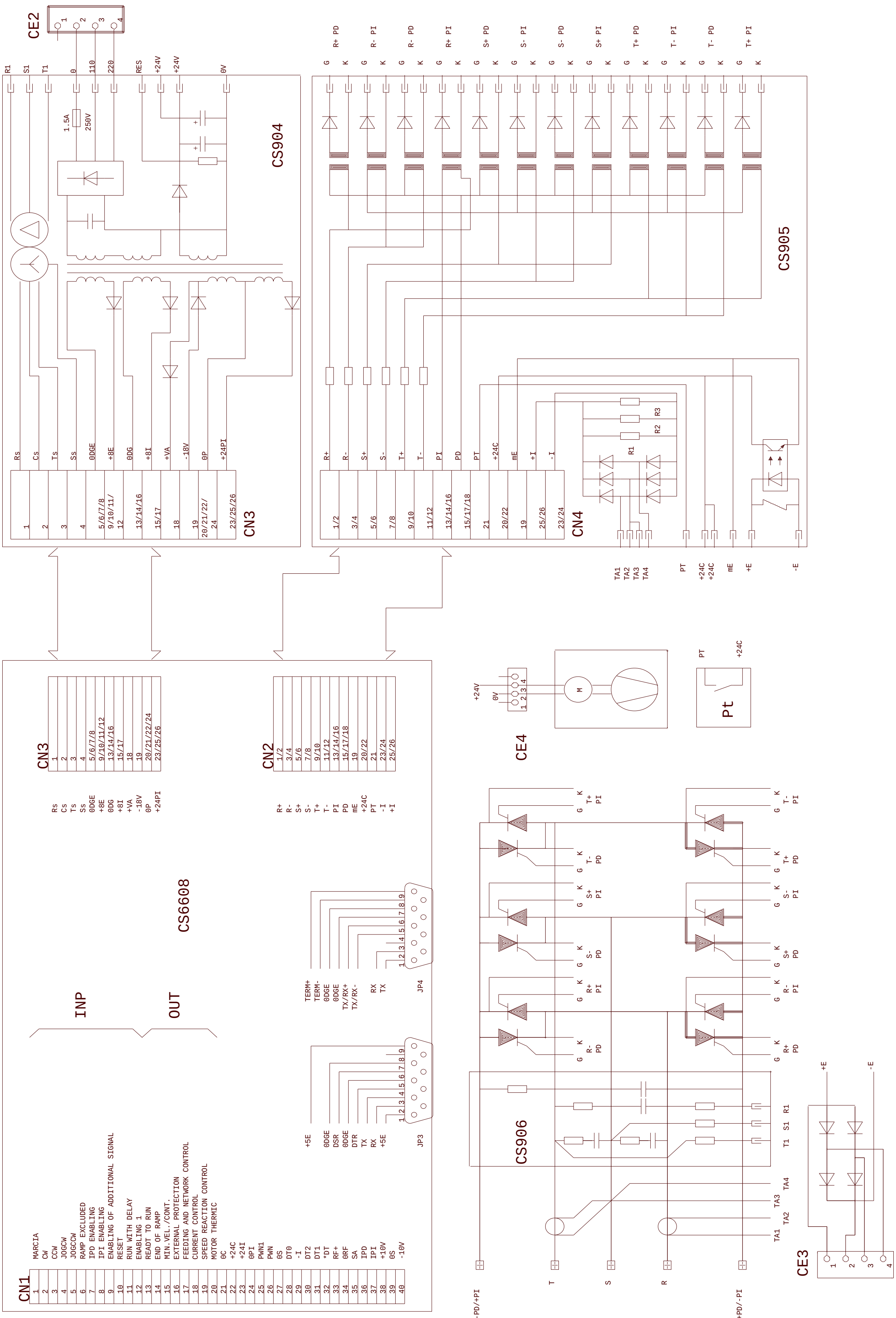


CS906 FILTERS R-C

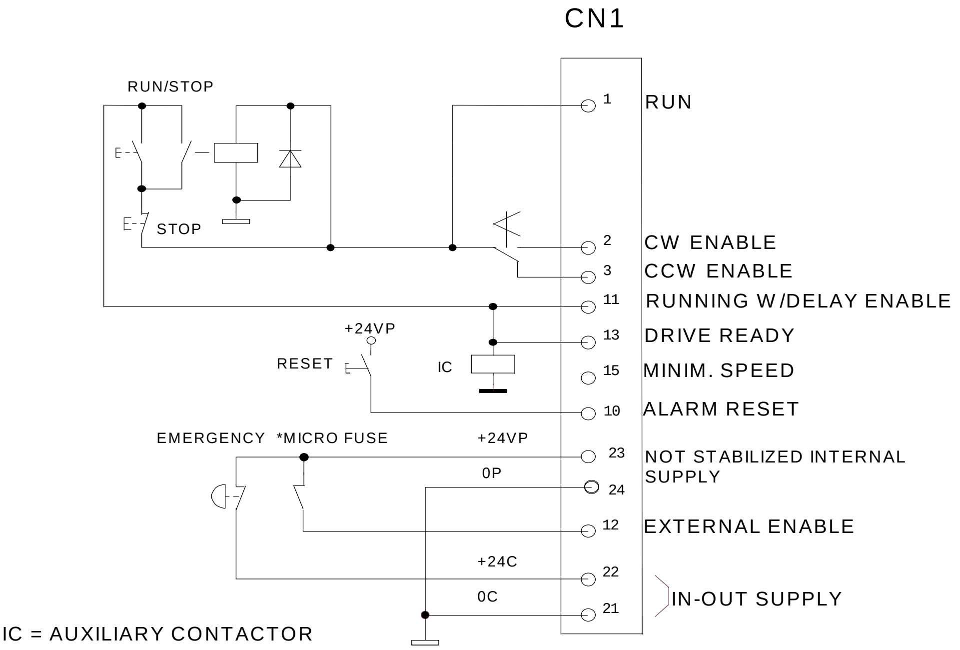


CS 8G3 KEYPAD

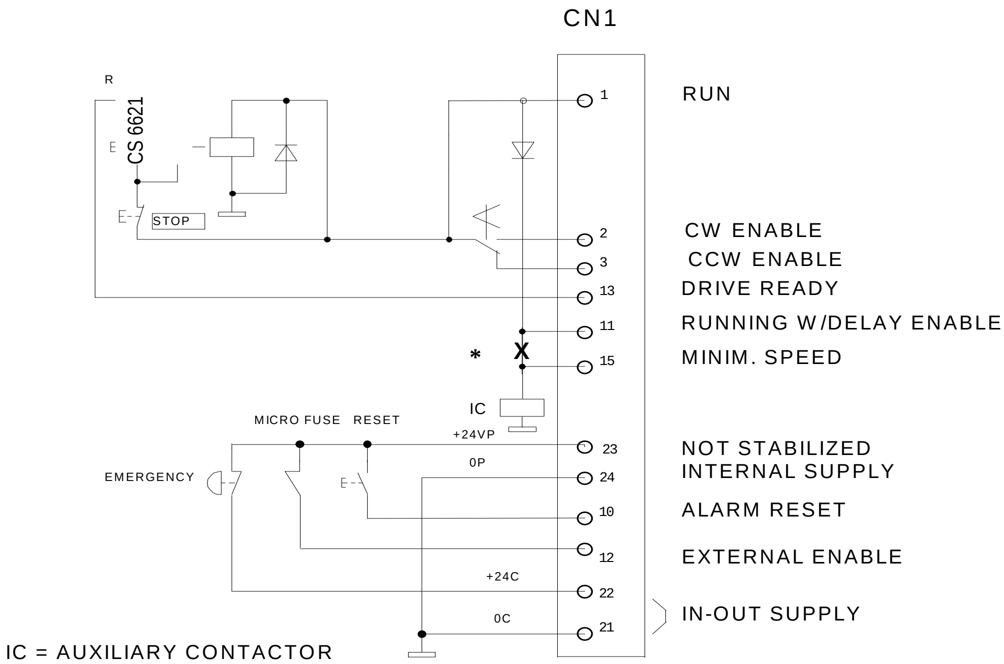



CE2
CS904
CS905
CN3
CN4
CN3
CN2
CS6608
INP
OUT
CN1
JP4
JP3
CE4
Pt
CS906
CE3

3.3 Contactor always on and stop by minumim speed



3.4 Contactor open/close and stop by minimum speed



***** N.B. IF NOT MADE CONNECTION INDICATED BY **X**, WHEN RUNNING STOPPED, THE CONVERTER WILL SHUTDOWN WITHOUT WAITING FOR THE MIN SPEED

3.5 Meaning of logic signals (connector CN1):

1	Run	Runs the converter on condition that all internal and external agreements are present.
2	Enable CW	Enables the speed reference to terminals 33-34 with its sign.
3	Enable CCW	Enables the speed reference to terminals 33-34 with opposite sign.
4	Enable rotation JOG-CW	Enables as speed reference the parameter P3 with its sign.
5	Enable rotation JOG-CCW	Enables as speed reference the parameter P4 with opposite sign.
6	Exclusion of ramp	Causes exclusion of the ramp.
7	Enable IPD	Enables the IPD signal.
8	Enable IPI	Enables the IPI signal.
9	Enable Add. Signal	Enables the additional signal.
10	Reset alarms	Resets the alarm memory.
11	Running with delay	Enables running after the P46 waiting time is through.
12	External enable	Enables the external consent. If lacks, the alarm turnes on.
13	Drive ready	Active if drive is ready (lack of alarms).
14	End ramp	Active when the ramp output is the same as the input
15	Drive running/minimum speed	Active if S6=1 and drive is running, if S6=0 active when exceeds the minimum speed.
16	External protections	Active when even one of the external inputs lacks.
17	Control main supply and feeding	Active with whatever alarm on connection or internal feeding.
18	Current control	Active with whatever alarm on converter conduction or failure on thyristors conduction.
19	Control on speed reaction	Active with whatever alarm on speed reaction (tachometer or encoder).
20	Thermic motor	Active when the motor thermic constants have been exceeded (it dosen’t shutdown the drive).
21	0c	It is the common negative of all inputs and outputs.
22	+24c	It is the common positive of all inputs and outputs (requires +24v feeding).
23	+24v	Not stabilized feeding +24v avaliable for eventual external charges.
24	Op	Zero referred to output of +24v.

N.B.: 1÷12 are controlled by signals in a range of 20V÷30V.

3.6 Meaning of analogical signals (connector CN1):

25	OA1	Output of size for driving of the excitation board ES 95003 (optional).
26	OA2	Analogic output programmable by SW1.
27	Ov common	Common zero for outputs OA1-OA2.
28	Speed analogic output	Standardized output of tachometer.
29	Current analogic output	Standardized output of current.
30	Input DT2	Input for tachometer dynamo 40-180v.
31	Input DT1	Input for tachometer dynamo 5-40v.
32	Ov common	Common zero for tachometer input.
33	Analogic input reference	Input for speed datum.
34	Ov common	Common zero for inputs 33-35-36-37.
35	Additional signal	Analogic input for the additional datum signal.
36	Signal IPD	Analogic input for signal of direct bridge limit.
37	Signal IPI	Analogic input for signal of inversed bridge limit.
38	Reference voltage	Output of +10v.
39	Ov common	Common zero for outputs 38-40.
40	Reference voltage	Output of -10v.

4. DESCRIPTION OF BASIC INFORMATION

To have a general overview of the information available for the user, see chapter 9, page 28 of the present handbook.

5. PROCEDURE OF SETTING AT WORK

Description is referred to the use of the keypad CS 8ET mounted on board (into brackets for the use with terminal or PC, chapter 12, page 46).

1) The driver is delivered with a set current limit in the maximum value of **1,15 In**, see plate on the side of converter, with parameters **P53**, **P54**, **P55** set respectively in values of **86,9%**, **10s** and **150%**. In case the use requires an increase of the limits, it is useful to contact TDE MACNO.

2) If mono- or bidirectional, the driver is set to work at two or four quadrants; but in case Deafault parameters are set and the driver runs monodirectionally, its has to be restored the converter type.

3) Before energize, check that all connections are at the state of the art and respond to the scheme.

4) Energize and eventually connect the terminal or the personal computer after having arranged connection cables as described at page 19 (for terminal or PC see operative procedure at pag.46). For the PC it has to be loaded the managing software by "AZ-BAT", then will appear the menu where choices are to be selected; the **password** software is delivered with, is "**TDEautom**", changeable later on by numbers or letters until 8 digits.

N.B.: If for any reason the Default parameters are reset, P53, P54, P55 have to be set at the above mentioned values, or the thermic drive alarm will turn on.

5) To correct the parameters "**Reserved**" the key **92** has to be charged to the parameter **P80**; the access to reserved parameters remains valid until drive is under tension (PC or terminal P80=1992).

6) If after having energized, some alarms turn on act as instructions (see table alarms, page 16); in any case, even no alarm turns on, tension has to be “calibrated” following the procedure:

   a) Close the contactor, read the tension value and calculate the value: Vnet/Vnet nom. x 100,
   b) Set at D17 ("views” ⇒ “internal sizes" ⇒ ”V17”) and adjust the trimmer "**P1**" on the board until the calculated value compares.

N.B. Keep such value 2 - 3% higher considering that later on, with the feeder on charge, the internal tension can decrease (it depends on the line impedance).

7) Set at P31 ("arrangements” ⇒ “parameters “ ⇒ P31) and charge the value resulted by the following formula:
   In motor/Illimit x 100.

8) Choose P38 and set the value: Vm/Veff.net x 100 where:
   Vm is the motor no-load voltage at nominal revolutions and
   Veff. net is the nominal grid tension.

9) Calibrate the tachometer input as follows:

a) Calculate the dynamo tension at the nominal motor revolutions, so to choose the adequate input and if the Jumper J10, tables on page 37, has to be inserted in position of work "L" or not,
b) Set the jumper J10 in test, position "T" and calculate by using the formula for the above choosen connection, tables on page 37, the value that has to appear in % on "D6",
c) pass in "D6" ("views" ⇒" internal sizes" ⇒"V6") and turn the trimmer of tachometer calibration P2 until such value compares,
d) remove Jumper from "T" and, if foreseen, connect it in "L". The calibration is finished, save some little revisions to do once running at the maximum revolvings.
(ex.: DT= 100V when choosen the input DT2 with Jumper J10 closed on L, during calibration, on D6 it must compare

$$\frac{3630}{100}\,\% = 36{,}3\%$$

N.B. refer to positions "T" and "L" on page 9

10) Turn off the motor field, turn off the line switch in case it is not turned off sequencely by the output 03 (CN1-15) but do not turn off CN1-1, otherwise it runs, activate C 71=1 ("self-calibration" ⇒ "current loop"). **Self-calibration has to be executed bringing the motor until the maximum foreseen current set in P29 e P30**; in case the maximum current is not desired, its limit can be decreased; we suggest in any case not to lower under the rated current. In case the limit is changed, at the end of the self-calibration it must be restored and captured in the EEPROM by C76=1("store" ⇒ "save parameters on eeprom"). The system executes the self-calibration of the current ring which closes after calculation and saving of parameters P39, P40. If case during this step the system alarms, verify in menu ("views" ⇒ "alarms") and take measures.

Possible alarms can be:

A8: **ALARM CONDUCTION**	Verify thyristors, connections, remote control switches off, etc.
A9: **MOTOR RUNNING DURING SELF-CALIBRATION**	It means that motor runs while self-calibration: field still on (disconnect), motor with magnetic retentivity or too high series (block the motor). In case running is imperceptible: disconnect the tachometer.
A12: **NEVER CONTINUOS CURRENT DURING SELF-CALIBRATION**	It means that motor is not much inductive for the set current limit; then the limit must be increased by decreasing the droop resistance of TA until maximum current reaches a continuous value and eventually then decrease "P29" and "P30" (maximum current limits) until the desired value; it must be considered that motor running in such condition abosrbs a Ieff. much higher thant the rated current with an overheating, therefore it must be decreased.
A13: **SELF-CALIBRATION IMPOSSIBILE**	It means that motor is too inductive to crisis the system. Such is almost impossible as the system operation limit is reached whith a peak current at continuity limit minus 3% of the limit current.
A16: **DROOP RESISTANCE TOO HIGH**	System does not operate if the motor inner ratio droop referred to rated current exceeds the 40% of the motor tension or if the limit of droop exceeds the 50% of voltage between lines. If it is about the first case, but far from the second one, it is sufficient to decrease P31 (Inom/Ilim) and repeat self-calibration once again.

11) Reconnect the filed, lower the limit current P29/P30 = 20% and run with the reference higher than zero. In case tachometer alarm operates, act as provided.

12) Bring gradually the motor to 100% (if system accepts) of its speed checking its stability (eventually correct P23 e P24) and adjust trimmer P2 in case speed is different from the desired one.

13) At the maximum speed (100%) read in "D18" ("views" ⇒ "internal sizes" ⇒ "V18") the E.M.F. and in case motor is de-energized read in "D6" ("V6") the number of revolvings in % corresponding to the beginning of de-energizing. Stop the motor and set the read value in "D6" to the parameter P37 and the value read in "D18" to the parameter P38; then save the parameters on EEPROM by C76=1.

14) Execute all other variations if required: ramp, jog, limits, inner connections, etc; then save the parameters or internal connections.

15) Write on the testing book enclosed to the converter all parameters for a possibile replacement or save it on disk ("store" ⇒ "save on disk").

5.1 Malfunctions with alarm signaling: diagnosis

ACTIVE PROTECTION		DESCRIPTION	REMEDY MEASURES
A1	Micro alarm	Adjustment board with funtionning problems	Replace the regulation board.
A2	Alarm RAM and EEPROM	Converter has registered wrong parameters	If it is not possible to void the problem by turning off and then on the converter, execute C74=1 ("store"⇒"reset default values"), or C75=1 ("store"⇒ "reset EEPROM") and then C76=1 ("store" ⇒ "write in EEPROM").
A3	Alarm cyclic sense	Phase sequence not correct	Invert two phases in input of converter (ex: phases R-T).
A4	Alarm lack of phase	Lack of one of the phases in input	Check power connections in input
A5	Alarm main supply	Indicates a variation on main supply	Check stability of main supply or change allowance range by parameters P49-P50
A6	Alarm inner tension not correct	Indicates a failure in one of the inner feedings	Check functionality of feeder board CS 904, in case all feedings are present, replace the board CS 6621.
A7	Alarm current peak	Controls that the momentary current peak is lower than the maximum admitted level	Check that thyristors are not damaged or downgraded, check also possible shortcircuits in motor.
A8	Alarm conductions	Verifies the correct conduction of thyristors	Check integrity of line contactor or continuity of armature: fuses, contactor, connections…
A9	Alarm speed reaction	Verifies the integrity of tachometer connection (D.T.) and polarity	If it operates, check integrity of tachometer connection or the correct connection sense (eventually correct).

A10	Alarm overspeed	Operates if value of D.T. exceeds the speed set in P51	It can operate if motor is dragged by the load.
A11	Motor thermic alarm	Operates if value calculated in P48 exceeds	Such alarm can operate if motor runs under work cycles that cause frequent overcharges. Check scaling of motor-drive system or calibrations of current limits.
A12	Alarm no direct current during self-calibration	Motor is not inductive enough for the set current limit	Increase the converter size and decrease subsequently limits P29-P30.
A13	Alarm self-calibration impossibile	Motor is too inductive	Pratically impossible on standard motors.
A14	Alarm external protections	Lack of the external input or excitation or thermic radiator pellet	Check presence of inputs or correct connection of ov/+24v on CN1-21/22.
A15	Alarm frequency out of range	Indicates that frequency is out of range (45-65Hz)	Check power grid stability.
A16	Alarm motor tension	Motor rated tension has exceeded	Check the setting of P38 parameter or execute the self-calibration of the current ring.

6. ANTI-NOISE REMEDIES REMEDIES

Electrical or electronic equipments can mutually influence in reason of grid connections or other metallic connections. To minimize or eliminate the mutual influence a correct installation of the converter connected to eventual noise limiters equipments is necessary.
The following advices refer to a free-noise feeding grid. In case the electrical grid is noised, other solutions have to be taken.
In such cases it is not possible to give general advices and in case the noise limiters do not satisfy properly, please get in touch with TDE MACNO.

- Make sure that all equipments in the board are properly connected to ground bar by using short cables star connected. It is important that any control equipment connected to the converter, i.e. PLC, is connected to the same ground by short cables.

- The drive must be fixed with screws and elastic washers, so as to guarantee a good electrical connection between the housing and the metallic support connected to the earth of the cabinet

- Keep separate and distant among them motor and converter connections and control cables.

- Lay control cables at a distance of 10 cm from parallel power cables. Also in this case we advice the use of a separate metallic raceway connected to ground. In case control cables will cross the power cables, maintain a 90° cross angle.

- In case R-C groups for coils in AC or CC flywheel diode for starter coils, relays and other electromechanical commutators are installed inside the same board of converter, provide theyr mounting directly on the same coils connections.

- Check all control connections, external measurements and regulations by using screened cables.

- All cables where noises can be spread must be layed separately and far from converter control cables.

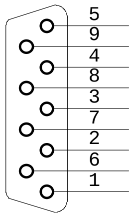
In case converter has to run in a particularly noisy location, the following advices must be taken into consideration to reduce conducted and radiated interferences.

- Insert a sigle phase EMC filter (type: Schaffner, RAFI, Timonta, etc.), to connect in series to CE1, to feed the regulation board.

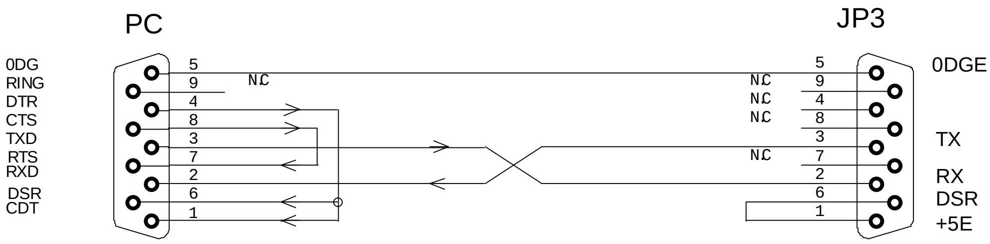
- Take all possible shrewdness in order to cut off all radiated emissions in the board, like grounding of all metallic parts, minimum holes on the external case, use of conducting gaskets.

7. DESCRIPTION OF SIGNALS ON CONNECTORS

7.1 Communication with PC or terminal (connector JP3)

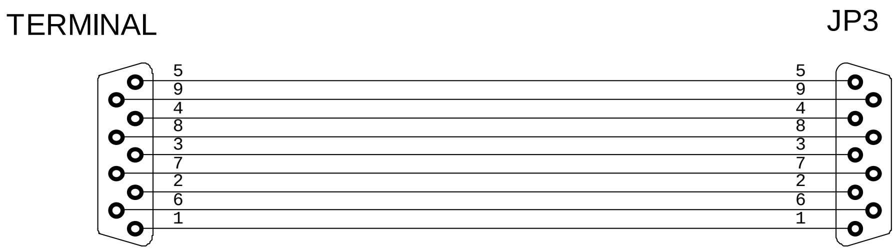
JP3  DB9 male pins	JP3 - 1 +5E JP3 - 2 RX JP3 - 3 TX JP3- 4 DTR JP3 - 5 0DGE JP3 - 6 DSR JP3 - 9 +5E JP3 - 4,6,7,8, nc	**RS - 232** Connector to be connected to the serial port of a PC or a terminal to program the board. The input and output signals are compatible with RS232 standard. Outputs are galvanically insulated in respect to the control circuits.

7.2 Connection cable between JP3 connector and RS232 of a PC



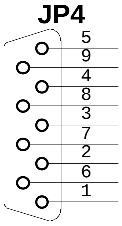
DB9 FEMALE PINS DB9 FEMALE PINS

7.3 Connection cable between JP3 connector and terminal



DB9 FEMALE PINS DB9 FEMALE PINS

7.4 Connector JP4

JP4  DB9 female pins	IP4 - 1 TX IP4 - 2 RX IP4 - 3 +5E IP4 - 4 TX/RX- IP4 - 5 TX/RX+ IP4 - 6 0DGE IP4 - 7 0DGE IP4 - 8 TERM - IP4 - 9 TERM +	JP4 contains either TX and RX signals referring to port RS232, and differential port signal RS485. JP4-6/7 is the common connection for both ports, while connections JP4/8/9 take in output the terminations to adapt the line. To end the line, JP4/9 has to be connected to JP9/5 and JP4/8 to JP4/4. All the signals together with the feedings, are galvanically insulated from the control circuits.

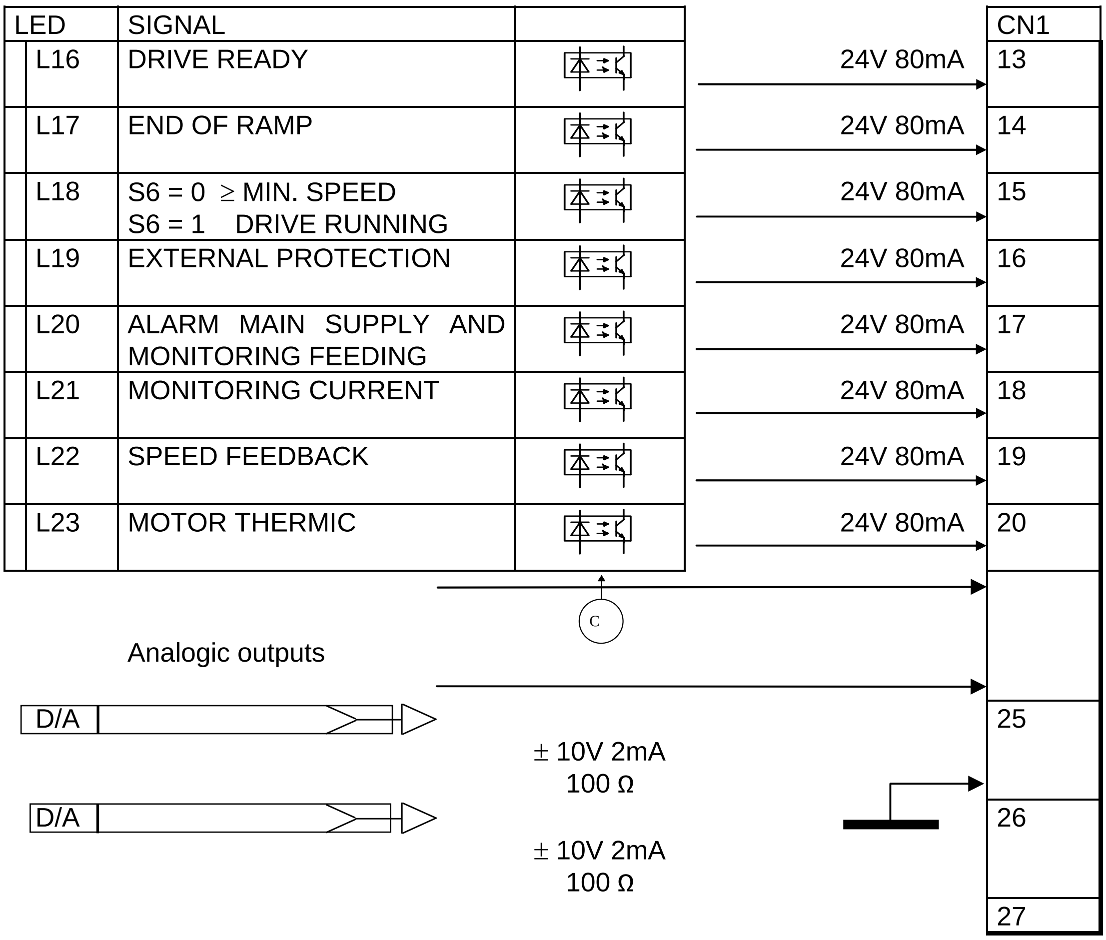
The serial line communicates in half duplex by four wires: RX+ and RX- are reception wires for the drive, while TX+ and TX- are transmission wires. Connection can be made also by two wires connecting among them RX+ and TX+ and RX- and TX- (**communication wires must be twisted**, TX+ and RX+ are at a high level at rest condition).

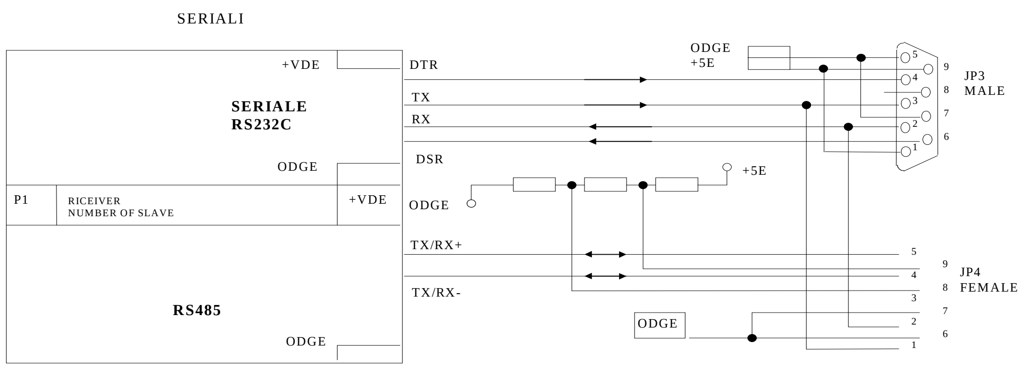
7.5 Signals on terminal boards

CN1		SIGNAL	LED
1	24V 5mA	RUN	L24
2	24V 5Ma	CW ENABLE	L25
3	24V 5mA	CCW ENABLE	L26
4	24V 5mA	JOG CW	L27
5	24V 5mA	JOG CCW	L28
6	24V 5mA	RAMP EXCLUDED	L29
7	24V 5mA	IPD ENABLE	L30
8	24V 5mA	IPI ENABLE	L31
9	24V 5mA	ADD. SIGNAL ENABLE	L32
10	24V 5mA	RESET ALARMS	L33
11	24V 5mA	RUN W/DELAY	L34
12	24V 5mA	EXTERNAL ENABLE	L35

CN2		SIGNAL	LED
21	24V 5mA	THERMIC PROTECTION	L5
19	24V 5mA	LACK OF EXCITATION	L6

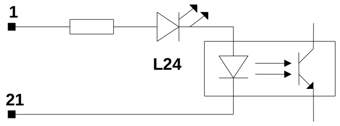
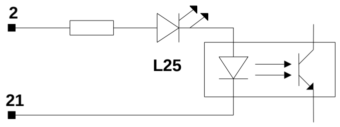
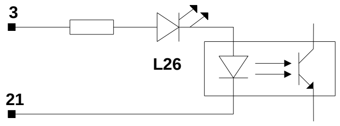
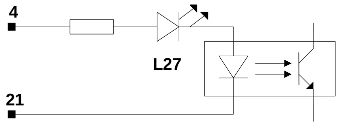
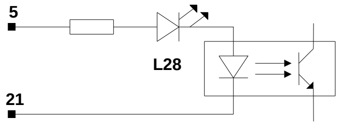
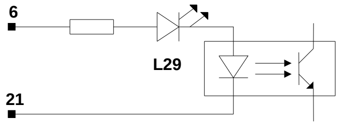
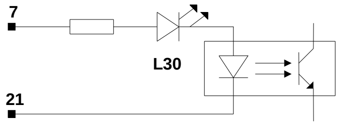
CN1		
21	0C	C
22	+24C	+V

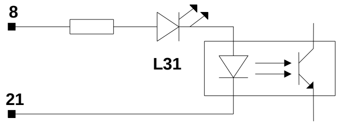

LED
SIGNAL
CN1
L16
DRIVE READY
24V 80mA
13
L17
END OF RAMP
24V 80mA
14
L18
S6 = 0 ≥ MIN. SPEED
S6 = 1 DRIVE RUNNING
24V 80mA
15
L19
EXTERNAL PROTECTION
24V 80mA
16
L20
ALARM MAIN SUPPLY AND MONITORING FEEDING
24V 80mA
17
L21
MONITORING CURRENT
24V 80mA
18
L22
SPEED FEEDBACK
24V 80mA
19
L23
MOTOR THERMIC
24V 80mA
20
C
Analogic outputs
D/A
D/A
25
± 10V 2mA
100 Ω
26
± 10V 2mA
100 Ω
27

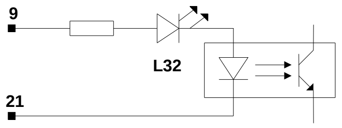
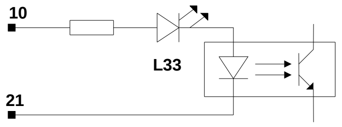
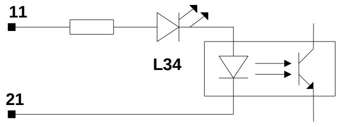
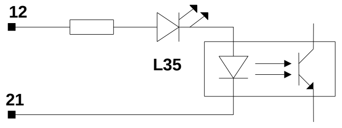
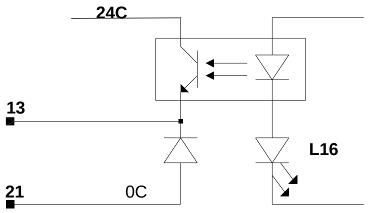
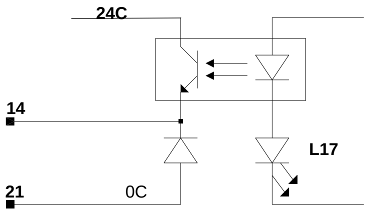

SERIALI
+VDE
SERIALE
RS232C
ODGE
P1
RICEIVER
NUMBER OF SLAVE
+VDE
RS485
ODGE
DTR
TX
RX
DSR
ODGE
TX/RX+
TX/RX-
ODGE
+5E
+5E
ODGE
JP3
MALE
JP4
FEMALE

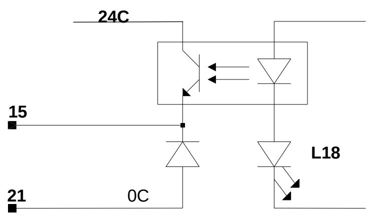
7.6 Connection of external signals to connector CN1

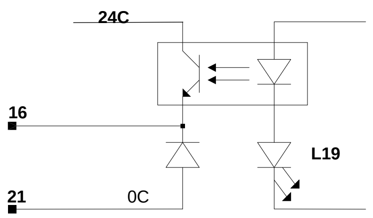
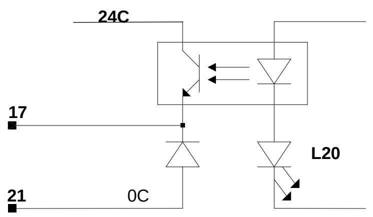
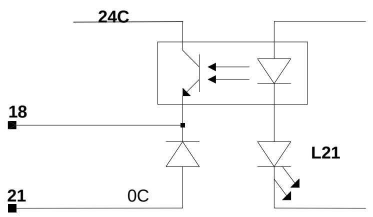
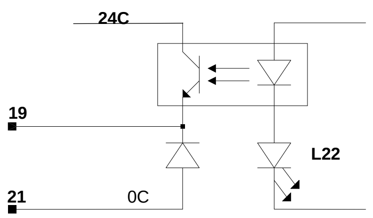
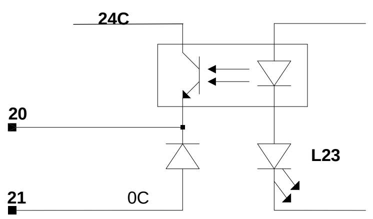
DIGITAL INPUTS (0÷+24V)
The admitted tension levels to the digital inputs are:
VL = 0 ÷4 V VH = 20 ÷ 30 V Iin = 5mA

CN1/1 - I1 - Run enable		References empower and drive running on condition that all internal and external consents are received. In case drive is running and I1 opens, at the minimum speed reaching, operation will shutdown.
CN1/2 - I2 - CW enable		Empowers the speed reference to the terminals 33-34 with its sign. Tachometer will have the same sign as the reference.
CN1/3 - I3 - CCW enable		Empowers the speed reference to the terminals 33-34 with overturned sign. Tachometer will have a sign opposite to the reference.
CN1/4 - I4- Jog-CW enable		Empowers as speed reference the parameter P3 with its sign (P3 positive ⇒ DT positive).
CN1/5 - I5- Jog-CCW enable		Empowers as speed reference the parameter P4 with overturned sign (P4 positive ⇒ DT negative).
CN1/6 - I6- Ramp exclusion		Empowerment causes exclusion of the ramp.
CN1/7 - I7- IPD enable		Empowers signal IPD depending on the function set by S7. If IPD is not empowered, the maximum inner limit for the direct bridge is given by the parameter P29.

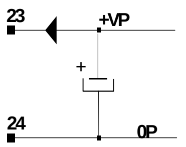
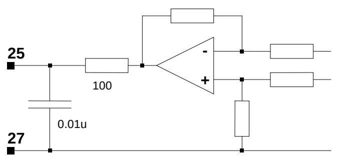
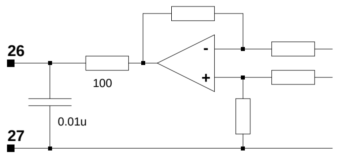
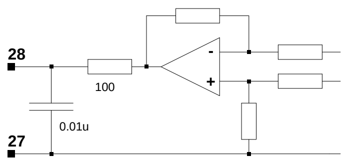
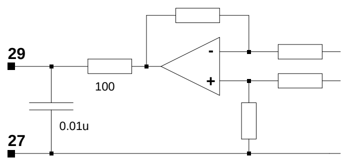
CN1/8 - I8- IPI enable		Empowers signal IPI depending on the function set by S7. If IPI is not empowered, the maximum inner limit for the inversed bridge is given by the parameter P30.

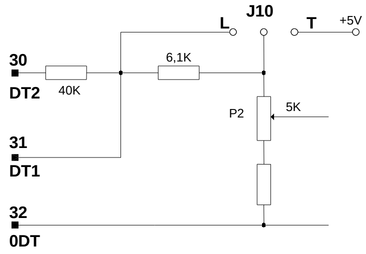
CN1/9 - I9- Additional signal enable		Empowers the additional signal depending on the function set by S4. This signal considers the corrective coefficients P6 proportional and P5 absolute.
CN1/10 - I10- Reset alarms		Resets the alarm storage if there are no alarms activated. Reset can be made only at the rise front of the input signal.
CN1/11 - I11- Run w/delay		Empowers the running of the drive when the waiting time P46 is passed. If open, the operation will immediately shutdown.
CN1/12 - I12- External enable		Gives external consent to the drive. If lacks, even temporarily, the situation is stored and it must be reset. At its lack the operation will shutdown.
CN1\13 - O1- Drive ready Imax 40 mA		+24V: (LED TURNED ON) If drive does not activate any alarm, the input must set to +24V; the output opens at the activation of any alarm, excluding the thermic one, and remains in such situation until further reset.
CN1/14 – O2- Ramp end Imax 40 mA		+24V: (LED TURNED ON) Bring to +24V when the drive is running and the ramp output becomes equal to the output. When drive is stopped, bring to 0V.

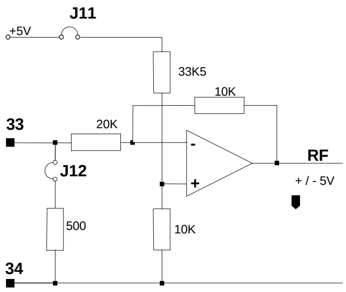
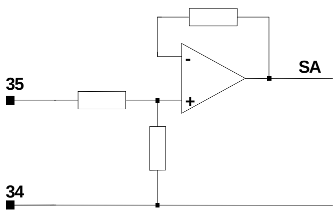
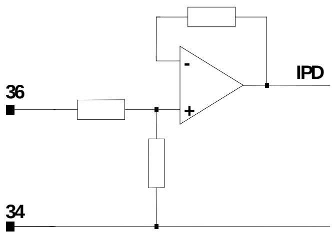
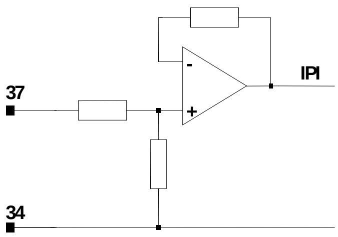
CN1/15 - O3 - Drive running/ minimum speed Imax 40 mA		+24V: (LED TURNED ON) If S6=1 and the drive is running, or if S6=0 and the minimum speed is exceeded, this output has to be brought to +24V. When stopped it is in any case at 0V even if motor is rotating.

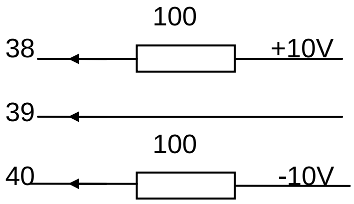
CN1/16 - O4 - External protections Imax 40 mA		+24V: (LED TURNED ON) It signals reaching +24V the lack, even transitory, of one of the external consents (consent 1, lack of excitation); operation will immediately shutdown. The shutdown remains stored and it must be reset
CN1/17 - O5 - Control main supply and feedings Imax 40 mA		+24V: (LED TURNED ON) It signals, reaching +24V, any alarm of the grid, inversed cyclic sense, lack of phase, tension out of allowance (P49, P50) and to the board inner feedings. It shutdowns the operation and remains stored.
CN1/18 - 06 - Control current Imax 40 mA		+24V: (LED TURNED ON) It signals, reaching +24V, any alarm related to converter, like the momentary maximum current and the lack of conduction of one or more thyristors It shutdowns the operation and remains stored
CN1/19 - O7 - Tachometer control Imax 40 mA		+24V: (LED TURNED ON) It signals, reaching +24V, any alarm related to speed like tachometer absent, inversed or over-speed (P51). It shutdowns the operation and remains stored.
CN1/20 - O8 - Motor thermic Imax 40 mA		+24V: (LED TURNED ON) It signals, reaching +24V, the exceeding of the thermic current (P45) slaked by the thermic constant (P44). The calculation is made considering the square of the medium current and is worked out even if operation is shutdown. The alarm is only signalled and dosen’t block the operation.

CN1/21 Negative common		Negative common of all the digital inputs and outputs.
CN1/22 Positive common 24V max 200mA		It is the positive common of all the digital outputs. It requires a 24V feeding.

CN1/23-24 Not stabilized supply 24V ±10% max 200mA		Not stabilized feeding in the board. It can be used for external charges such as logic inputs and outputs with a maximum of **200 mA.**
CN1/25 - OA1- Analogic output ± 10V / 2 mA		Analogic output related to the control of the exciting board ES95003 (optional), it comes from an operational amplifier with a resistance in series of 100Ω.
CN1/26- OA2- Analogic output ± 10V / 2 mA		Analogic output related to an inner size selectable through the switch S1. Value is comprehended between ±10V and comes from an operational amplifier with a resistance in series of 100Ω.
CN1/27 Common 0s		0V of the analogic outputs.
CN1/28 - OA3 - Analogic speed output ± 10V - 2 mA		Normalized tachometer output (10V=100% speed). It can be used as analogic reading and comes from an operational amplifier with a resistance in series of 100Ω.
CN1/29 - OA4 - Current analogic output ± 10V - 2 mA		Normalized output of current with positive sign for conduction of the direct bridge and negative sign for conduction of the inversed bridge; normalization is of 5V for 100% of current. It is the output of an operational amplifier with a resistance in series of 100Ω.

CN1/30/31/32 Tachometric dynamo inputs DT1: 5V÷40V, DT2: 40V÷180V		Input of tachometer signal. It enters at 30 or 31 depending on the tension level (see starting procedure, page14 and tables page 37).

CN1/33 Input analogic reference ± 10V, 0 ÷ 20mA, 4 ÷ 20mA.		Input of speed reference. Input is ± 10V. J12 open -> ± 10V J12 closed -> ± 20mA or 0 ÷ 20mA J11 and J12 closed -> 4 ÷ 20mA
CN1/34 Common 0v		0V of regulation: it is common for the inputs 33,35,36,37.
CN1/35 Input additional signal ± 10V - 0,25 mA		Analogic input for the additional reference signal SA connected to the inner connection S4.
CN1/36 Input signal IPD± 10V - 0,25 mA		Analogic input for the signal of direct bridge limit or other (see inner connection S7).
CN1/37 Input signal IPI ± 10V - 0,25 mA		Analogic input for the signal of inversed bridge limit or other (see inner connection S7).

CN1/38/39/40 Reference tensions ±10V - 10mA		Output of reference tensions ±10V/10mA obtained by operational amplifiers with 100ohm in series. They can be used as feeding for reference potentiometers.

8. DIAGNOSTIC

8.1 Views

Several are the analogic and logic sizes that can be displayed on the keypad or through the serial line easing in this way the diagnostic in case of relais intervention, protections or incorrect functionning. Their detailled list is in paragraph 9.11, page 35.

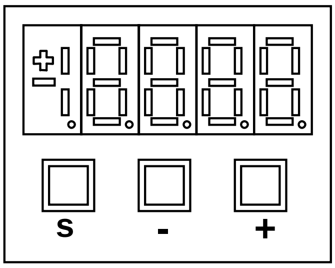
8.2 Alarms and exclusions

In presence of whatever alarm the operation shutdown and the signal OPERATION READY turns off.
When drive is in an alarmed situation, display blinks; it is possible to see wich are the alarms on, by sliding the alarm indications (**Axx**) and seeking the active ones (**H**); those not active are low (**L**). Detailled list of the alarms at paragraph 9.12, page 36.

9. DATAS AVAILABLE FROM KEYPAD

9.1 Description keypad

Keypad has three keys, **'S'** (selection), **'-'** (decrease), **'+'** (increase) and a four and a half digits with decimal ones and the '-' sign.



9.2 Rest situation

At the turning on of the equipment, the keypad displays a "**Stop**" situation; when drive is in alarm, the keypad display blinks alternating the word "**Stop**" displaying the first alarm turned on.

Keypad returns back in a rest position 10 seconds after the last command, unless it is not in the display situation of an inner size or in a digital state.

9.3 Setting and reading of parameters and connections

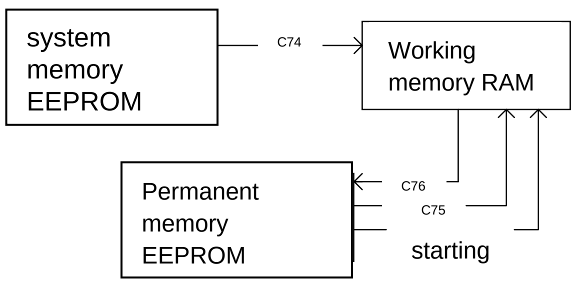
Push the key **'S'** , on the keypad will appear the address of the last selected parameter or size, move using keys **'+'** and **'-'** in the menu until the address of parameter (**P**) or connection (**c**) to be read or correct is found. Near the number of parameter or connection the letter **'t'** compares if reserved to TDE MACNO and the letter '**n**' if the parameter is one whose change requires the drive offline.
If pushed the key **'S'** value of parameter is displayed, so it can be read; by pushing again key '**S'** it turns back to menu, to correct the value of "**P**" or "**c**", when entered in views, the keys **'-'** and **'+'** have to be pushed simultaneously; at this very moment the decimal digit of the first number on the left blinks, warning that from that moment on the touching of the keys **'-'** and **'+'** will modify the set value; the change of the value can be made only stopped if parameter is offline and by **P80 =** *"key value"* for parameters reserved to TDE MACNO.
The parameters and connections reserved to TDE MACNO do not compare in the list if not set the access code **P80**.
Once correct the value, by pushing the key **'S'**, it turnes back to the menu by using the changed parameter or the connection; if it is desired to exit without saving the change, you have to wait ten seconds until it is displayed on the keypad the not changed address; if the value is not changed, to exit it is sufficient to push once again the key **'S'** (the same old value will be considered). When in menu, if not digited, the keypad will turn into rest position.
In case the saving of the new datas is required, it is necessary, before turning off the drive, to make connection c76=1 see paragraph xxx .

9.4 Display of inner sizes

From menu moving by keys **'+'** or **'-'** until the address of the size to be displayed **'dxx'** will appear; by pushing **'S'** the address will disappear and will appear the value.
From such state it is possible to go back to menu by pushing again the key **'S'**, from menu it is possible to automatically go back to the rest situation after a 10 seconds time.

9.5 STORE AND RESET OF ALARMS

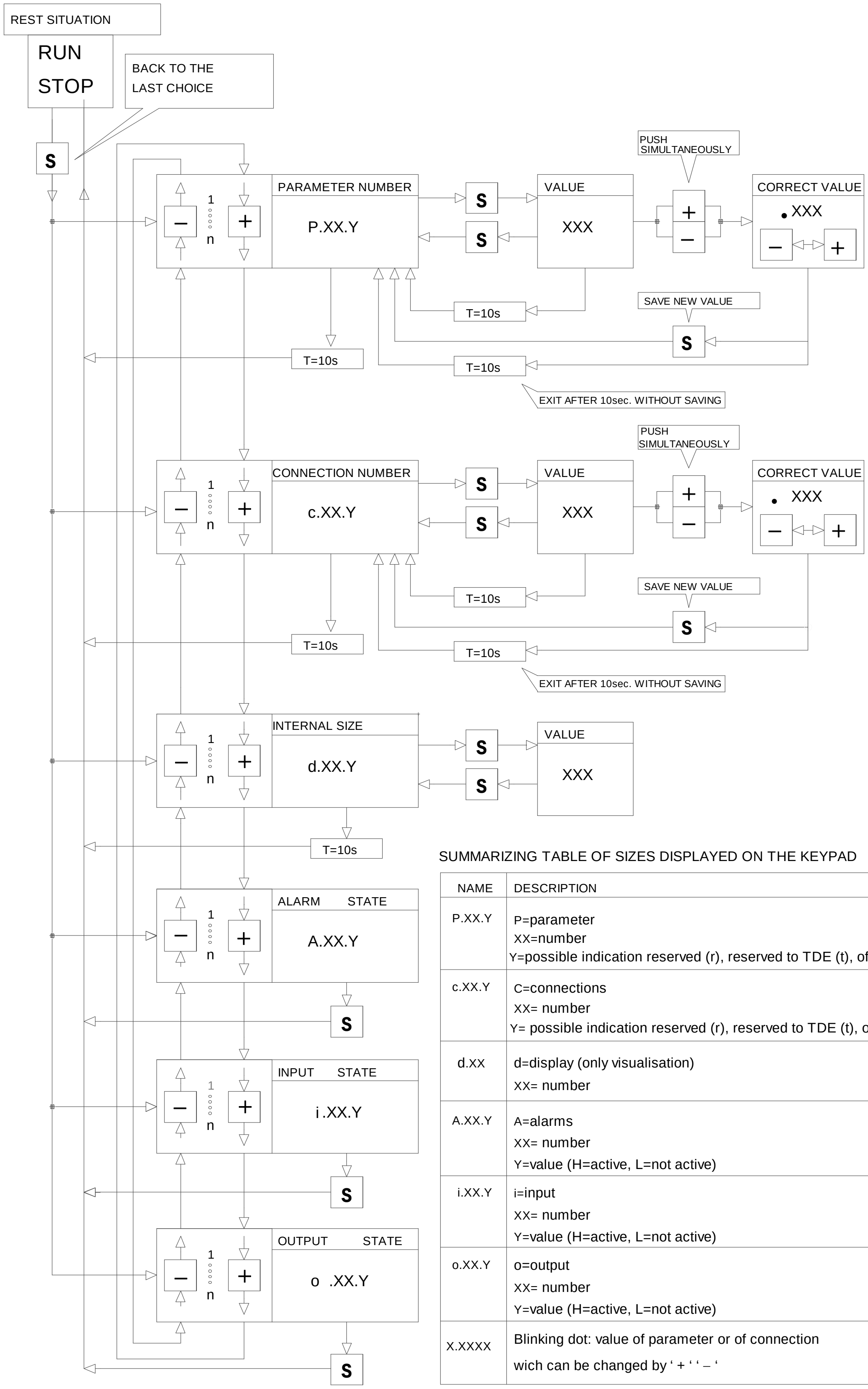
At ignition on the drive takes the parameters set in the permanent storage (EEPROM) and transfers them into the working storage (RAM). Any modification is made into the working storage (RAM); in case it is desired to store into the permanent storage (EEPROM), connection (**C76** = 1) must be activated.
In case of alarm in EEPROM (**A2H**) in the working storage the permanent values are not stored; to restore the system, the new values in the permanent storage must be written and then reset, use for this operation the default parameters in the system storage (EPROM), wich are first transferred into the working storage (**C74**=1) and then saved in the permanent storage (**C76**=1), afterwards reset can be made, except in case of permanent failure.
In case, after having made changes in the working storage (RAM), it is needed to go back to the previous parameters wich are in the permanent storage (EEPROM), without turning off and on, it is sufficient to activate connection (**C75** = 1).
Procedures are simplified as follows:



N.B. PARAMETERS WHO REACH VALUES HIGHER THAN 19999 (IE: P20 SCALE BOTTOM IS 25000) ARE DISPLAYED BY THE SEGMENT NEAR SIGN + AND BY THE SEGMENT NEAR SIGN - WICH ARE THE SEGMENTS IN THE DIGIT 2.

AS DEFAULT PARAMETERS ARE STANDARD AND CERTAINLY DIFFERENT FROM THOSE PERSONALIZED, IT IS USEFUL, <u>AFTER INSTALLATION</u>, TO MAKE A <u>CAREFUL COPY OF THE PERMANENT STORAGE</u> IN A WAY TO BE ABLE TO COPY IT IN A POSSIBLE SPARE DRIVE, OR IN CASE OF RESET OF THE DEFAULT PARAMETERS IN MEMORY.

9.6 DIAGRAM OF KEYPAD WORKING



SUMMARIZING TABLE OF SIZES DISPLAYED ON THE KEYPAD

NAME	DESCRIPTION
P.XX.Y	P=parameter XX=number Y=possible indication reserved (r), reserved to TDE (t), off-line (n)
c.XX.Y	C=connections XX= number Y= possible indication reserved (r), reserved to TDE (t), off-line (n)
d.XX	d=display (only visualisation) XX= number
A.XX.Y	A=alarms XX= number Y=value (H=active, L=not active)
i.XX.Y	i=input XX= number Y=value (H=active, L=not active)
o.XX.Y	o=output XX= number Y=value (H=active, L=not active)
X.XXXX	Blinking dot: value of parameter or of connection wich can be changed by ' + ' ' – '

9.7 Parameters

Note: offline = n, reserved = t

Par.	Description	Range	Default	Note
P1	Number of driver (for miltidrop connection)	1÷120	255	n
P2	Code for baud rate (0=9600, 1=38400, 2=57600, 3=115200)	0÷3	0	n
P3	Speed Jog Cw	±100.0 (%Vmax)	0.0	
P4	Speed Jog CCW	±100.0 (%Vmax)	0.0	
P5	Absolute correction coefficient for additional signal	±400.0 (%)	0.0	
P6	Correction coefficient proportional to speed for additional signal	±400.0 (%)	0.0	
P7	Correction coefficient for input reference signal	±400.0 (%)	100.0	
P8	Correction coefficient for IPD signal	±400.0 (%)	100.0	
P9	Correction coefficient for IPI signal	±400.0 (%)	100.0	
P10	Correction coefficient for final reference (after ramp)	±400.0 (%)	100.0	
P11	Acceleration time CW	0.5÷900.0 sec	10.0	n
P12	Deceleration time CW	0.5÷900.0 sec	10.0	n
P13	Initial rounding time CW	0.0÷10.0 sec	1.0	n
P14	Final rounding time CW	0.0÷10.0 sec	1.0	n
P15	Acceleration time CCW	0.5÷900.0 sec	10.0	n
P16	Deceleration time CCW	0.5÷900.0 sec	10.0	n
P17	Initial rounding time CCW	0.0÷10.0 sec	1.0	
P18	Final rounding time CCW	0.0÷10.0 sec	1.0	n
P19	Available			
P20	Maximum frequency encoder (/2)	3000÷25000	10000	n
P21	Max speed limit CW	0.0÷100.0 (%Vmax)	100.0	
P22	Max speed limit CCW	0.0÷100.0 (%Vmax)	100.0	
P23	Proportional gain of speed governor	1.0÷100.0	4.0	
P24	Time of the advance constant of speed governor	30.0÷1000.0 (ms)	150.0	
P25	Accomodation coefficient gain in constant power surface	0.0÷100.0	100.0	
P26	Coefficient of static drop of speed governor	0.0÷10.0 (%)	0.0	
P27	Departing value of speed governor integral	±100.0 (%max)	0.0	n
P28	Available			
P29	Maximum current limit of the direct bridge	0.0÷100.0 (%Imax)	100.0	
P30	Maximum current limit of the inversed bridge	0.0÷100.0 (%Imax)	100.0	
P31	Motor rated current	20.÷100.0 (%Imax)	66.7	n
P32	Available			
P33	Admitted current to motor (di/dt)	10.0÷300.0 (In/sec.)	150.0	n
P34	Rated field current	30.0÷100.0 (%)	90.0	n
P35	Motor tension at constant power area (% of P38)	40.0÷120.0 (%)	100.0	n
P36	Max level of motor tension (% of P38) (150% excludes control)	50.0÷150.0 (%)	120.0	n
P37	Ratio among revolutions start de-energizing and maximum revolvings	10.0÷100.0 (%)	100.0	n
P38	Motor tension referred to grid at rated revolvings	20.0÷125.0	105.0	n
P39	Resistive drop in % of motor at rated current referred to rated tension	2.0÷40.0(%)	7.0	n
P40	Time constant of armature	3.0÷200.0 (ms)	10.0	n
P41	Inversely proportional coefficient at current ring gain	2.0÷100.0	20.0	n

P42	Ratio coeff. between integral and proportioanl gain of the current ring	0.0÷100.0	20.0	n
P43	% line drop per I=0.82In (rated current in alternate)	2.0÷20.0 (%)	6.0	n
P44	Motor thermic constant Th (P44 = 2400.0 escl. control)	2.0÷2400.0 (sec.)	180.0	n
P45	Motor thermic current for prealarm	20.0÷100.0 %	66.7	n
P46	Idle time for contactor making	50.0÷2000.0 (ms)	250.0	n
P47	Minimum speed calibration level	0.0÷100.0 (%Vmax)	1.0	
P48	Motor thermic current for alarm	20.0÷100.0 (%)	70.0	n
P49	Maximum tension level admitted on the grid	105.0÷130.0 (%)	115.0	
P50	Minimum tension level admitted on the grid	50.0÷-95.0 (%)	85.0	
P51	Maximum admitted speed (>112.5% excludes control)	0.0÷115.0 (%)	110.0	
P52	Maximum delay for delayed alarms	0.1÷3000.0 (sec)	60.0	n
P53	Rated current drive (P53=100% excludes control)	20.0÷100.0 (%Imax)	66.7	n
P54	Drive thermic prealarm time (I=1.5*In)	10.0÷200.0 (sec)	30.0	n
P55	Drive thermic alarm time (% di P54)	100.0÷400.0 (%)	133.0	n
P56	Offset speed reaction channel	±4095 (±100%)	0.0	t
P57	Offset speed reference channel	±4095 (±100%)	0.0	
P58	Offset correction signal channel	±4095 (±100%)	0.0	
P59	Offset channel signal IPD	±4095 (±100%)	0.0	
P60	Offset channel signal IPI	±4095 (±100%)	0.0	
P61 ⇓ P79	Available			
P80	Key for access to reserved parameters	0÷32000	92	t

9.8 Parameters for absolute display

Par.	Description	Range	default	Note
P81	Motor max. speed for display n/1'	0.0÷3200.0	1500.0	
P82	Bridge limit current value (A)	0.0÷3200.0	50.0	
P83	Rated grid tension value (Veff)	0.0÷3200.0	380.0	
P84 ⇓ P89	Available			

9.9 Reserved parameters

Par.	Description	Range	default	Note
P90	Conduction control level (200% excludes control)	0.0÷200.0 (%Imax)	19.9	t
P91	Gain in correction of current governor	0.0÷8.0	0.0	t
P92	Correction offset F.E.M.	1.0÷10.0 (%)	3.7	t
P93	Current thresold for tachometer control (100% excludes control)	0.0÷100.0 (%)	2.0	t
P94	Zero thresold for tachometer dynamo	0.0÷5.0 (%)	2.0	t
P95	FEM thresold to reach DT >thresold	1.0÷100.0 (%)	20.0	t
P96	Value peak for max current (200% excludes control)	100.0÷200.0 (%)	100.0	t
P97	Life ignition impulse (ms)	0.1÷10.0 (ms)	1.6	t
P98	Idle time after turnaround (ms)	1.5÷30.0 (ms)	2.0	t
P99	Current thresold equivalent to zero	0.2÷3.0 (%)	0.6	t

9.10 INNER CONNECTIONS (IN HEAVY TYPE DEFAULT CONFIGURATION)

SW	Description	RANGE	Note
C1	Determines wich of the inner signals is layed on the analogic output CN1-26 (PWM)	1 ÷ 19 (**18**)	
C2	Determines what is used in the speed stage	**0 = all** 1 = only proportional 2 = rif. current stage 3 = locked	n
C3	Determines if JOG CW and JOG CCW are before or after ramp	**0 = jcw before jccw before** 1 = jcw after jccw before 2 = jcw before jccw after 3 = jcw after jccw after	n
C4	Determines if additional signal is before ramp, after ramp or after speed stage	**0 = after ramp** 1 = before ramp 2 = after speed stage	n
C5	Determines if views are in percentual or in absolute values	**0 = view in %** 1 = view in absolute	
C6	Determines if it is working with O3 = minimum speed or O3 = operation running	0 = minimum speed **1 = operation running**	n
C7	Determines if it is working with direct bridge and/or inversed in external limit, in inner limit or sum. It must be combined with I7, I8. (with I7, I8 = 0 it is working only with inner limits P29, P30)	**0 = I7 L_PD I8 L_PI** 1 = I7 sum I8 L_PD,L_PI 2 = I7 tiro PD, I8 L_PI 3 = I7 L_PD, I8 tiro PI 4 = I7 tiro PD, I8 tiro PI	n
C8	Determines converter type	**0 = two bridges (bidir.)** 1 = only direct bridge 2 = only inversed bridge 3 = unidir. invers. field 4 = bidir. invers. field	n
C9	Exclusion alarms offline	**0 = noone excluded** 1 = excluded lack of field	
C10	Exclusion alarm cyclic sense and alarms frequency and phase	**0 = noone excluded** 1 = excluded cyclic sense 2 = excluded freq. and phase 3 = excluded sysclic sense frequency and phase	n
C11	Select size (1) for drive state	1 ÷ 20 (**6**)	
C12	Select size (2) for drive state	1 ÷ 20 (**11**)	
C13	Select size (3) for drive state	1 ÷ 20 (**5**)	
C14	Select size (4) for drive state	1 ÷ 20 (**10**)	
C15	Validity multiple switch setting	**0 = not valid** 1 = valida	
C16	Select parameter (1) for multiple setting	1 ÷ 99 (**0 = no parameter**)	
C17	Select parameter (2) for multiple setting	1 ÷ 99 (**0 = no parameter**)	
C18	Select parameter (3) for multiple setting	1 ÷ 99 (**0 = no parameter**)	
C19	Select parameter (4) for multiple setting	1 ÷ 99 (**0 = no parameter**)	
C20	On/off passive terminal	**0 = off** 1 = on	
C21	Running software (in parallel with XMARCIA)	**0 = off** 1 = on	
C22	Emp. signal CW	**0 = off** 1 = on	

	(in parallel with XS_CW)		

C23	Emp. signal CCW (in parallel with XS_CCW)	**0 = off** 1 = on	
C24	Emp. signal JOG CW (in parallel with XJOGCW)	**0 = off** 1 = on	
C25	Emp. signal JOG CCW (in parallel with XJOGCCW)	**0 = off** 1 = on	
C26	Exclusion ramp (in parallel with XRAMPA_E)	**0 = off** 1 = on	
C27	Emp. direct bridge limit (in parallel with XAB_LIM_PD)	**0 = off** 1 = on	
C28	Emp. Inversed bridge limit (in parallel with XAB_LIM_PI)	**0 = off** 1 = on	
C29	Emp. additional signal (in parallel with XA_S_AGG)	**0 = off** 1 = on	
C30	Reset alarms (in parallel with XRIP_ALL)	**0 = off** 1 = on	
C31	Emp. delayed running (in series with XAB_MR)	0 = off **1 = on**	
C32	Service 1 (in series with XSERV1)	0 = off **1 = on**	
C33	Reserved		
C34	consent presence excitat. (in parallel with XMECC)	**0 = off** 1 = on	
C35	Reserved		
C36	Reserved		
C37	Meaning input IPR1	**0 ÷ 5** (0)	n
C38	Meaning input IPR2	**0 ÷ 5** (1)	n
C39	Reserved		
C40	Reserved		
C41	Bit in parallel with I_FUN1	**0 = off** 1 = on	
C42	Bit in parallel with I_FUN2	**0 = off** 1 = on	
C43	Bit in parallel with I_FUN3	**0 = off** 1 = on	
C44	Bit in series with I_FUN4	0 = off **1 = on**	
C45	Reserved		
C46	Reserved		
C47	Reserved		
C48	Reserved		
C49	Reserved		
C50	Reserved		
C51	Reserved		
C52	Reserved		
C53	Reserved		
C54	Reserved		
C55	Reserved		
C56	Reserved		
C57	Meaning output OPR1	**0 ÷ 2** (0)	n
C58	Meaning output OPR2	**0 ÷ 2** (1)	n
C59	Reserved		
C60	Reserved		
C61	Selection for x2/4 (0 = x2, 1 = x4)	**0 = off** 1 = on	n
C62	Emp. task profibus process datas	**0 = off** 1 = on	n
C63	Reserved		
C64	Reserved		

C65	Reserved		
C66	Reserved		
C67	Reserved		

C68	Reserved		
C69	Reserved		
C70	Reserved		
C71	Self-calibration current ring	**0 = off 1 = on**	n
C72	Reserved	**0 = off 1 = on**	
C73	Reserved	**0 = off 1 = on**	
C74	Reset default values	**0 = off 1 = on**	n
C75	Reset eeprom values	**0 = off 1 = on**	n
C76	Write eeprom	**0 = off 1 = on**	n
C77	Self-calibration offset external conv.	**0 = off 1 = on**	n
C78	Reserved		
C79	Reserved		
C80	Reserved		

9.11 Views

D	Description	View	PWM	Note
D0	Version EPROM board			
D1	Rif. external speed	(%)		
D2	Additional signal before matching	(%)		
D3	Additional signal after matching	(%)		
D4	Speed reference after ramp	(%)		
D5	Total speed reference	(%)	PWM	
D6	Speed reaction (filtr. 100 ms)	(%)	PWM	
D7	Speed reference before ramp	(%)		
D8	Integral part	(%)		
D9	Sum additional signal + correction	(%)		
D10	Current request (out governor)	(%)	PWM	
D11	Correct current request on bridge		PWM	
D12	Limit end direct bridge	(%)		
D13	Limit end inversed bridge	(%)		
D14	Grid frequency	(Hz)		
D15	External signal IPD	(%)		
D16	External signal IPI	(%)		
D17	Grid tension	(%)		
D18	Power motor E.M. referred to grid	(%)		
D19	Motor tension referred to grid	(%)		
D20	Speed reaction (average 10 ms)	(%)		
D21	Reserved			
D22	Reserved			
D23	Reserved			

9.12 Alarms

A	Description
A1	Alarm microprocessor fault
A2	Defaults in eeprom or ram

A3	Wrong cyclic sense
A4	Lack of phase
A5	Wrong grid tension
A6	Wrong inner feedings
A7	High current peak
A8	Alarm lack of conduction
A9	Error speed retroaction
A10	Motor overspeed
A11	Motor thermic
A12	Oscillation of current during self-calibration
A13	Impossible current self-calibration
A14	Alarm on inputs
A15	Wrong work frequency
A16	Wrong motor tension

9.13 Inputs

I	Description
I1	running
I2	selection ahead
I3	selection backwards
I4	jog ahead
I5	jog backwards
I6	ramp excluded
I7	empower current direct bridge
I8	empower current inversed bridge
I9	empower additional signal
I10	Reset alarms
I11	empower delayed running
I12	External consent

9.14 Outputs

O	Description
O1	Ready for running
O2	End of ramp
O3	Operation running/min. speed
O4	External protections
O5	Control feedings
O6	Control current
O7	Control tachometer
O8	Motor thermic

10. CALIBRATIONS AND SETTINGS

10.1 Calibration with motor

Set or check:

P29	Maximum current limit of direct bridge
P30	Maximum current limit of inversed bridge

P31	Ratio between motor rated current and rated driver
P53	Driver rated current (86.9%)
P54	Time prealarm thermic driver (10sec.)
P55	Time alarm thermic driver (% di P54) (133.0)

NOTE: if specified in the order, converter is already precalibrated for motor it is paired to.

10.2 Settings of speed references and limits

Maximum speed has to be calibrated in arrangement with **J10** and trimmer **P3**, by reading the size **D6** with **J10** in position **T**, as indicated in the following tables:

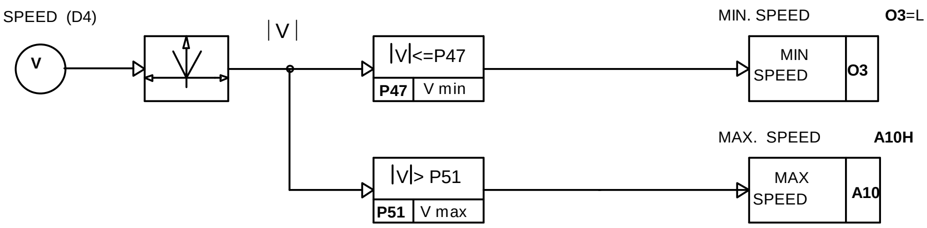
	L T	**L T**
DT1	5-20v	10-40v
DT2	40-120v	50-180v

L T	**L T**
500/VDT1 %	967/VDT1 %
3630/VDT1 %	4100/VDT1 %

Speed will be equal to ±100.0% of the inner references and to ±10V of the analogic reference, this can be eventually corrected by parameter **P7**.

10.3 Setting output level of minimum speed

The output **O3** (CN1-15) can be set as signaling of the minimum speed overflow through connection C6 = 1 (default = 0, operation running), reaching +24v when the programmed in P47 (default 1%) operating level has been exceeded.



The alarm of overspeed (A10H) operates when speed reaction exceeds the level programmed in P51 (default 110.0%).

10.4 Setting of limit and peak levels

Parameters **P29**, **P30** set the maximum admitted value for the effective peak current delivered by driver, they are expressed in percentual of the limit value typical for the size (1.15% Inom), example:

if In driver is 50Amp (57.5Amp Imax), In motor is 40Amp and the maximum delivered current has to be limited to a value not higher than 1.2 In motor (48Amp) has to be set:

P29=**P30**=48/57.5∗100=83.4%

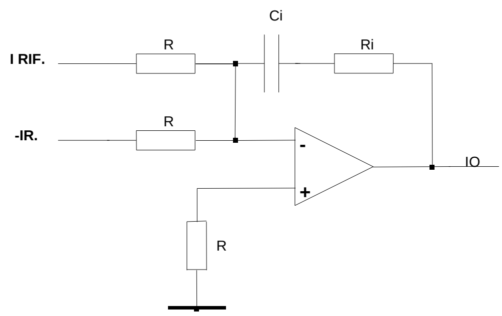
The ratio between the converter limit and the motor size is given by parameter **P31**, keeping the previous values:

P31=40/57.5∗100=69.5%

10.5 Command self-calibration of current ring

There are two parameters **P41** and **P42**. Their value is fixed and on the basis of such values the system in self-calibration stage settles the proportional and integral gain of the current ring.

Referring to the traditional schema:



where: IRIF = reference signal
-IR. = retroaction signal

And can be written:

$$\frac{V_o}{I_{rif.} - I_{r.}} = \frac{R_i}{R} + \frac{1}{s \cdot C \cdot R} = \frac{R_i}{R}(1 + \frac{1}{s \cdot C \cdot R_i} = K_P(1 + \frac{1}{s \cdot C \cdot R_i})$$

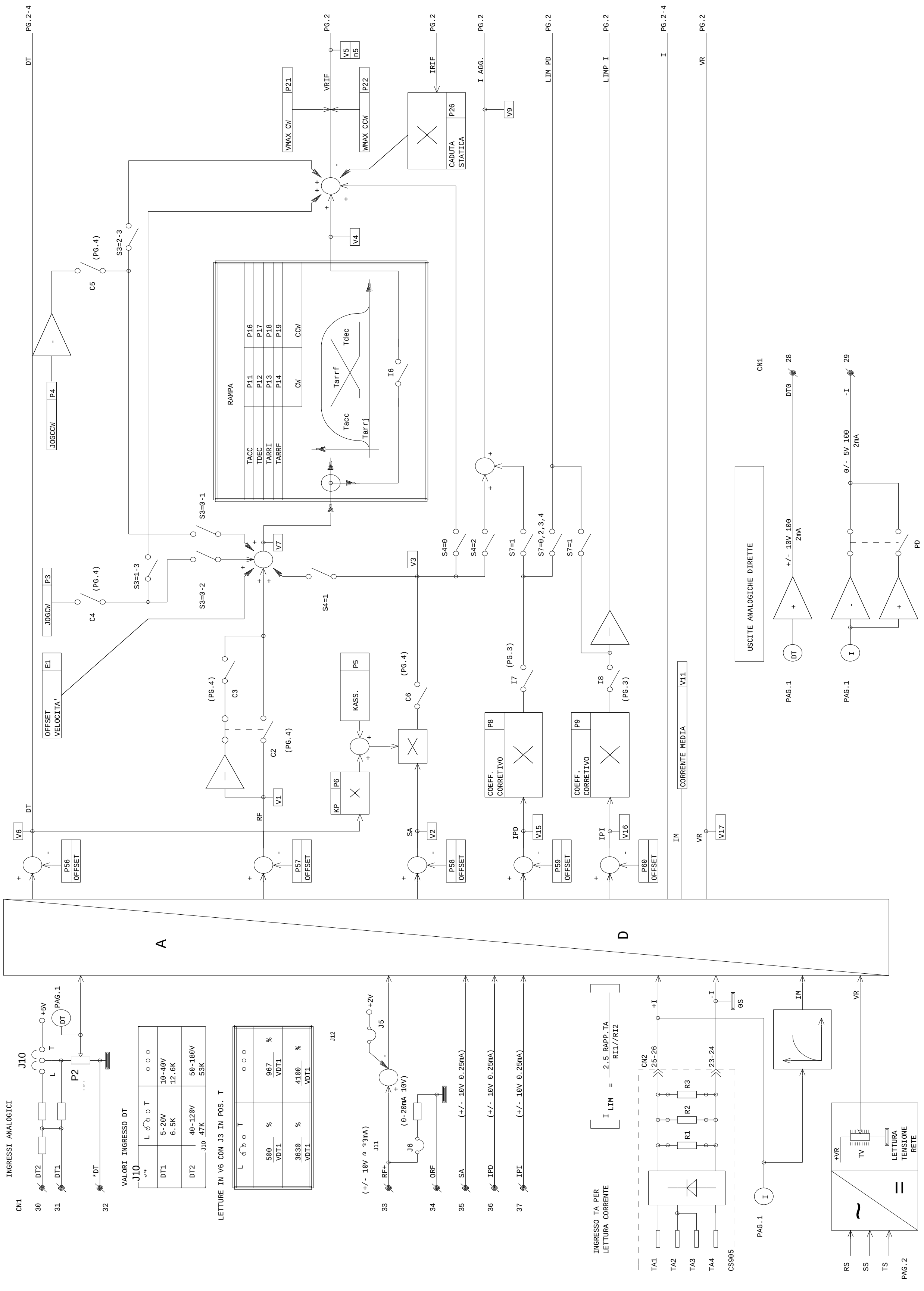
Values of P41 and P42 are linked to the above equation by the following relations:

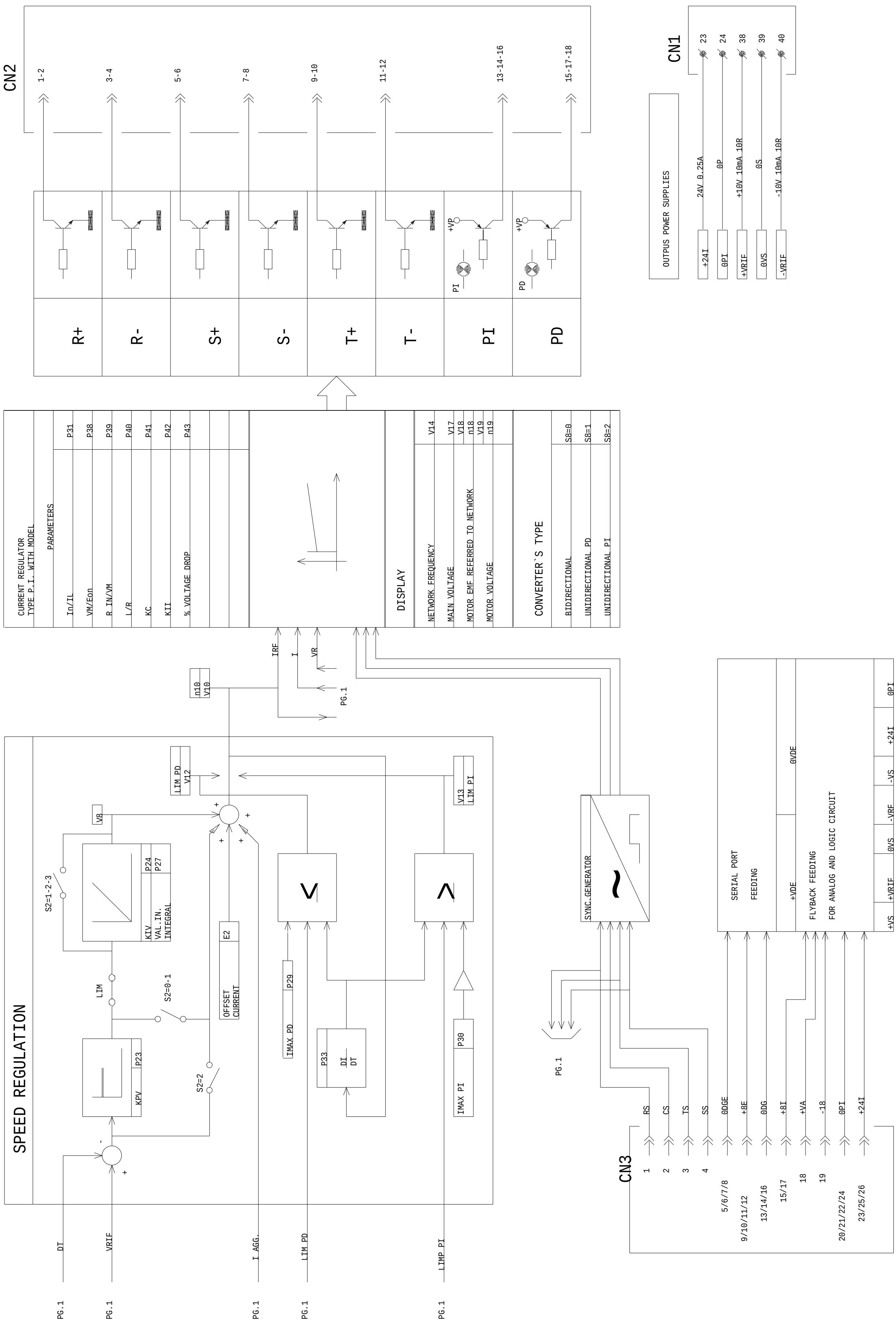
$$P41 \equiv \frac{Kautotar}{K_P}$$

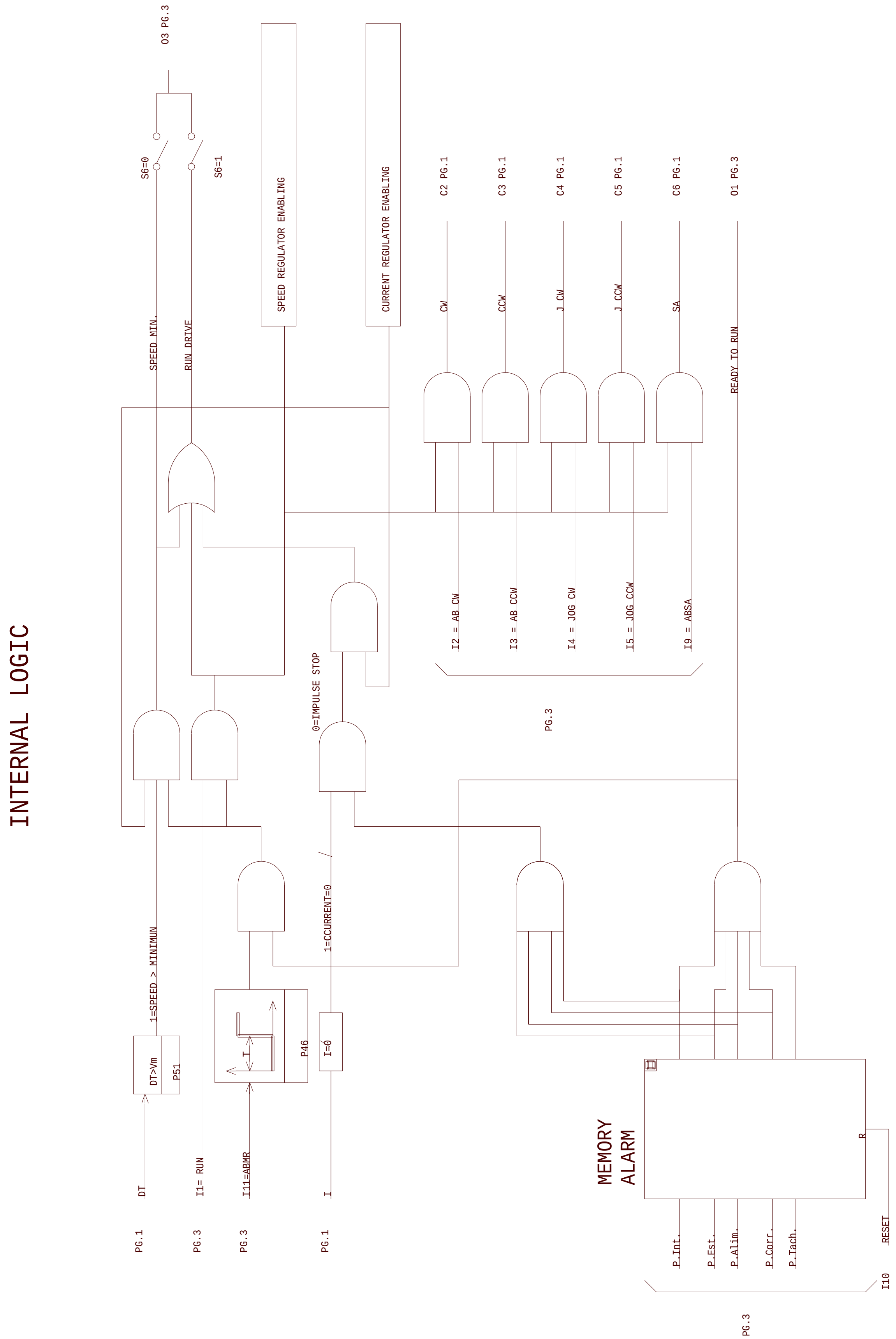
$$P42 \equiv \frac{K_P}{CR_i} = \frac{1}{CR}$$

Where it appears that encreasing **P41** is equal to slow the current ring in the gain both integral and proportional, while encreasing **P42** is equal to increase the integral gain (as reducing the only capacity).
The system bonds automatically such parameters to motor characteristics, calculating in self-calibration. Kautotar ; it is usefull not to change P41 and P42.

11. REGULATION BLOCK SCHEME




CN2
1-2
3-4
5-6
7-8
9-10
11-12
13-14-16
15-17-18
R+
R-
S+
S-
T+
T-
PI
PD
+VP
CN1
23
24
38
39
40
OUTPUS POWER SUPPLIES
24V 0.25A
0P
+10V 10mA 10R
0S
-10V 10mA 10R
+24I
0PI
+VRIF
0VS
-VRIF
CURRENT REGULATOR
TYPE P.I. WITH MODEL
PARAMETERS
In/IL
VM/Eon
R IN/VM
L/R
KC
KII
% VOLTAGE DROP
P31
P38
P39
P40
P41
P42
P43
DISPLAY
NETWORK FREQUENCY
MAIN VOLTAGE
MOTOR EMF REFERRED TO NETWORK
MOTOR VOLTAGE
V14
V17
V18
n18
V19
n19
CONVERTER'S TYPE
BIDIRECTIONAL
UNIDIRECTIONAL PD
UNIDIRECTIONAL PI
S8=0
S8=1
S8=2
IRF
I
VR
PG.1
n10
V10
SPEED REGULATION
LIM PD
V12
V13
LIM PI
V8
S2=1-2-3
KIV
VAL.IN.
INTEGRAL
P24
P27
LIM
S2=0-1
E2
OFFSET
CURRENT
P29
IMAX PD
P33
DI
DT
P30
IMAX PI
KPV
P23
S2=2
DT
VRIF
I AGG.
LIM PD
LIMP PI
SYNC.GENERATOR
SERIAL PORT
FEEDING
0VDE
+VDE
FLYBACK FEEDING
FOR ANALOG AND LOGIC CIRCUIT
+VS
+VRIF
0VS
-VRF
-VS
+24I
0PI
RS
CS
TS
SS
0DGE
+8E
0DG
+8I
+VA
-18
0PI
+24I
CN3
1
2
3
4
5/6/7/8
9/10/11/12
13/14/16
15/17
18
19
20/21/22/24
23/25/26


INTERNAL LOGIC
O3 PG.3
S6=0
S6=1
SPEED MIN.
RUN DRIVE
SPEED REGULATOR ENABLING
CURRENT REGULATOR ENABLING
C2 PG.1
C3 PG.1
C4 PG.1
C5 PG.1
C6 PG.1
O1 PG.3
CW
CCW
J CW
J CCW
SA
READY TO RUN
I2 = AB CW
I3 = AB CCW
I4 = JOG CW
I5 = JOG CCW
I9 = ABSA
PG.3
0=IMPULSE STOP
1=CCURRENT=0
1=SPEED > MINIMUN
DT>Vm
P51
T
P46
I=0
MEMORY
ALARM
R
DT
I1= RUN
I11=ABMR
I
PG.1
PG.3
PG.3
PG.1
P.Int.
P.Est.
P.Alim.
P.Corr.
P.Tach.
RESET
I10
PG.3

INPUTS ON / OFF

CN1 pin		SIGNAL	LED
1	24V 5mA	Run	L24
2	24V 5mA	CW enable	L25
3	24V 5mA	CCW enable	L26
4	24V 5mA	JOG CW enable	L27
5	24V 5mA	JOG CCW enable	L28
6	24V 5mA	Ramp excluded	L29
7	24V 5mA	IPD enable	L30
8	24V 5mA	IPI enable	L31
9	24V 5mA	additional signal enable	L32
10	24V 5mA	Reset alarms	L33
11	24V 5mA	Run w/delay	L34
12	24V 5mA	External enable	L35

CN2 pin		SIGNAL	LED
21	24V 5mA	Thermic protection	L5
19	24V 5mA	Lack of excitation	L6

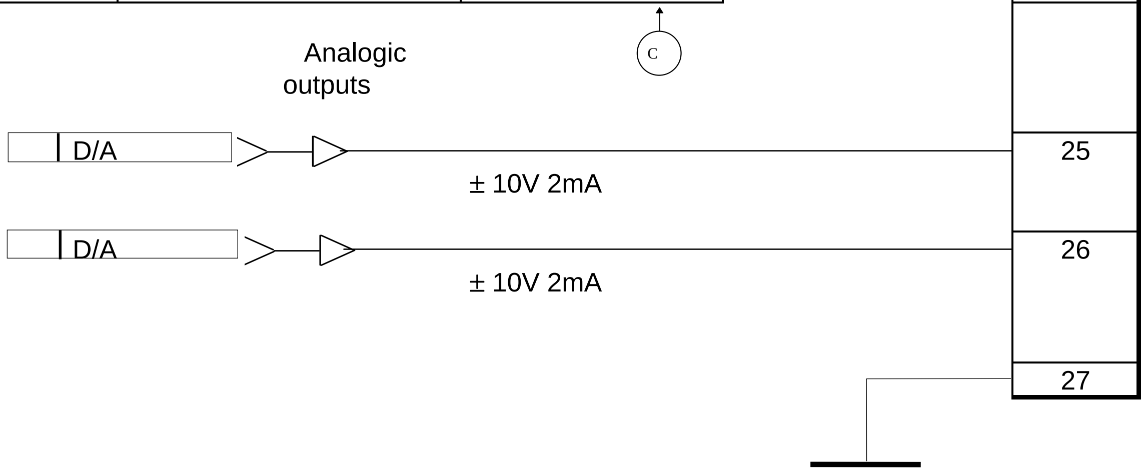
CN1 pin		
21	0C	C
22	+24C	+V

INNER VIEWS		
Alarm ram-eeprom		L5
Exchange		L6
Thermic transmitter		L7
Time signal		L8
Empower RS485		L9
Trasmitter RS485		L10
Cycle		L11
Synchronism		L12

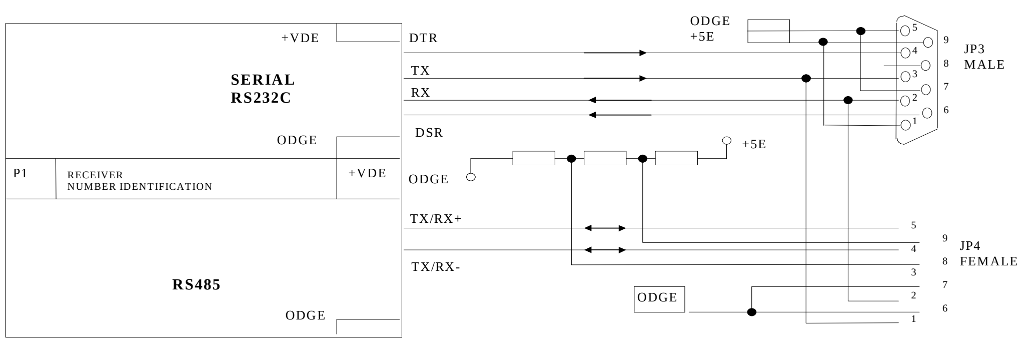
n	term. analogic outputs	valore corrente a 10V
5	Speed reference	100% Vmax
6	Feedback speed	100% Vmax
10	current	100% I lim
18	E.M.F	141% main supply
19	Motor tension	141% main supply

OUTPUTS ON / OFF

LED	SIGNAL			CN1 pin
L16	Drive ready		24V 80mA	13
L17	End of ramp		24V 80mA	14
L18	S6 = 0 ≥ Minim. speed S6 = 1 driver in run		24V 80mA	15
L19	External protection		24V 80mA	16
L20	Alarm main supply and intern. feeding		24V 80mA	17
L21	Current monitoring		24V 80mA	18
L22	Speed control feedback		24V 80mA	19
L23	Thermic		24V 80mA	20



SERIAL



11.1 Speed and ramp references

Three speed references are possible, one analogic and two digital.
The analogic reference, ±10V for the maximum speed is connected to terminal 33 of connector CN1, motor rotation sense will depend on empowering CN1-2 or CN1-3, in case the signal will show an offset, it can be adjusted by parameter **P57** whose resolution value is ±4095 bit (100% of the scale bottom).
In case the maximum speed has to be reached by a tension value of external reference different from ±10V, it can be set the correction coefficient to parameter **P07** (default 100%); it has to be considered that such operation reduces the reference resolution.
The two digital references can be set to parameters **P03**, **P04**, with scale bottom ±100.0% for the maximum speed.

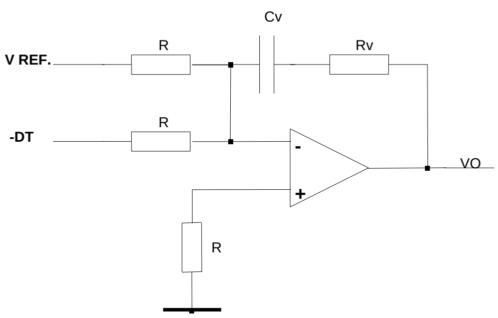
	CN1-2	CN1-3	CN1-4	CN1-5
Analogic ref. CW	H	L	L	L
Analogic ref. CCW	L	H	L	L
JOG-CW	L	L	H	L
JOG-CCW	L	L	L	H

11.2 Speed limiting and ramp stage with roundings

Parameters **P21** and **P22** are used to limit the maximum reference into the two running senses and are programmable in range 0÷100.0%; it has to be considered that being regulation digital, in no case the maximum set limit in **P21** and **P22** is exceeded.
The ramp on the speed reference and its roundings are always on, otherwise they can be excluded empowering the input CN1-6.
Times of Acc. CW, Dec. CW, Acc. CCW, Dec. CCW, to pass from speed 0 to Vmax can be set directly in seconds by parameters **P11**, **P12**, **P15**, **P16**, roundings can be set by parameters **P13**, **P14**, **P17**, **P18.**

11.3 Speed governor and current limits

Speed governor receives reference from reference block while taking speed from tachometer dynamo connected to driving shaft.
Maximum speed depends on trimmer calibration P2 and on J10. An idea of the speed with scale bottom ±10V can be viewed at analogic output CN1-28.
It is PI type (PROPORTIONAL-INTEGRAL) with a filter of first order on mistake. It is possible to set in a separate and independent way the proportional gain Kp, the advance constant Ta (equal to the integration time per Kp).
Practically the speed governor acts on constants calculated as per the following equations, refferring therefore to the traditional schema:



where : Vref = reference signal
-DT = feedback tachometer dynamo

it can be also written:

$$\frac{V_O}{V_{ref.} - DT} = \frac{R_v}{R} + \frac{1}{s \cdot C_v \cdot R} = \frac{R_v}{R}(1 + \frac{1}{s \cdot C_v \cdot R_v}) = K_P(1 + \frac{1}{s \cdot C_v \cdot R_v})$$

Two paramewters **P23** and **P24** are linked to the above equation by the relations:

$$P23 = K_P$$

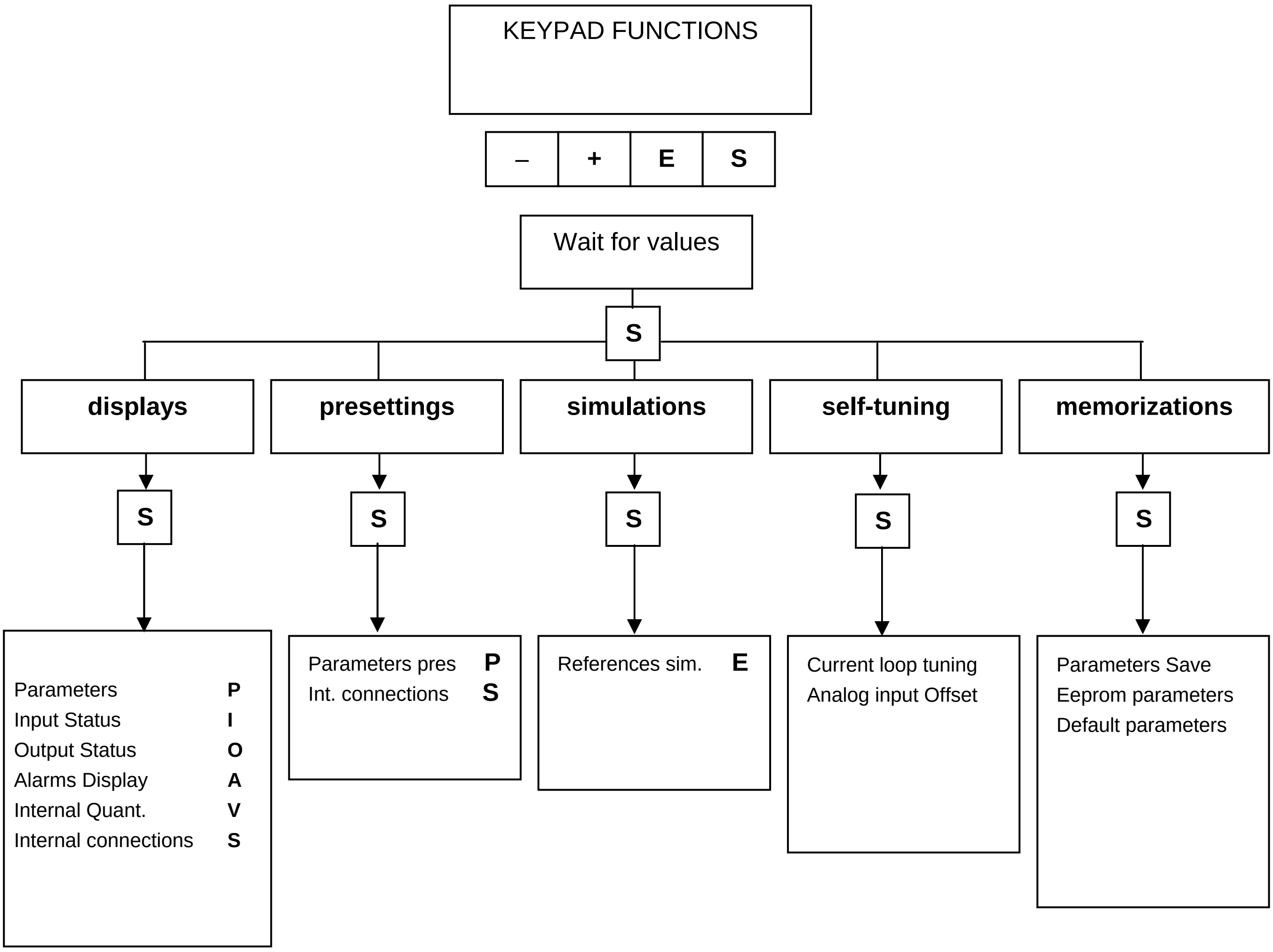
$$P24 = C_v R_v (mS)$$

where it is clear that modifying **P23** is equal to change the gain of all the system in a proportional way, while increasing **P24** is equal to slow up the integral gain, but to increase the phase margin.
The integral action of speed governor, that can be seen in the analogic size **D8**, can be excluded by setting the connection **c2**=1 (default **c2**=0 integral in).
The initial value of speed governor integrator can be set at parameter **P27** (scale ±100.0%). It sets the initial current value of the speed governor in the moment the drive begins to run.
It can be useful for startings on counterbrake or in case of umbalanced charges, where it is not necessary to enter immediately in a recovery phase.

11.4 Thermic motor protection

The calculation circuit of the thermic motor prealarm operates in case the medium quadratic value of the absorbed current (calculated on the medium value of the current in T/6, without considering the ripple of the same current!) exceeds the set thermic value “P45” taking into consideration the motor thermic constant “P44”. It doesn’ t cause the drive shutdown, but takes into a very high level the output CN1-20 (O8); it is not stored, therefore the operation reenters when the value falls under the thresold.
The operation of the circuit causes the immediate stop operating in case the value calculated as above exceeds P48. It is stored and causes the immediate stop of the drive; it must be restored. Restore is accepted only if calculated value has sloped lower than P48; therefore if not desired to wait, the drive has to be shutdown.

12. TERMINAL


KEYPAD FUNCTIONS
– + E S
Wait for values
S
displays
presettings
simulations
self-tuning
memorizations
S
S
S
S
S
Parameters P
Input Status I
Output Status O
Alarms Display A
Internal Quant. V
Internal connections S
Parameters pres P
Int. connections S
References sim. E
Current loop tuning
Analog input Offset
Parameters Save
Eeprom parameters
Default parameters

12.1 Description of keys and their functions:

The keys to communicate with the regulation board are:

–	To decrease
+	To increase
E	To esc and go back to previous level
S	To enter, select and confirm

As regulation board is fed, display shows the software version used at the moment and afterwards it positions to “Wait for Values”, where an inner size among V06 – V11 – V19 is shown.
By pushing the key **S** communication with converter is on and the displayed menu is: “**VIEWS**”.
At this point, by pushing the keys **+** and/or – it is possible to pass to the other main menu: **SETTINGS**, **SIMULATIONS**, **SELF-CALIBRATIONS** and **STORAGE**. Once choosen the menu it is possible to enter by pushing the key **S** and sliding the submenu by shifting the touches **+** and/or – .
After having choosen the submenu it is possible to enter by touching again the key **S** and go to view the specific sizes or parameters by shifting again **+** and/or **–**.

12.2 Main menus:

Main menus are:

DISPLAYS:	to view the state of inputs, outputs, alarms, parameters and inner sizes.
PRESETTINGS:	to modify parameters **P** and **S**.
SIMULATIONS:	to simulate speed or current references.
SELF-TUNING:	to execute self-calibration of the current ring and analogic offsets.
MEMORIZATIONS:	to store parameters, reset default parameters or eeprom ones, etc.

12.2.1 DISPLAYS:

Menu displays is composed by the following submenus:

parameters:	P parameters are viewed.
Input status:	indicates the state (on, off) of all inputs of converter regulation board. It indicates the state ON in case to the connected terminals the 24 Vdc release is applied.
Output status:	indicates the state (on, off) of all outputs of regulation board. State ON if a 24Vdc output is present.
Alarms Display:	indicates one or several alarms operated. In case there are no alarms it displays: “NO ALARM E = Esc “.
Internal quant.:	displays the sizes from V01 to V20 and their value at that moment.
Internal connections:	displays S parameters for board inner configurations.

12.2.2 PRESETTINGS:

Menu presettings is composed by:

Parameters pres:	it is possible to view and change all **P** parameters.
Internal connections:	it is possible to view and change all **S** parameters.

12.2.3 SIMULATIONS:

Menu simulations is composed by:

References sim. :	there are two sizes, speed offset E01 and current offset E02. The first one permits to create in the board a speed offset to be used as inner speed reference with no need of outside connections. The second one creates a current offset wich commands the drive by the only current ring.

12.2.4 SELF-TUNING:

Menu self-tuning is composed by:

current loop tuning:	converter autocalibrates constants and coefficients of the current ring.
analogic inputs offset tuning:	converter autocalibrates the analogic inputs by setting automatically their parameters (P56-P57-P58-P59-P60).

12.2.5 MEMORIZATIONS:

Menu storing is composed by:

Saving parameters:	by this menu it is possible to save all changeable parameters on EEPROM wich could be lost when board is turned off.
Restoring from eeprom:	by such operation it is possible to go back to the parameters of the last calibration, in case no new parameters have been saved on EEPROM.
Restoring default parameters:	by this operation it is possible to go back to default parameters set on board testing.
Saving parameters on disk:	this operation is possible only if connected to a PC; it permits to save parameters on Hard Disk, on a disk or a floppy.
Change of Password:	this operation is possible only if connected to a PC; it permits to change the access password to enter menù Seetings, Simulations, Self-calibrations and Storing.

12.3 Changing a value:

12.3.1 IDENTIFICATION MARKS:

For parameters and sizes present in the different menus, the following marks have been used:

"P"	=	Indicates the parameters in the menu "Settings" – "Set parameters".
"S"	=	Indicates the parameters who change the board inner connections (inner Switch), in the menu "Settings" – "Set inner connections"
"V"	=	Indicates all inner sizes displayed in menu "Views" – View inner sizes".

These marks are followed by numbers who identificate all parameters and/or sizes.

12.3.2 HOW TO CHANGE A PARAMETER:

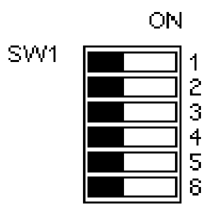
Parameters can be changed only in menu "Settings". Once found parameter "P" or "S" to be changed, push the key S more times and move the cursor under the number to be changed, then by touches + and/or – increase or decrease the value. Keeping pushed the touches + and/or – the numbers run. Once set the new parameter, push the key S to confirm the change, the new value is immediately active; once set all parameters it is necessary to store in EEPROM, by menu "Storings".

12.4 Alarm signaling:

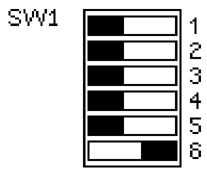
In case some alarm has operated, in whatever position you are in the menus, compares the blinking notice "Alarm Present". At this point **do not** execute the reset from the board or from S 30, (in this way the alarm is cancelled and it would not be possible to receive a dignostic) but move in menu "Views" and in submenu "View Alarms", push the key S and then + and/or – to check if there are several alarms. Take then the adequate measures.

12.5 Setting of communication language:

On the back side of board Display CS8G3 there is a 6 ways dip-switch for the setting of the "language" to view messages and parameters.



ITALIAN LANGUAGE

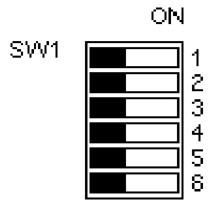


ENGLISH LANGUAGE

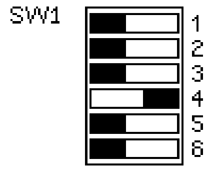
N.B. This operation has to be executed before giving tension to board or to terminal.

12.6 Setting of Baud rate

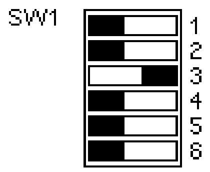
As already approached in the previous paragraph, on the therminal board CS8G3, two switches for baud rate setting are available; for communication between PC and/or terminal and the regulation board:
Keep in mind that:



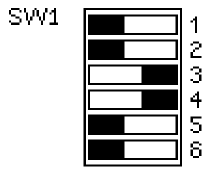
9.600 baud rate



38.400 baud rate



57.600 baud rate



115.200 baud rate

N.B. This setting on display has to be made by setting parameter P02, otherwise converter registers an error in communication. The switches setting has to be made on disconnected keypad.

12.7 PARAMETERS:

The complete setting up of the drive has to be done by allocating the right value to each parameter; but parameters that user has really to modify are almost always limited because most of them require defualt values.
Default value means a predetermined value (stored in EPROM memory), that system automatically takes over in case the user does not input a different value by interface.
Parameters are divided into 2 groups:
Parameters “P”,
Parameters for setting inner connections “S” .
For the description of the value see Par 9.7 and 9.20

13. ENCODER FEEDBACK

13.1 Description of connections and calibrations

Board CS 6621, has a feeder that can be calibrated by trimmer **P3** who, beginning from a 24v tension, ± 15% (terminals CN6-1/2), permits to obtain an output tension (terminals CN6-3/4) comprehended in the field 5-18 Volt, 300mA max, to feed the encoder. Feeding is **switching step-down** type, therefore if ***VA*** and ***IA*** are the tension and the absorbed current by encoder and ***VI*** is the tension of board feeding, the input current is:

$$I_I[mA] = \frac{V_A[V] \times I_A[mA]}{V_I[V]} + 15$$

It is possible to use the board with the following encoder types:

a) Encoder with **differential outputs**. The two output channels have to be connected to the inputs CN6-5/6 (channel a) and CN6-7/8 (channel b).
b) **Single outputs**. Use only the terminals CN6-6 (channel a) and CN6-8 (channel b), in such case the level of passage 0/1 is ½ V_A with 10% of hysteresis.
c) **Open collector**. The charge resistances have to be prearranged on the appropriate turrets: R173 and R174 for outputs **npn**, or R170 and R171 for **pnp**. The value of resistance is calculated on the basis of the maximum current it is desired to be absorbed (generate) ***Ic*** by the following formula:

$$R[Kohm] = \frac{V_A[V]}{Ic[mA]}$$

The part of feeder and impulse inputs are galvanically insulated by optoinsulators, the part of decoding is directly fed by adjustment board CS 6621.
Tension ***V_I*** can be taken by +24V of the adjustment board if absorption is compatible.
The maximum work frequency is given by relation:

$$frequency[Hz] = \frac{N_I \times N.\max}{60} \times \frac{4}{K}$$

where:

N_I impulses per encoder revolution
N.max Maximum motor revolutions per minute
K coefficient determined by C61 (0 = x2, 1 = x4).

Jumper J4 on excludes retroaction of integrated tachometric in the adjustment board and regulation transits to the encoder; if on, the system works in tachometer dynamo.
To work with the encoder, it must be set at parameter "P20" the maximum work frequency divided per 4, therefore simplifying the previous formula it can be written as follows:

$$P20 = \frac{N_I \times N.\max}{60 \times K}$$

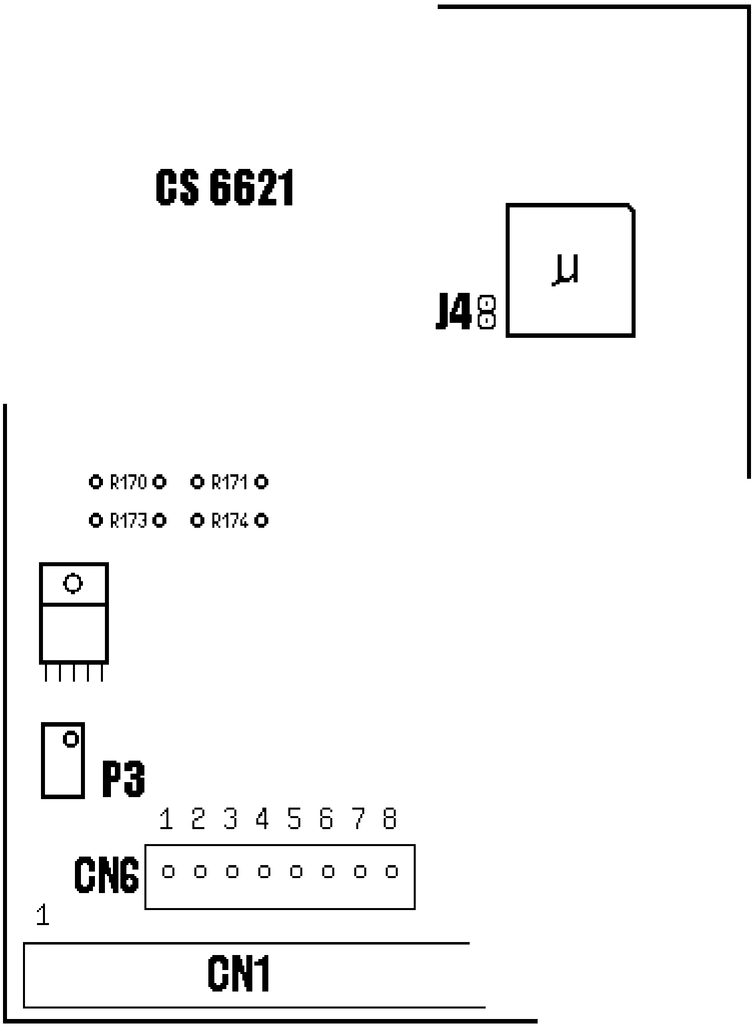
where:

K = 1 where C61=0
K = 2 where C61=1

The accepted work field for "P20" is 3000 – 25000 corresponding to a work frequency between 6 and 50 Khz.
The reference works as the tachometer dynamo and the maximum frequency is reached with V.rif. ± 10 V.
Setting the inner connection C1=6 it is set on the programmable analogic output (CN1-26) a signal ± 10V, proportional to the maximum motor speed.

N.B.: **- use always the highest frequency possible. Before running the motor, calibrate feeding tension of encoder by trimmer P3.**

13.2 Points of interest



CN6

1	-Input +24v
2	-0v
3	-0v
4	-out 5-18v
5	-channel A
6	-channel /A
7	-channel B
8	-channel /B

14. EXCITING FIELD BOARD ES 95003

14.1 Description:

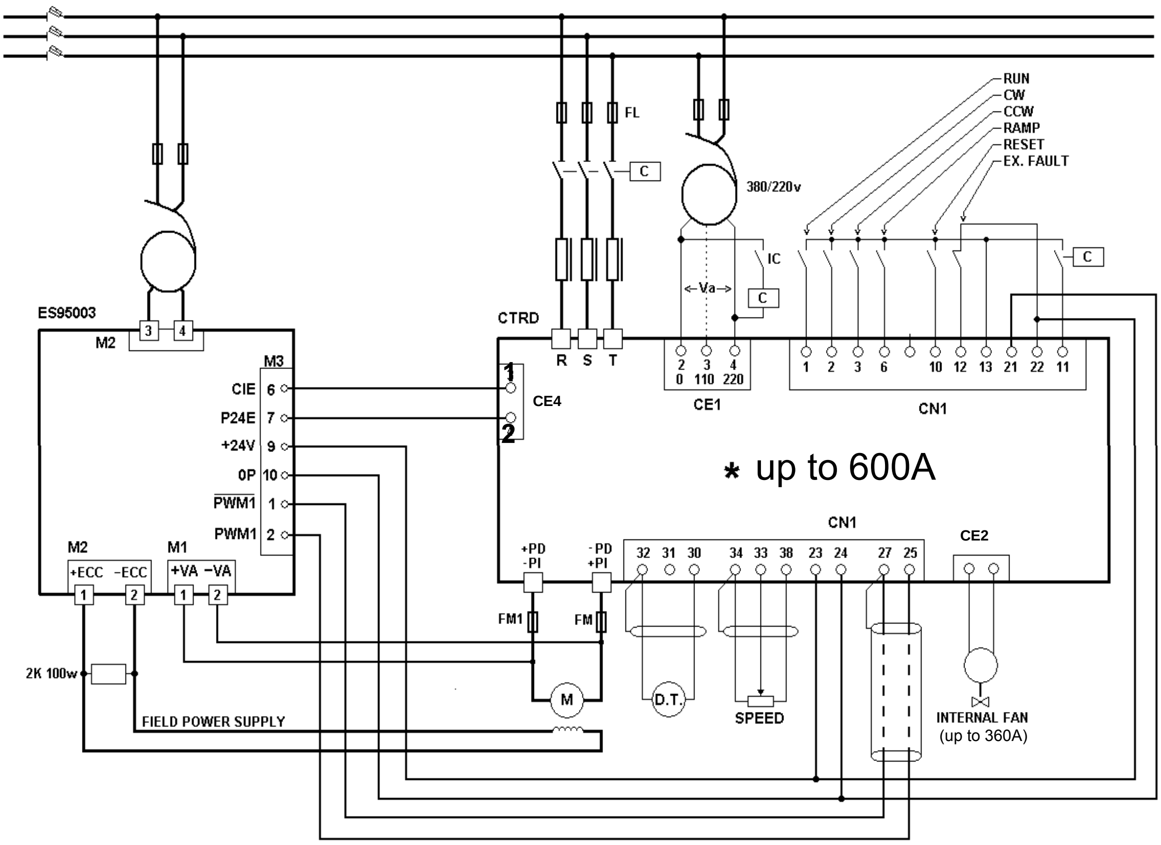
ES 95003 is a tension adjustment board who, acoupled with a converter series CTRD or board CS 6621, permits to adjust the field current of a c.c. motor. Calibration of board ES 95003 is made directly from a terminal or a PC by parameters P34, P35 e P37.
During phase of current ring self-calibration the system provides itself to block the field adjustment and therefore to turn off the excitation current.

14.2 Configuration of converter:

By this board it is possible to use all converter configurations, programmable by the switch “S8”, wich do not operate on the field inversion; in particular following configurations are possible:

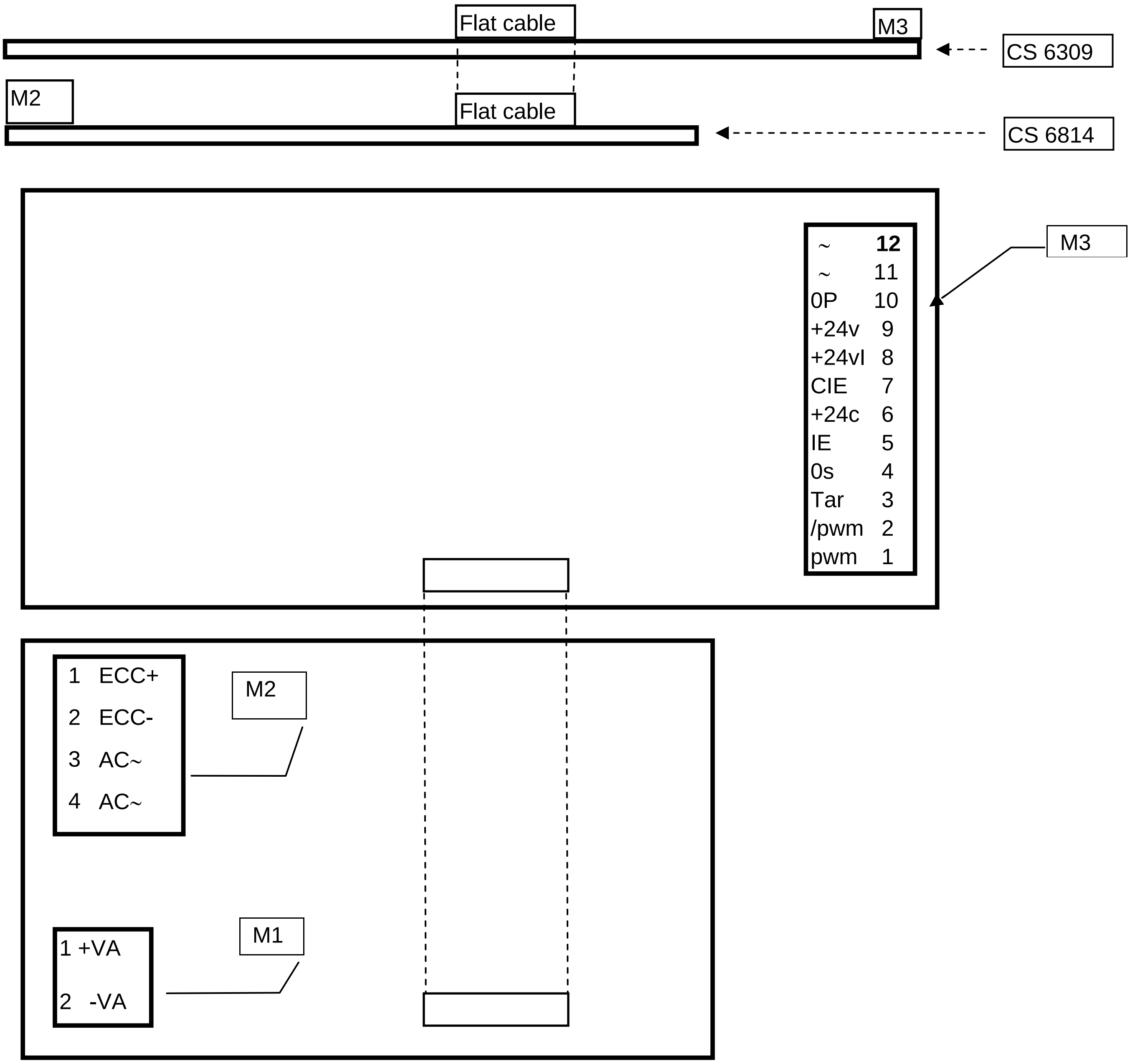
S8=	0	Double armature bridge with exchange logic. The use of the adjustment board is limited to work at constant power (unidirectional field).
S8=	1	Unique unidirectional armature bridge, only direct bridge. The adjustment board is used only for running at constant power.
S8=	2	Unique unidirectional armature bridge, only inversed bridge. The adjustment board is used only for running at constant power.

14.3 Connection exciting board with ctrd converter:



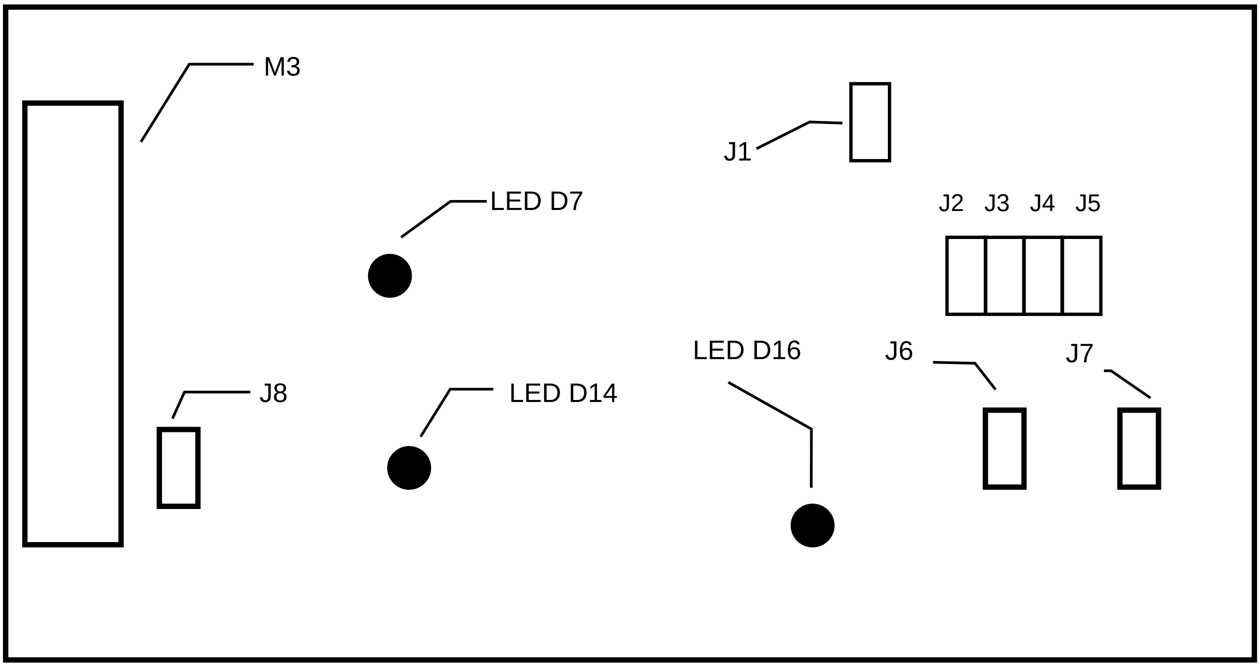
On terminal board M2 of ES 95003 and precisely at terminals 3-4 has to be connected the board feeding (AC), keeping into consideration that the max input tension is of 415 Vac. To terminals 1-2 of M2 has to be connected the motor excitation.
It is useful to connect in parallel to the “field” a resistance of at least 1 Kohm 100 Watt.
Empower of the field is made automatically from adjustment board when the Jumper J8 of excitation board is on.

14.4 Disposal of terminal boards:

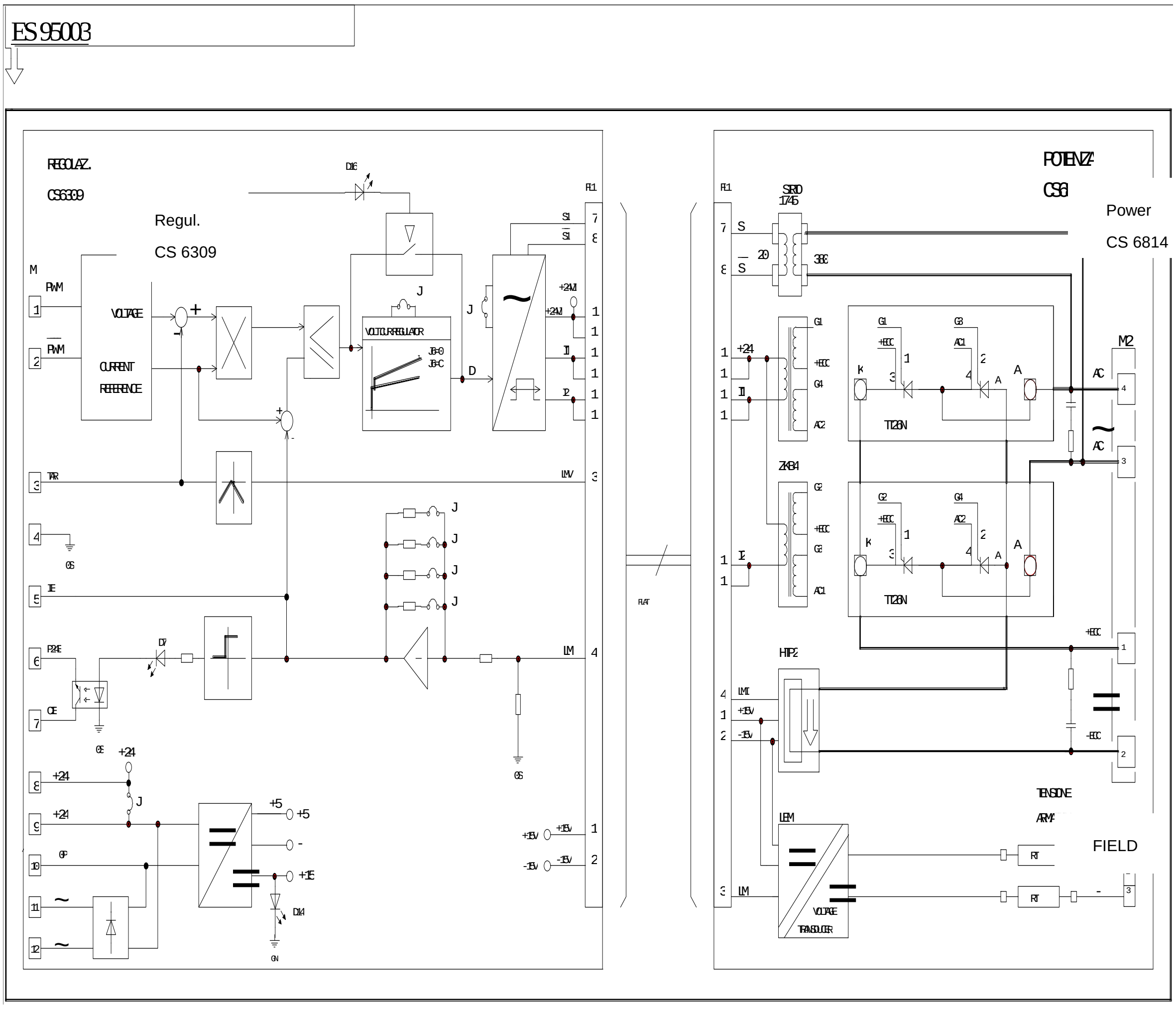


14.5 Meanings of jumpers and leds:

J1	Not used
J2	Calibration max Iecc
J3	Calibration max Iecc
J4	Calibration max Iecc
J5	Calibration max Iecc
J6	Change gain current ring ON=low, OFF=high
J7	(ALWAYS OFF)
J8	Empower excitation adjustment ON= release adjustment
LED D7	Signaling presence Iecc
LED D14	Signaling presence feedings
LED D16	Signaling release adjustment



14.6 Regulation block schema



14.7 Board calibration:

The maximum delivered current is 24 Amp and depends on loops passing by current transducer and on the jumpers make as per the following table:

J5	J4	J3	J2	Iecc max(A) per n° loops(Np)			
				Np: 1	Np:2	Np:3	Np:6
1	1	1	1	24.0	12.0	8	4
0	1	1	1	22.6	11.3	7.5	3.7
1	0	1	1	21.2	10.6	7	3.5
0	0	1	1	19.9	9.9	6.6	3.3
1	1	0	1	18.5	9.2	6.1	3.0
0	1	0	1	17.1	8.5	5.7	2.8
1	0	0	1	15.8	7.9	5.2	2.6
0	0	0	1	14.4	7.2	4.8	2.4
1	1	1	0	13.0	6.5	4.3	2.1
0	1	1	0	11.6	5.8	3.8	1.9
1	0	1	0	10.3	5.1	3.4	1.7
0	0	1	0	8.9	4.4	2.9	1.4
1	1	0	0	7.5	3.7	2.5	1.2
0	1	0	0	6.1	3	2	1

1	0	0	0	4.8	2.4	1.6	0.8
0	0	0	0	3.4	1.7	1.1	0.5

1=Jumper connect, 0= Jumper off
Np=Number of loops passing in the current transducer

Value in the table are obtained by the following formula:

Errore. Non si possono creare oggetti dalla modifica di codici di campo.1 = (A)

Considering Jumpers J2, J3, J4 and J5 all make, the value obtained in the parenthesys is 17.47; therefore it can be also written:

$$Np = \frac{1.373 \cdot 17.47}{Iecc_{\max}} \cdot X = \text{(A)}$$

From the formula it can be understood that to have 24 Amp in output, are needed n° 1 loops in the transducer.
The actual field current is given by the following relation:

$$Iecc\ [A] = Iecc_{\max} \cdot \frac{P34}{100} = \text{[A]}$$

Where P34 is the parameter who permits to adjust the excitation current once calibrated by the loops on the current transducer and the Jumper J2,J3,J4 e J5.
To simplify board calibration operations, three models with different loops in transducer have been provided:

1 loop: range 24A÷6A
3 loops: range 8A÷2A
6 loops: range 4A÷1A

(Specified current values have to be intended as Iecc Max possible values with such board type).
At this point, once knew the the motor excitation current, choose the most suitable model of ES 95003 and with the aid of table (page 69), set Jumpers J2 ÷ J5 in a way that the exciting current is about 5 ÷ 10% higher than the motor max rated current.
The armature tension has to be taken from converter by calculated resistances (see formula for calculation of R1 and R15) and taken to the terminal board M1: +VA, -VA of board ES 95003.
NB: Resistances R1, R15 are normally already calculated and mounted directly inside the exciter. In any case here after are listed their formulas to demonstrate the calculations to be made to find value and power.

$$R1 = R15 = \frac{V_{eff} - 63{,}75}{7}[Kohm]$$

Line 380Vac ------120//120//180Kohm = 45 Kohm=R1=R15

Line 415Vac ------100//100Kohm = 50 Kohm=R1=R15

Line 440Vac ------- 53Kohm=R1=R15

Where:
Veff = effective rated linked tension grid; that feeds the converter.
The max. dissipated power by each resistance (R1 and R15) is given by the following formula:

Pmax = R1x 0,04 [W] with R1 expressed in Kohm

To terminals M3-5/4 (IE - 0S) there is a filtered signal proportional to the field current with max value of -5V for Iecc.= Iecc. max, where Iecc max corresponds to calibration fixed by NP and J2-5.
From terminals M3-3/4 (Varm. - 0S) exits respectively a filtered signal proportional to the absolute value of motor tension, with a value of -7V, when the armature tension corresponds to the effective rated tension of the converter feeder.

14.7.1 CALIBRATION PARAMETERS

P25 range from 0 ÷ 100%
P35 range from 40 ÷ 120%
P34 range from 30 ÷ 100%
P37 range from 10 ÷ 100%

Once made the hardware calibrations, you can act on parameters P34 (rated field current) to eventually correct the max excitation current after after having precalibrated by the loops on T.A. and by the setting of Jumper and P35 (motor tension in % of P38) to define the tension of motor defluxion armature.
It has to be considered that:
a) if P34 = 100%, the field current is equal to the Iecc max calibrated by Jumper and n° loops on T.A.
In case P34 goes under 70% with Jumper J5, J4, J3 and J2 off, it is advised to change the number of primary loops NP for the reason of the governor reply.
b) if P35 = 100%, the tension of motor at start defluxion is equal to the one set in P38, such as:

$$V_{mot} = \frac{P38}{100} \cdot V_{eff} \cdot \frac{P35}{100} = [V]$$

where Veff. Is the effective rated linked tension grid that feeds the converter; ex.: 380V, 415V, 440V, ecc.
therefore:

$$P35 = \frac{10000 \cdot V_{mot}}{P38 \cdot V_{eff}} = [\%]$$

On parameter P37 has to be set the value in % given by the following formula:

$$P37 = \frac{\max revs.coupleconst.}{\max revs.powerconst.} \cdot 100 = [\%]$$

Once set these parameters, it can be run, verify that the field and tension value is the desired one and eventually correct parameters; in case the field is few inductive (Tecc.<u><</u>150ms) or there is an instability in the field current, it is useful to close the Jumper J6 who reduces the adjustment gain. By this system it is limited also the max field current in the defluxion area by the following relation:

$$I_{ecc} = Iecc_{\max} \cdot P34 \cdot \frac{P37}{|V6|}$$

where |V6| is the absolute value of the motor speed percentage read in V6, it is useful to take <u>P37 about 5% higher than speed of disexcitation starting</u> to consider a possible reaction of armature unless the machine is not particularly saturated, in such case P37 has not to be increased.
In P36 has to be set the level of max tension alarm as a function of P38; considering that this alarm is based on the calculated and not read tension, therefore subject to an unavoidable inaccuracy between the two values, such parameter must be 10-20% higher than P35, in any case it has to be adjusted in a way not to intervent at normal work. For a more precise calibration it is sufficient to put forewards a higher value, then take the motor in a defluxion area, read V18 (motor tension %) and set P36 as <u>P36xP38>1,1xV18</u>.
By parameter P25 it is possible to automatically increase the dynamic gain of the speed governor to consider the torque decrease at the equal current in the constant power area; the increase in gain is obtained following the below formula:

$$G = P23 \cdot \left(\frac{P25 \cdot \frac{|V6|}{P37}}{100} \right)$$

In the not defluxed area, when |V6| is < P37, the gain is kept constant to value G=P23.
From the above relation it is clear that an almost total compensation is obtained from the variation in gain of the speed ring with P25 = 100% , while there is no compensation if P25 = 0; therefore if P25=100% it is obtained almost the same dynamic performance of the speed governor at whatever work condition.

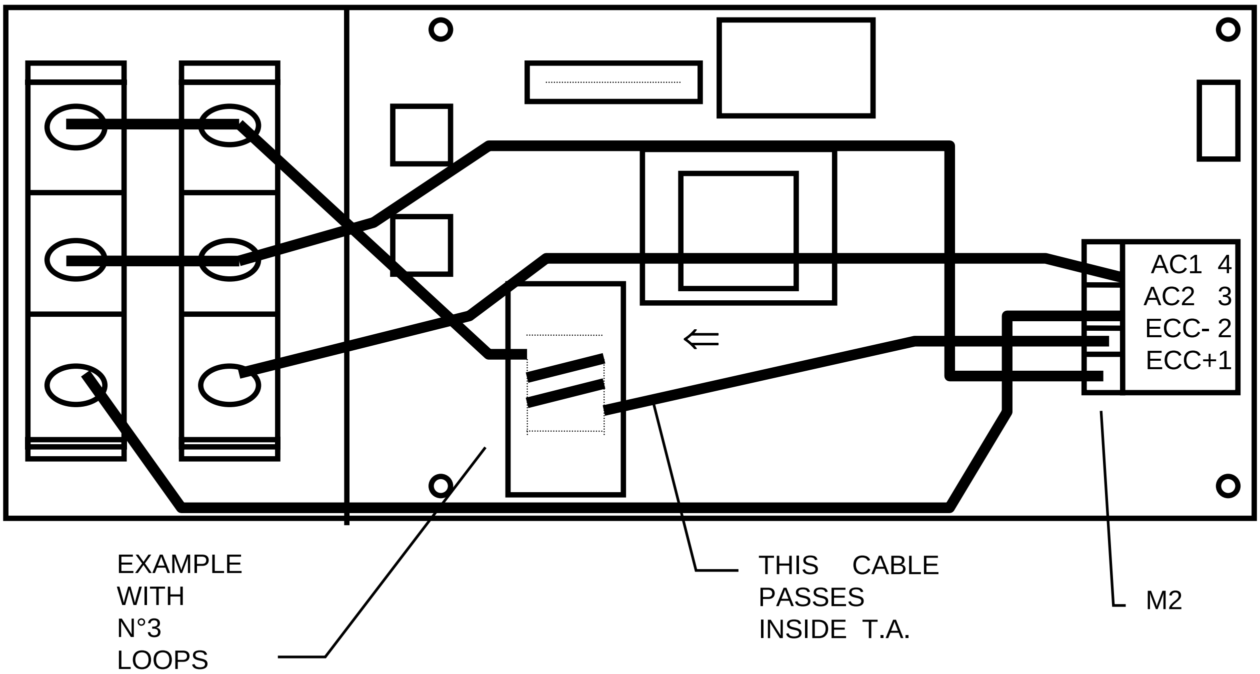
Alarm lack of excitation:
This alarm is obtained if at converter adjustment board there is no CIE signal when drive expects the insertion of a field; it occurs after the board feeding if S9= 0 or after on terminal CN1-11 (I 11) of converter adjustment board a +24V setting if S9= 1. With I 11=1, at the running entrance operates the "waiting time for contactor on" (P46) wich permits the field to go to the nominal value; in case of particularly inductive fields it has to be foreseen a sufficient time for this operation (P46>=2xT excitation where T excitation is the time constant in the field 0.5÷1sec.). The alarm is delayed of about 1sec, to take into consideration the settling of the same field; however, with no delay, at the moment of the measurement of the lack of field, the armature bridge/s current limits are put into zero and stay until field is absent (save in self-calibration).
The level of field presence control in the board <u>ES 95003</u> is made by checking that the field effective current is higher than 0,4 time the value calculated for Iecc by the formula in previous paragraph, therefore if value of P37 is higher than 50-100% respect to the value of disexcitation starting (P35), if speed is altered or disexcitation tension (P38) is too low, the intervention of lack of excitation control could be obtained once tension governor reveals an effective current.

$$Iecc.effettiva < 0.4 \cdot Iecc \max \cdot P34 \cdot \frac{P37}{|V6|}$$

14.8 Change of number of the transducer loops:

In case it is necessary to change the number of the T.A. loops in the board ES 95003, consider that it has to be used a conductor cable able to bring the maximum required excitation current. Consider also that the board ES95003 is able to deliver a max 24 Amp. Current.

Warning!: respect the winding sense of the loops. The number of loops coincides with the number of passages inside the transducer.



The drawing represents the board CS 6814 wich is in the lower side of ES 95003.

14.9 Procedure for replacement of ES 95003:

In case of replacement of the board, it has to be considered the following:

1) Turn tension off from electric panel.
2) Verify if max excitation current of the new board (4A, 12A, 24A; see identification plate at box side) corresponds to the board to be replaced. In such case the Jumper J2, J3, J4 and J5 have to be inserted in the same position of the fault board.
3) If Imax exit current is different, it is necessary to rewind the current transducer.
4) Calibrate Jumpers from J2 to J5 as per table at page 67.
5) Make sure that Jumper J1 and J7 are off.
5) Turn Jumper J6 off and insert it only if an instability in the excitation current is noted (see page 67).
6) Make sure that Jumper J8 is on.
7) Connect the new board as per schema, by connecting one voltmeter in parallel to the field.
8) Turn tension to the electrical panel on and take off the converter adjustment release (wire connected to terminal CN1-1 of the adjustment board).
9) Start the converter and check on voltmeter that output tension corresponds to the foreseen value, eventually calibrate again parameter P34.
10) If necessary refer to the present handbook for calibration of the other parameters (P35, P37, P25).
11) Store the parameter changes by saving them on eeprom.
12) Turn tension off from electric panel and reconnect the adjustment release on CN1-1 of the adjustment board, previously disconnected at point 8.
13) The board is now ready to run.

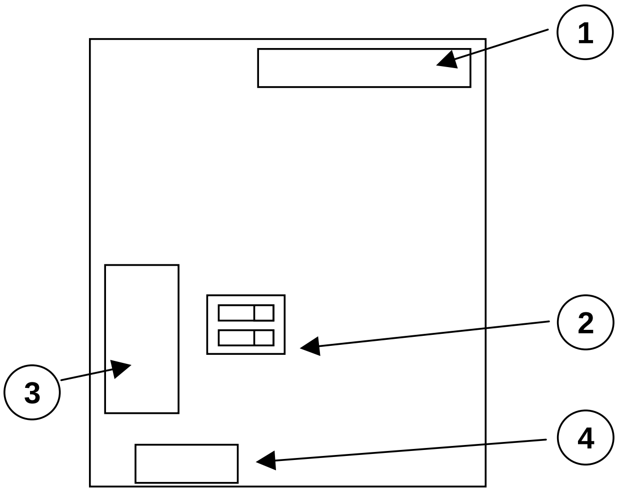
15. INTERFACE PROFIBUS CS948

CS948 is an interface board (software version 1.04) to be connected to drives TDEMACNO of series CTRD; it implements the communication protocol Profibus DP.

On the basis of the indications for standard profile communication for drives (PROFIDrive), profibus message is divided into two independent parts: datas to be parametered and process datas. This permit to work at different speeds on two datas types.

The board is connected to bus Profibus by a connector DB9 pinout diagram as per Profibus standard.

15.1 Description Hardware



1 Connector drive sense

2 Dip switch for selection of termination (not mounted)

3 Connector DB9 for bus Profibus

4 Connector flat for bus Profibus

Pinout diagram of connector DB9 (equal to Flat one):

Pin n.	Name	Description
1	SHIELD	Protection screen
2		
3	A	Rx/Tx data positive
4	DE	Control signal for repeater
5	GNDISO	0v of feeding
6	+5vISO	Feeding +5v in output
7		
8	B	Rx/Tx data negative
9		

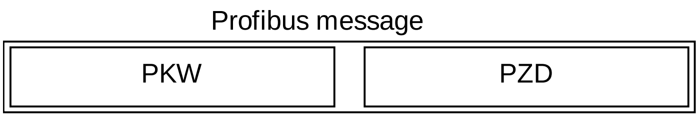
15.2 Setting of knot number

The Profibus knot number is the same as the slave set on drive by the keypad. To change the knot number:
- Set parameter P1: number of drive.
- Store datas in EEPROM
- Turn the drive off and on.

Consult the drive user's handbook for correspondence of parameters and for procedures for saving on EEPROM.

15.3 Description Profibus Message

Profibus message is transmitted cyclically from master to the drive. Drive sense request is composed by two parts:

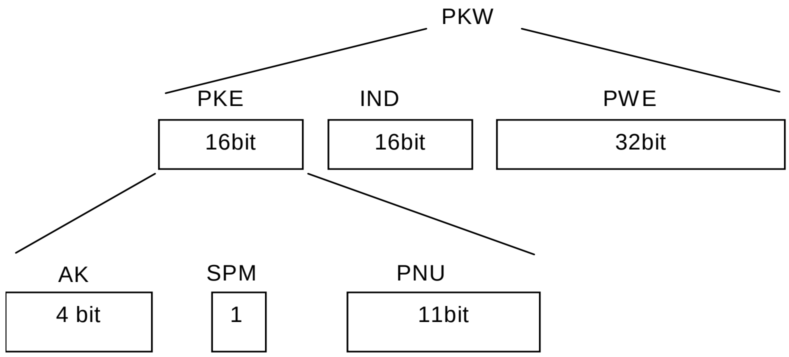


1) PKW : parametric datas
2) PZD : process datas

Response of driver in master sense is samely composed.

15.4 Parametric datas: PKW

Part of the message PKW has a fixed lenght (4 word), and permits to change driver parameters. In case application requires no change in parameters, it is sufficient to set field AK = 0 (No Task), to communicate the driver there is no request to be executed. The other field are automatically ignored.
Message PKW is composed as follows:



In the following description are listed all functions and parameters permitted by board CS948. However drives do not admit all the setting possibilities. To know wich combinations are admitted, the driver handbook has to be read.

15.5 AK

Field AK contains the operation to be executed. Valid values for request from master to drive:

AK	description
0	No task
1	Read byte
2	Read word
3	n.c.
4	Write byte
5	Write word

Valid values for response from drive to master:

AK	description
0	No task
1	Reading byte ok
2	Reading word ok
3	n.c.
4	Writing byte ok
5	Writing word ok
14	Operation not admitted

In case drive replies by code 14 (Operation not admitted), in the field PWE it is specified an error code:

PWE	description
1	Value out of range
2	Parameter key protected
3	Parameter protected when drive under run
4	Parameter not existing
5	Type operation not admitted

15.6 PNU

Field PNU contains the interested parameter type. For parameter description refer to user's handbook. The following table describes the value in fields AK and PNU of profibus message for reading and writing operations:

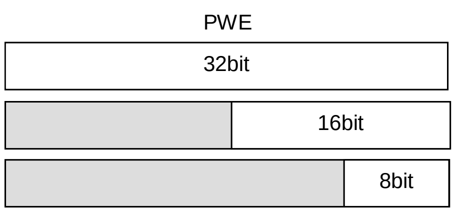
description	n. bit	Read (AK)	Write (AK)	15.6.1.1 PNU
parameters P	16	2	5	1
parameters c	8	1	4	2
parameters d	16	2	-	3
parameters A	8	1	-	4
parameters I	8	1	-	5
parameters O	8	1	-	6

15.7 IND

Value of field IND is the number of parameter. For parameter description refer to user's handbook.

15.8 PWE

Field PWE contains the value of parameter. For parameter description refer to user's handbook. Alignment of fields inside 32 bit is the following:



15.9 Example of writing n° 1:

WRITING OF P3 = 50% (SPEED JOG CW)

Field	Dec. value	hexadec. value	description
AK PNU IND PWE	= 5 = 1 = 3 = 4095x50/100 = 2047	= 5H (4 bit) = 001H (12 bit) = 00 03H = 00 00 07 FFH	(writing word) (parameter type P)

Question MS -> SL:

PKE IND PWE

5 001 00 03 00 00 07 FF

Reply SL -> MS:

PKE IND PWE

5 001 00 03 00 00 07 FF

15.10 Example of writing n° 2:

WRITING OF S3 = 1 (JCW BEFORE, JCCW AFTER RAMP)

Field	Dec. value	hexadec. value	description
AK PNU IND PWE	= 4 = 2 = 3 = 1	= 4H = 002H = 00 03H = 00 00 00 01H	(writing byte) (parameter type S)

Question MS -> SL:

PKE IND PWE

4 002 00 03 00 00 00 01

Reply SL -> MS:

PKE IND PWE

E 002 00 03 00 00 00 03

Drive replies by a code EH (operation not admitted) beacuse parameter S3 can be changed only out of running (PWE = 03). Parameter S3 remains not set.

15.11 Example of reading n° 1:

READING OF S10 (EXCLUSION ALARMS)

Field	Dec. value	hexadec. value	description
AK PNU IND	= 1 = 2 = 10	= 1H = 002H = 0AH	(reading byte) (parameter type S)

Question MS -> SL:

$$\underbrace{1\ 002}_{PKE}\ \ \underbrace{00\ 0A}_{IND}\ \ \underbrace{00\ 00\ \ 00\ 00}_{PWE}$$

Reply SL -> MS:

$$\underbrace{1\ 002}_{PKE}\ \ \underbrace{00\ 0A}_{IND}\ \ \underbrace{00\ 00\ \ 00\ 01}_{PWE}$$

Therefore parameter S10 = 1 (excluded alarm in cyclic sense)

15.12 Example of reading n° 2:

READING OF V6 (SPEED REACTION)

Field	Dec. value	hexadec. value	description
AK PNU IND	= 2 = 3 = 6	= 2H = 003H = 06H	(reading word) (parameter type V)

Question MS -> SL:

$$\underbrace{2\ 003}_{PKE}\ \ \underbrace{00\ 06}_{IND}\ \ \underbrace{00\ 00\ \ 00\ 00}_{PWE}$$

Reply SL -> MS:

$$\underbrace{2\ 003}_{PKE}\ \ \underbrace{00\ 06}_{IND}\ \ \underbrace{00\ 00\ \ 03\ 33}_{PWE}$$

Therefore the read value is 333H = 819. From user's handbook it results that V6 is a percentage on scale bottom 4095, therefore

V6 = 819*100/4095=20.0%

15.13 Process datas: PZD

The PZD message part contains the datas that have to be cyclic exchanged between master and slave: diagnostic, set point, measured speed, ecc. These datas are taken into consideration only if connection “enable profibus datas” is empowered. Master sends to board CS948 values in writing for the drive and the board replies with values in reading by the drive.

To empower these datas set **C62 = 1** (enable process datas).
It is possible by **C15 = 1** to force, via Profibus, connections from C21 to C34.
The reading proposes the state of the digital outputs in LSB while in MSB there is an alarm code

Control Word:		Status Word:	
bit	description	bit	description
0	C21	0	o1
1	C22	1	o2
2	C23	2	o3
3	C24	3	o4
4	C25	4	o5
5	C26	5	o6
6	C27	6	o7
7	C28	7	o8
8	C29	8	See table alarms
9	C30	9	See table alarms
10	C31	10	Self-calibration in execution
11	C32	11	*** N.U.
12	C33	12	*** N.U.
13	C34	13	*** N.U.
14	N.U.	14	Generic error
15	N.U.	15	Presence alarms

b8	b9	description
0	0	Generic error
0	1	Request out of range
1	0	parameters not empowered
1	1	on line not admitted

Master → Slave

Control Word	word data1	word data2	word data3	word data4	word data5

Slave → Master

Status Word	word data1	word data2	word data3	word data4	word data5

On CTRD are possible only four word in writing and five word in reading. It is possible to set parameter it is intended to change by setting in the predetermined connections (C16-C19) the parameter number, so for example if C16 = 3 we will change parameter P3 with word data1, if C19 = 29 we will change parameter P29 with word data4. For the views, system is similar, but we will use connections from C11 to C14 and will digit the number of the view size (from d0 to d20) we want to receive. The fifth word in reading contains the bits of the worked out inputs (combination between terminal board inputs and inner connections).

N.B.: It is important to set to 0 the content of the not used connections (C16-C19), otherwise the parameters addressed by these connections will be in any case overwritten.
If abled C15 it is in any case necessary to able the inputs: delayed running and external empower. It will not be possible to reset alarms from keypad.

To know the scale bottom used for profibus see the following groups:

Variables stored in direct mode:
P01, P02, P20, P56, P57, P58, P59, P60, P80

Variables stored as n*10 (view with one decimal)
P11, P12, P13, P14, P15, P16, P17, P18, P23, P24, P33, P40, P41, P42, P43, P44, P46, P52, P54, P81, P82, P83, P91, P92, P97, P98

Variables with scale bottom = 4095 (fsV):
P03, P04, P05, P06, P07, P08, P09, P10, P21, P22, P27, P29, P30, P34, P35, P36, P47, P51, P55, P90, P93, P94
d1, d2, d3, d4, d5, d6, d7, d8, d9, d10, d11, d12, d13, d14, d15, d16, d17, d18, d19, d20

Variables with scale bottom = 6143 (fsT):
P49, P50, P95

Variables with scale bottom = 32767 (fsN):
P25, P26, P31, P37, P39, P45, P48, P53

Variables with scale bottom = 511 (fsC):
P96, P99

Variables with scale bottom = 1000 (fsM):
P43

Variables with scale bottom = 23170 (=32767/1.414)(fsX):
P38

The management of PROFIBUS interface routine is executed in polling every 2-3 ms (with waiting peaks of 6 ms) in offline condition, while with online drive (motor running) is obtained a scanning at any starting (3.3 ms average) with power grid at 50 Hz, and one every two startings (5.5 ms average) with power grid at 60 Hz.

N.B.: in different descriptions of adjustment board for CTRD it is referred indifferently to terms innser SWITCH (SW01-:-SW70) and inner connections (c01-:-c70), and also for inner sizes (V01-:-V20) or (d01-:-d20).

N.B.: during self-calibration it is not executed the management PROFIBUS routine, and moreover at the end of self-calibration there is a storing phase on eeprom while are suspended all serial and PROFIBUS management routines.

A.A.A: The profile related of serial for sizes d17 d18 d19 is different and has to be read its handbook (Az_Prot.txt).