

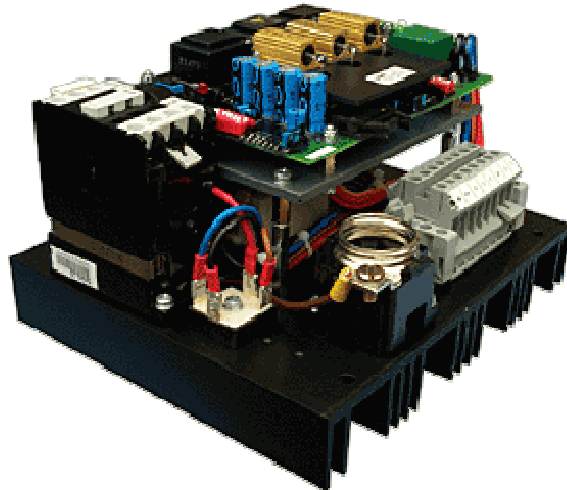


# ASR

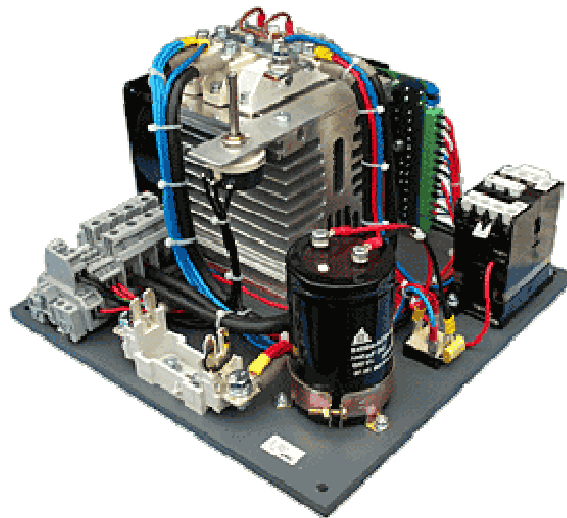
## STATIC EXCITER

*Voltage regulator for generators*  
*ASR - 35, 100, 150, 250, 350*

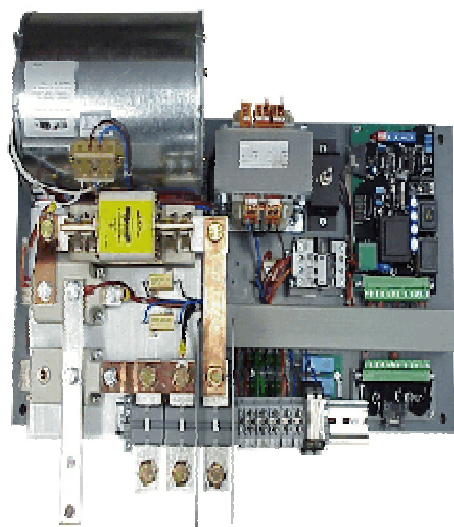
**Instruction Manual V2.0.1**



**ASR35**



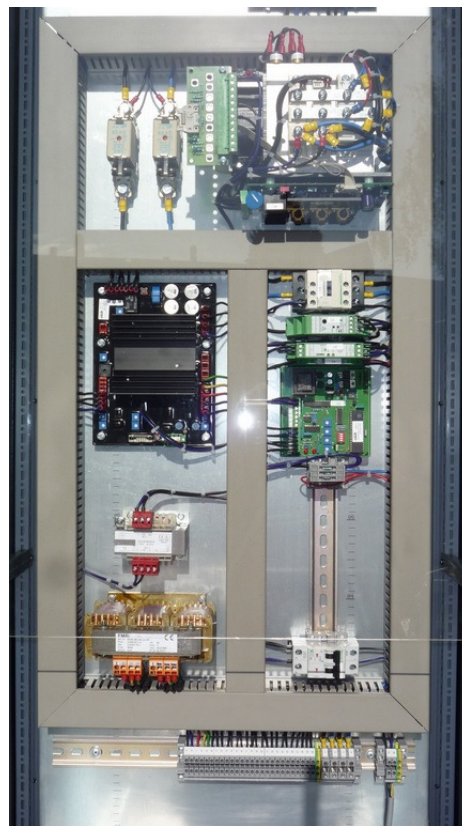
**ASR100 / 150**



**ASR250 / 350**

If the selected product does not meet your requirements, please contact us.  
EMRI supplies tailored static exciters:

- external supply
- internal supply
- power factor control
- hydro application
- HV application
- Three phase supply full bridge
- Series boost



# WARNINGS AND COMMISSIONING INFORMATION



## HAZARDOUS VOLTAGES.



### DO NOT OPERATE WHEN NOT FAMILIAR WITH GENERATORS.

- ***Check the isolation of the generator windings before installation.***  
***Poor isolation will cause damage to the AVR and dangerous situations for persons.***
- The system should not be installed, operated, serviced or modified except by qualified personnel who understand the danger of electric shock hazards and have read and understood the user instructions.
- Never work on a LIVE generator. Unless there is another person present who can switch off the power supply or stop the engine.
- Dangerous voltages are present at the voltage regulator board. Accidental contact with live conductors could result in serious electrical shock or electrocution.
- Disconnect the power source before making repairs, connecting test instruments, or removing or making connections to the voltage regulator or generator.
- Defects in the generator or AVR may cause consequential loss. Precautions must be taken to prevent this from occurring.
- The unit should be installed with respect to the environmental specifications as well as the rules mentioned in the General installation information.
- For safety reasons the voltage level potentiometers are best turned completely counter clockwise in order to start at the lowest possible voltage.
- Never change the dipswitch settings during operation.

## **NOTE**

**Upon commissioning, it may be necessary to tighten the power terminals.**

**These terminals may have become loose due to elasticity in the wiring and terminals**

**The cooler and therefore the Droop Rheostat can be connected to earth/ground/chassis potential**

ASR static exciter/avr since 2001 are equipped with printed circuit board VCB01.

Older model ASR AVR's may have ASR12 or ASR14 printed circuit board fitted.

Please find below the differences between the two printed circuit boards.

## Difference between PCB versions:

### ASR12 & ASR14 type regulators:

ASR12 type regulators have only 1 dipswitch, with single potentiometers.

Dipswitch S1 is situated next to the rheostats of the ASR12/14 pcb

S1:	On:	Off:	Default:
S1.1	50% output reduction	100% output	Off
S1.2	Fast voltage ramp up	Slow voltage ramp up	On
S1.3	Frequency trip enabled	Frequency trip disabled	On
S1.4	S&T shorted	Ext. rheostat enabled	On

The rheostats on the ASR12 pcb have the following functions (top to bottom, fig. 1)

FR: frequency trip setpoint

I: I stability

P: P stability

V: Voltage setpoint



Fig 1: ASR12 printed circuit board

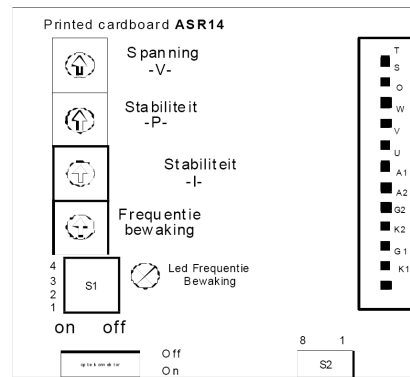


Fig 2: ASR14.1 printed circuit board

### ASR14.1 and higher type regulators:

ASR regulators with ASR14.x type pcb's have 8 dipswitches (bottom right corner, fig.2) more than the ASR14. The functions of these dipswitches are:

S2:	On:	Off:	Default:
S2.1	No function	No function	Off
S2.2	No function	No function	Off
S2.3	Supply frequency for SCR's is 400 Hz		Off
S2.4	Supply frequency for SCR's is 150 Hz		Off
S2.5	AVR disable option is available on option connector		Off
S2.6	No function	No function	Off
S2.7	No function	No function	Off
S2.8	Phase loss protection disabled	Phase loss protection enabled	Off

## ASR type regulators with VCB circuit board:

On the VCB pcb the dipswitches have the following function:

S1:	On:	Off:	Default:
S1.1	AVR disable option is available on option connector	AVR disable option is <i>NOT</i> available on option connector	Off
S1.2	Supply frequency for SCR's is 150 Hz	<i>S1.2 &amp; S1.3 may not be on at the same time</i>	Off
S1.3	Supply frequency for SCR's is 400 Hz	<i>S1.2 &amp; S1.3 off, SCR supply is 50Hz</i>	Off
S1.4	Two SCR's enabled	One SCR disabled	On

S2:	On:	Off:	Default:
S2.1	50% output reduction	100% output	Off
S2.2	Fast voltage ramp up	Slow voltage ramp up	On
S2.3	Frequency trip enabled	Frequency trip disabled	On
S2.4	S&T shorted	External rheostat enabled	On
S2.5	Extra smoothing of measure signal enabled		Off
S2.6	3 x 230 Volt sensing	3 x 400 Volt sensing	Off
S2.7	Phase loss protection disabled	Phase loss protection enabled	On
S2.8	No function	No function	Off

The VCB pcb has 2 potentiometers more than the ASR12/14 types. The potentiometers of the VCB have the following function: (left to right, fig 3)

- D: Droop
- F: Frequency trip set point
- I: I stability
- P: P stability
- Vf: Fine voltage set point
- Vc: Course voltage set point

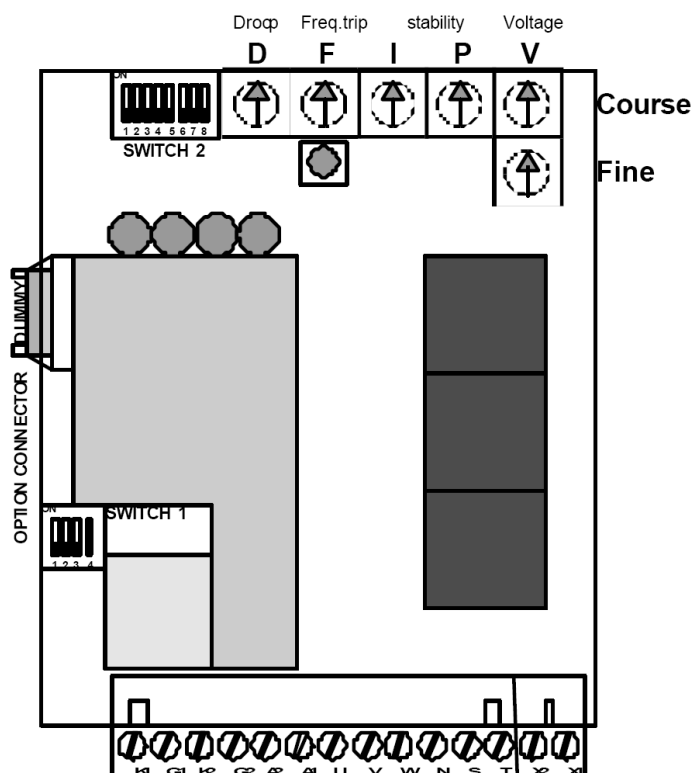


Fig 3: ASR with VCB printed



**UNIVERSAL  
VOLTAGE REGULATOR  
FOR GENERATORS  
type ASR**

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**CONDITIONS FOR INSTALLATION and COMMISSIONING**

**Mounting and commissioning of this product may only be done by qualified people with knowledge of electrical machines !**

**This product is meant to be build in, in a closed cabinet or machine, so that any contact with persons is excluded.**

**Do not touch the printed cardboard during operation. High Voltage !**

**Only use isolated measuring instruments.**

EMRI bv points out that this product is meant to be assembled as a component in a system or installation on which the following standards take effect :

89/336 EEG (EMC guidelines)  
72/23 EEG (Low voltage guidelines)

**General**

The static exciter / voltage regulator type ASR consists of a printed circuit board, which is suitable for working with a separate mounted controlled rectifier. The avr can to be used with any kind generator, whatever its exciting power may be. EMRI supplies several standard types ASR models.

Standard models are: ASR35, ASR100, ASR150 en ASR250.

**Specifications**

Printed cardboard : ASRxxx or VCBxxx  
Sensing : Three or single phase 230 Volt or 400 Volt  
Generator voltage : 230-440 Vac (terminals U,V,W, 0), 50/60Hertz or 400 Hertz  
Accuracy : < 1 % on sinusoidal voltages

**Maximum field current standard types:**

ASR35 : 35 A  
ASR100 : 100 A  
ASR150 : 150 A  
ASR250 : 250 A

**Fuses :**

ASR35 : 50 AUR DIII  
ASR100 : 125 AUR NH00  
ASR150 : 160 AUR NH00  
ASR250 : 315 AUR. NH2

(UR = Ultra Rapid)

**Maximum field voltage:** 70% of the voltage between terminals U&0 in DC voltage

**Dimensions :**

ASR35 : 200x200x115 mm (LxWxH) fig. 4  
ASR100-150 : 300x300x210 mm (LxWxH) fig. 5  
ASR250 : 600x300x300 mm (LxWxH)

Dimensions pcb : 110x165 mm.

Ambient temp. : max. 50 °C  
Protection class : IP00

The printed cardboard is protected against vibrations and moisture by an epoxy coating.  
For parallel-operation with other generators a droop-kit is available.



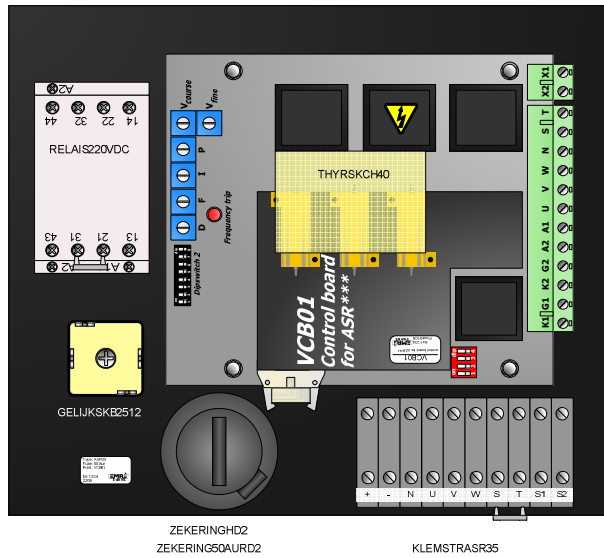


Fig 4

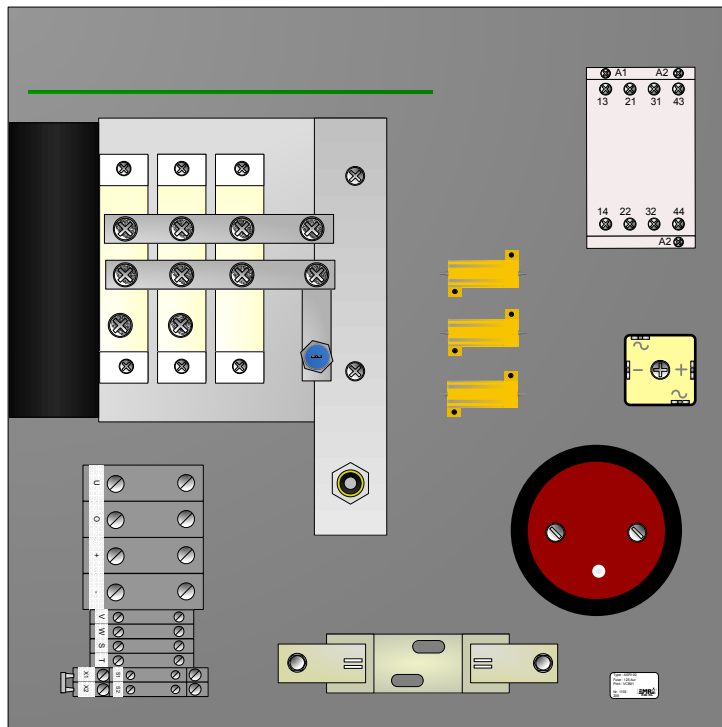


Fig 5

**Installation**

A complete mounted regulator has an isolated ground plate or cooling device. If placed in a closed cabinet, there must be sufficient ventilation because of the produced heat. The connection is according to the diagrams. The terminals X1 and X2, if provided, are for connecting a droop transformer. If no droop-transformer is used, these terminals are not used. The terminals S and T are for an external potentiometer for voltage adjustment (10kOhm). If used, dipswitch S1.4 must be 'off'.

**Adjustments VCB01 control card**

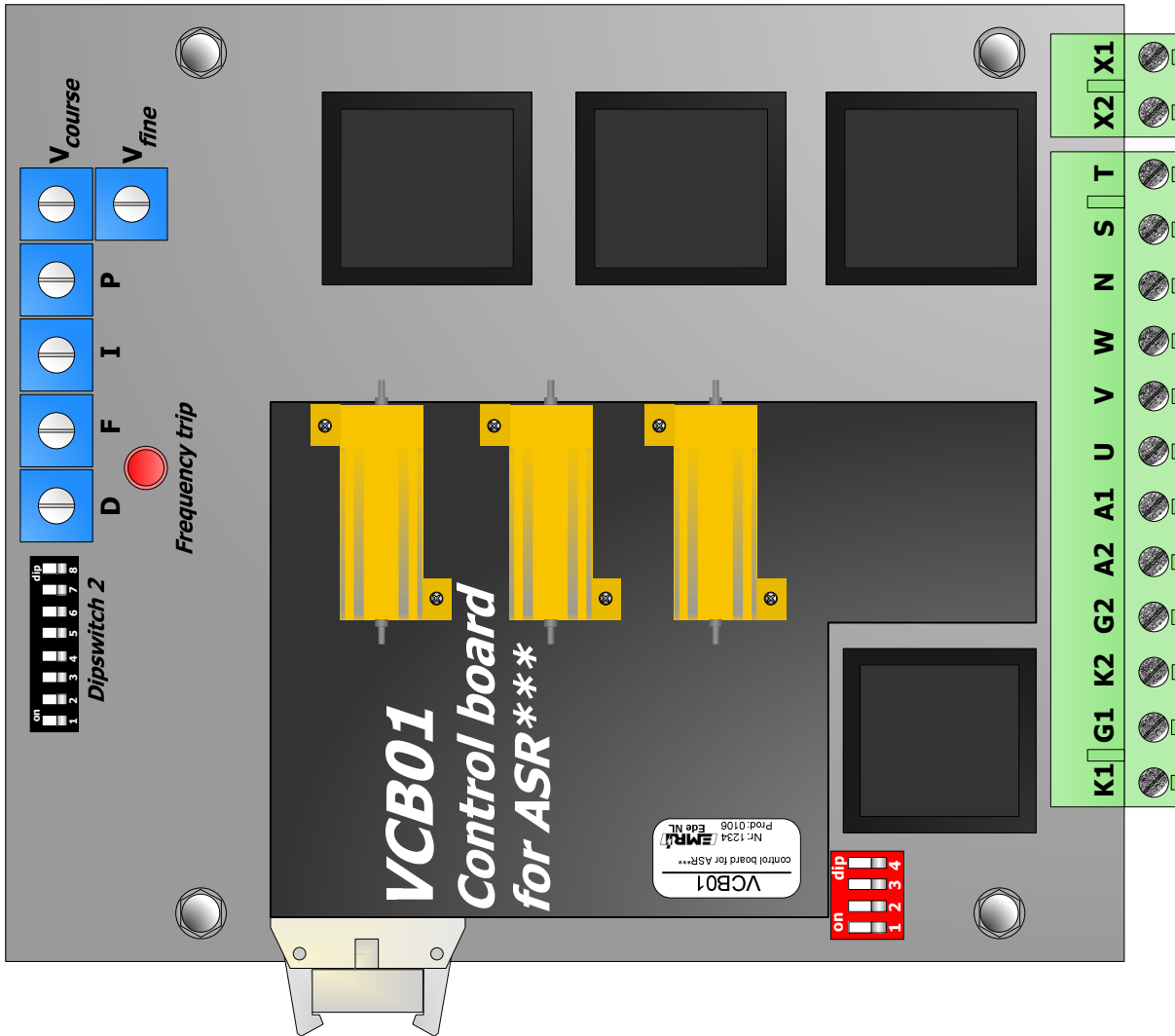


Fig 6

**Voltage**

The potentiometer V is for adjusting the Generator voltage. This potentiometer is factory adjusted to 230 V between the terminals U and 0, with S and T connected or DIP S2.4 is on. If the desired Generator voltage is much less (eg. 110 Volt), the potentiometer V must be turned completely counter clockwise before starting up. The potentiometer Vfine may be used to obtain an accurate adjustment.

**Stability**

The potentiometers P and I are for the adjustment of the voltage stability. Before starting up these potentiometers are in centre position. Instability is recognized by a continuous varying of the Generator voltage. In general the P must be turned as far clockwise as possible, without starting the voltage to vary. If instability occurs the P must be turned just so far counter clockwise, until the instability disappears. Turning too far counter clockwise will result in a poor, weak regulating behaviour. The potentiometer I is to optimize the regulating behaviour during load changes. It changes the regulating speed. Normally the adjustment is not critical. Sometimes alternating adjustment of both potentiometers is necessary. Adjusting I will slightly influence the P adjustment. If no stable regulating behaviour can be obtained, the output may be reduced with S2.1, or one SCR from the full rectifier bridge may be disabled with S1.4.

## Under speed / Frequency trip

The regulator has a built-in Frequency trip function. This function drops the Generator voltage to approximately 50% of the nominal value, when the generator frequency comes below the adjusted value. The factory adjustment is 45 Hz. Adjustment is made at nominal frequency by turning the potentiometer counter-clockwise until the voltage decreases. Then turn it the other direction until the red LED just goes out. The frequency of the generator is determined by its rotating speed. The voltage regulator can not adjust the actual frequency.

Do not run the generator on lower speed for longer periods, since this may cause damage to generator and avr. The frequency trip may be disabled with dip S2.3 to the off position.

## Phase Loss detection

The regulator has a built-in protection against missing phases. If one of the three phases is missing, the generator voltage will go down to appr. 50% of normal value. In this case the red LED will burn.

The missing phase detection may be disabled with dip S2.7 .

If the connection diagram with only two phase sensing is chosen, this protection must be switched of by moving the dip S2.7 to the on position.

## Parallel operation

If the generator is in parallel operation with one or more generators, reactive current sharing can be accomplished by means of Quadrature Droop Compensation (QDC). A droop kit must be installed.

The amount of voltage droop must be precisely set to be equal for all generators under equal load conditions.

The influence of the voltage droop on the generator voltage is depicted in diagram 7.

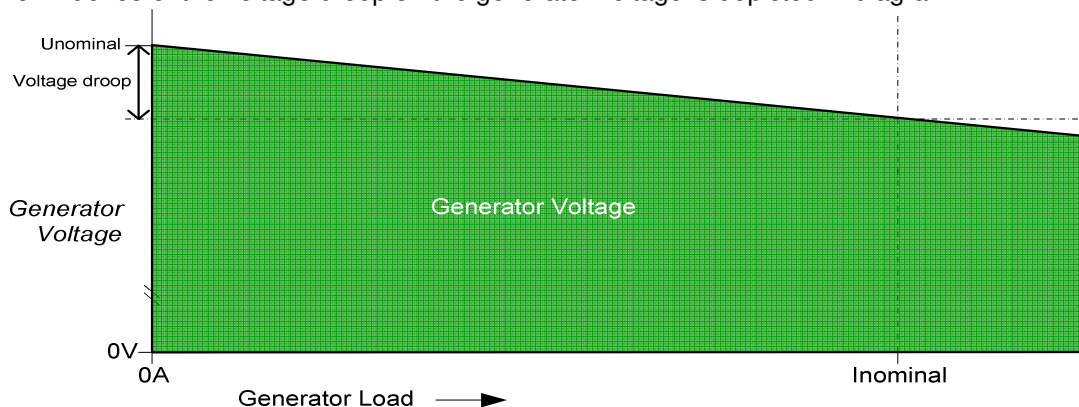


Fig 7. Voltage droop

## Installation of droop kit

The droop kit must be placed in the generators main current according to the connecting diagrams of our regulators. The maximum current of the droop transformer (see tag plate) must be equal or more then the generator maximum current. If the generator main current is much less then the droop transformers current, the generator cable must be led through the droop transformer twice or more. Be sure that the amount of windings multiplied with the generator current does not exceed the maximum current of the droop transformer.

The droop functionality is phase and phase sequence sensitive !

## Troubleshooting during commissioning parallel operation

Parallel operation does no work properly

Check

- connections of the voltage regulator and the droop transformer according the correct diagram
- direction of the droop transformer
- clockwise rotation of the generators main voltage
- the current through the droop transformer. The current must as much as possible of the phase current.
- voltages of the generators in no load conditions. These voltages must be equal
- the stability of the engines and the load sharing of the engines

## Special settings Dip switch

The regulator is equipped with an option connector for connection of optional facilities, such as a measuring filter or power-factor-regulating. Normally there is dummy plug in it. This dummy should **not** be removed if the connector is not used. The regulator is also equipped with four dipswitches S1.1-4. They have the following functions:

### Dipswitches printed cardboard VCB VCBxx DipSwitch1

S1	ON	OFF	DEFAULT
S1.1	Disable option via option connector possible	Disable function not available on option connector	OFF
S1.2	Frequency from the supply voltage is 150 Hertz	Always only one dipswitch S1.2 or S1.3 on	OFF
S1.3	Frequency from the supply voltage is 400 Hertz	Both S1.2 and S1.3 off for supply voltage is 50 Hertz	OFF
S1.4	Two SCR activated	One SCR disabled	ON

### VCBxx DipSwitch2

S2	ON	OFF	STANDAARD
S2.1	50 % output reduction	100 % output	OFF
S2.2	Fast voltage ramp up	Slow voltage ramp up	ON
S2.3	Frequency trip enabled	Frequency trip disabled	ON
S2.4	Terminals S & T shortened	Terminals S & T open for use ext. potmeter	ON
S2.5	Extra smoothening on measured voltage		OFF
S2.6	3 x 230 Volt sensing <sup>(1)</sup>	No function	OFF
S2.7	Phase loss protection disabled	Phase loss protection enabled	ON
S2.8	Not used		OFF

- 1) When using two phase sensing, the phase loss protection needs to be disabled (S2.7=ON), and the extra smoothening needs to be enabled (S2.5=ON). The sensing in this situation is meant for 400 Volt phase to phase.

## Troubleshooting during commissioning

-Generator does not give voltage at all

Check

- connections of the avr
- rotating speed of the generator
- windings of the generator for short-circuits to earth on fields, exciters, rotor and stator
- windings of the generator for short-circuits between phases
- windings of the generator for short-circuits on fields, exciters, rotor and stator
- loose connections of fields, exciters, rotor and stator
- rectifiers on the rotor or from compound systems
- load which is already switched on
- excite the generator according the field flash diagram

-Generator voltage remains low and is not adjustable

Check

- connections of the avr
- rotating speed of the generator
- setting of the Frequency trip of the avr
- rectifiers on the rotor
- potentiometer or jumper between the terminals s and t
- value of the field current. When less than 0.5 A an optional resistor parallel to the field may help

-Generator voltage remains instable and is not adjustable

Check

- settings of the stability potentiometers from the avr
- connections of the avr
- rotating speed of the generator
- jumper between the terminals x and x for avr type LASR
- value of the field current. When less than 0.5 A an optional resistor parallel to the field may help
- windings of the generator for short-circuits to earth on fields, exciters, rotor and stator

-Generator voltage too high and is not adjustable

Check

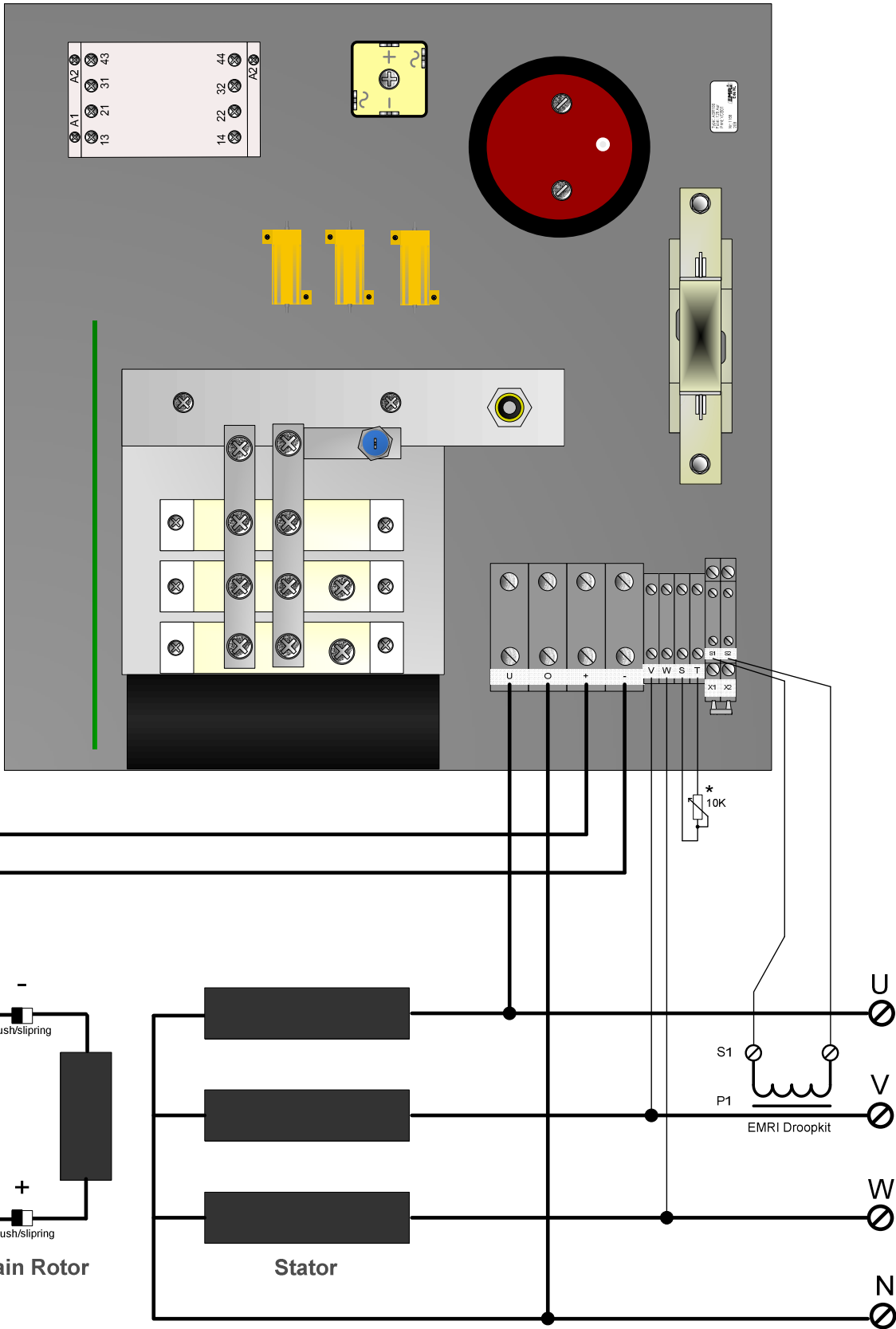
- connections of the avr (three phases)
- connections droop potentiometer and droop transformer
- setting of the voltage potentiometer on the printed cardboard or the potentiometer between s and t
- presence of compound systems
- presence of self excitation systems or build up units

-Fuse of the avr is blown

Check


- rating of the avr for the machine data
- Main windings or slip ring body, brush holders, wiring for short circuits to earth, or between wires for rotor and stator.
- Main stator windings of the generator for short-circuits between phases
- loose connections of wirings, slip ring bodies, brushes, rotor and stator
- connections of the avr
- rotating speed of the generator
- rectifiers of eventually installed compound systems

In all cases where you are not able to solve the problem with this help, we advise you to contact an expert or let the generator be checked in an electrical repair workshop.

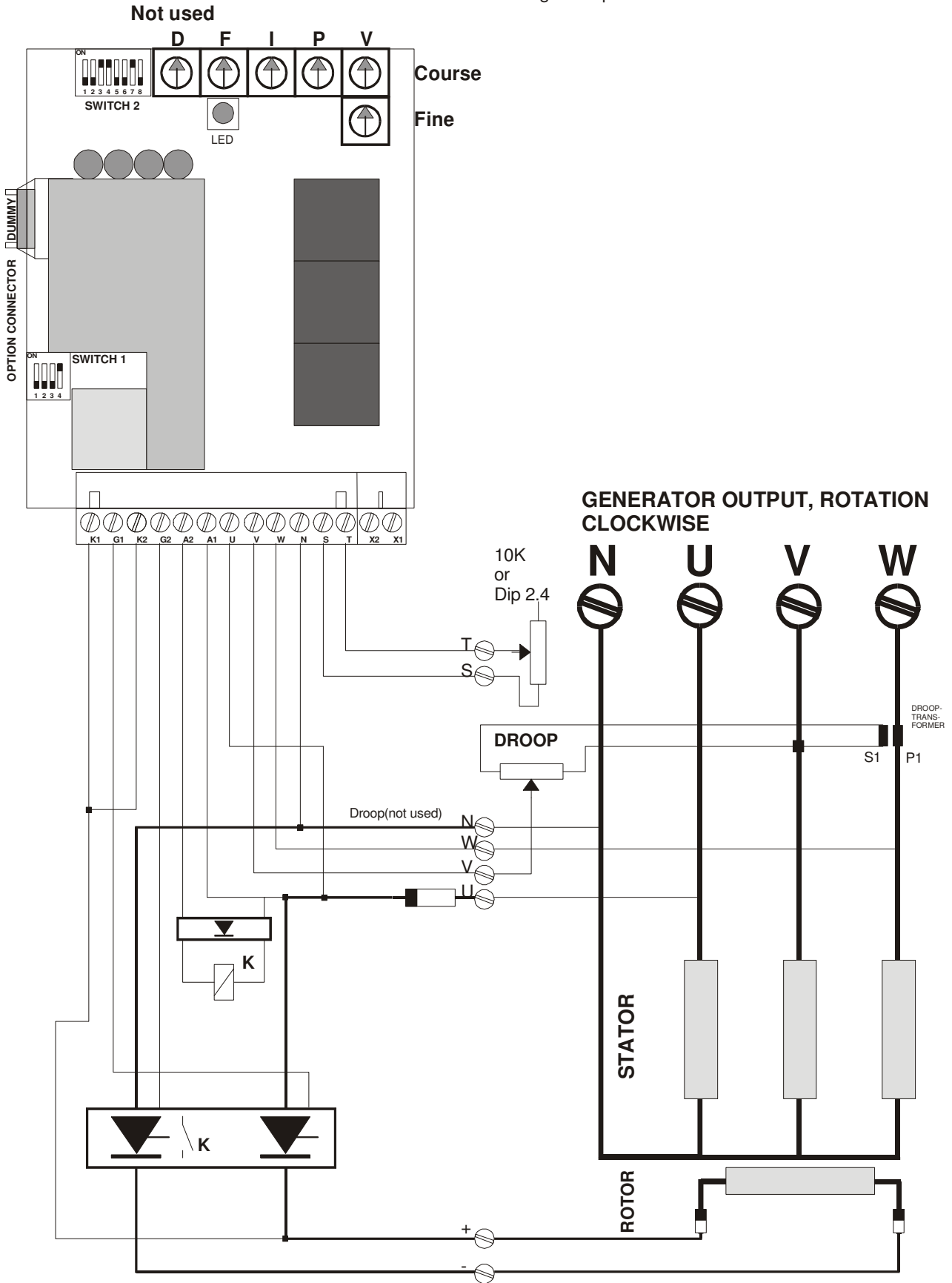


\* The use of external voltage setting is optional. (See manual)

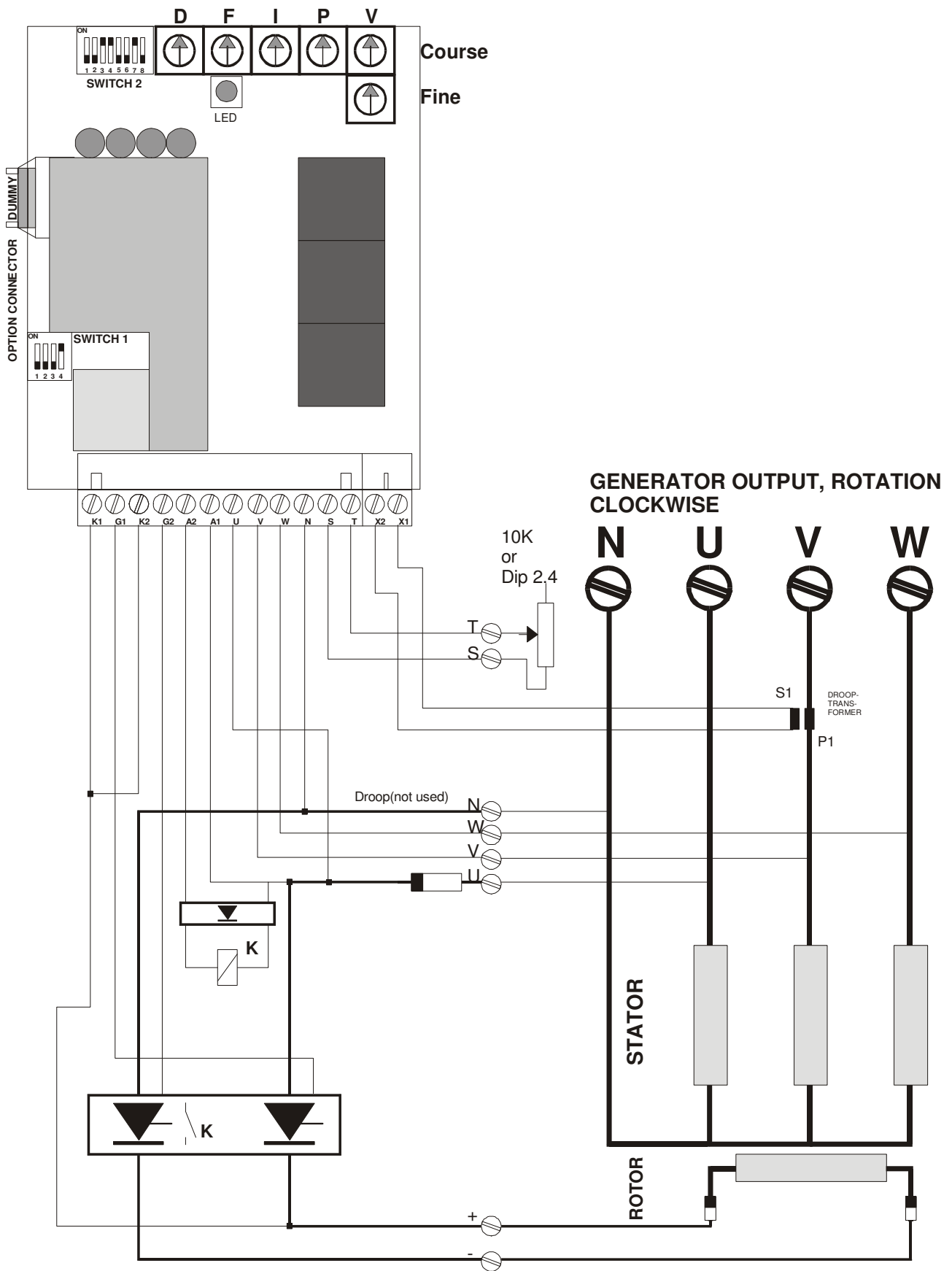
Standard Connection Diagram: ASR100	
ENG	PLoader
DATE	2021/08
VERSION	V0x
PAGE	1/1



**ASR35 VOLTAGE REGULATOR WITH VCBXXX PCB**  
 3 X 400 Volt + Neutral  
 External Voltage Droop

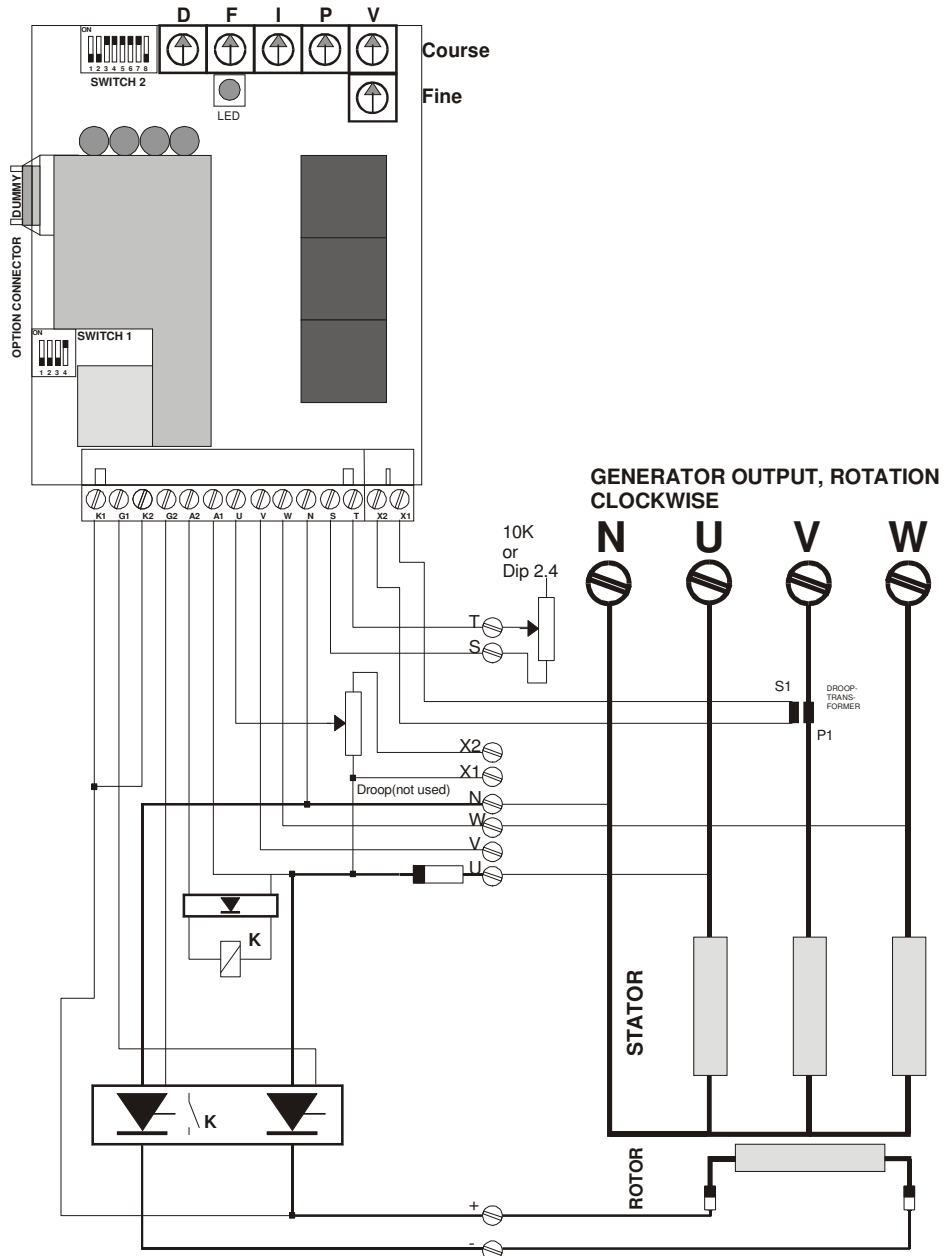


**ASR35 VOLTAGE REGULATOR WITH VCBXXX PCB**  
 3 X 400 Volt + Neutral  
 Internal Voltage Droop

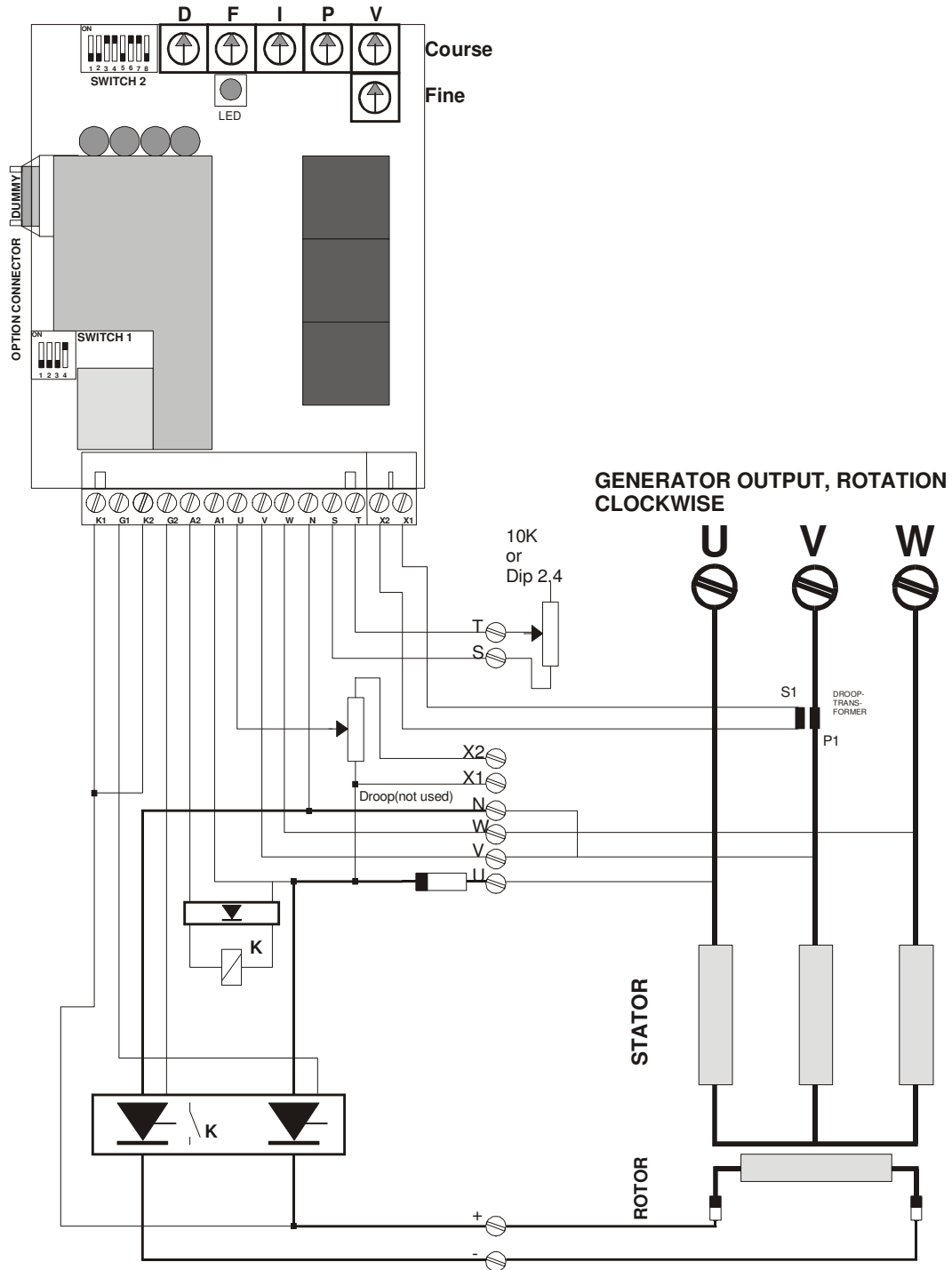




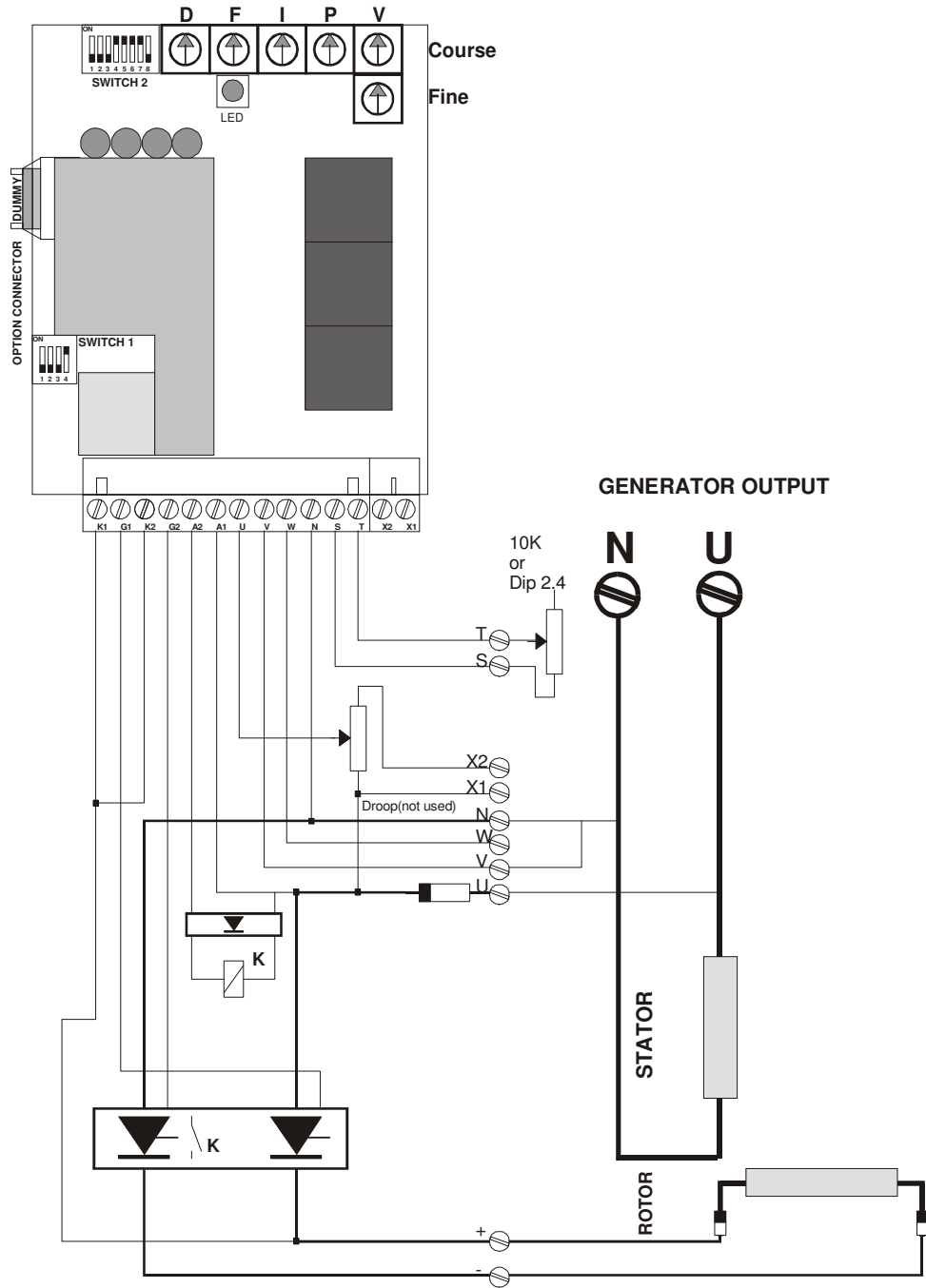
ASR VOLTAGE REGULATOR WITH VCBXXX PCB  
2 X 400 Volt + Neutral



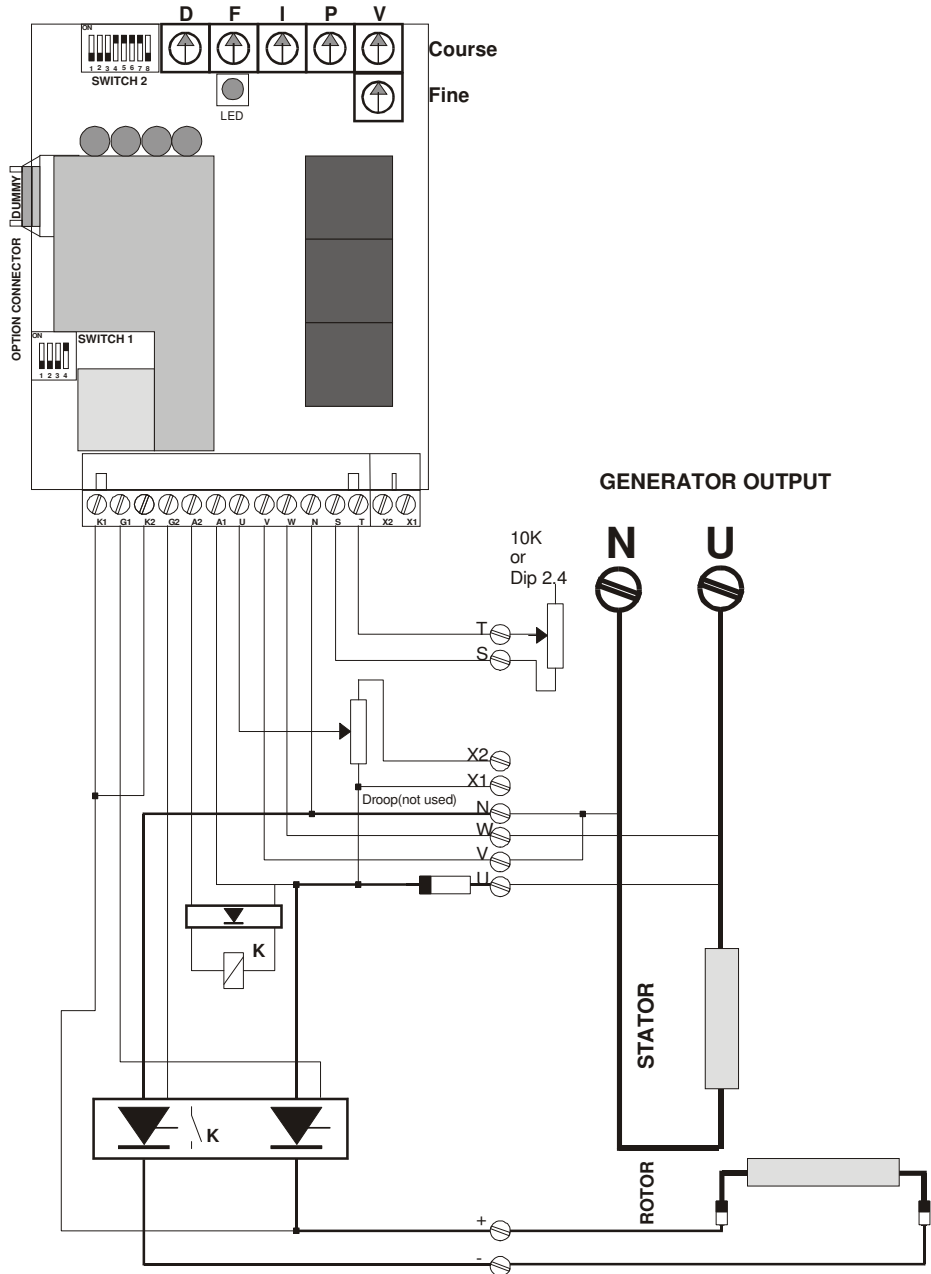
ASR VOLTAGE REGULATOR WITH VCBXXX PCB  
3 X 230 Volt without Neutral



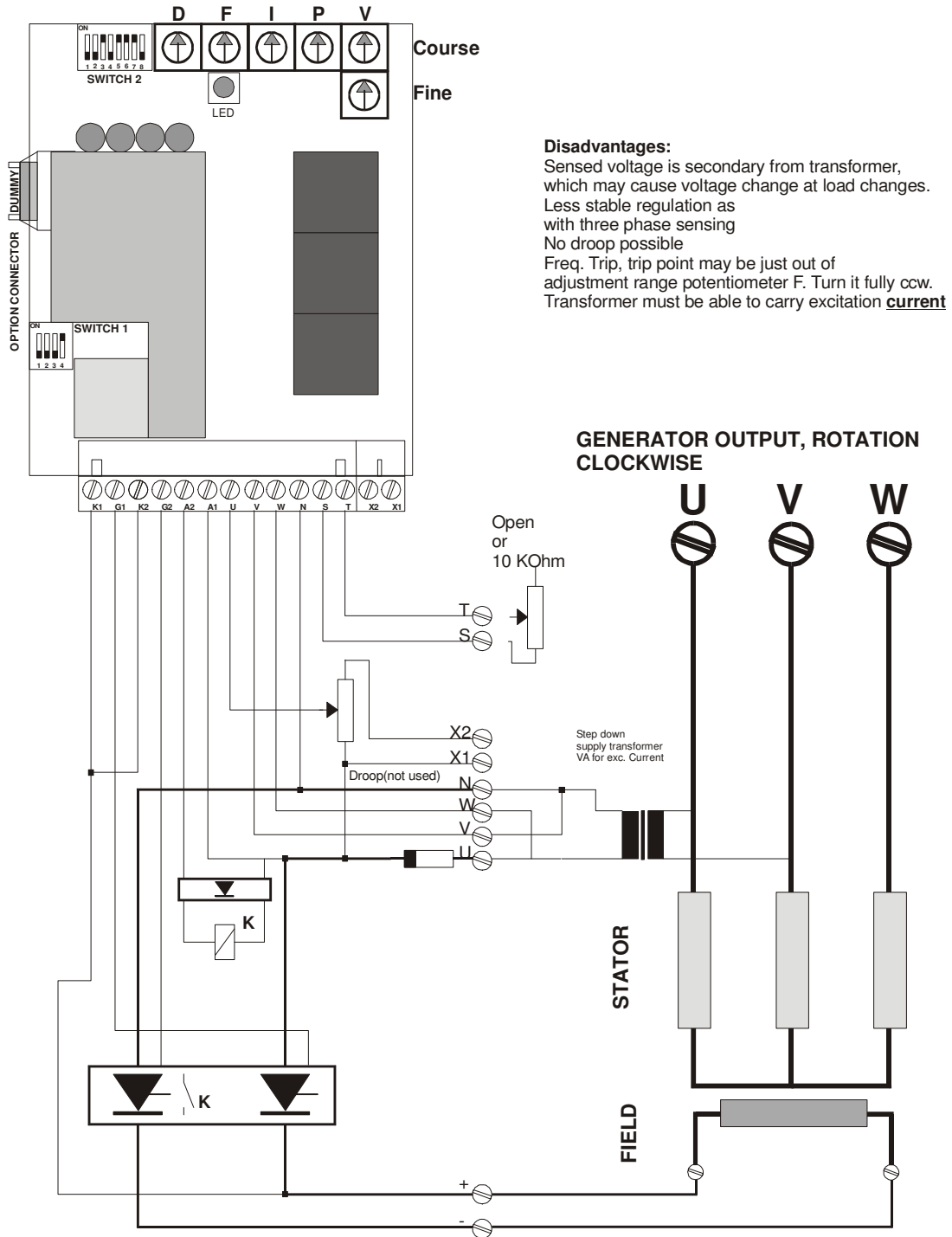
ASR VOLTAGE REGULATOR WITH VCBXXX PCB  
1 x 230 Volt



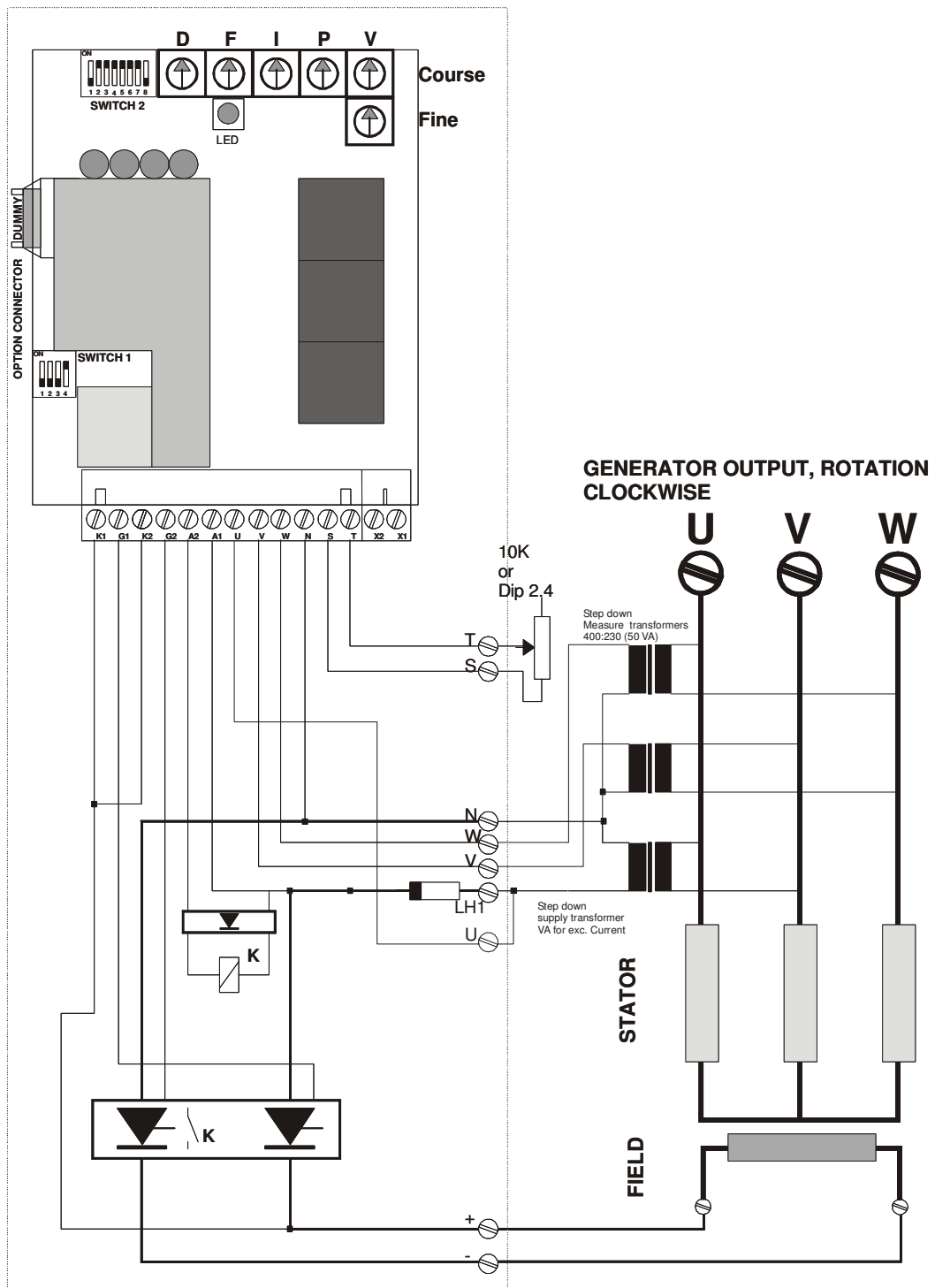
ASR VOLTAGE REGULATOR WITH VCBXXX PCB  
1 x 230 Volt

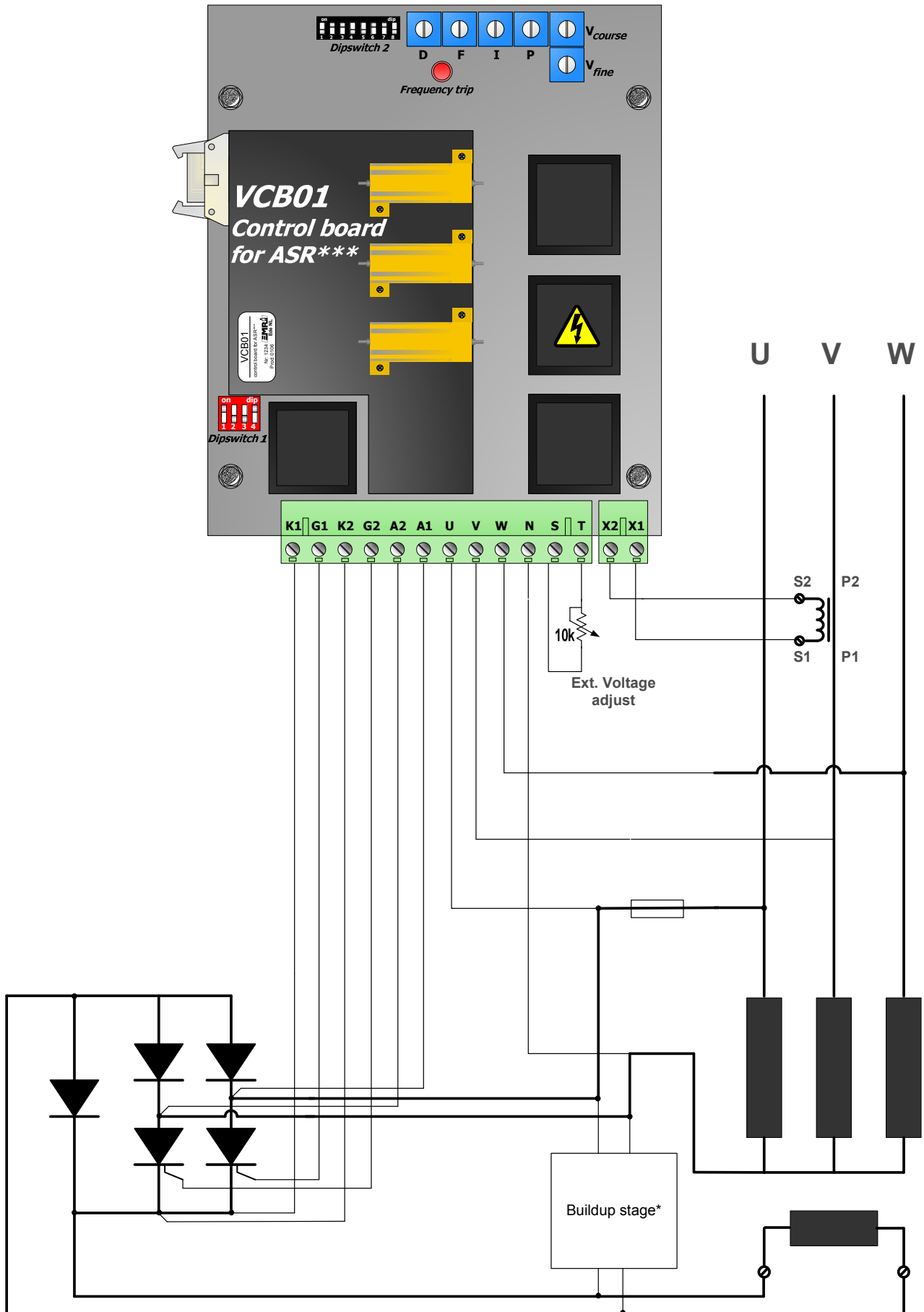


ASR VOLTAGE REGULATOR WITH VCBXXX PCB  
 3 x 400 Volt  
 with step down transformer



ASR VOLTAGE REGULATOR WITH VCBXXX PCB  
 3 x 400 Volt  
 with step down transformers  
 400:230 Volt



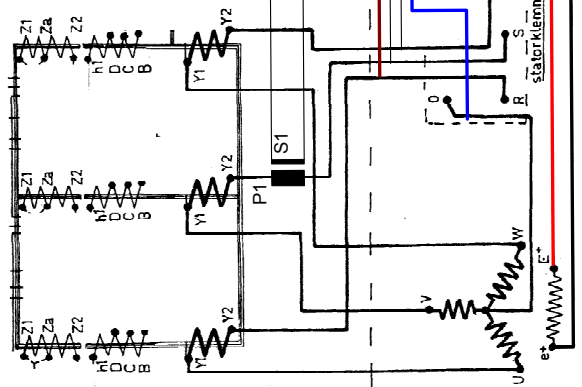


# Draaistroom compound generator <sup>SS</sup> 652 198

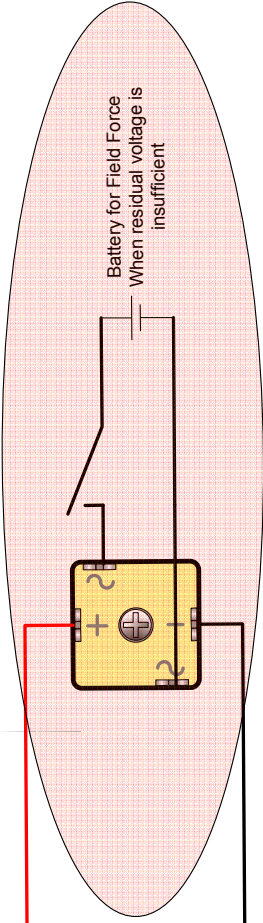
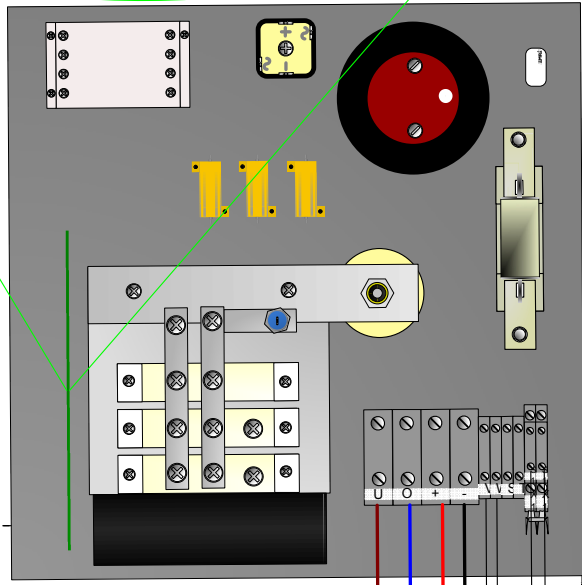
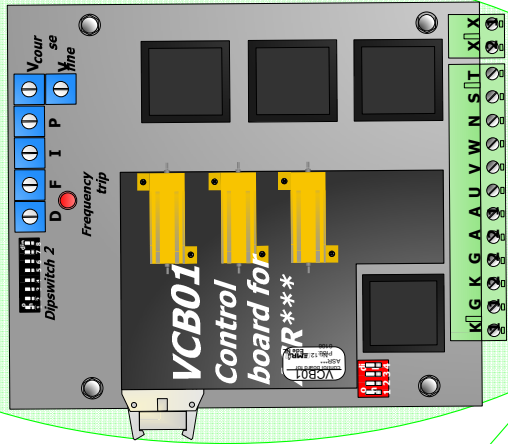
Opgebouwd compound, toestel met ventilatie door de generator.

Principeschema voor normale uitvoering max. 525 Volt.

compounderingsstoel



Phase sequence:  
R → S → T



get. <i>AV</i>	21/2-65	HEEMAF N.V. Hengelo, Nederland	vervengt
grec. <i>9813</i>	13/12-65		

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# GENERAL INSTALLATION INFORMATION

## Absolute Maximum Ratings

- The Absolute Maximum Ratings are those limits for the device that, if exceeded, will likely damage the device. Exceeding the absolute maximum ratings voids any warranty and/or guarantee.

## Mounting

Mounting of the product should be done in such a way that:

- the absolute maximum ambient temperature rating of the product will never be exceeded.
- maximum cooling (direction of cooling ribs and direction of airflow) is achieved.
- Mounting no humid air can flow through the product or condensation occurs.
- dust or other materials or residue will not remain in or on the product.
- the maximum vibration is not exceeded.
- personal contact with persons is impossible.

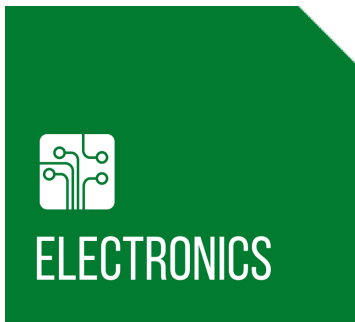
## Wiring

- Diameter size of the wiring should be enough to carry the expected current. Wire insulation should be enough to withstand the expected operating voltages and temperatures.
- To improve EMC emission and immunity, care should be taken for the lay out of the wiring. This in respect to all wiring in the installation.
- Keep current carrying wires as short as possible.
- Keep wires carrying a total sum of zero Ampere close to each other, or in one single cable, E.g. U, V, W, or X (+) and XX (-), or Phase and neutral, or S and T.
- Avoid current carrying conductors next to sensing or control wiring. Especially current controlled by SCR's or PWM controlled transistors.
- If sensitive sensing signal cables need to be laid across distance along other cabling, shielded cable is preferred. Keep the shield as long as possible and the wiring outside the shield as short as possible. Do not solder or shrink the shield to a regular wire. Connect the original shield to ground at one side with an as large as possible contact surface.

## Additional installation information

- When the product is supplied by means of a transformer, it should never be an auto-transformer. Auto-transformers react as voltage sweep up coil and may cause high voltage peaks.
- Standard fit capacitors or over-voltage suppressers across X (+) and XX (-), or exciter field terminals inside the generator should be removed.
- When the product is supplied by means of a transformer, it should be able to carry at least the maximum expected current. Advisable is, to have a transformer which can carry twice the maximum expected current. Inductive loads make voltage sags and peaks into the secondary voltage of a transformer, from which the device may malfunction.
- It is not recommended to apply switches in dc outputs. It is preferred to use switches in the ac supply inputs of devices. In case it is unavoidable to have switches in the dc output of a device, action must be taken to avoid over voltage damage to the device due to contact arcing. Use a voltage suppressor across the output.
- It is not recommended to apply switches or fuses in the sensing lines. Defects can cause high voltage situations due to over-excitation.
- When using a step down transformer in medium or high voltage generators, the transformer should be three phase (if three phase sensing), and the transformer should be suitable for acting as a sensing transformer. If the transformer is unloaded, connect a resistor to avoid voltage waveform distortion.
- The phase relation from the generator to the AVR is important. Also when voltage transformers and/ or current transformers are installed.
- When using a step down or insulation transformer in the droop circuit, phase relation from the generator to the AVR is important.
- CT's wiring, connected to the AVR should never be grounded.
- Always disconnect electronic products, circuits and people before checking the insulation resistance (Megger check).
- Due to differences in generators impedance's, EMC behavior is not predictable. Therefore the commissioner / installer should be aware of proper and correct installation.
- Large, highly inductive, exciter stator windings can cause destructive high voltage peaks. Adding a resistor from 10 to 20 times the exciter stator field resistance reduces voltage spikes. If necessary filter can be fitted additionally. (e.g. snubber, RC-network)
- Upon problems during commissioning, faulty behavior or defects in the generator, consult the fault finding manual at our web site
- Some advises may be overdone or seem extraordinary, but since the electrical rules are the same everywhere, these advises are given.

# CONTACT



EMRI Electronics B.V.  
Morsestraat 10  
6716 AH, Ede, Netherlands  
Tel: +31 (0)318 620 427  
Website: [www.emri.nl](http://www.emri.nl)  
E-mail: [info@emri.nl](mailto:info@emri.nl)

**Manufacturer**



**CANARY ISLANDS**, Las Palmas  
**Zamakona Yards**  
Tel: +34 928467521  
Fax: +34 928461233  
Website: [www.zamakonayards.com/](http://www.zamakonayards.com/)  
E-mail: [jbetancor@zamakonayards.com](mailto:jbetancor@zamakonayards.com)

**CHILE**, Santiago  
**Lucio Vicencio y CIA.LTDA**  
Tel: +1-281-334-2904  
Fax: +1-832-221-5642  
Website: [www.luciovicencio.cl](http://www.luciovicencio.cl)  
E-mail: [luciovincenciolt@gmail.com](mailto:luciovincenciolt@gmail.com)

**GREECE**, Piraeus  
**Stavros Kassidiaris S.A.**  
Tel: +30 210 4636000  
Fax: +30 210 4624471  
Website: [www.kassidiaris.gr](http://www.kassidiaris.gr)  
E-mail: [info@kassidiaris.gr](mailto:info@kassidiaris.gr)

**ICELAND**, Hafnarfjordur  
**Rafeining ehf**  
Tel: +354 565 3049  
Fax: +354 565 3048  
Website: [www.rafeining.is](http://www.rafeining.is)  
E-mail: [rafeining@rafeining.is](mailto:rafeining@rafeining.is)

**INDIA**, Faridabad  
**Power Solutions**  
Tel: +91 9868907903  
Fax: +91 129 2431216  
Website: [www.psolindia.com](http://www.psolindia.com)  
E-mail: [ramesh.powersolutions@gmail.com](mailto:ramesh.powersolutions@gmail.com)

**NORWAY**, Bergen  
**Frydenbø Electric A/S**  
Tel: +47 55 34 91 00  
Fax: +47 55 34 91 10  
Website: [www.frydenbo.no](http://www.frydenbo.no)  
E-mail: [firma.fel@frydenboe.no](mailto:firma.fel@frydenboe.no)

**POLAND**, Gdynia  
**An-Elec Sp. z o.o.**  
Tel: +48 58 668 44 00  
Fax: +48 58 668 44 66  
Website: <http://an-elec.pl>  
E-mail: [info@an-elec.pl](mailto:info@an-elec.pl)

**POLAND**, Szczecin  
**MARCONTROL**  
Tel: +48 91 4 888 474  
Fax: +48 91 4 888 475  
Website: [www.marcontrol.com](http://www.marcontrol.com)  
E-mail: [emri@marcontrol.com](mailto:emri@marcontrol.com)

**POLAND**, Szczecin-Mierzyn  
**Marel Serwis**  
Tel: +48 91 48 58 388  
Fax: +48 91 48 79 948  
Website: [www.marel.szczecin.pl](http://www.marel.szczecin.pl)  
E-mail: [handel@marel.szczecin.pl](mailto:handel@marel.szczecin.pl)

**REPUBLIC OF PANAMA**, Panama  
**PASRAS S.A.**  
Tel: +507 3140095  
Fax: +507 3140094  
Website: [www.pasras.com](http://www.pasras.com)  
E-mail: [info@pasras.com](mailto:info@pasras.com)

**ROMANIA**, Constanta  
**SAMTEC SRL**  
Tel: +40 241 517 047  
Fax: +40 241 517 047  
Website: [www.samtec.ro](http://www.samtec.ro)  
E-mail: [samtec\\_srl@yahoo.com](mailto:samtec_srl@yahoo.com)

**SINGAPORE**, Singapore  
**Cyclelect Electrical Engineering**  
Tel: +65 6868 6013  
Fax: +65 6863 6260  
Website: [www.cyclelect.com.sg](http://www.cyclelect.com.sg)  
E-mail: [heng.p@cyclelect.com.sg](mailto:heng.p@cyclelect.com.sg)

**SOUTH AFRICA**, Roodepoort  
**Yneldo Electronics**  
Tel: +27(0)117637053  
Fax: +27(0)117634212  
Website: [www.yneldo.com](http://www.yneldo.com)  
E-mail: [yneldo@yneldo.com](mailto:yneldo@yneldo.com)

**SWEDEN**, Kungälv  
**Elektrisk Drivteknik EDT AB**  
Tel: +46-705-28 20 60  
Tel: +46-709-50 47 90  
Website: [www.edtab.se](http://www.edtab.se)  
E-mail: [info@edtab.se](mailto:info@edtab.se)

**THAILAND**, Bang Lamung  
**Semtec Maritime/Genetech Co.Ltd**  
Tel: +66 38301262  
Fax: +1-832-221-5642  
Website: [semtecmaritime.com/](http://semtecmaritime.com/)  
Email: [ron@northstarusa.co](mailto:ron@northstarusa.co)

**TURKEY**, Izmir  
**INTEGRAL**  
Tel: +90 (555) 211 55 75  
Email: [ozgur@integralguc.com](mailto:ozgur@integralguc.com)

**UNITED ARAB EMIRATES**, Sharjah  
**KDU Technical Services**  
Tel: +971-6-5575480  
Fax: +971-6-5575490  
Website: [www.kdutech.ae](http://www.kdutech.ae)  
E-mail: [kdutech@kdutech.ae](mailto:kdutech@kdutech.ae)

**UNITED KINGDOM**, Stockton on Tees  
**MJR Controls**  
Tel: +44 1642 762 151  
Fax: +44 1642 762 502  
Website: [www.mjrcontrols.com](http://www.mjrcontrols.com)  
Email: [chris.milner@mjrcontrols.com](mailto:chris.milner@mjrcontrols.com)

**UNITED KINGDOM**, Cheadle Hulme  
**TGS Total Generator Solutions Ltd**  
Tel: +44161 8188720  
Fax: +447754677963  
Website: <http://totalgeneratorsolutions.com>  
Email: [sales@totalgeneratorsolutions.com](mailto:sales@totalgeneratorsolutions.com)

**UNITED STATES**, Kemah - Texas  
**Ramtec Marine Systems LLC**  
Tel: +1-281-334-2904  
Fax: +1-832-221-5642  
Website: [www.ramtec-marine.com](http://www.ramtec-marine.com)  
Email: [waling@ramtec-marine.com](mailto:waling@ramtec-marine.com)