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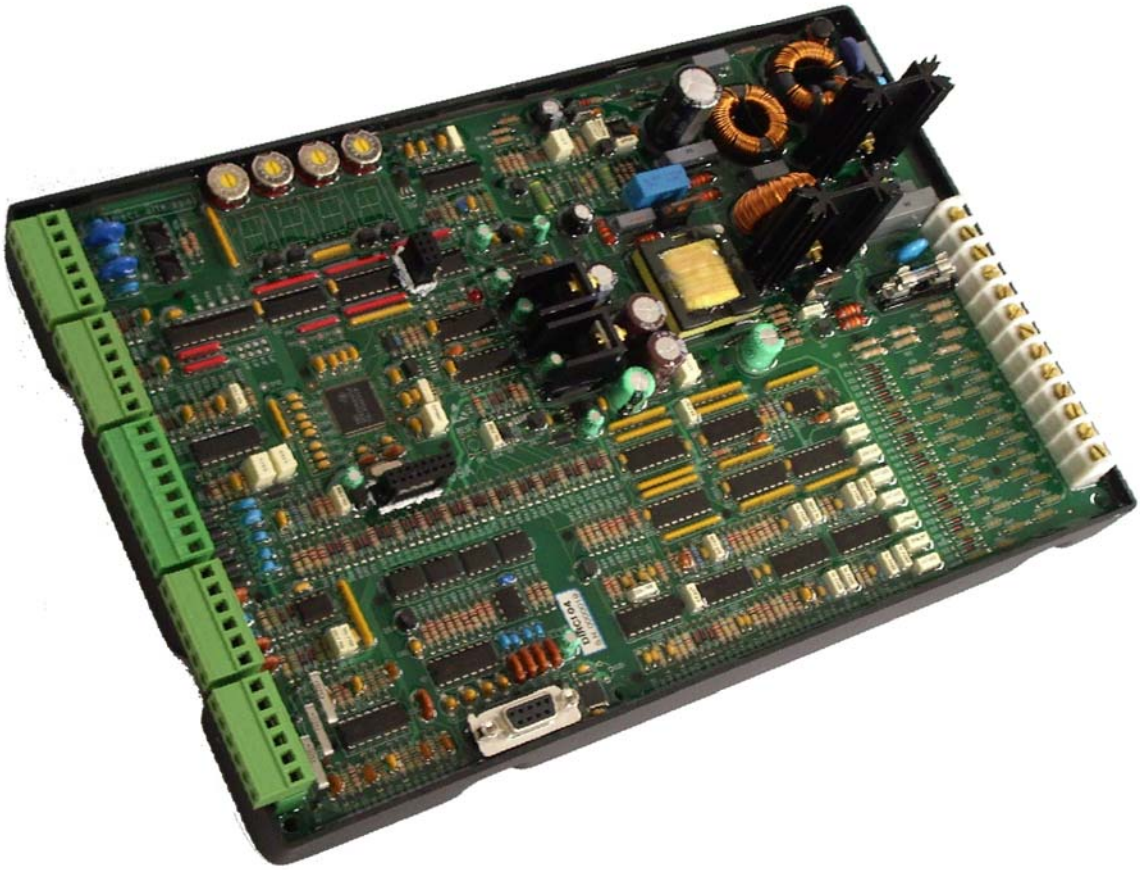

DIRCI04 DIGITAL REGULATOR

INSTRUCTION MANUAL

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The information given in this manual can be modified without notice.
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INTRODUCTION

This manual contains information on how the DIRCI04 digital regulator works and how to use it.

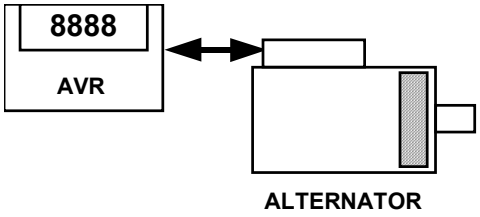
To avoid damage to things and injury to people only qualified personnel, namely people who fully understand the information contained in this manual, should carry out the described procedures. The voltage of the powered unit can be lethal for the operator.
All connections must be made when the unit is not fed.

The plastic protection devices must not be removed from connectors J8 and J9 for any reason whatsoever.

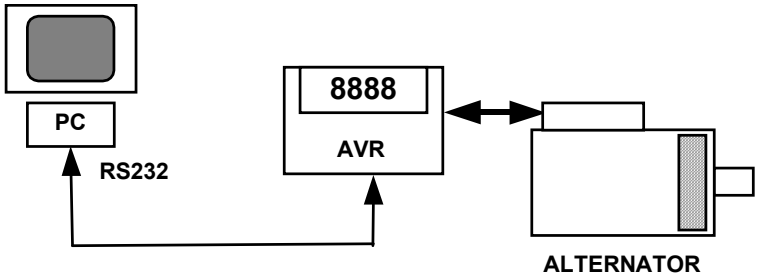
GENERAL INFORMATION

1. System architecture

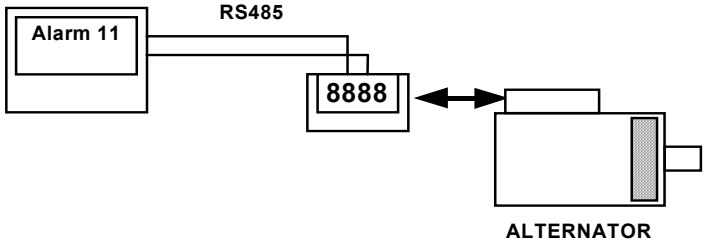
Two components are necessary for complete system functionality: the DIRCI04 regulator (control unit) and a supervising unit (optional) as shown in figure 1.
The DIRCI04 regulator holds, in particular, all the terminals for connections with and from the electric generator, the screen, the communication port and the control software.
The supervising unit can be a personal computer, another "synoptic" device or both. Control is not carried out in real time, but permits programming and visualisation of all the DIRCI04 regulator functional parameters.



Stand-Alone Regulator



PC connected to the regulator by way of an RS232 line



Regulator with synoptic panel connected by RS485 line.

fig. 1

1.1 Regulator

As it is set for controlling many types of generators and for a variety of configurations, the regulator must be correctly configured. The majority of the settings is saved in an integrated non volatile memory (EEPROM). A default configuration is present when the regulator is switched on for the first time, therefore, the most requested characteristics are met, which eases board installation. The regulator holds a four digit 7-segment display, where the output voltage, the type of operation and the eventual alarms are shown.
The regulator has an RS232/485 port, through which it is possible to set the parameters (both configuration and operative) and "monitor" generator operation. The regulator implements a subset of the standard ModBus for serial communication, therefore the regulator carries out a "slave" function, the address of which is held in EEPROM and is set during the configuration phase.
Given the typology of the communication bus, more than one regulator can be connected (therefore more generators) in parallel to the same 485 bus, in order to monitor operation with a single supervising unit.

1.2 Synoptic supervising system

The controller has a standard RS485 connection and communicates by way of a subset of the ModBus protocol. In this manner it is possible to access memory registers which control regulator operation.
The "master" unit, made up of a PC or other equivalent apparatus, can access the parameters and regulator operation.
The master unit can:

- repeat or display the generator state sizes, even from a distance
- set values or activate different operation modes (e.g. PFR)
- programme all the parameters
- carry out interface conversion with other field buses or communication networks.

2. Technical characteristics

- Completely digitally controlled regulator, based on DSP
- Installation on board the machine
- Suitable for all self-regulating alternators
- Supply voltage: 30Vac ÷ 280Vac (from auxiliary winding, output voltage or PMG)
- Frequency operation interval: 12Hz ÷ 72Hz
- "Sensing" of the voltage with measurement of the true effective value or the average value (0-900Vac)
- Maximum direct current at output: 5Adc; up to 15Adc during transients
- Precision of the voltage regulation: ± 0.25% from no load to nominal load in static conditions with any power factor and for frequency variations included between -5% and +20% of the nominal value.
- Transient voltage droop and overvoltage within ± 15%
- Voltage reset time: ± 3% of the value set in less than 300 msec.
- Transient overvoltage at starting: less than 5% of the nominal voltage
- Single phase or three phase "sensing", also on the phase with load
- Regulation at minimum, maximum or average voltage of the three phase voltages
- Parameters: VOLT, STAB, AMP, Hz, settable with trimmers (default), 50/60Hz with "jumper" (default); all the values can also be programmed via software
- Possibility of analogic remote control of the output voltage by way of external voltage (-5Vdc ÷ +5VDC) or with potentiometer
- Visualisation of the parameters and the operating conditions from a 7-segment display
- RS232 and RS485 serial communication interfaces
- Ambient temperature: -25°C - +70°C
- Under frequency protection with adjustable threshold and slope
- Overvoltage and undervoltage alarms with adjustable limits
- Excitation over-current protection with delayed intervention
- Transient short circuit handling (starting asynchronous motors)
- Signalling of winding overheating (optional module)
- Fault finder on the rotating diode bridge (currently R.B.D.)
- Protection against reference loss
- Insulated protection intervention signalling output
- Saving of the irregular operation conditions (type of alarm, number of events, duration of last event, sum of the times)
- Possibility of working with P.F.R. function (Power Factor Regulator, currently PFR96/A)

3. Inputs and Outputs: technical specifications

J1 CONNECTOR			
Terminals	**Function**	**Specifications**	**Notes**
Aux / Exc+ Aux	Supply	Type : Frequency: Range: Absorption:	Single phase from 12Hz to 72Hz from 30Vac to 280Vac 9VA	Absorption is intended at zero excitation current.
Aux / Exc+ Exc-	Excitation	Type: Continuous reg. Transient reg.	Single phase maximum 5Adc 15Adc at peak	
U+ U-	U phase voltage sensing	Type: Range: Absorption:	Single phase or three phase 10-900Vac, 4 ranges <1VA per phase	Measurement of the average value or effective value for voltage regulation (on the average of the 3, the maximum, the minimum or loaded phases if A.T. are present), reactive power or cosφ
V+ V-	V phase voltage sensing	Range 1: Range 2: Range 3: Range 4:	150V f.s. for 115V-120V 300V f.s. for 230V-240V 600V f.s. for 400V-480V 900V f.s. for 690V	
W+ W-	W phase voltage sensing			
L+ L-	Network phase voltage	Type: Range: Absorption: Range 1: Range 2: Range 3: Range 4:	Single phase 10-900Vac, 4 ranges <1VA 150V f.s. per 115V-120V 300V f.s. per 230V-240V 600V f.s. per 400V-480V 900V f.s. per 690V	Voltage matching and activation at parallel switch closing by way of insulated contact on J5 terminals 1 and 2
B+ GND	Back-up supply	Type: Range: Absorption:	D.C. insulated 22-40Vdc <6VA	Makes it possible to maintain the regulator in a state of permanent blockage after short circuits, even if Vaux<20Veff.

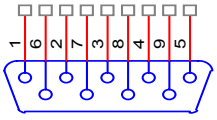
J2 CONNECTOR			
Terminals	**Function**	**Specifications**	**Notes**
1, 2	U phase current	Type: Single phase or three pase Range: $5A_{rms}$ maximum Absorption: < 0,5VA per phase	Effective value for voltage regulation of loaded phase, reactive power, cosφ and for the signalling of phase overload. 5A correspond to the short circuit current
3, 4	V phase current		
5, 6	W phase current		

J3 CONNECTOR			
Terminals	**Function**	**Specifications**	**Notes**
1, 2	Voltage remote control input	Type: Range: Regulation: Absorption:	Uninsulated differential from – 5Vdc to + 5Vdc from –10% to +10% of Vn <1mVA	Programmable output range
3, 5	Stabilised reference voltage output	Tipo Tensione: Corrente:	Uninsulated + 5V at 3, -5V at 5 10 mA	Reference voltage for manual external potentiometer
4, 6	Common	Tipo: Corrente:	Uninsulated 10 mA	Common for manual external potentiometer

J4 CONNECTOR			
Terminals	**Function**	**Specifications**	**Notes**
1, 2	RBD setting or Voltage Matching activation	Contact type: Uninsulated - 2 = GND Current: 0,2 mA	Blockage/Signalling setting in case of rotating bridge breakage or, alternatively, activation of voltage matching(1)
3, 4	Low speed protection or PFR activation	Contact type: Uninsulated - 4 = GND Current: 0,2 mA	Selection of the under frequency protection threshold 50·(1-0, 1·α_{Hz}) or 60·(1-0, 1·a_{Hz}) α_{Hz} is the position of the Hz trimmer or the P22 parameter or, alternatively, activation of regulation of the cos φ or the reactive power(1).
5, 6	Parallel switch closure	Contact type: Uninsulated - 6 = GND Current: 0,2 mA	Enabling of PD functioning

1) For function details of inputs on connector J4, see pag. 37.

J5 CONNECTOR			
Terminals	**Function**	**Specifications**	**Notes**
1,2	PSw_En	Contact type: Uninsulated Current: 100mA Voltage: 30V	Parallel switch enabling contact
2,3	APO	Contact type: Uninsulated Current: 100mA Voltage: 30V	Active protection output contact
5, 6	PW_OUT	Type Non isolato - 6 = GND Voltage: PWM from 0 to 5Vdc Duty cicle from 0 to 50% Current: 10 mA	PWM signal proportional to the delivered active power, a duty cycle of 50% corresponds to the nominal power of the machine (at least one C.T. is necessary)

J6 CONNECTOR				
	Pin N°	**Function**	**Description**	**Notes**
 J6 SUB-D9/F	1	Reserved		Do not connect
	2	232 - TX	RS 232 TX - Insulated	Setting of the parameters from PC and for software updating
	3	232 - RX	RS 232 RX - Insulated	
	4	Reserved		Do not connect
	5	232/485 - GND	Common RS232/RS485	
	6	485 - B	RS 485 channel B Insulated	Connection to a multipoint network as slave, setting of parameters and reading of the function state.
	7	Reserved		
	8	485 - A	RS 485 channel A Insulated	

J7 CONNECTOR			
Terminals	**Function**	**Specifications**	**Notes**
1-8	Optional module connection		Winding temperatures Optional additional module

TRIMMERS		
Denominazione	**Funzione**	**Note**
VOLT	Trimmer for setting the voltage	Setting ranges from ± 10% of the nominal voltage in one of the 4 ranges. The default setting is 300Vfs for regulation of the 230V/50Hz and 240V/60H voltage between the phase and the star centre.
STAB	Trimmer for setting the dynamic response	
AMP	Trimmer for setting the excitation overcurrent protection	See the section entitled “Setting the excitation overcurrent protection”
Hz	Trimmer for setting the under frequency protection intervention threshold	Variation up to -10% of the nominal speed value set by parameter 50/60

4. Block diagram

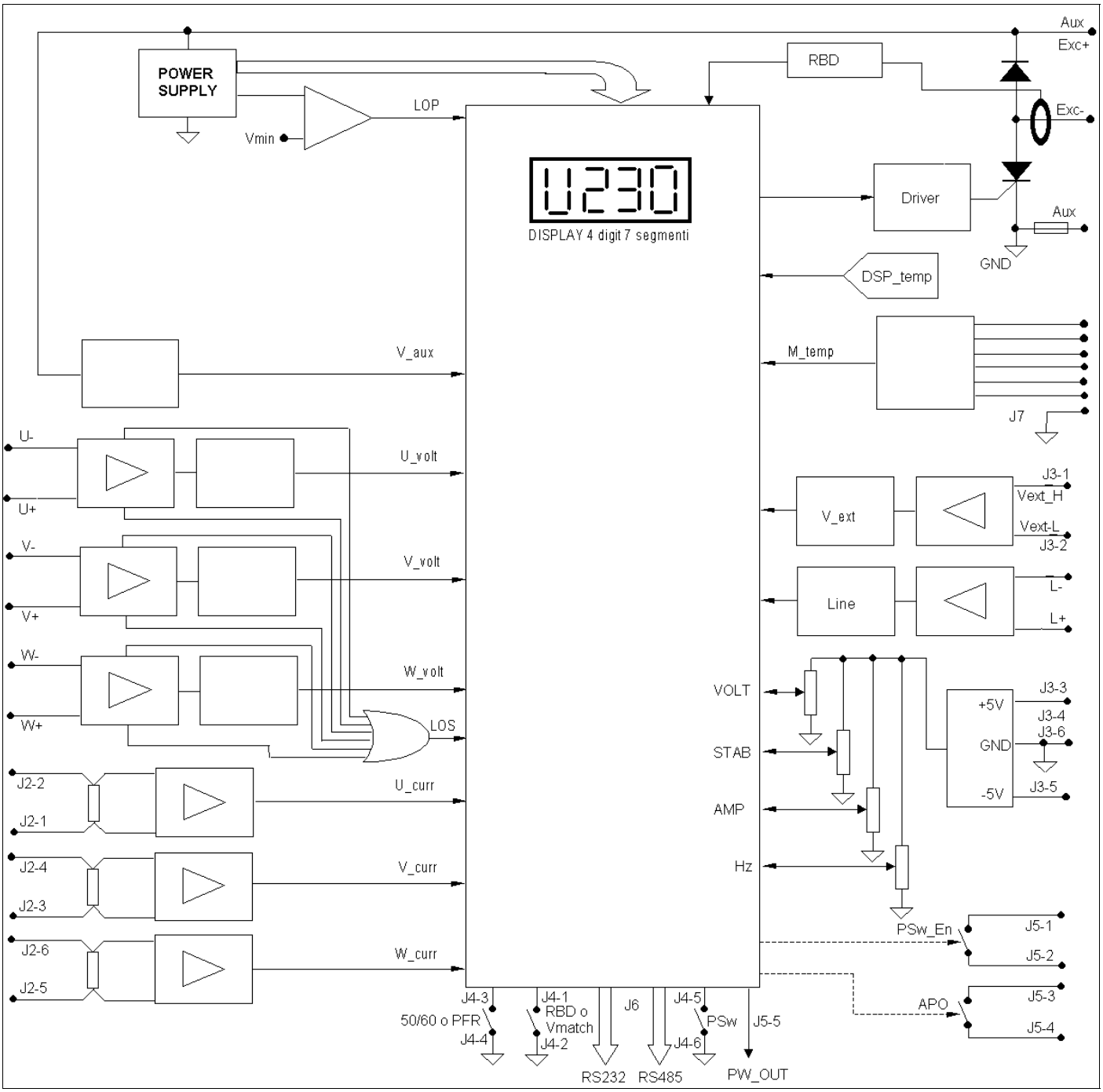


fig. 2

5. General technical specifications

Operation as regulator
Regulation range: 4 (150 V f.s., 300 V f.s., 600 V f.s., 900V f.s.)
Voltage regulation: from 10 to 900V
Thermal drift: ± 0.5% with a temperature variation of 40°C in 1 hour
Response time: less than 300 msec. (within ± 3% of the set voltage value)

V/Hz characteristic:

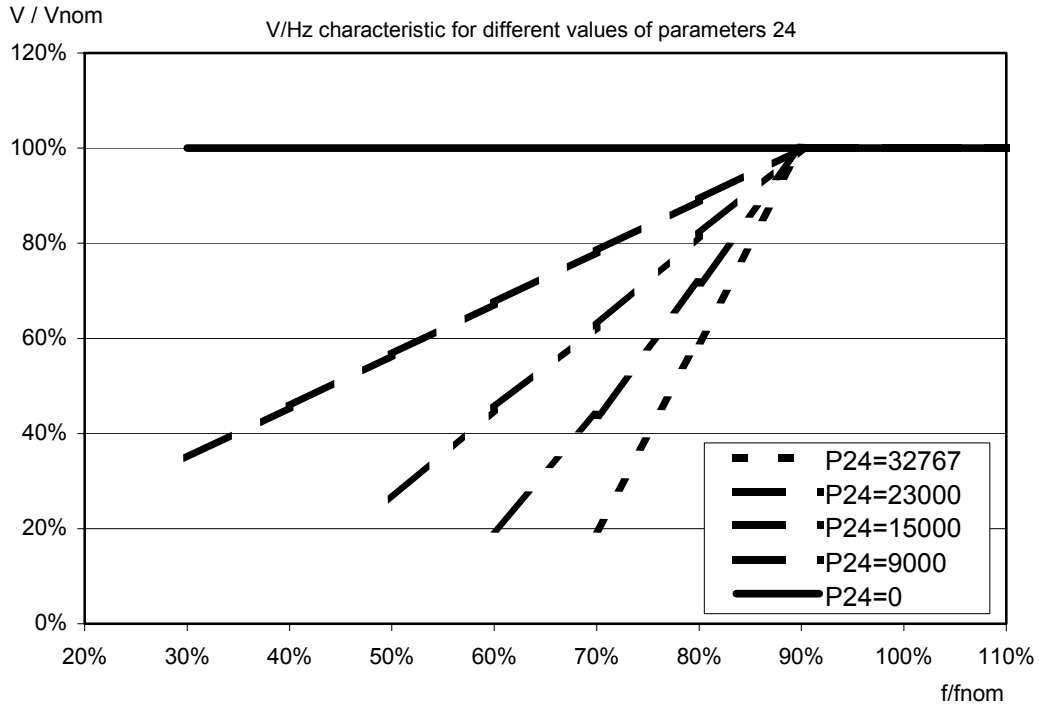


fig. 3

DIRCI04 regulator operation is not specified below 12Hz.

Slope: from 0 to 4 (see fig. 3)
Values: 32767
Frequency threshold: settable within ±10% of the nominal frequency (from 40Hz to 50Hz for a nominal frequency of 50Hz, from 48Hz to 60Hz for a nominal frequency of 60Hz).

Regulating the reactive power (Var)
Regulation range: from 0 to nominal current
Values 32767

Functioning as a PFR
Regulation range: cosφ from 0 to 1
Values 32767

Parallel compensation (PD)
Fall regulation range: from 0 to 5%
Value: 32767

Phase overcurrent alarm
Phase overload range: from nominal current to double the nominal current
Values 32767
Delay Time: Instantaneous

Overload alarm
Overload is determined by the output of a function I x t on each of the three currents, accumulating only the excess of the phase current as to the nominal value (see figure 4).
The confrontation threshold is fixed, while the changeable parameter is the discharge resistance R (parameter 32). With the Ksvr, C and Threshold values set, the alarm intervention specification is respected after around 20 seconds with 300% of In.
Varying the resistance parameter takes into account the ability to dispose of heat, which can vary according to the machine. The parameter influences the minimum alarm intervention threshold, which is greater than 100% of In. The alarm protects single phases, therefore, it activates even if only one phase is overloaded.

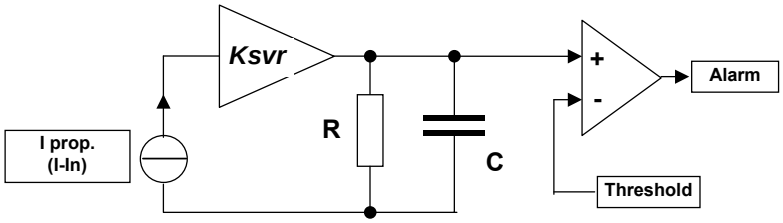


fig. 4

Field: from 65000 to 65535
Values: 535

Overvoltage alarm
Overvoltage threshold: +5% of the set voltage
Delay time: 2 sec.

Soft-Start function (only in the voltage regulator mode)
Time regulation range: from a period to infinite (no variation)
Values: 1000

Voltage Matching
Precision: the voltage of the generator follows the line voltage with a default of less than 1%.

N.B.: An C.T. must be used to regulate the reactive power and the power factor and to compensate the parallel, as well as for the phase overcurrent and overload alarms.

INSTALLATION

When you receive the digital regulator, check that no damage has been caused during transportation and apparatus movement. If any forms of damage can be seen, please inform the shipping agent, the insurance company, the retailer or Mecc Alte immediately. If the regulator is not installed immediately, keep it stored it in its original packaging in a clean and dry place.

The regulator is normally installed in the generator terminal box. It is fixed using six screws (M4x30) and it must be assembled where the room temperature does not exceed the required environment conditions. Refer to the enclosed diagrams to see the overall dimensions. Pay attention during assembly, not to damage the components which are not covered by resin, in particular the Amp trimmer, the J2 and J5 connectors and the L23 component.

1. Overall diagram

View from the lower side

dimensions in mm

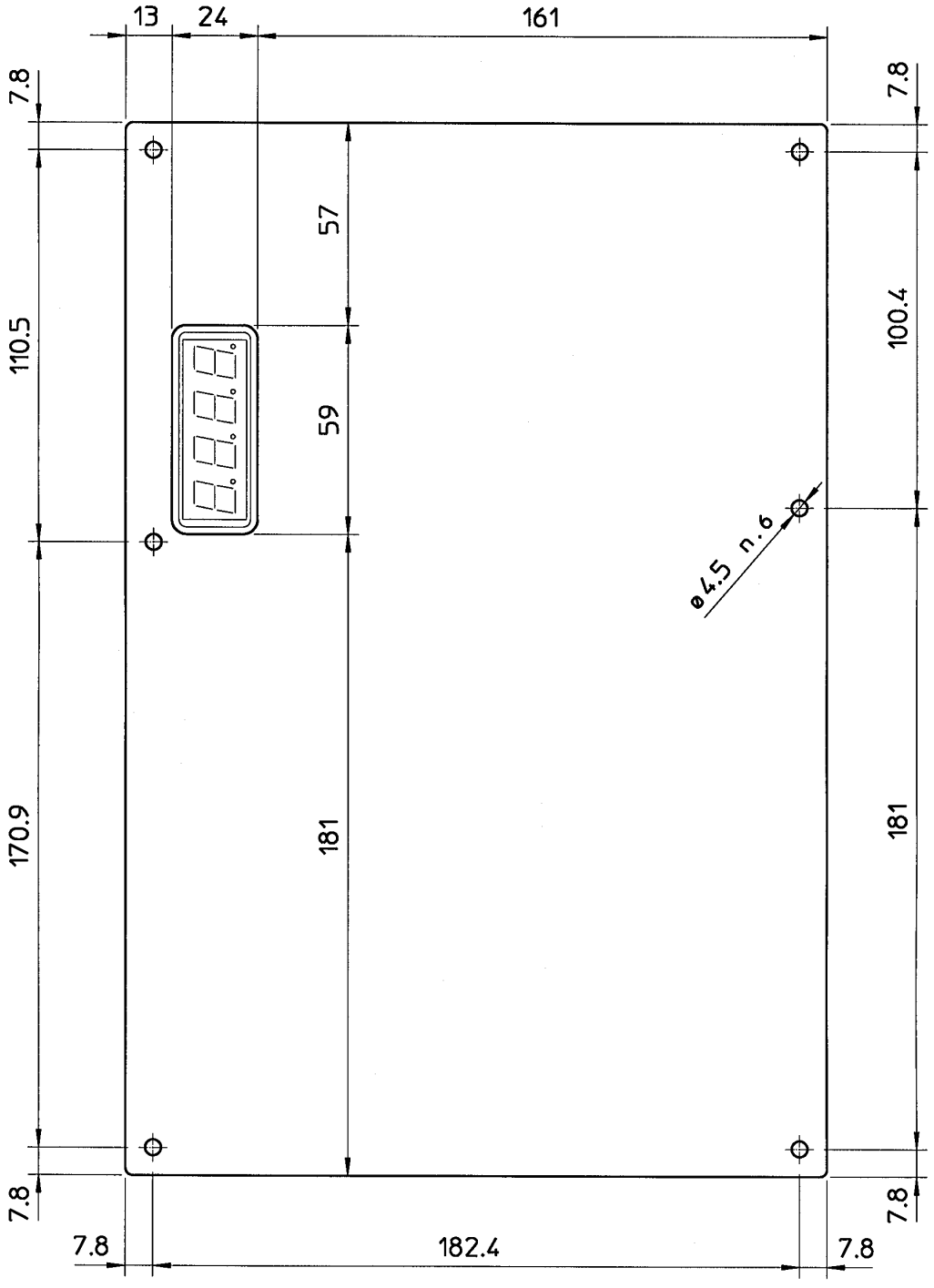
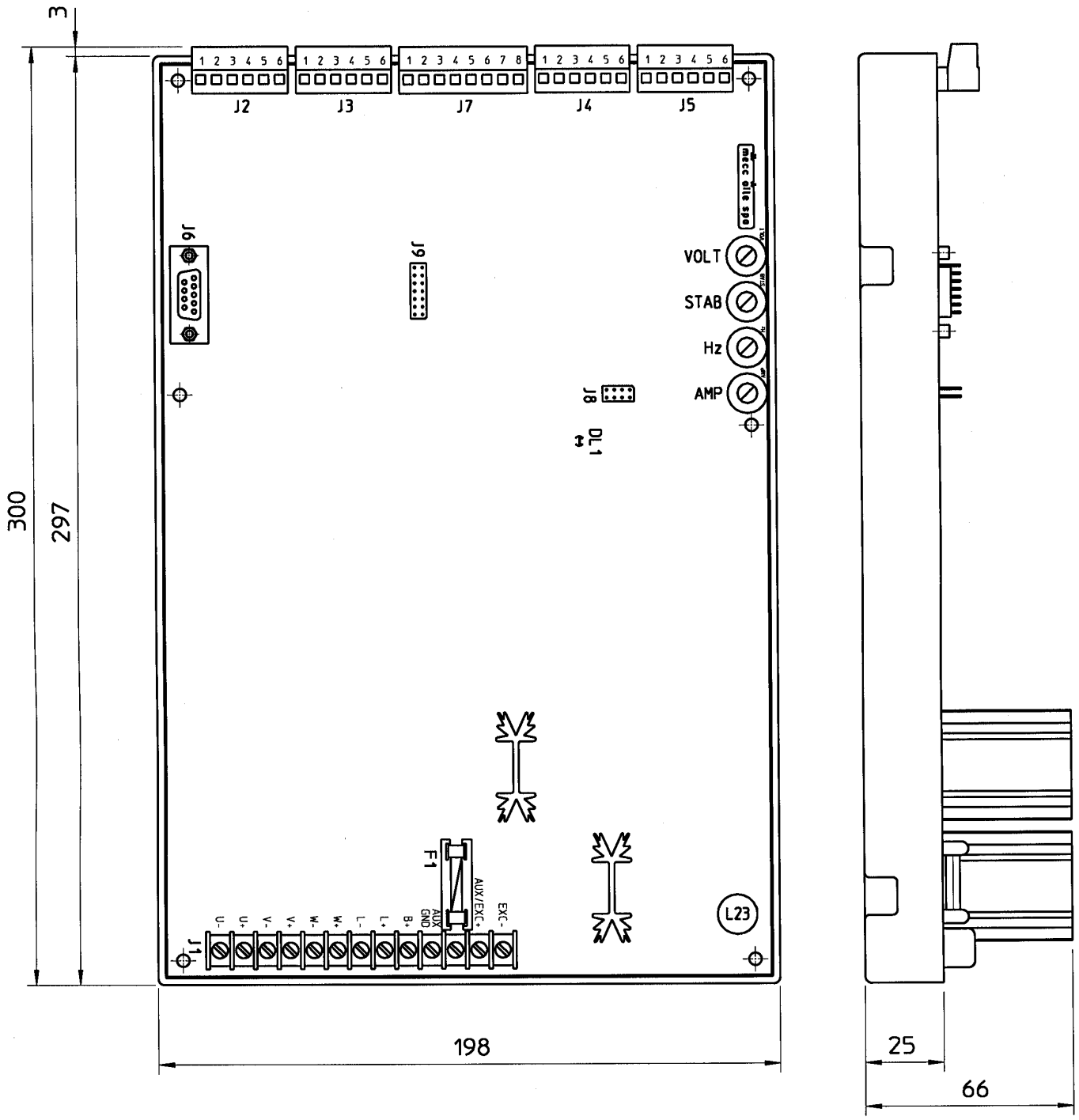


fig. 5

dimensions in mm

View from top side



Details of J1 connector

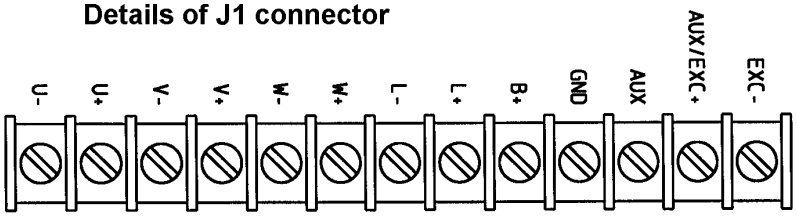


fig. 6

2. Connections

The connections going towards the digital regulator depend on the use of the device and the excitation system.

Connection errors may seriously damage the unit.
Carefully check and make sure that all connections are exact. Follow the enclosed diagrams before powering the unit.

3. Terminals

All terminals are situated in the upper part of the regulator.
Figure 6 shows the connection terminals. When connecting use cables with the following minimum sections:
-) for power cables (exc-, aux/exc+, aux) and for the connections to J2: **1.5 mm²**
-) for signal cables: **0.75 mm²**

4. DIRCI04 connections for typical applications

Diagrams SCC0004, SCC0005, SCC0010, and SCC0011 show DIRCI04 regulator connections for the most typical applications.

The SCC0004 diagram shows: 6-terminal connection to a generator with three phase sensing, measurement of the current of each of the three phases and connection of an optional external potentiometer.

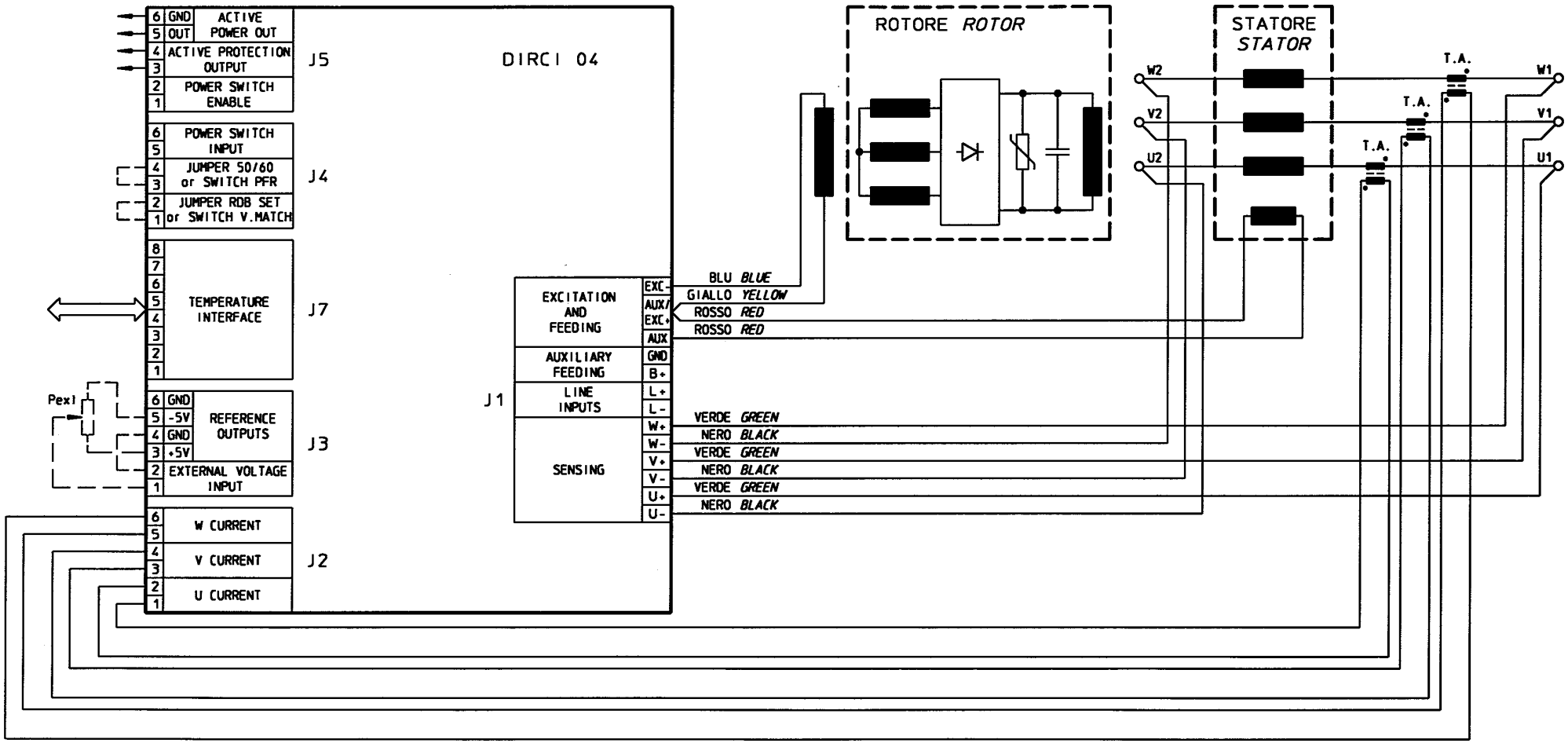
The SCC0010 diagram shows: 12-terminal connection to a generator with three phase sensing, measurement of the current at each of the three phases and connection of an optional external potentiometer.

The SCC0005 diagram shows: a simplified connection with three phase sensing, without measurement of the phase current (therefore without overload alarm and without the possibility of regulating the loaded phase).

The SCC0011 diagram shows: connection with single phase sensing (can be used both with three phase generators and single phase generators), with optional measurement of the phase current (therefore with overload alarm and possibility of regulating the loaded phase only if the current measuring device is present).

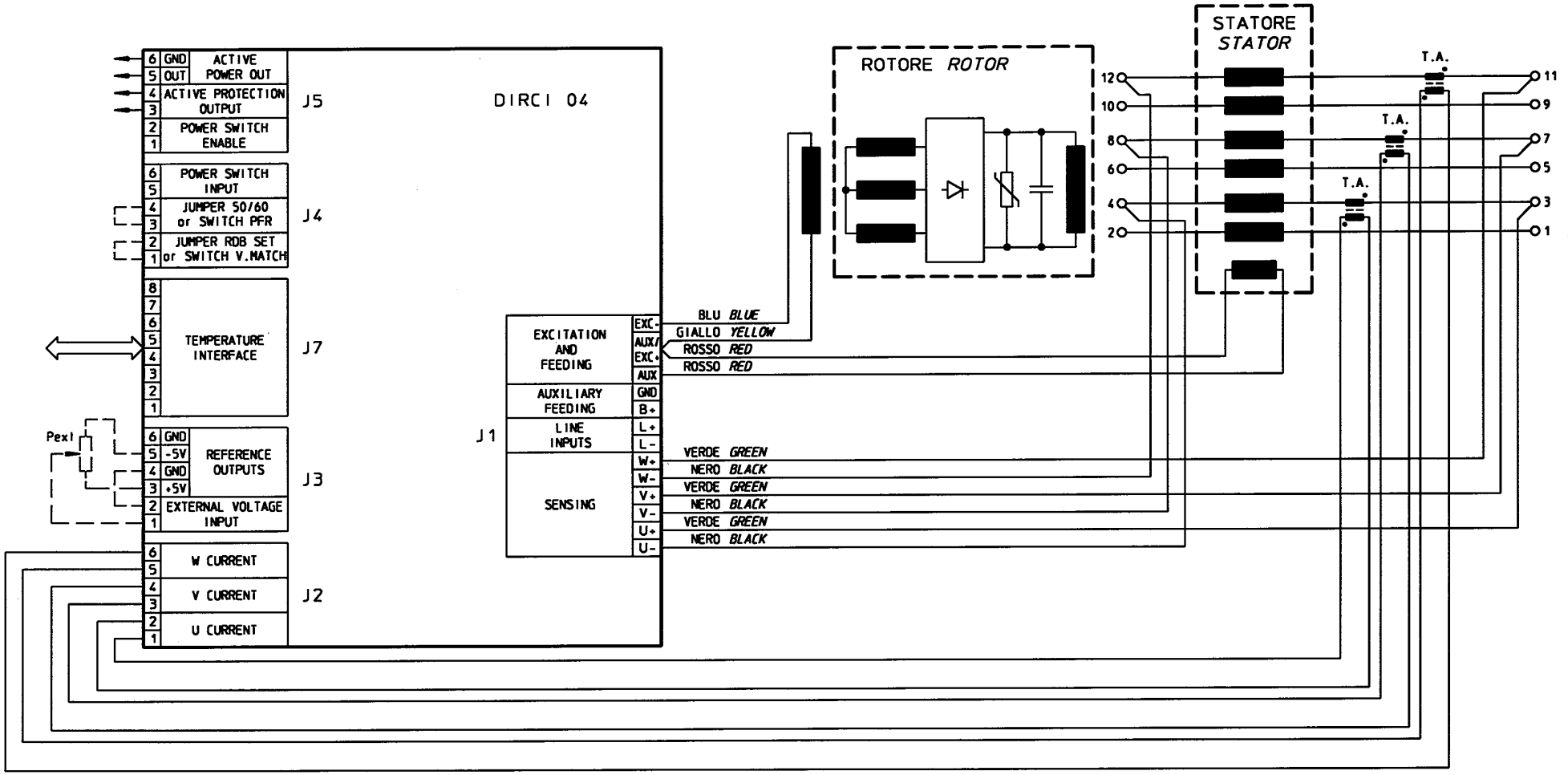
5. WIRING DIAGRAM

Complete three phase connection, 6 terminals



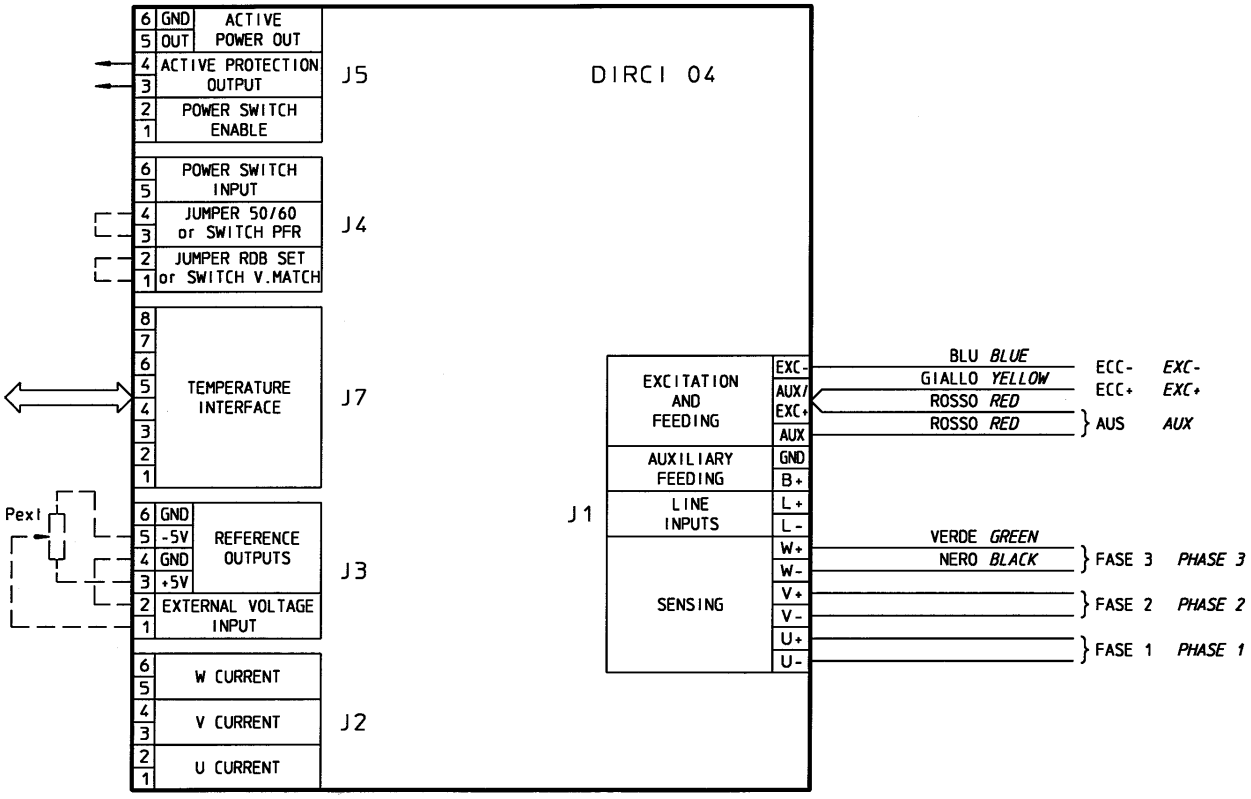
SCC0004

Complete three phase connection, 12 terminals



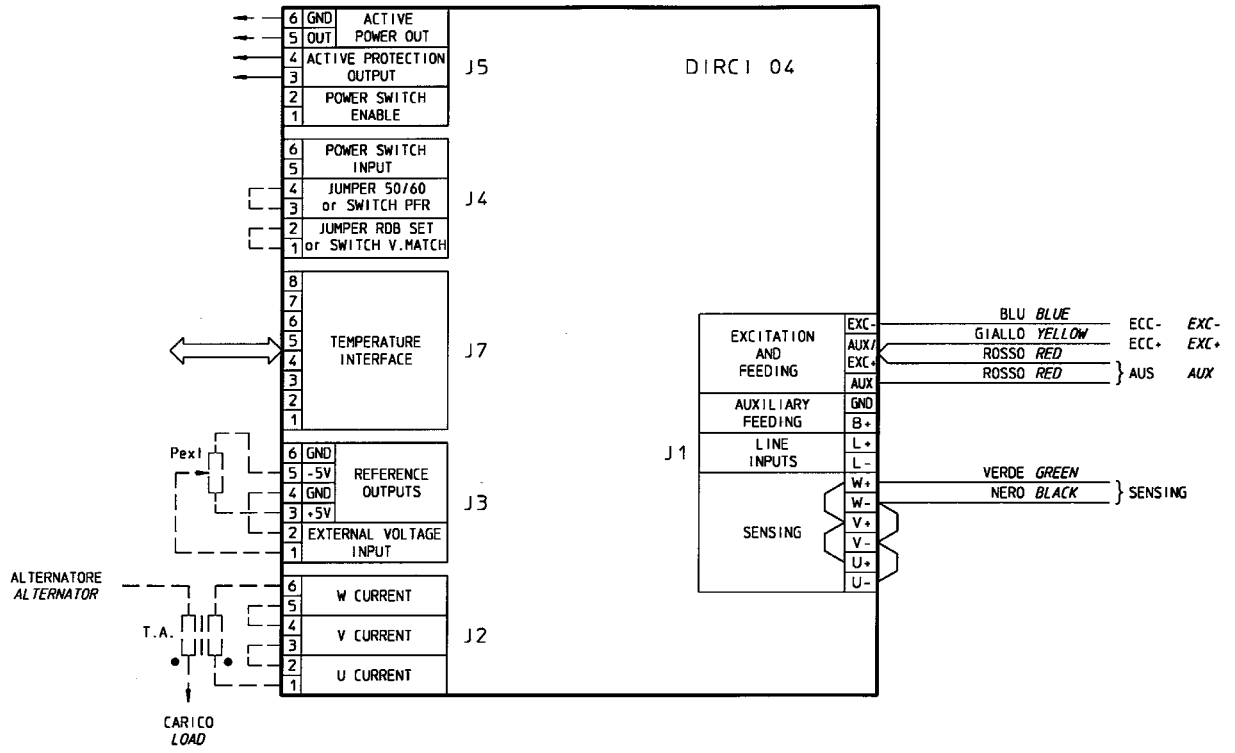
SCC0010

Three phase sensing without overload alarm and regulation of phase with load



SCC0005

Single phase sensing



SCC0011

6. Regulator Settings

See block diagram on page 8, fig. 2

6.1. Alternator Voltage signals

Terminals U-, U+, V-, V+, W- and W+ of connector J1 are used for the voltage sensing.
The signals U_volt, V_volt, W_volt represent the 3 voltage phases acquired by the control.
Gain of channels can be selected by way of the voltage set point set on 4 different scales :
150V f.s. (for the 115V-120V setting), 300V f.s. (for the 230V-240V setting), 600V f.s. (for the 400V-440V-460V-480V setting), 900V f.s. (for the 690V setting).

Depending on the voltage regulation mode you must use the correct control variable.
Summarised chart of variable :

Regulation on:	average value	rms value
Minimum	min (U_u^{AV}, U_v^{AV}, U_w^{AV})	min (U_u^{rms}, U_v^{rms}, U_w^{rms})
Medium	(U_u^{AV} + U_v^{AV} + U_w^{AV})/3	(U_u^{rms} + U_v^{rms} + U_w^{rms})/3
Maximum	max (U_u^{AV}, U_v^{AV}, U_w^{AV})	max (U_u^{rms}, U_v^{rms}, U_w^{rms})

The data acquired are also used for the overvoltage and undervoltage alarms and for the reactive power or of the power factor control.

6.2 Calibrating the U, V, W channels

To compensate any tolerances which could be found in the analogic voltage acquisition channels, calibration of these channels could be necessary.
Calibration could be necessary every time there is a scale switching due to a change in the previously set nominal voltage (e.g. Vnom=230 means the use of the 300Vf.s. scale, Vnom=115V means the use of the 150Vf.s. scale)

1. Write 0 on address 20
2. Disable Trimmers (from the **Configuration** Menu)
3. Disable Vext (from the **Configuration** Menu)
4. Check that Line is disable (write 4 on address 88)
5. Disable the short circuit alarm (write 1 on address 34)
6. Set regulation on maximum (write 2 on address 9)
7. Set voltage to its nominal value (address 10)
8. Set regulation on its average value or on the rms value (from the **Configuration** Menu)
9. Put the 2 NON calibrated channels in short circuit
10. Connect the phase under measurement to the channel to be calibrated
11. Measure voltage by means of an instrument suitable for the kind of regulation you are making (at average value or at real effective value)
12. Set the value of the data shown on address 12 (13,14) until the value of the voltage measured by the instrument reaches the nominal value (preset at point 7), keeping in mind that an increase in the preset value will diminish the preset voltage and vice-versa.
13. Repeat points 9-13 for the other 2 channels.
14. To make sure that the voltage visualised on the display is the same one measured at point 12, calibrate the value of the data on address 15.
15. Remove short circuit (point 9) from the 2 channels.
16. Set regulation to the average, or to the minimum or to the maximum (write 0, 1 or 2 on address 9).
17. Reset short circuit alarm: write 0 on address 34
18. Activate trimmers you want to be active (from the **Configuration** Menu)

6.3. LOS (Loss of Sensing) Signal

The LOS (Loss of sensing) signals the loss of one of the voltage measuring channels; if at least one of the 3 inputs is open, the signal changes status, it signals the loss of reference and the corresponding alarm is activated.

6.4 Current Signals

Terminals from 1 to 6 of connector J2 are used to measure the phase currents. The system foresees the use of an C.T. with primary winding included between 3 times to 6 times the nominal current and secondary $5A_{rms.}$ The U_curr, V_curr and W_curr signals represent the 3 currents of the phase acquired by the control. The gain of the channels is fixed, it involves the full scale value with a current of $7,5A_{pk}$.
The acquired data are used to:
-) determine which phase is supplying the maximum current in case of voltage regulation on the charged phase
-) calculate the output power
-) signal the overcurrent alarm of the phase
-) check the reactive power or the cos φ

6.5 Zero setting of current acquisition channels

To compensate any existing tolerances in the analogic current acquisition channels it could be necessary to perform the zero setting of these channels.

1. Disconnect all cables from connector J2.
2. Read the offset value measured in addresss 92, 93 and 94.
3. Write this value on addresss 37, 38 and 39.

4 Verify zero setting at addresss 71, 72 and 73.

6.6 AT Settings

The system considers the nominal value at the secondary winding of the A.T ($5A_{rms}$) equal to 3 times the nominal current of the machine. Since C.T.s with turns ratio 3In/5A are not always available, it is possible to set the gain of the current acquisition channels with a variable amplification between 1 to 2. The amplification value is written on address 16 and is determined by the following formulae:

$$K_I = \frac{I_1^{TA}}{3 \cdot In} - 1 \qquad P_{16} = INT(32767 \cdot K_I)$$

where the symbols have the following meanings:

I_1^{TA} : C.T. primary nominal current

In : nominal current of alternator
P_{16} : value to be written on address 16

Note: the INT (number) annotation indicates the integer of "number"
Example:
Generator type ECO43-2S/4, 50Hz, power 930kVA, nominal current at 400V 1340Amp.
3In=1340x3 = 4020Amp
You must use a 5000A/5A C.T.

$$K_I = \frac{I_1^{TA}}{3 \cdot In} - 1 = \frac{5000}{4020} - 1 = 0,244 \qquad P_{16} = INT(32767 \cdot K_I) = INT(32767 \cdot 0,244) = INT(7955,15) = 7955$$

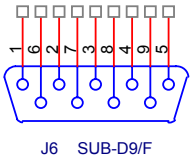
6.7 50/60 or PFR Signal

A jumper placed at the 50/60 input (connector J4, terminals 3 and 4), if enabled by the **Configuration** menu, it implies the switching of the low velocity protection threshold from $50 \cdot (1\text{-}0,1 \cdot \alpha_{Hz})$ to $60 \cdot (1\text{-}0,1 \cdot \alpha_{Hz})$, where α_{Hz} represents the position of the Hz trimmer or the value written on address 22, it also implies the switching of the default voltage from $230V_Y$ to $240V_Y$.
If you disable function 50/60 (from **Configuration** menu) and you write 8 or 24 on address 34, this input will activate regulation of the power factor or of the reactive power (see paragraph 4 on page 36).

6.8 RBD_Set or Voltage Matching Signal

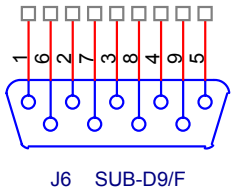
A jumper placed at the RBD_Set input (connector J4, terminals 1 and 2), if enabled by the **Configuration** menu, it implies the switching of the blocking mode to that of a simple signal in case of alarm signalling breakage of rotating bridge. Software disconnection of blocking can be done by setting the 30 (time in RBD) parameter to “0”.
If you disable the RBD_Set function and you write 16 or 24 on address 34, this input will activate the voltge matching to the value seen on the Line input (see paragraph 2 on page 35).

7. RS232 serial communication



Pin N°	Function	Description
2	232 - TX	RS 232 TX - Insulated
3	232 - RX	RS 232 RX - Insulated
5	232/485 - GND	Common RS232/485 insulated

8. RS485 serial communication



Pin N°	Function	Description
6	485 - B	RS 485 channel B insulated
8	485 - A	RS 485 channel A insulated
5	232/485 - GND	Common RS232/485 insulated

The communication protocol is MOD-BUS.

Attention
Serial communication devices must be connected only on pins 2, 3 and 5 for RS232 protocol, only on pins 6, 8 and (optional) 5 for RS485 protocol.
Standard connection cables may cause communication failure and several damages to regulator DIRCI04 and connected devices.

9. PSw input

The PSw input (connector J4, terminals 5 and 6) should be used to connect an insulated contact which signals closure of the parallel switch to the DIRCI04 regulator. When the contact closes a Voltage drop regulation mode activates, equivalent to the actual PD parallel device. This fact is signalled by the appearance of the letter P on the display. The reactive power regulation or cosö modes can only be activated after the aforementioned contact has been closed.

10. PW_OUT Signal

Available on connector J5 (terminals 5 and 6), this uninsulated PWM signal between 0 and +5V refers to the board common (connector J1, Aux terminal) and is proportional to the delivered active power. A duty cycle of δ=0% corresponds to zero active power P=0 kW or operation as a motor (P<0 kW, signalled by the negative power alarm), a duty cycle of δ=50% corresponds to the nominal active power (P=P_N).

11. APO contact

An acronym for **A**ctive **P**rotection **O**utput: insulated contact 30V-100mA, normally open. It closes when any alarm activates.

12. PSw_En contact

Insulated 30V-100mA contact, normally open. It closes to enable parallel switch closure.
Any alarm can be the potential cause of parallel deactivation, with subsequent opening of the parallel if the PswEn contact is correctly handled.
In reality a mask is used (positioned on two adjacent memory locations), where each bit is associated with an alarm, and only the truly involved alarms are activated. The masks can be modified and are saved in the memory at address 27 and 28 (for details, refer to note 6 on page 32).

13. VOLT, STAB, Hz and AMP trimmers

Trimmers are activated via software from the **Configuration** menu. If they are not activated they **DO NOT** carry out any function.
The **Volt** trimmer permits a ± 10% variation of the nominal value set at address 10.
The **Stab** trimmer regulates the dynamic response (statism) of the alternator in transient conditions.
The **Hz** trimmer permits a ± 10% variation of the nominal speed value set by the 50/60 jumper (if active) or in the 50/60 box in the **Configuration** menu (at 50 H the threshold can be set at from 40 to 50 Hz, at 60 Hz the threshold can be set from 48 to 60 Hz).
The **Amp** trimmer regulates the intervention threshold of the excitation overcurrent protection.

14. Line input

14.1 Line voltage signal

Terminals L- and L+ of the connector J1should be used to measure the line voltage or the voltage of another alternator. This measurement is used for voltage matching (generally before closing the parallel) and can be activated by writing 2 on address 88 (can be deactivated by writing 4 again on address 88).

14.2 Line channel setting

The channel may need to be set in order to compensate possible tolerances that may exist in the analogic acquisition channel of the line voltage.
Setting may be necessary each time there is a scale switchover following a variation of the set nominal current (e.g. Vnom=230V implies use of the 300V f.s. scale, Vnom=115V implicates use of the 1500V f.s. scale).

1. Make sure that the Line has been disabled (write 4 on address 88)
2. Disable the short circuit alarm (write 1 on address 34)
3. Set regulation at maximum (write 2 on address 9)
4. Enable RBD_Set from the Configuration menu
5. Set the regulation on the average value or the rms value (from the Configuration menu)
6. Short circuit 2 channels
7. Connect the measuring phase to the remaining channel
8. Connect the line to be followed to the Line channel
9. Measure the voltage at line input, using an instrument suitable for the type of regulation that is being carried out (average value or rms value)
10. Set the value of the datum in address 36 until the value of the voltage measured at address 83 reaches the value measured with the instrument (connected between the L- and L+ terminals of the J1 connector), keeping in mind that an increase in the set value causes a proportional increase of the voltage measured by the regulator.
11. Activate Line using the “V. Match ON” key and verify that the measured voltage (on the display and at address 91) is equal to the line voltage (address 83)
12. Deactivate Line using the “V. Match OFF” key
13. Remove the short circuit (point 6) from the 2 channels
14. Set regulation at average, minimum or maximum (write 0, 1 or 2 on address 9)
1. Reactivate the short circuit alarm by writing 0 on address 34.

15. Vext Input

The Vext input at the head of connector J3 (terminals 1 and 2) permits analogic remote control of the output voltage by way of continuous voltage from -5V to +5V and with a variation range that can be programmed until ± 10% (in parameter 11, default, the setting is ± 5%) of the set value. Should a potentiometer be used, connect its laterals to the -5V and +5V outputs (connector J3, terminals 5 and 3), the Vext_L input (connector J3, terminal 2) to GND (connector J3, terminal 4 or 6) and the Vext_H input (connector J3, terminal 1) to the cursor, as shown in the attached diagrams SCCxxxx.

16. Signals of connector J7

An additional, optional module can be connected to connector J7, making it possible to collect signals coming from 3 PTCs or 6 PTCs or, alternatively, the signals coming from 3 PT100s or, again, those coming from 3 PT100s and those coming from 3 PTCs that can be used for measuring the temperature of the windings.

The following can be used:

- 3 PTC “Ziehl K150”, or
- 6 PTC “Ziehl K150”, or
- 3 PT100 “Ziehl Tf101/U”, or
- 3 PT100 “Ziehl Tf101/U” and 3 PTC “Ziehl K150”.

17. Regulator display

The regulator has a display of four 7-segment LED numbers which show: the output voltage, the type of operation and the alarms. An example is given in table 1.

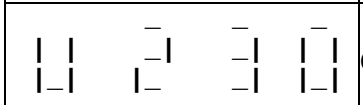
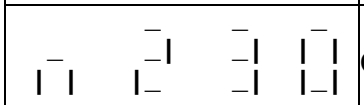
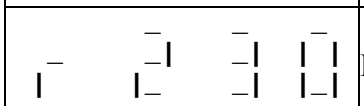
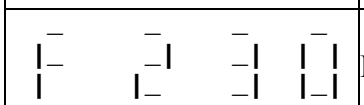
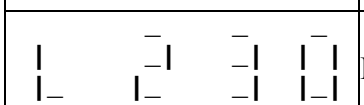
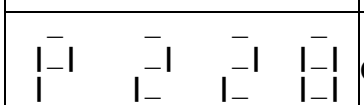
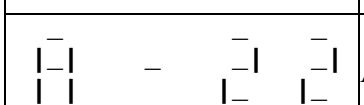
Display	Meaning
	Output voltage, RMS regulation and normal operation
	Output voltage, regulation on average and normal operation
	PFR in reactive power control, output voltage
	PFR in power factor control, output voltage
	Line voltage (voltage matching on line activated)
	Output voltage, parallel switch closed, voltage drop active
	Alarm 22

Table 1 – Example of messages on display

The screen flashes whenever an alarm activates. In the presence of more than one alarm, they are all displayed but in succession with a pause of 2 seconds between one alarm and the next.
The subject of alarms is described more specifically later on in this manual. Given the limited energy available during the starting phase, the display remains switched off up to 20 Hz (the same thing happens during the switching off phase). Only one decimal point remains active to signal operation of regulator.
In addition to the 4 digit display, there is another fault LED on the upper section. This LED flashes during normal operation, but it remains permanently lit when processor is powered but in a reset mode, or when a fault occurs.

SERIAL CONNECTION

The regulator has an RS485 type serial interface, which supports a subset of ModBus protocol commands and makes it possible to insert, whenever necessary, the regulator in a network with other regulators or with other devices of a different type but with the same type of bus. If a detailed description of the ModBus commands used is necessary, please contact the technical office.
The following functions can be carried out with serial connection:

- Setting the parameters
- Reading the state (alarms, data measured)
- Setting references
- Reading alarm memory data.

ModBus register list

When using serial connection, it is possible to read/insert the parameters and set machine operation. Table 2 on pages 22-23 gives a complete list of the parameters that can be set and which define all the operative conditions of the regulator.

To save the configuration parameters and other data that must not be lost when the generator stops, use an EEPROM memory.

ADD	Parameter description	Range	Default	Description
0	Reserved	16bit	0	Do not use
1	ADDR slave; 0 broadcast	1..31	1	Identifier of the device in the 485 network; the device replies even to 0 address
2	Reserved	16bit	0	Do not use
3	Reserved	16bit	0	Do not use
4	Reserved	16bit	0	Do not use
5	Reserved	16bit	12093	Do not use
6	Shipt P: Proportional gain	0..5	4	n = 0..5 corresponds to a shift to the left of n bit, equivalent to a multiplication by 1, 2, 4, 8, 16, 32.
7	Shift I: Integral gain	0..5	3	
8	Coefficient which ties Ki to Kp	0..32767	16384	Coefficient which ties Ki to Kp in order to have only one “stability” trimmer
9	Type of feedback (way of finding it)[1]	0...4	0	Selects feedback source: average of phases, min, max, loaded
10	Nominal voltage (determines the capacity)	0..8000	2300	Nominal machine voltage, the number includes the first decimal
11	Limitaz. Variat. V_ext (0->0; 32767->10%)	0..32767	16384	Limits the range of the external analogic input
12	Setting coefficient, phase U	6357..6749	6553	Coefficients which make it possible to set the voltage acquisition channels
13	Setting coefficient, phase V	6357..6749	6553	
14	Setting coefficient, phase W	6357..6749	6553	
15	Visualisation setting coefficient	0..32767	31000	Coefficient which corrects the visualisation on the display
16	CT GAIN (K = 1+GAIN_TA; 0->TA nominal)	0..32767	0	Coefficient which makes it possible to set the gain in the phase current measurement. The gain varies from 1 to 2; this make it possible to use an C.T. with a greater capacity
17	Reserved	0..65535	55000	Do not use
18	Reserved	0..65535	14000	Do not use
19	Step limitation reference	1..1000	20	In the case of step variations in the voltage loop setpoint, the move from one value to another occurs in small steps which are added to or subtracted from each network period.
20	Output voltage reference	± 32767	0	Value taken if the VOLT trimmer is inactive 0=>Vnom; from 0 to 32767 =>from Vnom to Vnom + 10%; from 65535 to 32768 => from Vnom to Vnom -10%
21	Stability	0..32767	16384	Value taken if the STAB trimmer is inactive
22	Freq. threshold $\pm$ 10% $freq_{nom}$	± 32767	0	Value taken if the Hz trimmer is inactive 0=>45/54Hz from 0 to 32767 => from 45/54Hz to 50/60H from 65535 to 32768 => from 45/54Hz to 40/48Hz
23	Excitation overcurrent	0..32767	16384	Value taken if the AMP trimmer is inactive (to be set according to the value of the variable at address 89). Read “Excitation overcurrent” paragraph on pages 25-26.

ADD	Parameter description	Range	Default	Description
24	V/F slope	0..32767	9000	Slope of the V/F curve during normal operation. During start-up a dedicated ramp is used, 0 => zero slope, 32767 => maximum slope. See figure 3 on page 9
25	V/F slope at START	0..32767	12000	Slope of the V/F curve during the first start-up. After the low speed alarm frequency threshold has been exceeded, the work ramp is used.
26	PD gain	0..32767	26213	Parallel drop voltage 0=>0 32767 => -5%.
27	Mask 1, parallel opening	16bit	28799[3]	Masks which activate or deactivate parallel opening in alarm cases. Each bit corresponds to an alarm[2]
28	Mask 2, parallel opening	16bit	1152 [4]	
29	Short circuit time	0..255	20	Functioning time with the alternator in short circuit expressed in tenths of a second (from 0.1 sec. to 25.5 sec.). Once this time has passed the regulator stops. 0 deactivates the stop.
30	RBD time	1..32767	30	Functioning time with rotating bridge. Fault expressed in tenths of a second (from 0.1s to 54min).
31	Overspeed 110% $freq_{nom}$ ± 10%	± 32767	0	Variation by ±10% of the overspeed alarm intervention with regard to the default value set 55/66Hz
32	Thermal dispersion coefficient	0..65535	65500	Parameter which simulates alternator cooling in overload conditions.
33	PFR regulator gain	0..32767	2000	Integral gain of the PFR regulator
34	Input configuration connector J4	16bit	0	Set only at 0, 8, 16 or 24.
35	Reserved	0..32767	6553	Do not use
36	LINE channel setting coefficient	0..32767	31000	Coefficient which makes it possible to set the line voltage acquisition channel (31000 corresponds to the unitary gain).
37	Offset current U	± 32767	0	Compensation parameters for the offset of current acquisition channels.
38	Offset current V	± 32767	0	
39	Offset current W	± 32767	0	
40	PFR Reactive Power Reference	± 32767	0	Reactive power reference
41	Cosφ PFR reference	± 32767	6553	PFR reference: Cosφ [0 => cosφ = 1 ; 6553 => cosφ = 0.8]
42[(5)]	Ki excitation overcurrent alarm	0..32767	12287	Integral gain of excitation voltage regulator in case of excitation overcurrent alarm
43[(5)]	Kp excitation overcurrent alarm	0..32767	24575	Proportional gain of excitation voltage regulator in case of excitation overcurrent alarm
44[(5)]	Thermal dispersion excitation overcurrent alarm	0..65535	63600	Thermal dispersion coefficient used by the temperature observer in case of excitation overcurrent alarm
45	Reserved			Do not use
...	...	...	...	...
49	Reserved			Do not use

Table 2

Note

Note:

1. 0: average of the 3 phases; 1: minimum, 2: maximum; 3: regulation on loaded phase (only if C.T. is being used)
2. Contact opening = Alarms active AND Alarm mask, see note 6 in the alarm description table
3. PsW_En activated by alarms from 1 to 7 and from 13 to 15
4. PsW_En activated by "No voltage matching" and "Forced opening of parallel switch"
5. These parameters are available since firmware rel. 2.1

Summary of the addresses used during the setting phase.

Add.	Register	Range	Access	Description
50	Volt trimmer	0...32767	Read only	Position of the VOLT trimmer
51	STAB trimmer	0...32767	Read only	Position of the STAB trimmer
52	Hz trimmer	0...32767	Read only	Position of the Hz trimmer
53	AMP trimmer	0...32767	Read only	Position of the AMP trimmer
54	Display voltage	0...900	Read only	Value of the voltage displayed on the screen
55	State	0...65535	Read only	The bits of the state word have the following meaning: 1,2 Phase used 4 PFR activation command received 8 Stopped : waiting for supply drop 16 PFR active in power factor control mode 32 PFR active in reactive power control mode 64 PSw input active 128 jumper 50/60 input active 256 RBD input active 512 Stop for alarm state 1024 Voltage Matching state (L on display) 2048 Voltage matching received command 4096 PSW_EN active
56	Alarms 1 – 16	0...65535	Read only	Each bit corresponds to an alarm, if equal to 1 the alarm is active
57	Alarms 17 – 27	0...65535	Read only	
...	...	...	...	...
71	U current	0...32767	Read only	r.m.s. current, U phase (Nominal value about 6000)
72	V current	0...32767	Read only	r.m.s. current, V phase (Nominal value about 6000)
73	W current	0...32767	Read only	r.m.s. current, W phase (Nominal value about 6000)
...	...	...	...	...
88	Word commands		Write only	The single bits are interpreted as commands 2 “Voltage Matching” activation 4 “Voltage Matching” deactivation 8 PFR activation 16 PFR deactivation 32 Configure transduction constants 64 RESET Alarm 27
89	Estimated Temperature	0...32767	Read only	Estimation of the temperature of the windings when excited (see par. 3 on page 26)
90	Frequency measurement	0...32767	Read only	Frequency measurement (50Hz = 16384)
92	Average Iu value	0...65535	Read only	Average value of the U current acquisition channel (only for offset zeroing)
93	Average Iv value	0...65535	Read only	Average value of the V current acquisition channel (only for offset zero setting)
94	Average Iw value	0...65535	Read only	Average value of the W current acquisition channel (only for offset zero setting)

Tabella 3

SETTING THE VOLT, STAB, AMP and Hz PARAMETERS

1. Output Voltage

1.1 Setting the output voltage

The output voltage can be set using the trimmer or software. The total range is 10-900 Vac, and 4 different channel gain scales can be selected according to the voltage set point, set with parameter 10:

- **150V f.s.** (for 115V-120V regulation)
- **300V f.s.** (for 230V-240V regulation),
- **600V f.s.** (for 400V- 440V – 460V 480V regulation)
- **900V f.s.** (for regulation at 690V)..

It is possible to vary the working point by ± 10% in three manners:

1. with the trimmer volt, which must be activated from the **Configuration** menu
2. with address 20 (the Volt trimmer must be deactivated from the **Configuration** menu)
3. from the Vext input (connector J3 terminals 1 and 2) by way of continuous voltage from -5V to +5V, if activated from the **Configuration** menu.

The measurement of the effective true or the average value is decided in the **Configuration** menu.
Voltage sensing is threephase: in dissymmetric load conditions, addressr 9 can be used to select whether to regulate the **minimum voltage** (address 9 = 1), the **maximum voltage** (address 9 = 2), or the **average of the three phases** (address 9 = 0). In addition, **the most loaded phase** can be regulated, but C.T.s are necessary (address 9 = 3).

1.2 Single phase connection

Single phase sensing is possible (see diagram SCC0011).
Using a single phase reference, **connect terminals U- V- to W-, and U+ V+ to W+.** Doing this makes it possible to regulate the average of the three phases (address 9 = 0).

1.3 Default settings

The default setting can be used to regulate the rms value on the average of the three phases, with scale at 300Vfs for regulation of 230V/50Hz voltage and 240V/60Hz voltage between the phase and the star centre.

1.4 Voltage matching

It is possible to regulate the output voltage in the **Voltage matching** mode: it can be activated by instructions given in 2.2.3. point. In this case **the reference** comes from the **"LINE"** input (connector J1 terminals L- and L+). The **variation** permitted by the n**ominal value is: ± 10%.** The A24 alarm condition ("Voltage mismatching") occurs when the regulated voltage reaches 110% of $V_{nominal}$ while V_{line} > 110%$V_{nominal}$, or alternatively when in reaches 90%$V_{nominal}$ while V_{line} < 90%$V_{nominal}$, less than the intervention of the other protections. This manner of regulating should be used when using an alternator in a parallel network, like **PFR** (see "Operation like a Power Factor Regulator" on page 34).

1.5 Soft start function

In cases of fast reference variation due to **sudden regulator supply**, return of the alarm that signals loss of the reference before the block, or distanced voltage setting (using the analogue inputs **V_ext** or **Line** or else serial), there is a "soft" variation mode. In reply to a step variation, address 19 determines the speed at which transition is carried out.
A value of 1 creates the slowest possible variation, while a value of above 100 causes an almost immediate variation. A value of 0 deactivates any variation.

2. Stability

2.1 Adjusting stability

The proportional gain (at the voltage error) of the regulator takes its value either from the position of the **STAB** trimmer if activated from the **Configuration** menu, or from address 21, the value of which varies from 0 to 32767. The integral gain depends on the proportional gain according to the value written in address 8 (a value of 0 corresponds to a zero integral gain, a value of 32767 corresponds to an integral gain equal to the proportional one).
Each of the two gains can be multiplied by a coefficient that can take on values of 1, 2, 4, 8, 16 or 32 according to the value written in position 6 (for the proportional gain) and 7 (for the integral gain). This value represents the exponent assigned to base 2 (fixed) to obtain the desired gain (e.g. address 6 = 4 => coefficient = 2^4 = 16).

3. EXCITATION OVERCURRENT

3.1 Description

The DIRCI04 regulator is equipped with a temperature estimator for the excitation windings (mainly rotor). An estimate of the temperature is saved in real time (and can be read) at address 89. The progress of the temperature is of the exponential type (see fig. 7).
Using address 23 or the AMP trimmer, it is possible to define a limit (which causes alarm 7 to intervene) for the excitation current, therefore the temperature.
This alarm not only signals a condition of excess heat, but works actively in the decreasing of the cause. We have, in fact, a regulation loop which takes control of the voltage generated after the set threshold has been exceeded. The action carried out is a reduction of the voltage such as to reduce the excitation current to a value that is compatible with the thermal dissipation capacity of the machine.
The regulation stability during the intervention of the overexcitation alarm is settable by parameters 42 and 43. Default values are suitable for most of machines.

Attention
In case of high magnetic gain of the alternator instability situations could appear during the intervention of the overexcitation protection; therefore it is necessary to act on 42 and 43 parameter values (it is usually enough to decrease the 42 parameter value).

As can be seen in figure 7, when the estimated temperature (represented by the continuous line) reaches the threshold value set in address 23, the reduction set at the excitation current (and the subsequent drop in the generated temperature) causes stabilisation of the temperature around a limit value.

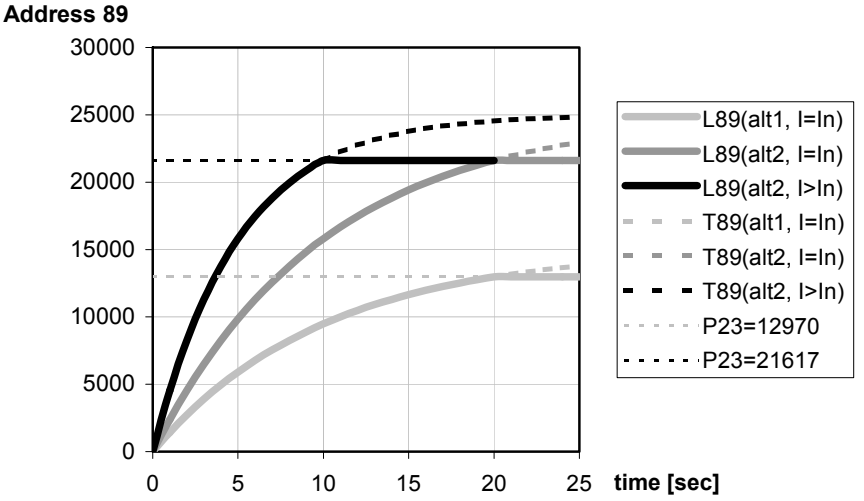


fig. 7

Curve	Description
L89 (alt1, I=In)	The value read at address 89 considering a type of alternator (1)
L89 (alt2, I=In)	The value read at address 89 with a second alternator of a different type (1)
L89 (alt2, I>In)	The value read at address 89 with the second alternator in overload (2)
T89 (alt1, I=In)	The value that would be read at address 89 with the first alternator but without protection(1)
T89 (alt2, I=In)	The value that would be read at address 89 with the second alternator but without protection(1)
T89 (alt2, I>In)	The value that would be read at address 89 with the second alternator in overload but without protection(2)
P23=12970	Represents the value that should be written at address 23 for the first alternator
P23=21617	Represents the value that should be written at address 23 for the second alternator

(1) with nominal load and frequency equal to 90% of the nominal one
(2) with load greater than the nominal one

3.2 Setting with a supervising unit

To set the overload protection, follow the procedure given below:

1) lower the low speed protection threshold by rotating the Hz trimmer fully counterclockwise (if activated by the **Configuration** menu) or by writing -32737 on address 22.
2) Rotate the AMP trimmer fully clockwise (if activated by the **Configuration** menu) or write 32767 on address 23
3) Apply nominal load to the alternator
4) Reduce speed by 10%
5) Read the value of position 89 after 20 seconds from speed reduction
6) Should the AMP trimmer be activated, rotate it counterclockwise until the value of position 53 is the same as the value read at point 5 (position 89). If the trimmer is not activated, insert the value read at point 5 (position 89) into position 23.
7) Alarm 7 should activate (visible both on the Mecc Terminal control panel and on the display) and the voltage should start decreasing
8) Upon returning to normal speed, alarm 7 disappears after a few seconds and the generator voltage increases to the nominal value.

3.3 Setting without a supervising unit

NB: this setting can only be carried out if the AMP trimmer was activated beforehand.
To set the overload protection, follow the procedure given below:

1) Apply nominal load to the alternator
2) Reduce the speed by 10%
3) Rotate the “AMP” trimmer fully counterclockwise
4) After a few seconds, you should see a decrease in the generator voltage value, and alarm 7 should activate (visible on the display)
5) Under these conditions slowly rotate the “AMP” trimmer clockwise until the value of the output voltage is taken to 97% of the nominal value. Alarm 7 is still active.
6) Upon returning to normal speed, alarm 7 disappears after a few seconds and the generator voltage increases to the nominal value.

4. Under frequency

4.1 Description

For speeds that are lower than a settable threshold, the machine voltage is no longer constant but is regulated proportionally to the frequency with a ratio that can also be programmed as shown in figure 3 on page 9. The intervention threshold depends on the following:

- The state of the 50/60 jumper (connector J4 terminals 3 and 4), if activated from the configuration menu
- The state of the 50/60 setting in the same menu
- The position of the Hz trimmer if activated from the **Configuration** menu
- The value written on address 22.

Activation of functioning with voltage proportional to the frequency is signalled by the activation of alarm 14 (visible both on the Mecc Terminal control panel and the display).

4.2 Setting with a supervising unit

To set the low speed protection, follow the indications below:

1) Write 0 on address 34
2) If the machine is to work at 60Hz, make sure that a bridge is inserted between terminals 3 and 4 of the connector J4 if activated from the **Configuration** menu, or else activate 50/60 from the same menu.
3) If the Hz trimmer is active, the protection intervention threshold value can be read on address 52, otherwise it should be immediately written on address 22.
   The value 0 written on address 22 (equal to 16384 read on address 52) corresponds to an intervention at 45/54Hz (according to the activation or not of 50/60).
   Values between 0 and 32767 inclusive at position 22 (equal to values from 16384 to 32767 read at position 52), correspond to an intervention that varies from 45/54 Hz to 50/60Hz.
   Values between 65535 to 32768 inclusive at position 22 (equal to values from 16384 to 0 read on address 52) correspond to an intervention that varies from 45/54Hz to 40/48Hz.
4) When the speed falls below the threshold value, the generator voltage starts decreasing and at the same time the alarm (A-14) is shown on the display and on the Mecc Terminal control panel.
5) Increasing the speed should normalise the generator voltage and the alarm (A-14) should disappear.

4.3 Setting without a supervising unit

NB: this setting can only be carried out if the Hz trimmer and the 50/60 jumper were activated beforehand.
To set the overload protection, follow the procedure given below:

1) Rotate the Hz trimmer fully counterclockwise
2) If the machine is to work at 60 Hz, make sure that there is a bridge between terminals 3 and 4 of the connector J4.
3) Take the generator to a speed that is equal to 90% of the nominal one
4) Slowly rotate the “Hz” trimmer clockwise until the generator voltage starts decreasing. At the same time make sure that the display shows the alarm (A-14)
5) If the speed is increased, the generator voltage should normalise and the alarm (A-14) should disappear
6) Set the speed to nominal value.

HANDLING ALARMS OF REGULATOR

1. Summary table

N.	Event description	Action	J5[6] terminal 1-2	Reset	Saving [1]	Display
1	Eeprom checksum	Default data reset; Block	OFF	OFF/ON	AL, NN	A-01
2	Loss of reference	APO, Block	OFF	OFF/ON	AL, NN	A-02
3	Rotating bridge breakage	APO, Optional Block (delayed)	OFF [4]	OFF/ON	AL, NN, DD, TT	A-03
4	Overvoltage	APO	OFF	AUTO	AL, NN, DD, TT	A-04
5	Undervoltage	APO	OFF	AUTO	AL	A-05
6	Short circuit	APO, Progr. Delay Block	OFF	AUTO - OFF/ON	AL, NN, DD, TT	A-06
7	Excitation overcurrent	APO, Excitation current reduction	OFF	AUTO	AL, NN, DD, TT	A-07
8	U phase overcurrent [3]	APO	ON	AUTO	AL, NN, DD, TT	A-08
9	V phase overcurrent [3]	APO	ON	AUTO	AL, NN, DD, TT	A-09
10	W phase overcurrent [3]	APO	ON	AUTO	AL, NN, DD, TT	A-10
11	Overload	Delayed APO (2)	ON	AUTO	AL, NN, DD, TT	A-11
12	Temperature limit (70°C)	APO	ON	AUTO	AL, NN, DD, TT	A-12
13	Overheating (85°C)	APO, Regulator block	OFF	OFF/ON	AL, NN	A-13
14	Under frequency	APO	OFF	AUTO	AL [5]	A-14
15	Overspeed	APO	OFF	AUTO	AL, NN, DD, TT	A-15
16	Thermal probe loss	APO, ignore alarms from 17 to 22	ON	AUTO	AL, NN, DD, TT	A-16
17	Probe 1 overheating [3]	APO	ON	AUTO	AL, NN, DD, TT	A-17
18	Probe 2 overheating [3]	APO	ON	AUTO	AL, NN, DD, TT	A-18
19	Probe 3 overheating [3]	APO	ON	AUTO	AL, NN, DD, TT	A-19
20	Probe 4 overheating [3]	APO	ON	AUTO	AL, NN, DD, TT	A-20
21	Probe 5 overheating [3]	APO	ON	AUTO	AL, NN, DD, TT	A-21
22	Probe 6 overheating [3]	APO	ON	AUTO	AL, NN, DD, TT	A-22
23	Capacity load [3]	APO	ON	AUTO	AL, NN, DD, TT	A-23
24	No voltage matching	APO	OFF	AUTO	AL [5]	A-24
25	Negative Power [3]	APO	ON	AUTO	AL, NN, DD, TT	A-25
26	PFR out of range	APO	ON	AUTO	AL, NN, DD, TT	A-26
27	Forced parallel opening	APO	OFF	OFF/ON	AL, NN	A-27

The state of the active alarms is saved in address 56 and 57, which can be read by way of serial.
The index of the bits that present a value of 1 corresponds to the active alarm.

Address 56															
B_{15}	B_{14}	B_{13}	B_{12}	B_{11}	B_{10}	B_9	B_8	B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1
32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

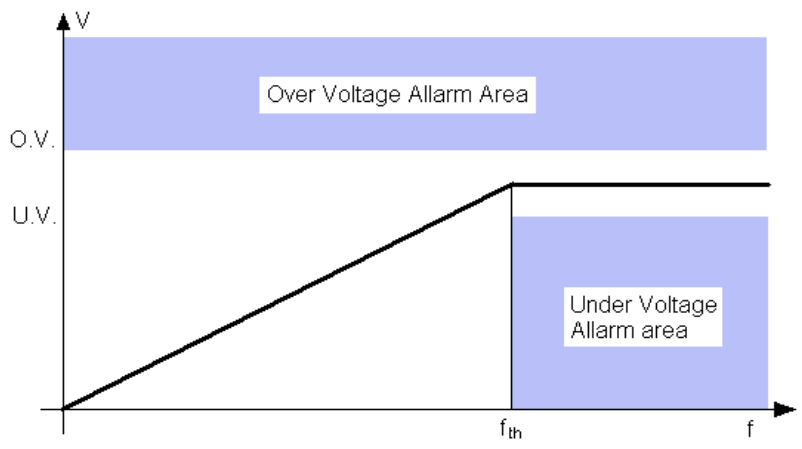
Address 57															
B_{15}	B_{14}	B_{13}	B_{12}	B_{11}	B_{10}	B_9	B_8	B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
-	-	-	-	-	A_{27}	A_{26}	A_{25}	A_{24}	A_{23}	A_{22}	A_{21}	A_{20}	A_{19}	A_{18}	A_{17}
32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

EXAMPLES

Example 1:
Address 56 = 8192_{10} = 0010000000000000_2 means that bit B_{13} is at 1 therefore only alarm A14 is active.

Example 2:
Address 56 = 198410 = 1024+512+256+128+64 = 0000011111000000_2 means that the bits from B6 to B10 are at 1 therefore alarms A7 to A11 are active.

2. ALARMS DESCRIPTION

N.	Event description	Action
1	Eeprom Checksum	This goes into action once the Regulator is switched on. The actions are: loading of default settings, saving, and blocking of regulator while awaiting switching off. When switched on again, if memory is faulty, the alarm will be active again, otherwise, the regulator will start operating with default parameters. The alarm is signalled and saved (default), and this causes opening of parallel switch(6)
2	Loss of reference	The alarm is almost instantaneous. When the LOS alarm activates, the regulator goes into a safety block. The alarm is signalled and saved (default), and this causes opening of parallel switch.(6)
3	Rotating bridge breakage	The alarm is displayed immediately. If configured for the blocking, after a time that can be programmed in address 30 (at steps of 1 second), the regulator goes into a safety block and (default) this causes opening of parallel switch(6). If 0 is written on address 30, the block is deactivated. It is possible to activate the reading of a bridge on connector J4 terminals 3 and 4 which stops blocking, from the Configuration menu. Adding the jumper, the regulator starts again or continues operating even if the rotating bridge breaks. The alarm, the indication on the display and the APO output remain active. In other words, only the regulator block is deactivated.
4	Overvoltage	The alarm is displayed immediately, and can be caused either by irregular operating conditions (such as overspeed or capacitive load) covered only by already existing signalling alarms, or by some kind of regulator fault. The overvoltage alarm activates if the output voltage control is lost. Overvoltage depends on the speed and is inhibited during transients. The alarm is signalled and saved (default), and this causes opening of parallel switch(6). The threshold has a fixed value equal to 5% above the nominal value. 

5	Undervoltage	The alarm is displayed immediately and only intervenes when above the intervention threshold of the low speed alarm. It is inhibited when the “excitation overcurrent” alarm intervenes and during the transients. The alarm is signalled and saved (default), and this causes opening of parallel switch[6]. The threshold has a fixed value equal to 5% below the nominal value.
6	Short circuit	Condition display is INDEPENDENT from the presence of a C.T. The alarm is not active under 20Hz. The alarm is signalled immediately and saved (default), and this causes opening of parallel switch[6]. The short circuit time tolerated goes from 2 to 25.5 seconds (can be programmed in steps of 100ms). Then, after having saved DD and TT, the regulator goes into blockage. With the “time in short circuit” parameter set at zero, the blockage is cancelled. The stop condition causes a fall in excitation, with subsequent switching off and on again of the regulator. The cycle then repeats.
7	Excitation overcurrent	This alarm does not only signal a condition of excess excitation winding temperature but it also has an active function in elimination of the cause. There is, in fact, a regulation loop which takes control after a threshold has been exceeded. This action reduces the excitation current, therefore the output voltage. The available parameter is the “threshold”, which determines the equilibrium value at which the system stabilises. The alarm is signalled and saved (default), and this causes opening of parallel switch[6]. For setting, refer to the excitation overvoltage paragraph.
8	U phase overcurrent[3]	Active if C.T.s are present. The alarm is immediate and keeps the effective phase current under control. The threshold has a fixed value (which corresponds to the machine nominal current transduced by the C.T.) even if conditioned by the setting of address 16.
9	V phase overcurrent[3]	
10	W phase overcurrent[3]	
11	Overload [3]	The overload condition is determined by the output of a relative It type function for each of the 3 currents. Alarm activation causes only signalling and saving. The alarm is activated even if only one phase is in overload. The time constant of this alarm is set using address 32.
12	Reg. limit temperature	Activates when the board temperature reaches 70°C. Causes immediate visualisation but no action.
13	Reg. overheating (85°C)	Activates when the board temperature reaches 85°C. Causes: display, saving of the state, opening[6] of parallel switch (default) and immediate safety block.
14	Under frequency	Only signalling (immediate) and (default) opening of the parallel switch[6]. This alarm also appears during starting and stopping. The alarm is not saved. The alarm intervention threshold depends on the state of the 50/60 jumper (hardware or software) and on the position of the Hz trimmer or address 22. The V/F ramp is present under the threshold.
15	Overspeed	Similar to the “low speed” alarm, it is immediately displayed, saved and (default) causes parallel switch opening[6]. An overspeed condition can cause, as in the case of capacitive load, overvoltage. The threshold can be set using address 31.
16	Thermal probe loss[3]	The noticed event is the disconnection of at least one probe or the lack of the probe temperature board. Active only if the probes are present. Immediate display.

17	Probe 1 overheating[3]	Probe presence is indicated in the Configuration menu. Display is immediate and causes no action. This alarm is activated when the corresponding probe senses that a threshold has been exceeded (programmable at addresss 17 for PT100 and 18 for PTC). The system can independently recognise the type of board (optional) and the corresponding probes.
18	Probe 2 overheating[3]	
19	Probe 3 overheating[3]	
20	Probe 4 overheating[3]	
21	Probe 5 overheating[3]	
22	Probe 6 overheating[3]	
23	Capacitive load[3]	Alarm only available if C.T.s are present. The alarm is displayed by way of a function (which calculates the cosö) and appears immediately. No action is associated. The presence of capacitive load makes the generator self-excite if the load is too capacitive overvoltage may arise and in this case alarm 4 intervenes to open the parallel switch and if necessary to block the regulator. NB: In this case the concrete risk of irreversibly damaging the diodes of the rotating bridge exists.
24	No Voltage Matching	This alarm means that the voltage at the LINE input is too different from the nominal voltage to follow it. The alarm is not available in manual parallel. The alarm condition is active if $V_{line}>110\%V_{nominal}$, or if $V_{line}<90\%V_{nominal}$. The alarm condition inhibits closure of the parallel switch(6) and remains until the automatic parallel is removed or the described condition is exited. Closing the parallel switch, signalled to the regulator by the closing of an insulated contact on the connector J4 terminals 5 and 6, deactivates the alarm.
25	Negative Power[3]	Alarm available only if C.T.s are present. No action is associated. The generator is behaving like a motor.
26	PFR out of range[3]	Alarm available only if C.T.s are present. The alarm can only activate if you are in control of the cosφ. It also causes signalling and the move to “reactive power control” mode, with a set point equal to the alarm threshold (Qn = 0.6 Sn).
27	Forced parallel opening[6]	This alarm signals that something has already happened. Its presence indicates that an alarm belonging to the set of those with effects that are incompatible with the parallel has occurred. This alarm, therefore, has caused the opening of the parallel by way of deactivation of the PswEn output. Given that the alarm has caused opening of the parallel, it can return without leaving trace, this alarm witnesses the finished action. To reset this alarm you can turn off the regulator or give the resetting command from the supervising unit.

3. Notes

(1) AL = Alarm code, NN = Event counter, TT = Time Total, DD = Duration last event

(2) 300% for 20 seconds every 260 seconds.

(3) Presence of AT and thermal probes defined by **Configuration** menu

(4) Deactivation of the parallel switch on the delayed action, after alarm appearance

(5) To avoid saving useless data (low speed during the starting and stopping phases)

(6) Opening of Parallel
The indications in the table refer to the default configuration. Should there be several multiple alarms, it is sufficient for only one alarm to cause opening of parallel switch in order that contact on connector J5 terminals 1 and 2 opens.
Every alarm could be the cause of deactivation of the parallel switch (opening of contact on connector J5 terminals 1 and 2) and as a consequence, the opening of the parallel switch, if the contact is handled correctly.
In fact, the use of a mask (placed on 2 addresses) where every bit is joined to an alarm can determine opening of parallel only if caused by real necessary alarms.

The values contained in the two address can be modified, and are found at addresses 27 and 28.

Address	Contents	B_{15}	B_{14}	B_{13}	B_{12}	B_{11}	B_{10}	B_9	B_8	B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
56	Active alarms 1	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1
27	Alarm mask 1	M_{16}	M_{15}	M_{14}	M_{13}	M_{12}	M_{11}	M_{10}	M_9	M_8	M_7	M_6	M_5	M_4	M_3	M_2	M_1
57	Active alarms 2	-	-	-	-	-	A_{27}	A_{26}	A_{25}	A_{24}	A_{23}	A_{22}	A_{21}	A_{20}	A_{19}	A_{18}	A_{17}
28	Alarm mask 2	-	-	-	-	-	M_{27}	M_{26}	M_{25}	M_{24}	M_{23}	M_{22}	M_{21}	M_{20}	M_{19}	M_{18}	M_{17}

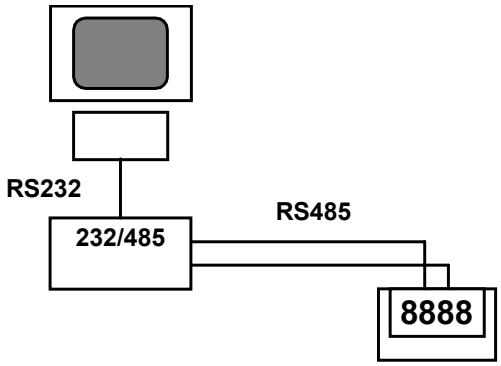
Opening of Contact = **Active alarms** AND **Alarm mask**

EXAMPLE
All alarms from 1 to 7, from 13 to 15, and alarms 24 to 27 must cause opening of parallel switch. The “alarm mask 1” must be 0111000001111111_2 = 28799_{10}; the “alarm mask 2” must be 0000010010000000_2 = 1152_{10}

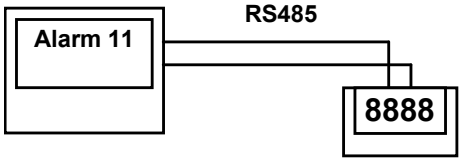
(7) The regulator remains indefinitely in the “block state” if the supply voltage remains above 30V. Should this not happen the regulator can switch itself off. As a result is resets and the alternator starts circulating the short circuit current again for another time interval, the duration of which is defined by address 29. The user must correctly handle the external protections which prevent this from happening. It is also possible to supply the regulator with an insulated backup supply of at least 24Vdc by connecting the positive pole to the B+ terminal of the connector J1, and the negative pole to the GND terminal of the connector J1. For further details please contact Mecc Alte S.p.A. directly.

POSSIBLE SYSTEM CONFIGURATIONS

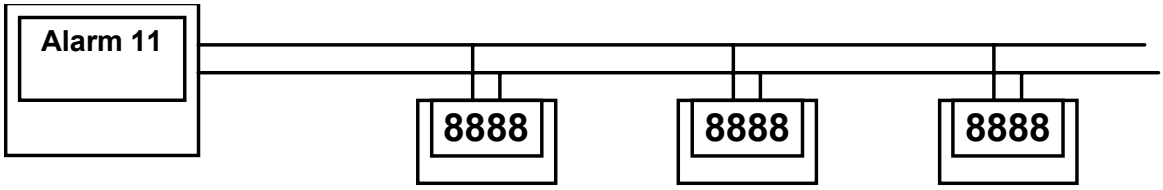
As an example, some of the configurations permitted by the system as well as controller in stand-alone operation, are given below.



PC connected to the regulator by way of an RS485 line and 232/485 converter 232/485



Regulator with synoptic panel, connected by way of an RS485 line.



Regulator network (generators) connected with a synoptic panel.
The synoptic panel can be replaced by a PC with 232/485 converter

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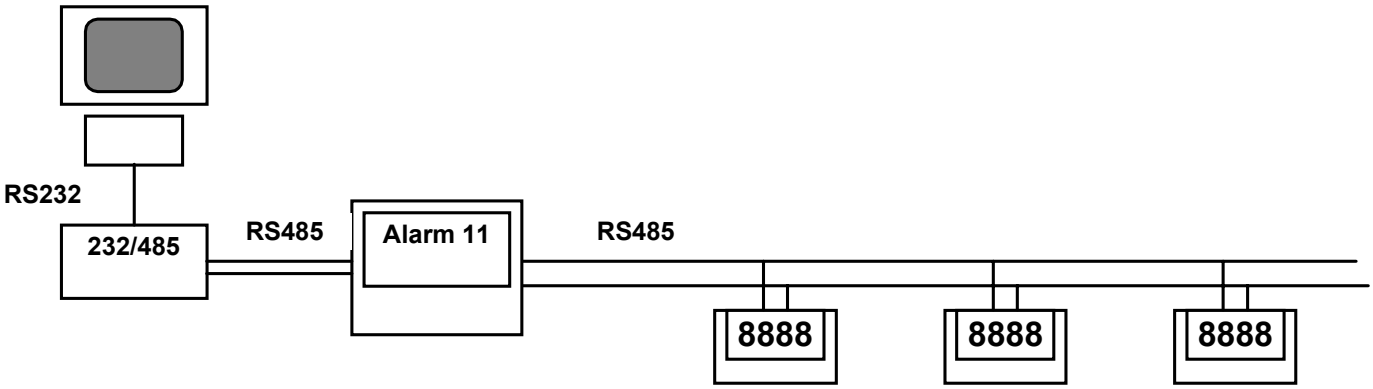
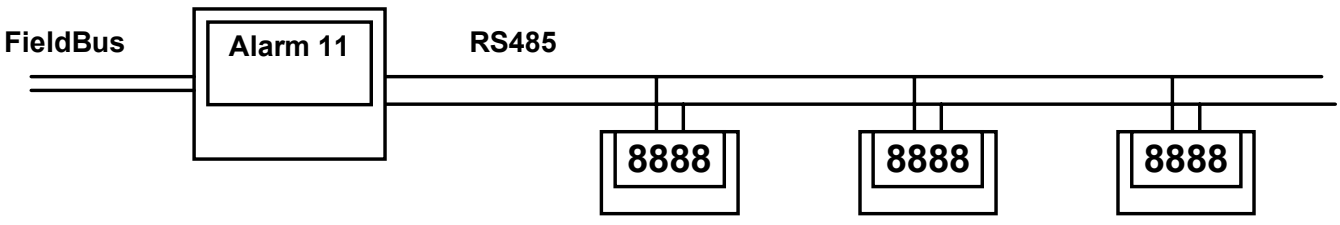


System where the synoptic panel works as a by-pass



Connection to a network by way of a field bus

OPERATION AS A POWER FACTOR REGULATOR (PFR)

1. Introduction

Reference should also be made to the Mecc Alte document entitled “Parallel operation of the synchronous alternators”, where a generic definition of how to regulate the reactive power is given.
The reference diagrams are: from SCC0001 to SCC0003, from SCC0007 to SCC0009.

The generator can be connected in parallel or to the network or to another generator. The “put into parallel” operation always requires the presence of an operator for synchronisation of the phase and control of voltage equalisation. The parallel occurs after closure of the parallel switch.

The alternator can operate in a parallel network only when it is already at nominal speed.

2. Preliminary operations

The generated voltage must be equal to the network voltage before operation in parallel. This can be done following one of 6 methods, 3 manual and 3 “automatic”.

2.1. Manual methods

2.1.1. By way of external potentiometer connected to the connector J3

2.1.2. By way of a manually variable voltage between -5Vdc and +5Vdc applied to connector J3 terminals 1 and 2.

2.1.3. With the writing of address 20

2.2 Automatic methods

2.2.1. By way of a variable voltage between -5Vdc and +5Vdc applied to connector J3 terminals 1 and 2. The contact on connector J5 terminals 1 and 2 closes when it reaches the matching of the two voltage modules if the line voltage is connected to terminals L- and L+ of connector J1.

2.2.2. With the writing of parameter 20 by a system supervisor, if the line voltage is connected to inputs L- and L+ of the J1 connector, the move from 0 to 1 of the B_{12} bit from the datum read on address 55 signals matching of the two voltage modules.

2.2.3. By activation of the “Voltage Matching” mode (the voltage to follow must be connected to inputs L- and L+ of connector J1)

2.2.3.1. If active, press the “**V. Match ON**” key

2.2.3.2. Alternatively, write 2 in address 88 (if activated with 0 or 8 at address 34 and if “Jumper RBD” is deactivated from the **Configuration** menu).

2.2.3.3. Alternatively close the J3 terminals 1 and 2 contact if activated at the function (16 or 24 at address 34 and if “Jumper RBD” is deactivated from the **Configuration** menu).

2.2.3.4. If the “Voltage Matching” mode is active, the letter “L” is displayed on the screen and the line voltage value, the bit B_{10} of the datum read on address 55 moves from 0 to 1.

2.2.3.5. Exiting from this operation state can happen for 3 reasons:

- because exiting is requested by the “Voltage Matching” mode by pressing the “**V. Match OFF**” key or writing 4 at address 88 or by opening the contact on J4 terminals 1 and 2.
- because the contact on J4 terminals 5 and 6 is closed (this signals to the regulator that the parallel switch has been closed), automatically activating the regulation mode with its characteristic descending voltage-reactive current (Drop).
- because the A-24 alarm intervenes.

As the generated voltage is the same as the voltage measured at terminals L- and L+ of the connector J1, the bit B12 of the datum read at address 55 moves from 0 to 1 and the contact on the connector J5 terminals 1 and 2 closes.

3. Parallel closing

The parallel switch can be closed only after the generated voltage is the same as the network voltage in frequency, mode and phase. The switch on connector J5 terminals 1 and 2 which closes the parallel switch results as being closed only when the module of the two voltages is equal.

Contextually to the closing of the parallel switch, the contact on J4 terminals 5 and 6 must also be closed (which signals to the regulator that the parallel switch has closed). This automatically activates the regulation mode with decreasing voltage-reactive current characteristic and activates the regulator to work as a PFR.

Regulation of the torque is assigned to the thermal motor, the system is stable around the working point because in case of the tendency of speed decreases, the network tends to drag the generator, decreasing the torque extracted from the first motor, therefore this torque takes it back to the previously set speed. In case of speed increases the network tends to brake the increase, therefore, the motor accelerator decreases the torque to return to normal.

4. Activation of cosφ or reactive current regulation

4.1 Generalities

The setting of the operation mode (regulation of the cosö or the reactive power) is defined in the **Configuration** menu.
Operation as a PFR can be activated from the Mecc Terminal Control Panel by pressing the “PFR ON” key or writing 8 on address 88, or by closing a contact between terminals 3 and 4 of connector J4. It can also be done automatically after software activation of the Voltage Matching mode followed by closure of parallel switch signalled to regulator by the contact between terminals 5 and 6 of connector J4 (see diagrams SCC0001-2-3-7-8-9). Operation as a PFR can be deactivated from the Mecc Terminal Control Panel by pressing the “PFR OFF” key or writing 16 on address 88, or by opening the contact between terminals 3 and 4 of connector J4.

4.2 Parameters

Operation as a PFR is tied to 3 specific parameters:

- Parameter 33 (settable from 0 to 32767) defines the cosö regulator gain or the reactive power, in practice it determines the stability of the regulation (cosφ or reactive power) both under constant load conditions and during transients.
- Parameter 40 (settable from -32767 to 32767) defines the reactive power reference: 0 corresponds to a zero reactive power (default setting), 32767 to an inductive type reactive power equal to 0.6 times the apparent nominal power. Negative values correspond to reactive powers of a capacitive type.
- Parameter 41 (settable from -32767 to 32767) defines the cosφ reference: 0 corresponds to cosφ=1, 6553 to cosφ=0.8 inductive, 32767 to cosö=0 inductive. Negative values correspond to capacitive cosφ

4.3 Configuration

As described in paragraphs 2 and 4, the regulation modes in “Voltage Matching” and PFR can be activated with suitable commands given by the supervising system or, alternatively, using two digital inputs that end up in connector J4 (terminals 1, 2 and terminals 3, 4). These inputs are also used for configurating the low speed protection and for deactivating the regulator block in cases of rotating bridge breakage. The interpretation of these inputs by the regulator depends on how they are configured. They can be configured from the Configuration menu and with the use of the correct values written on address 34.

- If reading of jumper 50/60 is activated from the **Configuration** menu, the J4 input (terminals 3, 4) configures the low speed protection, **independently** from what is written on address 34. In this case the command which activates the PFR can **only** be given by the supervising unit.

- If reading of jumper 50/60 is deactivated and address 34 shows values 0 or 16, the J4 input (terminals 3, 4) is not active the under frequency protection configuration can be modified from the **Configuration** menu at the option “Value Jumper 50/60 on” and the command which activates the PFR can only be given by the supervising unit. If values 8 or 24 are written on address 34, the J4 input permits activation of the PFR if a contact between terminals 3 and 4 is closed. In this case the “PFR_On” key on the Mecc Terminal is not active and the command transmitted by the supervising unit is not carried out.

- If reading of the RBD jumper is activated from the **Configuration** menu, the J4 input (terminals 1, 2) deactivates the regulator block in case of rotating bridge breakage, independently from what is written on address 34. In this case the "Voltage matching" command can only be given by the supervising unit.

- If reading of the RBD_Set jumper is deactivated and the values 0 or 8 are written on address 34, the J4 input (terminals 1, 2) is not active. Block deactivation in case of rotating bridge breakage can only be carried out by writing 0 on address 30. The command which activates the "Voltage matching" can **only** be given by the supervising unit. If the values 16 or 24 are written on address 34, the J4 input activates "Voltage matching", should a contact between terminals 1 and 2 be closed. In this case the "V.Match On" key on the Mecc Terminal **is not active** and the command transmitted by the supervising unit is not carried out.

Summary for the configuration of the functions that can be carried out by the inputs on connector J4 terminals 1 and 2, 3 and 4

	□ Act. 50/60Hz Jumper □ Act. RBD Jumper	■ Act. 50/60Hz Jumper □ Act. RBD Jumper	□ Act. 50/60Hz Jumper ■ Act. RBD Jumper	■ Act. 50/60Hz Jumper ■ Act. RBD Jumper
Address 34 = 0	Jumper 50/60 inactive RBD_set Jumper inactive PFR Command from Serial Com. V. match from Serial	Jumper 50/60 attivo RBD_set Jumper inactive PFR Command from Serial Com. V. match from Serial	Jumper 50/60 inactive RBD_set Jumper active PFR Command from Serial Com. V. match from Serial	Jumper 50/60 attivo RBD_set Jumper active PFR Command from Serial Com. V. match from Serial
Address 34 = 8	Jumper 50/60 inactive RBD_set Jumper inactive PFR can be act.from J4-3 and 4 Com. V. match from Serial	Jumper 50/60 active RBD_set Jumper inactive PFR Command from Serial Com. V. match from Serial	Jumper 50/60 inactive RBD_set Jumper active PFR can be activ. from J4-3 and 4 Com. V. match from Serial	Jumper 50/60 active RBD_set Jumper active PFR Command from Serial Com. V. match from Serial
Address 34 = 16	Jumper 50/60 inactive RBD_set Jumper inactive PFR Command from Serial Com. V. match can be activa-ted from J4-1 and 2	Jumper 50/60 active RBD_set Jumper inactive PFR Command from Serial Com. V. match can be activa-ted from J4-1 and 2	Jumper 50/60 inactive RBD_set Jumper active PFR Command from Serial Com. V. match from Serial	Jumper 50/60 active RBD_set Jumper active PFR Command from Serial Com. V. match from Serial
Address 34 = 24	Jumper 50/60 inactive BD_set Jumper inactive PFR can be act.from J4-3 and 4 V. match can be activated from J4-1 and 2	Jumper 50/60 active RBD_set Jumper inactive PFR Command from Serial V. match can be activated from J4-1 and 2	Jumper 50/60 inactive RBD_set Jumper active PFR can be act. from J4-3 and 4 Com. V. match from Serial	Jumper 50/60 active RBD_set Jumper active PFR Command from Serial Com. V. match from Serial

4.4 Operation mode

In cases of parallel-network, a variation of the excitation current only causes a variation of the reactive power. Two operation modes can therefore be considered:

4.4.1. Active power lower than 10% of the nominal [(1)]

In this case it is possible to regulate a reactive current constant value (settable using address 40)

4.4.2 Active power above 20% of the nominal

In this case two regulations are possible:

4.4.2.1. At constant cosφ: the excitation current is regulated in such a manner as to maintain the power factor constant (settable using address 41).

4.4.2.2. At constant reactive power: the excitation current is regulated in such a manner as to maintain the reactive current constant (settable using address 40).

NOTE 1

The constant cosφ regulation mode can be selected from the **Configuration** menu. With this mode activated, if the active power is lower than 10% of the nominal power ($P<10\%P_n$), regulation moves automatically from constant cosφ to constant reactive power Q. If the active power is 20% over than the nominal power ($P>20\%P_n$), regulation moves automatically from constant reactive power Q to constant cosφ. In case of contact opening on connector J4 terminals 5 ans 6, the system returns to the Voltage regulation mode.

5. Alarms during parallel

The aim of the protections is to protect the alternator and the regulator from irregular work conditions.
The alarms are divided into two subsets: the activation of an alarm belonging to the first group does not cause the opening of the switch on connector J5 terminals 1 and 2, while the activation of an alarm belonging to the second group causes the opening of the switch on connector J5 terminals 1 and 2 which can be used to open the parallel teleswitch. The choice of alarms to belong to one group or another can be set on address 27 and 28, as indicated in note (6) of the alarms chapter. Should the contact on the connector J5 terminals 1 and 2 not be used, a series of alarms could arise (some irreversible) which would cause a safety STOP. Before the safety STOP intervenes, the machine operation conditions would have become incompatible with the network/PFR parallel, therefore the external protections should already have intervened.

If the protections were not predicted, or are incorrect or were not set correctly, the regulator is not autonomously able to protect the electric machine.

Particularly important addresses for parallel operation

Address 55, which can only be read, supplies the regulator state during parallel operation in real time.

Bit of state	B_{15}	B_{14}	B_{13}	B_{12}	B_{11}	B_{10}	B_9	B_8	B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
Address 55	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

The bits of the state word have the following meanings:

Value read	**Meaning**
0004	PFR activation command received
0008	Frozen, waiting for supply fall
0016	PRF active in cosphi control mode
0032	PFR active in Q control mode
0064	PSw input active
0128	Jumper 50/60 input active
0256	RBD input active
0512	Stop state for alarm
1024	Line voltage following state (L on display)
2048	Command for voltage matching received
4096	PSW_EN active

Example: Value on address 55: 424010 = 4096+128+16 = 00010000100100002, which means that: the contact on connector J5 terminals 1 and 2 is closed, that the jumper 50/60 is present on connector J4 terminals 3 and 4, that the PFR has been activated and that the DIRCI04 is regulating the cosφ.

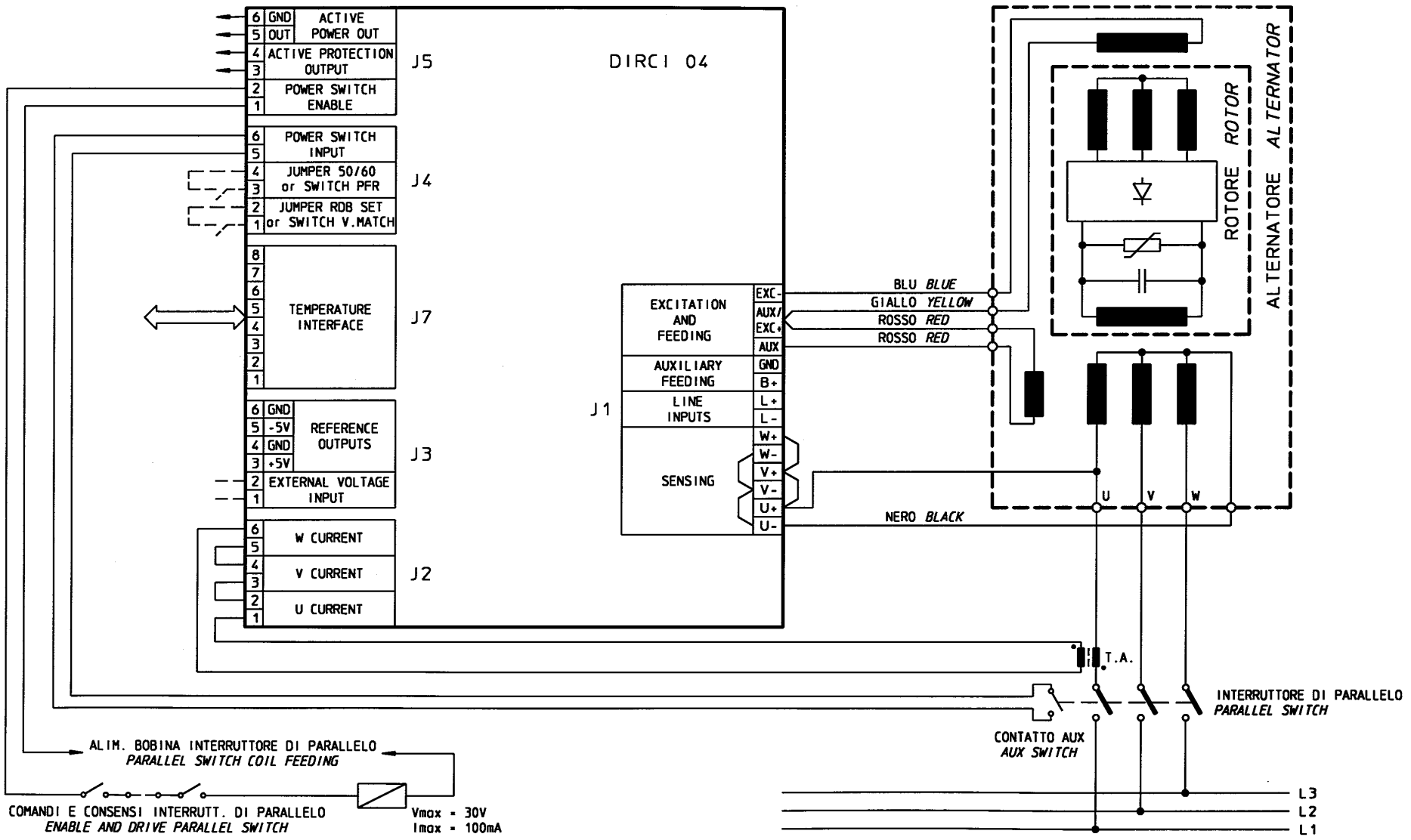
Address 88, which is written by the supervising unit, carries out the word command function: the single bits are interpreted as commands.

Command Bit	B_{15}	B_{14}	B_{13}	B_{12}	B_{11}	B_{10}	B_9	B_8	B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
Address 88	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

Written value	**Function carried out**
2	“Voltage matching” activation
4	“Voltage matching” deactivation
8	PFR ON activation
16	PFR OFF deactivation
32	Configuration of the transduction constants
64	Reset alarm 27

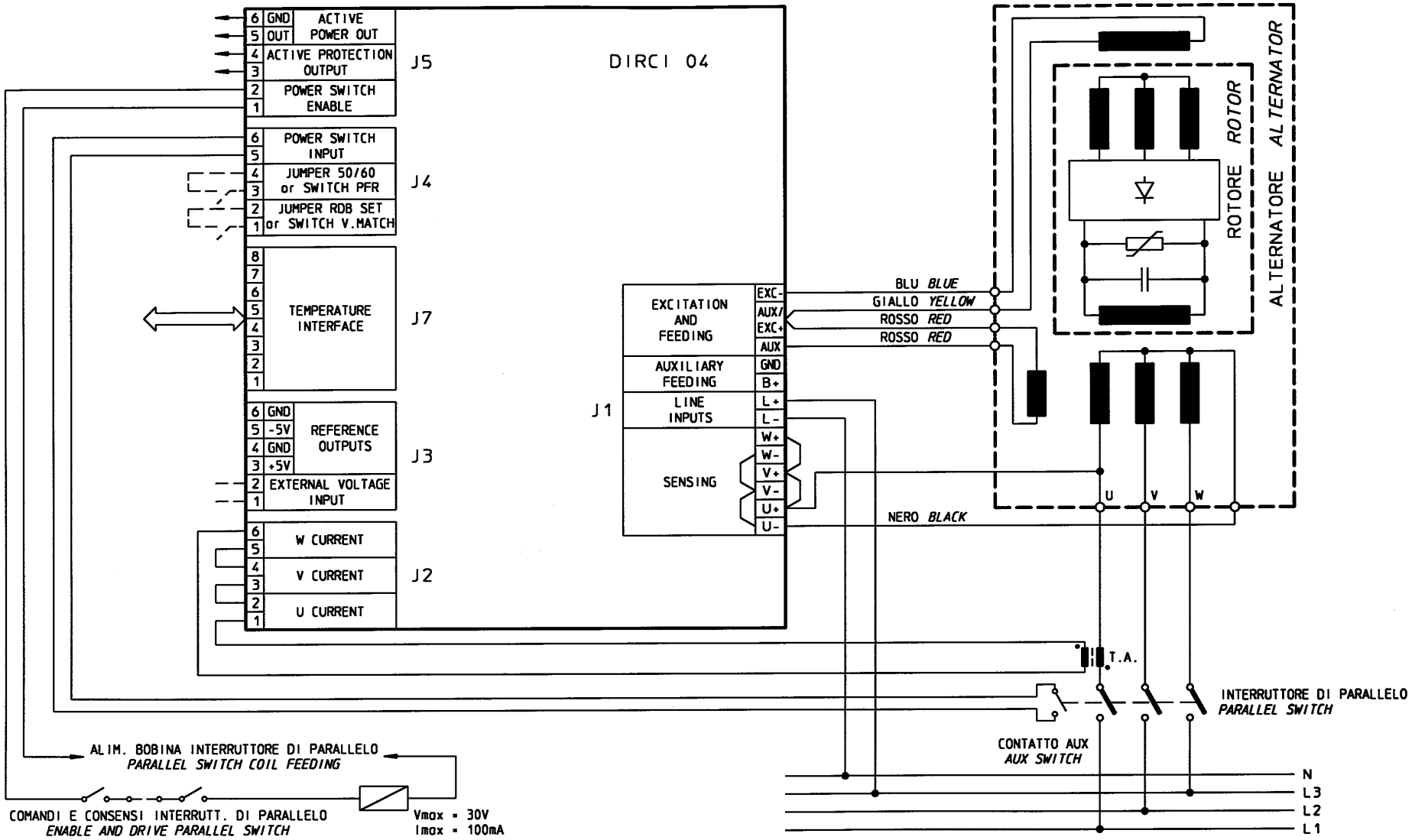
Only the values 2, 4, 8, 16, 32 or 64 can be written on address 88.

THREEPHASE PARALLEL NETWORK WITHOUT LINE CONTROL, SINGLE PHASE SENSING



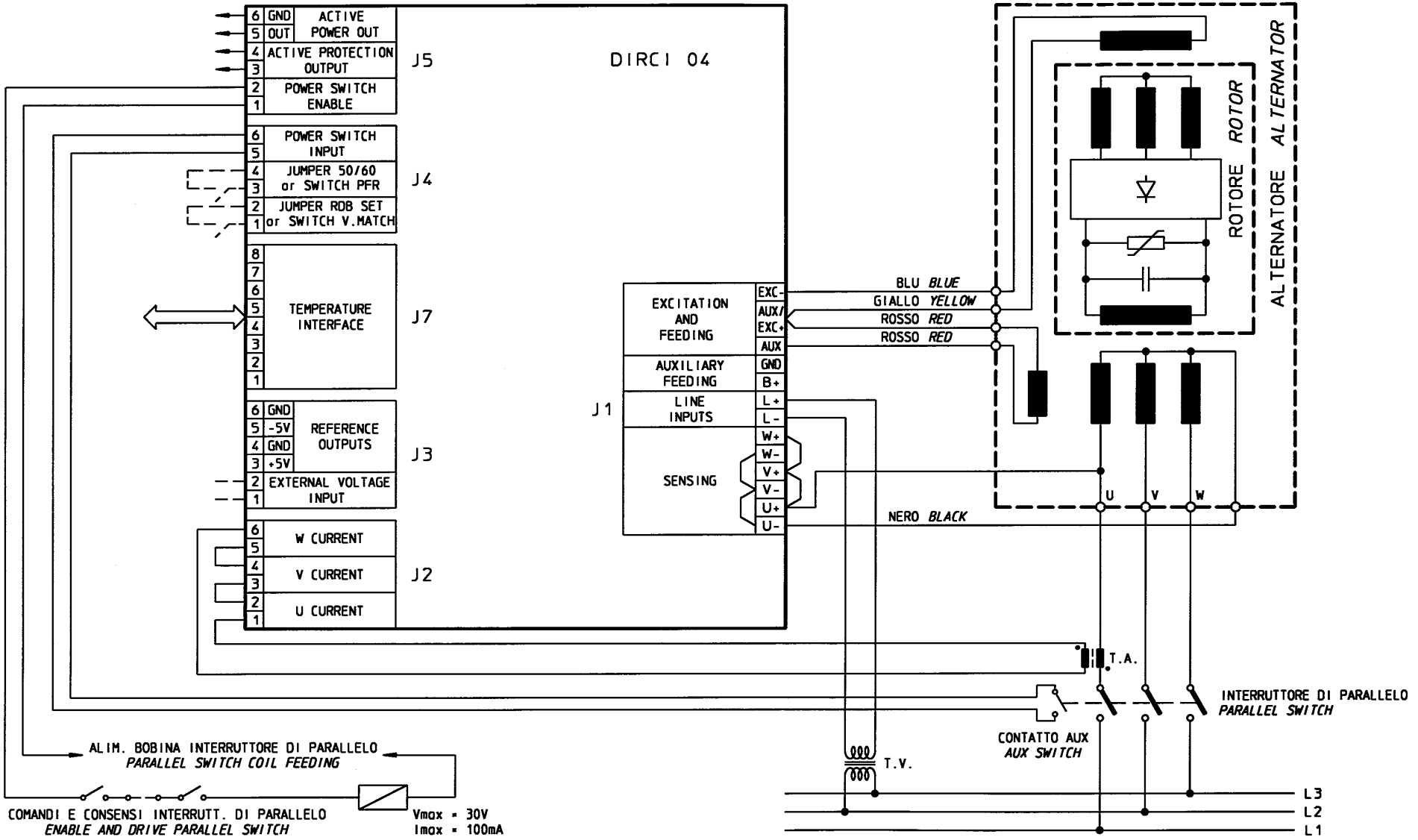
SCC0009

THREEPHASE PARALLEL NETWORK WITH NEUTRAL AND SINGLE PHASE SENSING



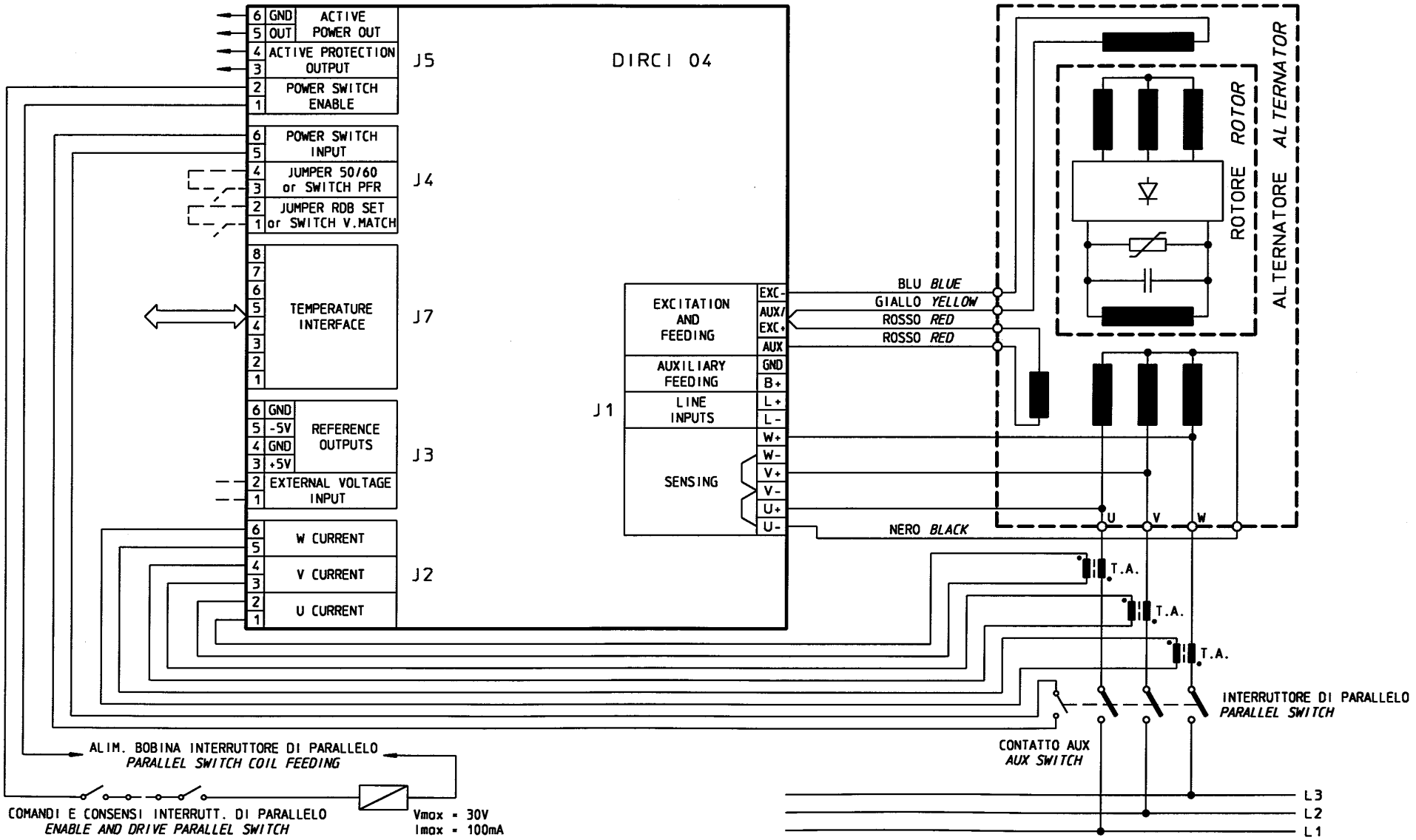
SCC0008

THREEPHASE PARALLEL NETWORK WITHOUT NEUTRAL, SINGLE PHASE SENSING



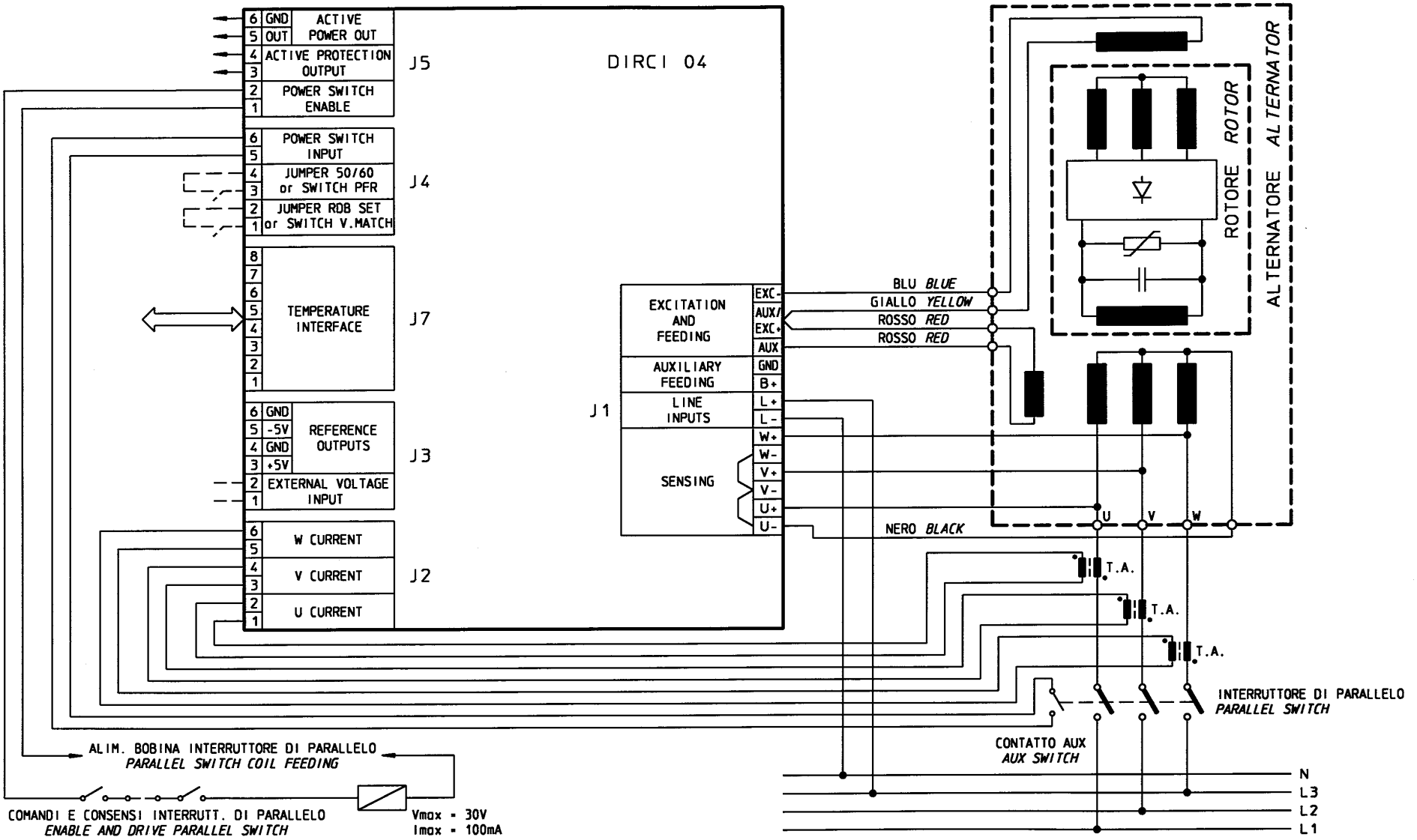
SCC0007

THREEPHASE PARALLEL NETWORK WITHOUT LINE CONTROL



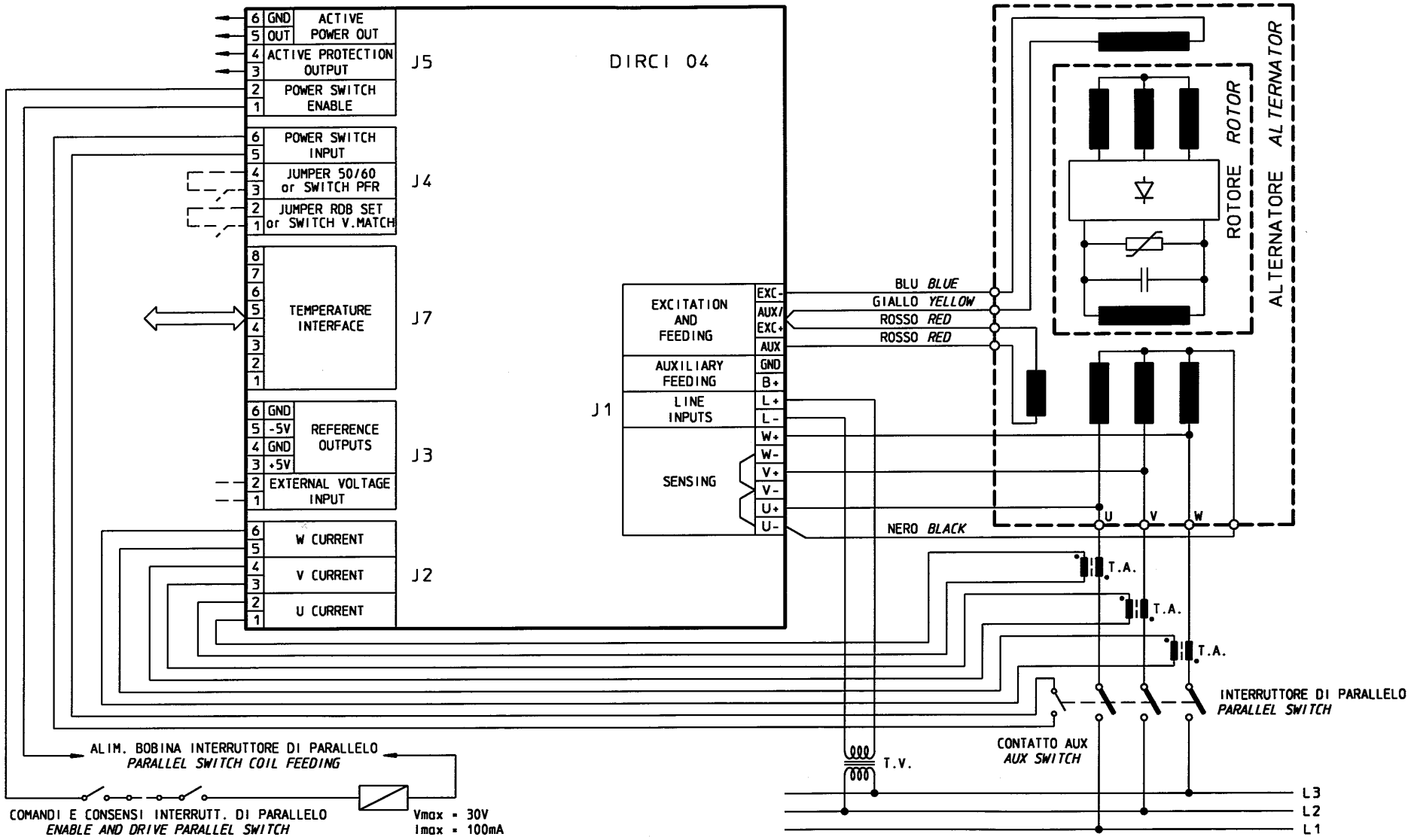
SCC0003

THREEPHASE PARALLEL NETWORK WITH NEUTRAL



SCC0002

THREEPHASE PARALLEL NETWORK WITHOUT NEUTRAL



SCC0001

USING THE PROGRAMMING/MONITORING SOFTWARE “MECC TERMINAL”

1. Installation

Run the Windows “install.exe” program
This creates the file C:\Mecc-Terminal, with its executable code and creates the connection on the desktop. Launch the Mecc Terminal program from the Windows desktop.

2. Configuration

When the user interface is opened, it appears as shown in fig. 8
The **ComPort** menu presents 2 functions:
1. Connect activates or deactivates connection towards the slave unit (DIRCI 04 regulator)
2. Settings opens a window as shown in fig. 8, with which it is possible to set some parameters necessary for communication.

Connection is confirmed when the **Connected** indicator changes from yellow to green.
If communication occurs without errors, the **Com STAT** indicator changes from red to green.
IMPORTANT: Communication can only take place if all three indicators, namely **Connected**, **Com STAT** and **Com ERROR** are coloured green. The “ADDRESS” window indicates, almost in real time, the address of the Slave you are in communication with.

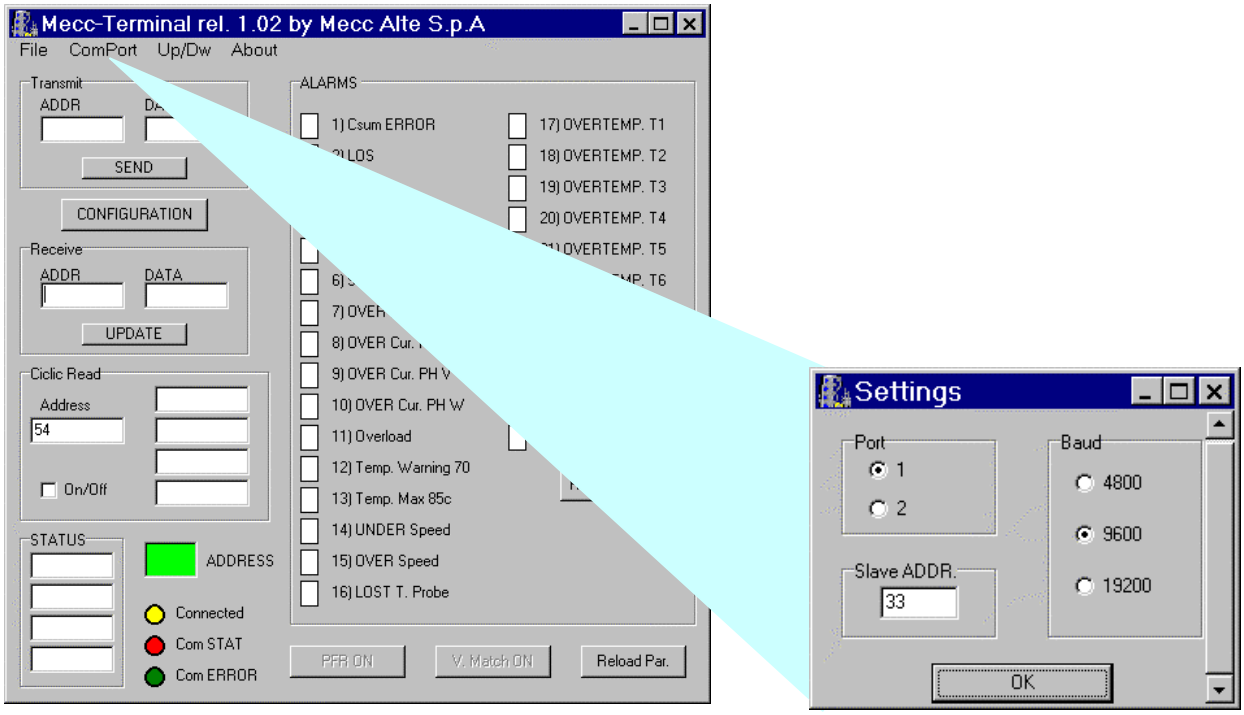


fig. 8

The **Port** setting determines which serial port is to be used for communication (COM1 or COM2).
Slave ADDR is the parameter of the device with which you intend communicating (address 1).

To change the regulator address using the Mecc Terminal software, follow this procedure:

a) Select the option **Settings** from the **ComPort** menu (the Settings menu opens)
b) Key in 0 in the **Slave ADDR** input window, then confirm with OK (the Settings menu closes)
c) Key in 1 in the **ADDR.** Window in the **Transmit** section on the main menu, then key in the selected address (from 1 to 33) in the **Data** window, and press **Send** (the ComStat indicator turns red)
d) Select the option **Settings** from the **ComPort** menu (the Setting menu opens)
e) In the **Slave ADDR,** input window, key in the same address entered in the Data window at point c, then confirm (the Settings menu closes and the ComStat indicator turns green again).

IMPORTANT: Communication can only be carried out if the parameter set in address 1 of the DIRCI04 regulator is the same as the parameter set using the Slave Address on Mecc Terminal.

The Baud parameter sets the transmission speed at which the master unit (system supervisor) exchanges data with one or more slave units (DIRCI04 regulators).

3. Functioning

When a personal computer has been connected to a powered DIRCI04 regulator (therefore working) and correctly set as described in the “Configuration” paragraph, after having given the connection command the Mecc Terminal user interface appears as shown shown in fig. 9. The system can program and monitor from 1 to 32 slave units connected by way of RS485 serial connection, or a single unit connected via RS232. The available functions are indicated in the table on page 46.

The Mecc Terminal user interface is divided into 6 areas with different functions:

Transmit: Handles the data that is transmitted towards the slave unit (DIRCI04)
Receive: Displays a single datum requested from the slave unit (DIRCI04)
Ciclic Read: Displays, almost in real time, four pieces of data saved at consecutive addresss in the slave unit (DIRCI04)
STATUS: Displays the operative registers from 54 to 57
ALARMS: Displays the active alarms
Command area: All the remaining space of the user interface is occupied by the pushbuttons described in the “Configuration” paragraph and by the buttons used for parallel network handling and for correctly configuring the transduction constants of the control program.

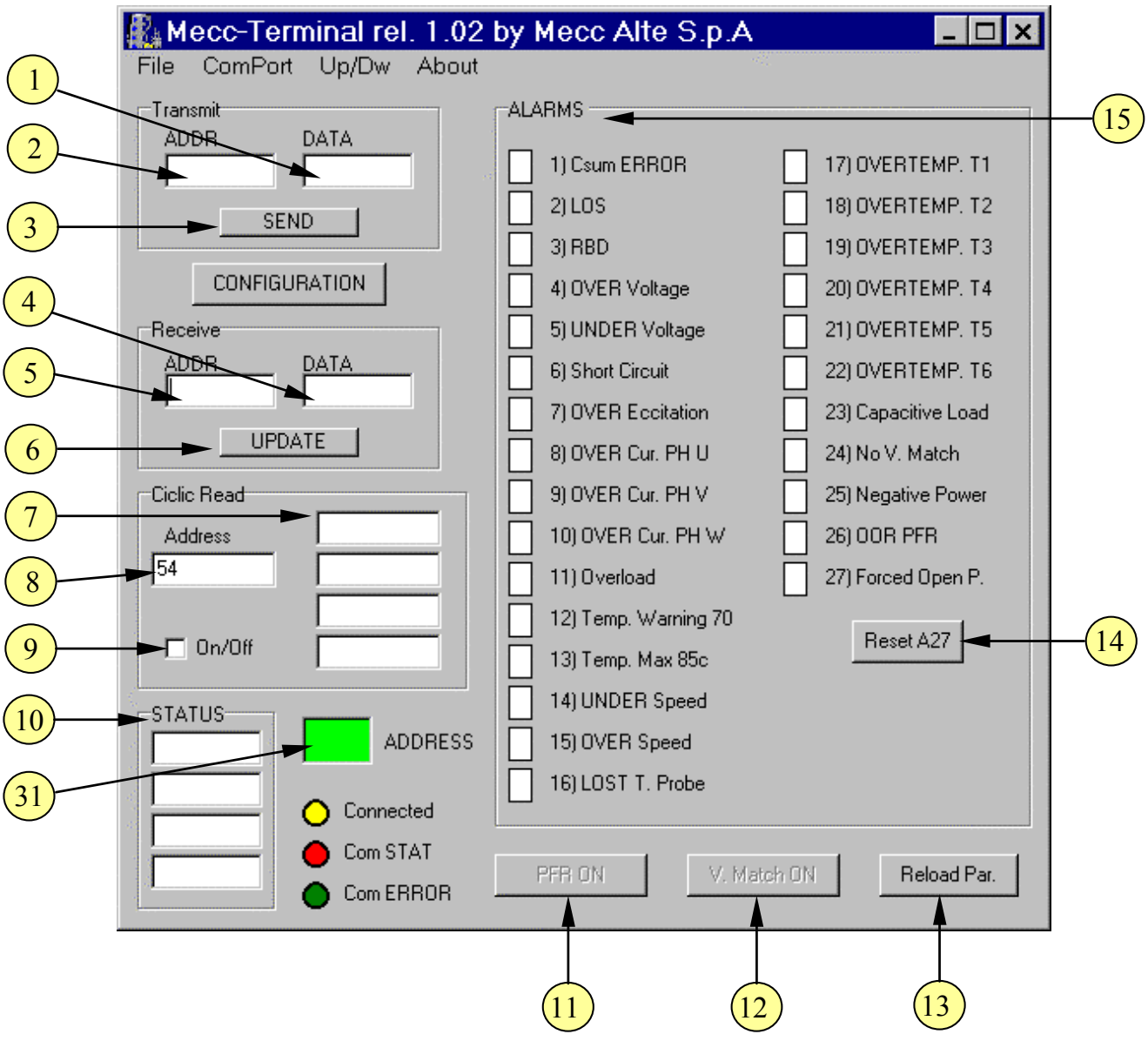
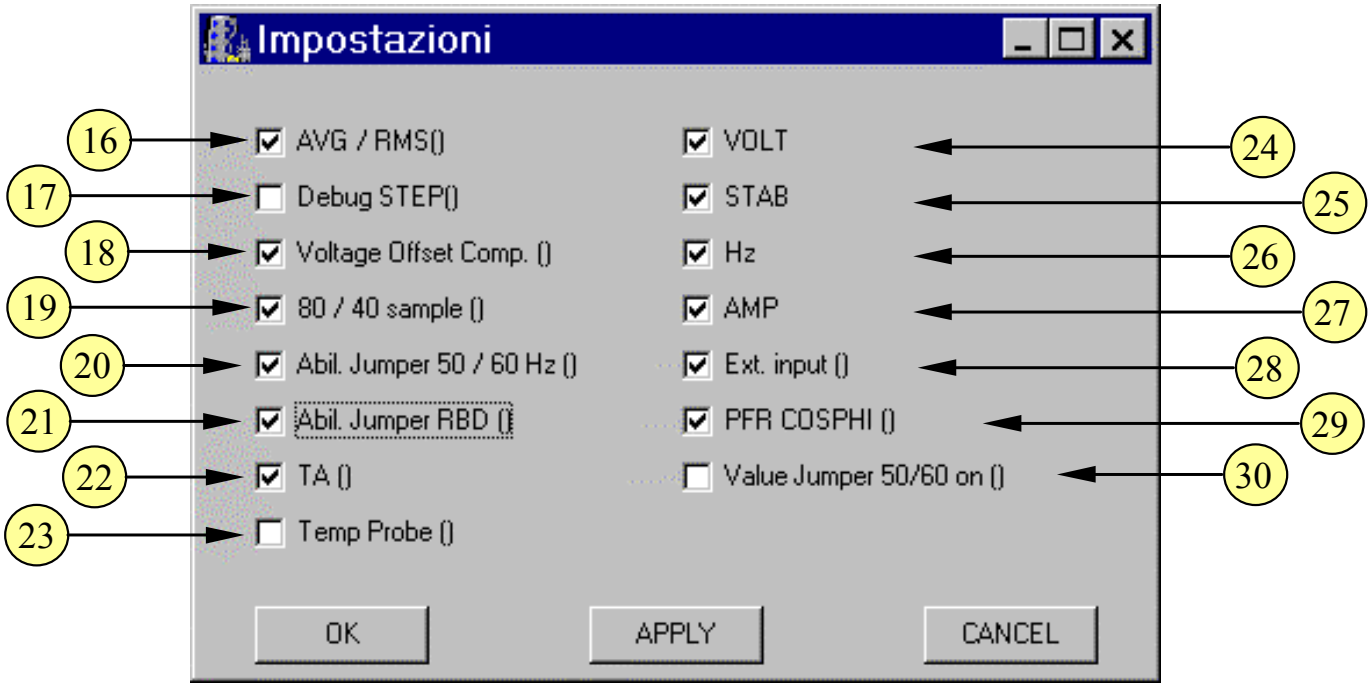


fig. 9

4. Configuration menu

The Configuration menu permits configuration of the DIRCI04 regulator (address 5). The meanings of the individual setting options are given in the table on page 46.



5. File menu

The File menu represents the only Exit option for closing the Mecc Terminal user interface.

6. Up/Dw Menu

The Up/Dw menu is used to load and discharge the settings file (which has a .dat extension) onto and from the regulator.
There are three possible options:

1. **UpLoad Data:** Opens the “UpLoad” window
   - The **Open** key permits you to select the file with .dat extension which must be loaded
   - The **UpLoad** key unloads the freshly loaded settings file into the DIRCI04 regulator
   - The **Done** key closes the UpLoad window
2. **DownLoad Data:** opens the “DownLoad” window
   - The **DownLoad** key transfers the settings file to the personal computer
   - The **Save** key saves the settings file with .dat extension
   - The **Done** key closes the DownLoad window
3. **DownLoad Alarm:** opens the DownLoad Alarm window
   - The **DownLoad** key transfers the list of the saved alarms to the personal computer, the number of times they have intervened, and for every alarm, the duration of the last event and overall duration.
   - The **Save** key saves the alarm file with .alr extension
   - The **Done** key closes the DownLoad Alarm window.

7. About menu

The **About** menu signals the current revision of the Mecc Terminal software.

8. Description of the Mecc Terminal user interface

Ref.	Functional description
1	Value of the parameter to be transmitted to the regulator
2	Position of the parameter to be transmitted to the regulator
3	Transmission command
4	Value of the parameter requested from the regulator (updated following the command indicated in 6)
5	Position of the parameter requested from the regulator
6	Updating command
7	Values of 4 parameters situated in 4 consecutive addresses (starting from the address indicated in 8)
8	Position of the first of the 4 parameters requested from the regulator
9	Updating activation, almost in real time
10	Display addresses 54 to 57
11	PFR function activation / deactivation(1)
12	Voltage matching activation / deactivation(1)
13(2)	Configures the transduction constants
14	Command for Forced Parallel Opening alarm RESET (A27)
15	Active alarm signalling
16	Setting the regulation on the Effective value
17	Activation of a periodic variation of the voltage reference (for preliminary setting)
18	Activation of the automatic compensation of the offset in the voltage acquisition channels
19	Setting for sampling on a semiperiod
20	Activation of jumper 50/60Hz reading (connector J4 terminals 3 and 4)
21	Activation of jumper RBD SET reading (connector J4 terminals 1 and 2)
22	AT presence signalling (activates current acquisition channel reading)
23	Temperature probe presence signalling (activates reading of the corresponding channels)
24	Activation of reading of the voltage reference from the VOLT trimmer
25	Activation of reading of the stability parameter from the STAB trimmer
26	Activation of reading of the low speed prot. Threshold parameter from the Hz trimmer
27	Activation of reading of the Excitation current threshold parameter from the AMP trimmer
28	Activation of reading of the External voltage input (V ext)
29	Setting of the PFR regulation on cosö (if inactive, the reactive power is regulated)
30	Setting of the machine nominal frequency (active for 60 Hz)
31	Current Slave address

(1) Keys are active (the terms “PFR ON” and “V.Match ON” are in black), if the inputs on the J4 connector (terminals 1-2 and 3-4) have not been activated to carry out the same function. Otherwise, the terms “PFR ON” and “V.Match ON” are grey and the keys are inert.

(2) Command available only until release 1.05, to use exclusively with DIRCI-04 not regulating.