

3FBD DC Motor Drive User Manual



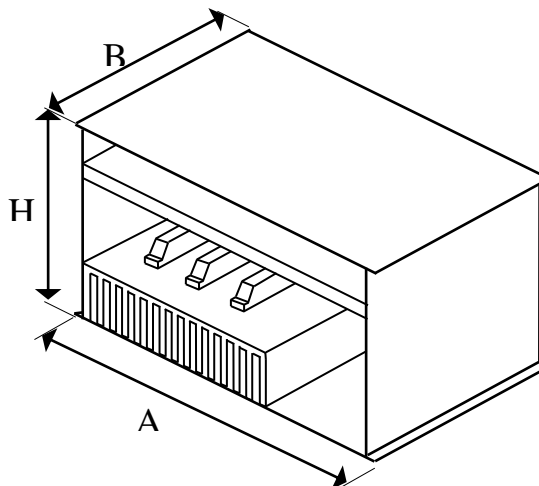
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General features

Mechanical features:



Available size :

Drive Type	I nominal (Ampere)	Vdc max motor (Volt)	HP	Supply Vac 3F ±10%	EMI Filter	Dimensions AxBxH
20-3FBD	20	260/440	6/10	220/380 V	832030V	315x245x215
30-3FBD	30	260/440	9/15	220/380 V	832030V	315x245x215
40-3FBD	40	260/440	12/20	220/380 V	832050V	315x245x215
50-3FBD	50	260/440	15/25	220/380 V	832050V	315x245x215
60-3FBD	60	260/440	18/30	220/380 V	832080V	315x245x215
80-3FBD	80	260/440	24/40	220/380 V	832080V	315x245x215
100-3FBD	100	260/440	30/50	220/380 V	832100V	315x245x215
120-3FBD	120	260/440	36/60	220/380 V	832150V	315x245x215
150-3FBD	150	260/440	45/75	220/380 V	832150V	315x245x215
200-3FBD	200	260/440	60/100	220/380 V	832200V	315x245x215
300-3FBD	300	260/440	90/150	220/380 V	832360V	315x245x215
400-3FBD	400	260/440	120/200	220/380 V	832500V	450x310x325
500-3FBD	500	260/440	150/250	220/380 V	832500V	450x310x325
700-3FBD	700	260/440	210/350	220/380 V	-	560x630x280
1000-3FBD	1000	260/440	300/500	220/380 V	-	560x630x280

* It's possible to have custom drives on specific features.

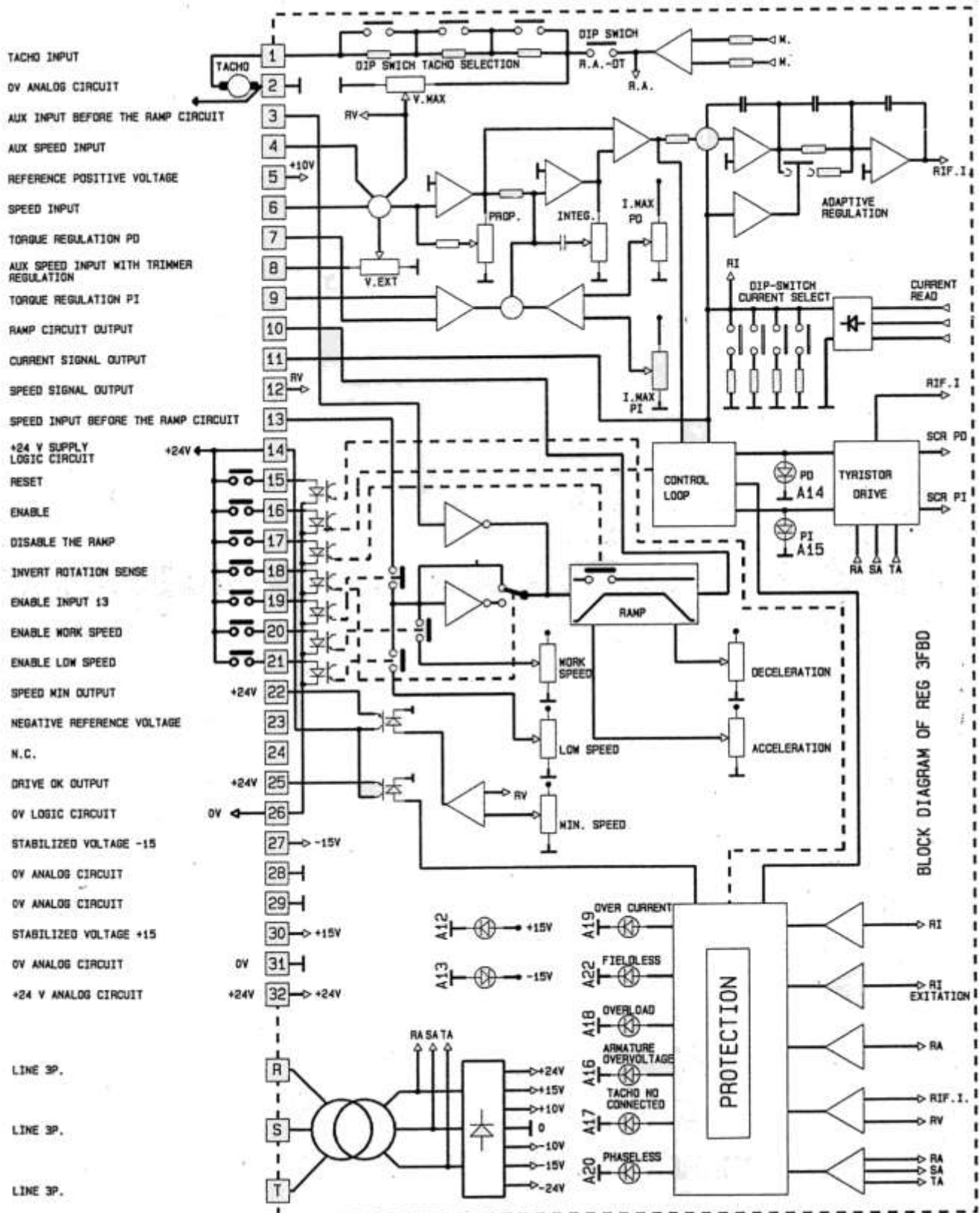
Electrical features:

- Two quadrant three phase thyristor bridge
- Thyristor drive by means of pulse transformer
- Current loop, feedback by current transformer
- Speed loop, feedback by tachogenerator or by armature voltage
- Ramp circuit for deceleration and acceleration
- Protection circuit for over current, phase loss, tachogenerator loss, overload, field loss
- The field supply bridge is on the board
- Speed regulation by potentiometer or by a voltage source $0 \div \pm 10V$

Protections:

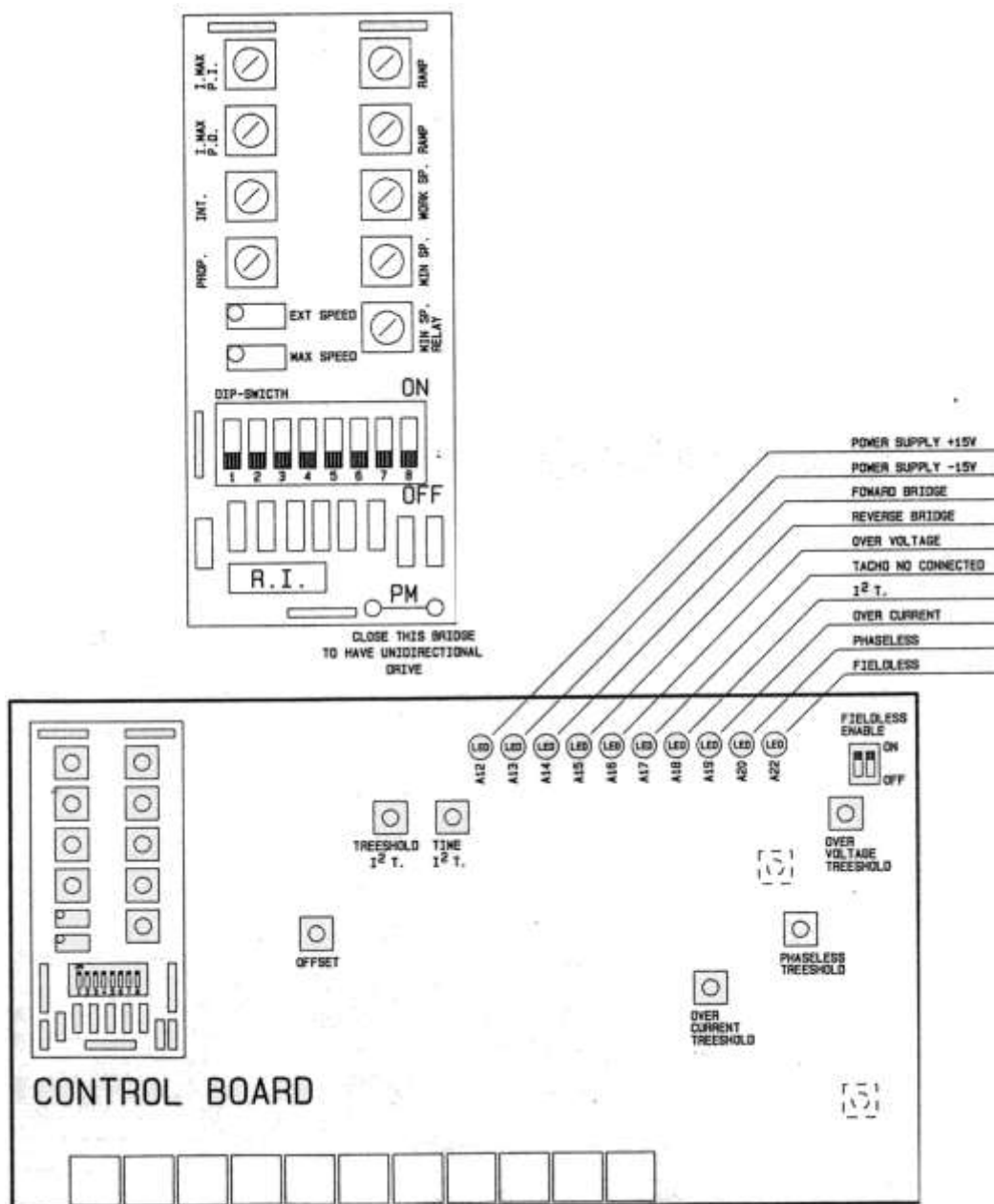
- **Over current:** Is caused by an internal or external short-circuit
- **Phase loss:** Is caused by a phase failure on the control board
- **Tachogenerator loss:** Is caused by a tachogenerator fault
- **Overload:** is caused by an high current flow for a long time (prevent motor damaged)
- **Field loss:** Is caused by a field current fault

Drive block diagram:



Regulations:

Led and regulation trimmers:



- **Rampa:** set the rise and the fall time of the ramp circuit
- **V.min:** set the speed reference enabled by 21 terminal
- **V.lav:** set the speed reference enabled by 20 terminal
- **V.max:** set the max motor speed
- **V.est:** regulate the speed input on 8 terminal
- **Relè V.min:** set the threshold value to become active the 22 terminal output
- **I.max PI / I.max PD:** set the max drive current, one for each direction
- **Prop.vel.:** set the speed loop gain

- **Int.vel.:** set the speed loop integral gain

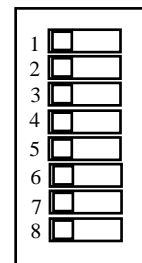
Dip switch:

There are 8 dip-switch used to configure the drive:

Feedback type:

With switch 1 is it possible to set the feedback, tacho or armature:

	Dip switch 1
Armature feedback	ON
Tacho feedback	OFF



Tacho Voltage:

With the 6-7-8 switches is possible to set the voltage of tacho:

	Dip switch 6	Dip switch 7	Dip switch 8
10V	ON	ON	ON
60V	OFF	ON	ON
120V	OFF	OFF	ON
180V	OFF	OFF	OFF

Current:

With 2-3-4-5 switches is possible to set the current of the drive:

	Dip switch 2	Dip switch 3	Dip switch 4	Dip switch 5
10A	OFF	OFF	OFF	OFF
20A	OFF	OFF	OFF	ON
30A	OFF	OFF	ON	ON
40A	OFF	ON	ON	ON
50A	ON	ON	ON	ON

There is another double dip-switch used to enable or disable the field less protection.

Terminal description:

Control board (32 poli):

1. Tacho generator input
2. Zero tacho generator
3. Aux speed reference, before soft start
4. Aux speed reference, after soft start
5. Positive reference voltage +10V
6. Speed loop input
7. Input to modify maximum current PI
8. Speed loop input through trimmer V.est
9. Input to modify maximum current PD
10. Output soft-start circuit ($0 \div \pm 10V$)
11. Output current signal ($0 \div -4.5V$)
12. Output speed signal ($0 \div \pm 10V$)
13. Speed input reference before soft-start
14. Positive supply voltage +24V
15. Reset
16. Drive enable
17. Soft start enable
18. Forward / Reverse rotation
19. Enable external reference
20. Enable internal reference V.lav
21. Enable internal reference V.min
22. Min speed relay output (+24V under Vmin speed, 0V over)
23. Negative reference voltage -10V
24. Not connected
25. Drive OK relay output (+24V if drive is OK; 0V if drive is faulted)
26. Zero voltage
27. Negative internal supply voltage -15V
28. Zero voltage
29. Zero voltage
30. Positive internal supply voltage +15V
31. Zero voltage
32. Positive internal supply voltage +24V

Supply terminal (7 poli):

Ra. R line voltage
Sa. S line voltage
Ta. T line voltage
~. Field supply ac voltage
~. Field supply ac voltage
+. Field
-. Field

Power terminal:

R. R line voltage
S. S line voltage
T. T line voltage
M. Motor armature
M1. Motor armature

Drive linking:

Power supply: the power supply pass through 3 extra rapid fuses (operating with current 30% higher of nominal drive current) and carried to line impedance ZL and to line remote control switch; after it is carried to R S T connectors.

An auxiliary switch of the remote control switch closed the 14-16 terminals to enable the drive.

The control board power supply is connected before the line impedance; it's important to respect the connection of R-Ra S-Sa T-Ta, if it's not respected the drive function abnormally.

DC Motor: the motor armature is connected to M and M1 terminals, the field is connected to + and – terminals. The field AC supply is $V_{ac}=1.16 \times V_{ecc}$ and it's protected with extra rapid fuse $I_n=1.5 \times I_{ecc}$. The max current is:

3A for drives up to 60A
5A for drives up to 150A
10A for higher drives

Logic command: The logic commands are opto-isolated to analog circuits; they are supplied with an external supply of 24Vcc from 24-14 terminal. If is not required insulation is possible to supply the circuit from drivers to link 14-32 and 26-28 terminals.

The available commands are:

Terminal 15: reset the drive, set to zero the protection memory.

Terminal 16: drive enable, it must set only after supplied the control and power, otherwise the fuses burns

Terminal 17: set to zero the ramp time setted by ramp trimmers

Terminal 18: invert the polarity of the output signal of ramp circuit, and so invert the motor rotation

Terminal 19: enable input at terminal 13

Morsetto 20: enable V.lav trimmer

Morsetto 21: enable V.min trimmer

Tacho generator: connected to 1 and 2 terminal.

The tacho generator and all analogical signals must be connected with shielded cable. The shields and the analogical 0V must be connected to the ground in the same point.

Analog inputs: the analog signals are applied behind one of the 0V terminal (2-28-29-31) and the most fitting input for the regulation in use.

There are 3 inputs (4-6-8) connected of the sum input to the speed loop, the signal applied to 8 terminal can be reduced by V.est trimmer. The sense of rotation is depending by the polarity of the signal.

Ramp circuit: the 13 input terminal is used when the speed come from a potentiometer or from a PLC logic. The signal can be positive or negative and it must be activated from 19 terminals. In the ramp circuit can be used other two positive speed signals, setted by V.min trimmer (from 0 to 25% of max speed) and V.lav (from 0 to 100% max speed), the signals are activated from 20 and 21 terminals. If the signals are activated in the same time, the higher signal is considered. The polarity can be turned (with the sense rotation) by the 18 terminal.

At the output of the invert amplifier can be applied a correction signal (positive or negative) by terminal 3. The signal is an input of the ramp circuit with adjustable acceleration and deceleration time by RAMPA trimmers. This time can be set to zero by 17 terminals. The ramp output (10) must be connected with the speed loop input (6). Unused inputs (4-8) can be sum at the 6 input, a positive or negative signal.

The current limit PD or PI can be modified, only one or together by means of an 0 +10v signal applied at 7 (PI) and 9 (PD) terminals.

Motor speed synchronization: the 4 and 8 terminals of the slave drive is connected to the 12 terminal of the master drive.

Visualization: at terminal 12 is present a $0 \div \pm 10V$ signal, this is proportional motor speed; it can be used to read motor speed.

Logic output: at terminal 22 is present a logic signal of +24V when the motor speed is over a threshold setted by Rele V.min trimmer. At terminal 25 is present logic signal of +24V when the drive is efficient and of 0V when protections are active.

Stabilized reference voltage: at terminals 5 and 23 are present respect +10V and -10V used to supply the potentiometer.

Starting:

Select the type of feedback (DT or armature).

For DT feedback set the 6-7-8 switches to have a correct dynamo voltage at the max motor speed.

Set the 2-3-4-5 switches to have the max drive current. Every switch increase 10A the current setted by RI resistor.

With V.max trimmer adjust the max speed.

If DT is inverted or V.max is too high the over voltage protection becomes active.

For a fine current adjustment stop the motor, disconnect the field, close the switch to exclude field less protection, enable the drive and with I.max trimmer adjust the current into two sense of rotation.

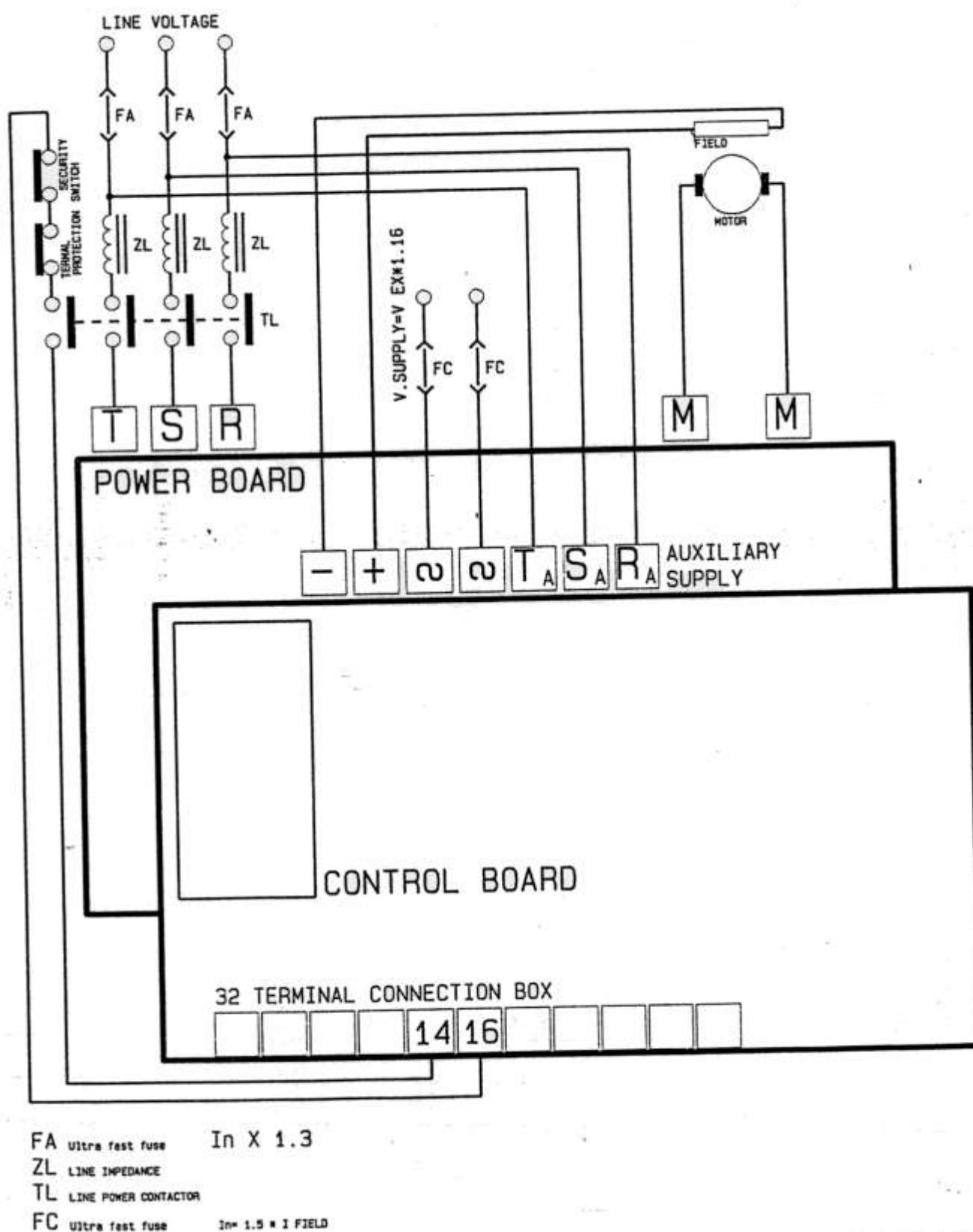
If the current is read on the AC line, use the relation $I_{phase} = 0.8 \times I_{cc}$

Stability adjustment:

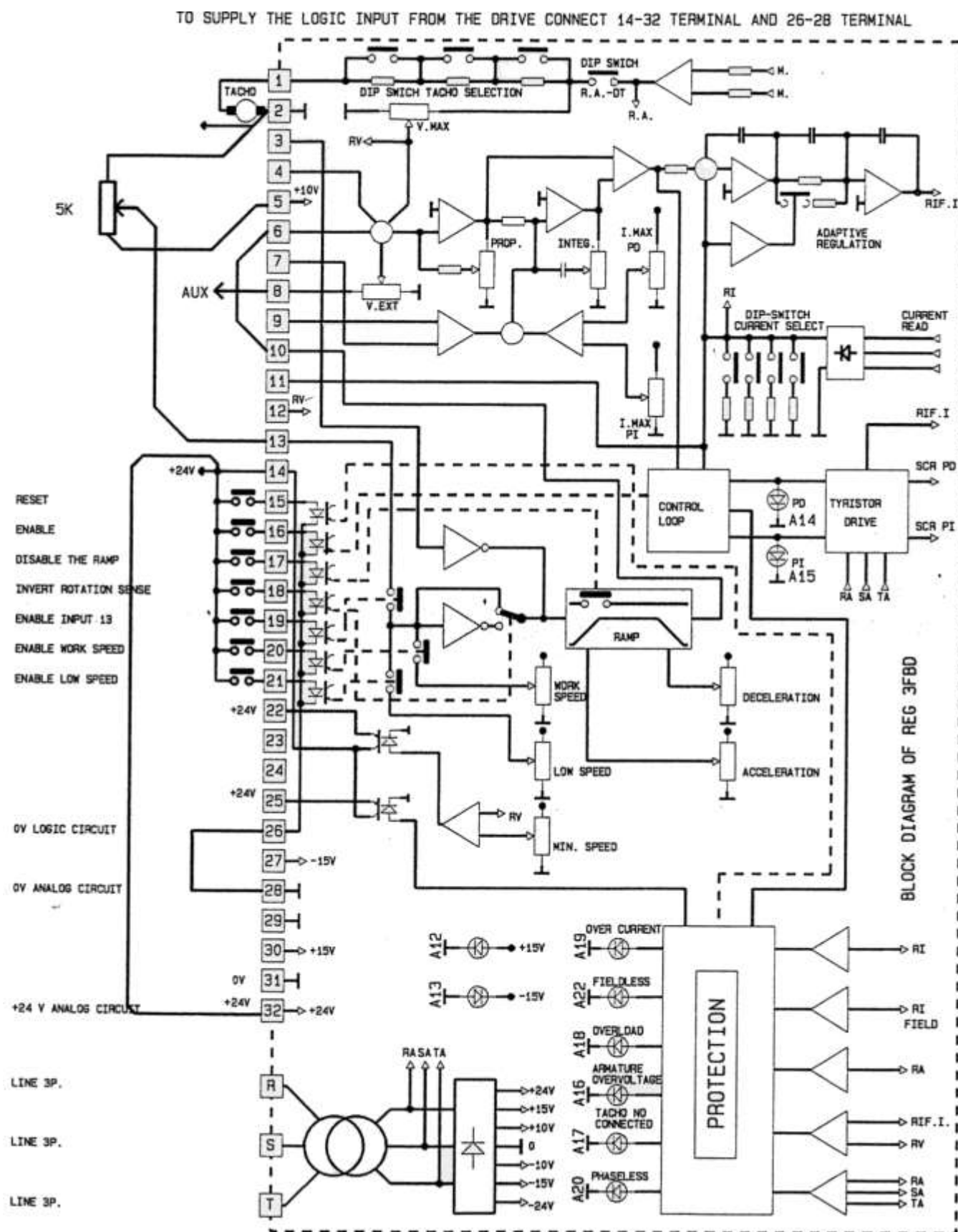
Give to the drive a step signal and look DT signal with an oscilloscope. Turn in anti clockwise direction Int.vel trimmer to cancel the overshoot in the transitory, after with a fixed speed signal turn in anti clockwise direction the Prop.vel Trimmer as far as the stability limit.

If you don't have an oscilloscope set the Int.vel trimmer at half scale, turn in anti clockwise direction Prop.vel trimmer as far as the stability motor limit. Repeat the operation with Int.vel trimmer.

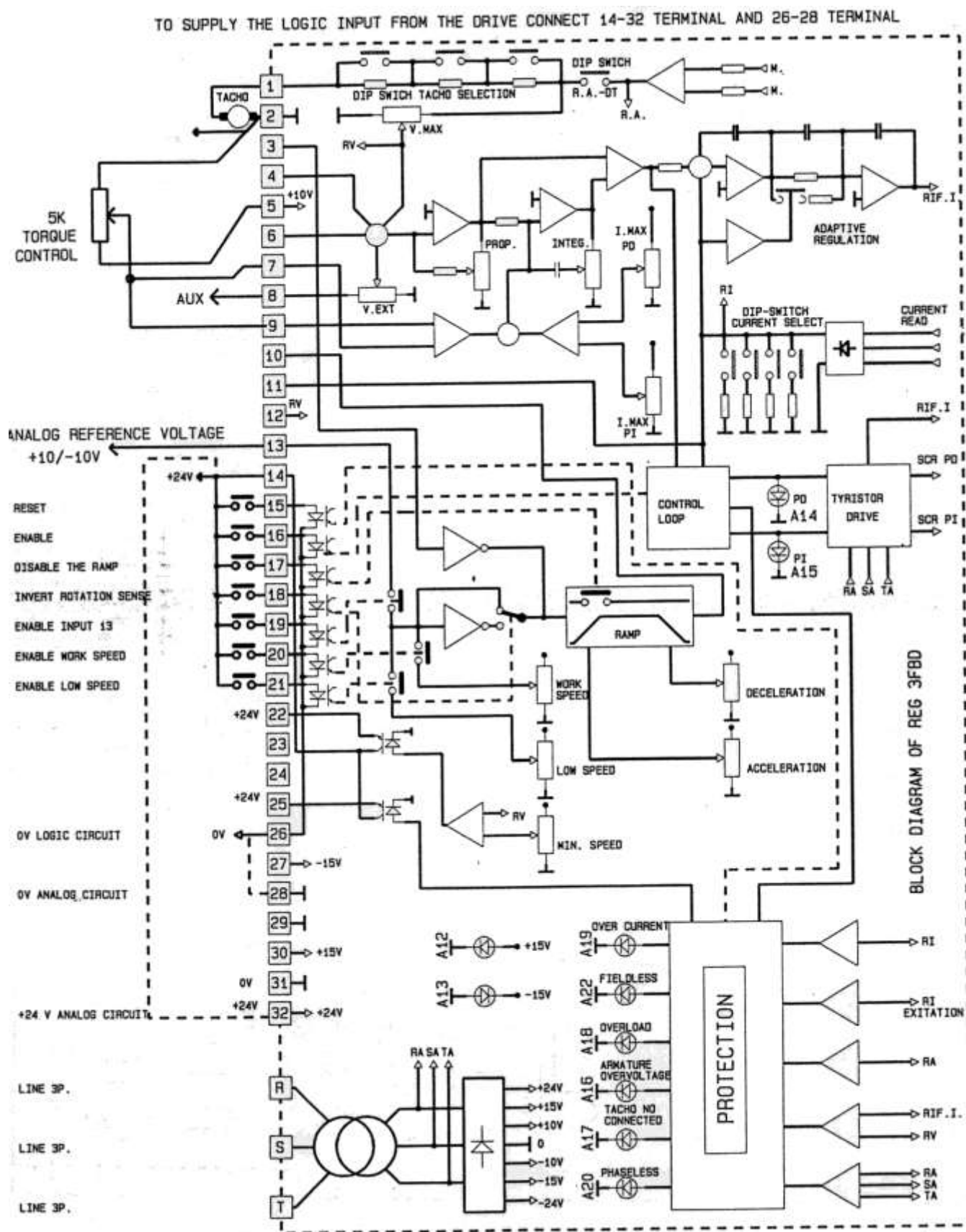
Power connection:



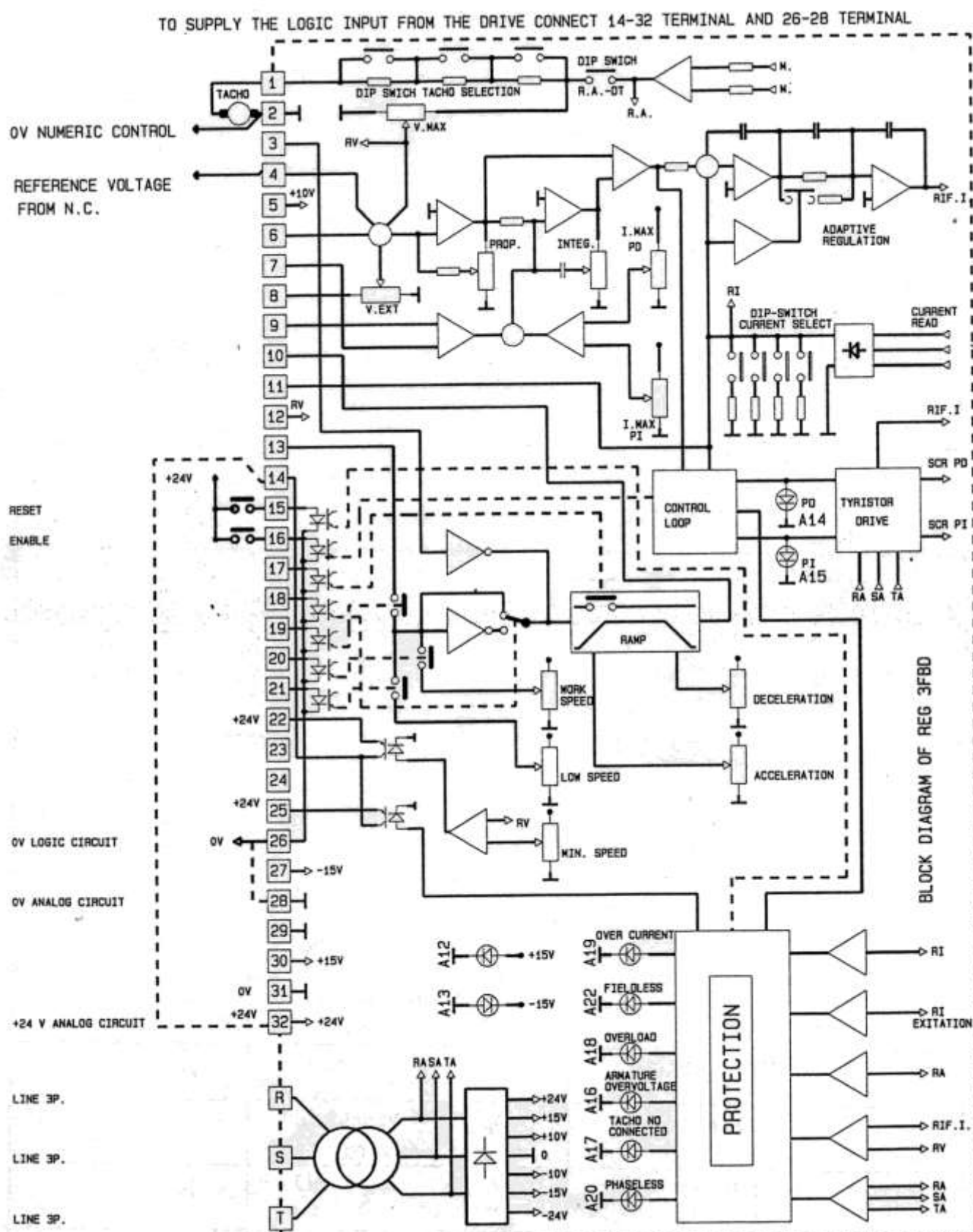
Connection with potentiometer reference voltage:



Connection with analog reference voltage:



Connection with reference voltage from N.C.:



Throubleshooting

Throuble	Possible causes	Solution
<ul style="list-style-type: none"> Supplying the driver and turning the potentiometer in any position the motor don't start The motor cannot start under load 	<ul style="list-style-type: none"> Power supply fail Enable input is not closed Speed reference fail Required current exceed the current limit Motor field fail Current calibration is wrong Mechanical obstacle on the machine 	<ul style="list-style-type: none"> Check power supply Provide to close it Check the potentiometer connection or change it. Motor power inadeguate Check the field circuit is supplied and check fuses Check motor current
<p>The motor reach immediately maximum speed without operate on potentiometer</p> <ul style="list-style-type: none"> Motor speed under load isn't stable 	<ul style="list-style-type: none"> Speed feedback fail Tacho signal is not correct Tacho signal is inverted Speed potentiometer is dirty or defective Tacho loose turns respect the motor Integration gain is to elevated 	<ul style="list-style-type: none"> Check connections Check tacho efficiency Check tacho connections Change it Check the joint between tacho and motor Adjust integral gain trimmer
<ul style="list-style-type: none"> The motor cannot reach the nominal speed 	<ul style="list-style-type: none"> The drive has reach the current limit The drive has been calibrated for a different max speed One or more tyristor don't fire 	<ul style="list-style-type: none"> Verifiythe motor power dimensioning Calibrate the max speed Change tyristor don't fire
<ul style="list-style-type: none"> Line fuses burned 	<ul style="list-style-type: none"> Accidental short circuit or defect of insulation on the connection or on the motor One or more tyristor are burned 	<ul style="list-style-type: none"> Check all connection and the insulation Replace the damage tyristor

For any other defect please contact our technical service.