

# **Operating Manual**

# **SHOCK DISCHARGE GENERATOR**

# **SWG 500**



**Consultation with Megger**

The present system manual has been designed as an operating guide and for reference. It is meant to answer your questions and solve your problems in as fast and easy a way as possible. Please start with referring to this manual should any trouble occur.

In doing so, make use of the table of contents and read the relevant paragraph with great attention. Furthermore, check all terminals and connections of the instruments involved.

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For damage resulting from a violation of their duty to repair or re-supply items, Megger can be made liable only in case of severe negligence or intention. Any liability for slight negligence is disclaimed.



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## 1 Description

### 1.1 General

The shock discharge generator SWG 500 is used for the location of cable faults, by generating flashovers or punctures at the weak point of the cable insulation. For this purpose, the four impulse capacitors are charged and then discharged into the faulty cable via an operating spark gap. This discharge creates a flash-over noise at the fault, which is picked up on the ground surface by means of a geophone microphone, amplified via a receiver/amplifier FLE 66 or FLE 90, and then indicated acoustically and/or optically

#### IMPORTANT:

The SWG 500 is a high voltage instrument. Hence, the safety precautions have imperatively to be observed. These can be found under paragraph 2.1. on page 3.

### 1.2 Technical data

Surge voltages :	a) 2,5 - 5 - 10 kV b) 4 - 8 - 16 kV
Output :	195 Ws at 2,5 / 5 / 10 kV 500 Ws at 4 / 8 / 16 kV
Impulse sequence :	single-shot pulse or 1,5 - 6 seconds
Power supply :	220/240 V, 45-60 Hz
Current consumption :	2,5 A (average value)
Meter :	0 - 20 kV (direct measurement)
Weight :	45 kg
Dimensions (LxHxB) :	520 x 255 x 500
Standard accessories :	a) Power cable NK-G 01 b) Earthing cable EK 01 c) 4 m high voltage cable HSK 13 d) Operating manual
Special accessories :	e) Protective cover SD 50

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### 1.3 Design

The shock discharge generator SWG 500 is a completely self-contained instrument and can be operated without any additional units. The four main sub-assemblies viz control unit, high voltage generator, impulse capacitors and the operating spark gap are mounted in a rugged 19"-housing. Modern indicating and sensor elements, combined with VDE indicating elements (VDE 0104) facilitate operation and handling of the instrument.

A built-in kV meter indicates the surge voltage and measures the high voltage directly at the capacitor bank.

All operational and indicating elements are mounted on the front panel of the instrument. The connections for the power supply, earthing cable and the high voltage output have been provided at the rear of the instrument.

The connection of the instrument on the high voltage side to the faulty cable is made by means of a 4 m high voltage lead with a high voltage plug connector. The instrument cannot be put into operation unless this high voltage lead is connected.

### 1.4 Current supply

The SWG 400 is operated from a 220 V AC mains with a frequency of 45 to 60 Hz. For 240 V operation, an internal voltage matching for the mains supply of the control unit has been provided. If the instrument is to be operated from a 110 V AC mains, the high voltage transformer has to be replaced. The connection change-over for the transformer of the control unit for 110 V operation has been provided.



## **2 Putting into operation**

### **2.1 Safety**

The shock discharge generator SWG 500 releases dangerous contact voltages. Hence the instrument must be operated by specialists or personnel who have been trained or instructed in the use of the instrument. The following safety precautions should be adhered to:

- Para. 2.2. Earthing of the instrument
- Para. 2.3. Connection to the faulty cable
- Para. 2.4. Isolation of open cable ends
- Para. 2.5. Selection of a suitable surge voltage
- Para. 2.6. Safety terms

### **2.2 Earthing of the instrument**

Prior to putting into operation, the Instrument has to be earthed. For this purpose, the earthing terminal (13) is to be connected to a reliable protective earth by means of the earthing lead supplied. The protective earthing provided through the earthing contact of the mains supply lead is not sufficient.

### **2.3 Connection to the faulty cable**

The plug of the high voltage lead is connected to the high voltage socket (15) and is secured by means of the fixing screw. Now a micro contact inside the instrument closes and renders the instrument ready for the connection of a mains supply.

After the faulty cable has been disconnected and verified to be dead, the high voltage lead can be connected. For this purpose, the wire clamp is fixed to the faulty phase conductor, whereby care should be taken to ensure a good contact. The sheath clamp is screwed onto the sheath or screen of the defective cable. Additionally, in the case of a fault between two cores, one of these cores has to be connected to the sheath or screen and in the event of plastic cables, to systems earth.

### **2.4 Isolation of open cable ends**

Since the high voltage impulses applied to the defective cable assume dangerous values, the cable ends must be isolated as per VDE 0104 in order to avoid physical contact. This also goes for teed low voltage cables which, if need be, have to be disconnected in order to avoid flashovers in the installations or terminal boxes.

Only when dealing with longer cables (exceeding 100 m) it is recommended to short-circuit and earth one cable end. In spite of the shorted conductors, a flashover can be obtained at the fault.

## **2.5 Selection of the surge voltage**

The selection of the surge voltage depends both on the test voltage of the faulty cable and on the ignition behaviour of the fault. The ignition behaviour is governed not only by the voltage level, but also by the duration of the surge impulse. The latter again mainly depends on how the Impulse capacitors are connected.

In practice, 2,5 or 4 kV are recommended for low voltage cables. In the event of medium or high voltage cables, it might be necessary to determine the surge voltage to be set by trial. In this case one should always start with the lowest voltage of 2,5 kV.

Surge impulses which do not cause a flashover are reflected at the cable end, whereby their impulse voltage is doubled. This fact is to be taken into account as laid down by VDE 0298.

## **2.6 Safety terms as per VDE 0104**

### **2.6.1 Ready for mains connection**

Indicated by a white pilot lamp (6).  
Mains voltage is connected.  
Instrument is not on.

### **2.6.2 Ready for operation**

Indicated by a green pilot lamp (7).  
Instrument is on.  
No high voltage.  
Output earthed.

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### 2.6.3 Ready for switching on

Indicated by a red pilot lamp (5).

Instrument is on.

Green pilot lamp goes out.

Caution: HIGH VOLTAGE IS ON !

#### \*NOTE:

If the green pilot lamp goes out and the red pilot lamp does not light up, the instrument is also ready for switching on!!

## 2.7 Mains connection

The earthed power supply lead supplied is connected to socket (14). The mains voltage should be 220 - 240 V. A mains frequency of 45 - 60 Hz is permissible.

## 2.8 Setting the surge voltage

Only in switching state "Ready for mains connection". (Only the white pilot lamp lights up). The desired surge voltage is set on the high voltage change-over switch (12). For this purpose, the knob in "OFF" position is pulled out, turned to the desired voltage and firmly depressed (rotary plug-in switch). If the instrument is switched on, but the high voltage switch has not been properly set, a locking magnet prevents an operation of this switch.

The voltages which can be selected on this switch, are coupled with each other

Position I :	2,5 kV (195 Ws)	or	4 kV (500 Ws)
Position II :	5 kV (195 Ws)	or	8 kV (500 Ws)
Position III :	10 kV (195 Ws)	or	16 kV (500 Ws)

## 2.9 Selecting the surge output

### 2.9.1 195 Ws operation

In the normal position, the instrument is set to 195 Ws. This is indicated by the yellow illuminated pushbutton (8) after switching on.

### 2.9.2 500 Ws - operation

For the purpose of setting the surge output of 500 Ws, operate pushbutton (9) with the instrument switched on. This switching state is indicated by the same illuminated pushbutton (9).

### 2.10 Switching the instrument on

Prerequisites:	a) Earthing of the instrument b) Connection to the faulty cable c) READINESS FOR MAINS CONNECTION (white pilot lamp).
Operation	I: Luminous pushbutton (6) white
Result	: Pushbutton (6) continues lighting
Switching state	I: READY FOR OPERATION
Indication	: Luminous pushbutton (7) green
Operation	II: Luminous pushbutton (7) green
Result	: Luminous pushbutton (7) goes out
Switching state	II: READY FOR SWITCHING ON or High Voltage connected resp.
Indication	: Luminous pushbutton (5) red
Meter	: kV-meter 2,5/5/10 kV
Indication	II: Luminous pushbutton (8) yellow, 195 Ws at 2, 5 - 5 or 10 kV resp. This is the normal position. or after corresponding preselection:
Indication	II: Luminous pushbutton (9) yellow, 500 Ws at 4 , 8 or 16 kV resp .

### 2.11 Setting the Impulse sequence

Rotary control (11) is combined with a rotary switch. When the rotary control is turned fully to the left, the automatic impulse sequence is switched off (single-shot impulse). If the rotary control is turned to the right (clockwise), then the impulse sequence can be continuously selected after the switching point has been passed. The shortest impulse sequence (fully to the left) is 1,5 seconds and the longest (fully to the right) 6 seconds. One scale division corresponds to approx. 0,5 seconds.

## 2.12 Single-shot pulse

In order to trigger single-shot pulses, e.g. by radio command, the rotary control (11) is to be set fully to the left, whereby a switching off point has to be crossed. A single-shot impulse is triggered by means of pushbutton (10).





### 3 Switching Off

After completion of the test, the instrument is switched off by operating the luminous pushbutton (5), whereby both the control unit and the high voltage generation are switched off. Simultaneously, the instrument is automatically discharged and the connected cable is earthed. The pointer of the kV-meter returns to Zero.

**Important:**

Prior to disconnecting the high voltage lead from the cable under test, both connections have to be touched with an earthing rod in order to ensure a "visible" discharge and earthing.



#### 4 Description of operating and connecting panel

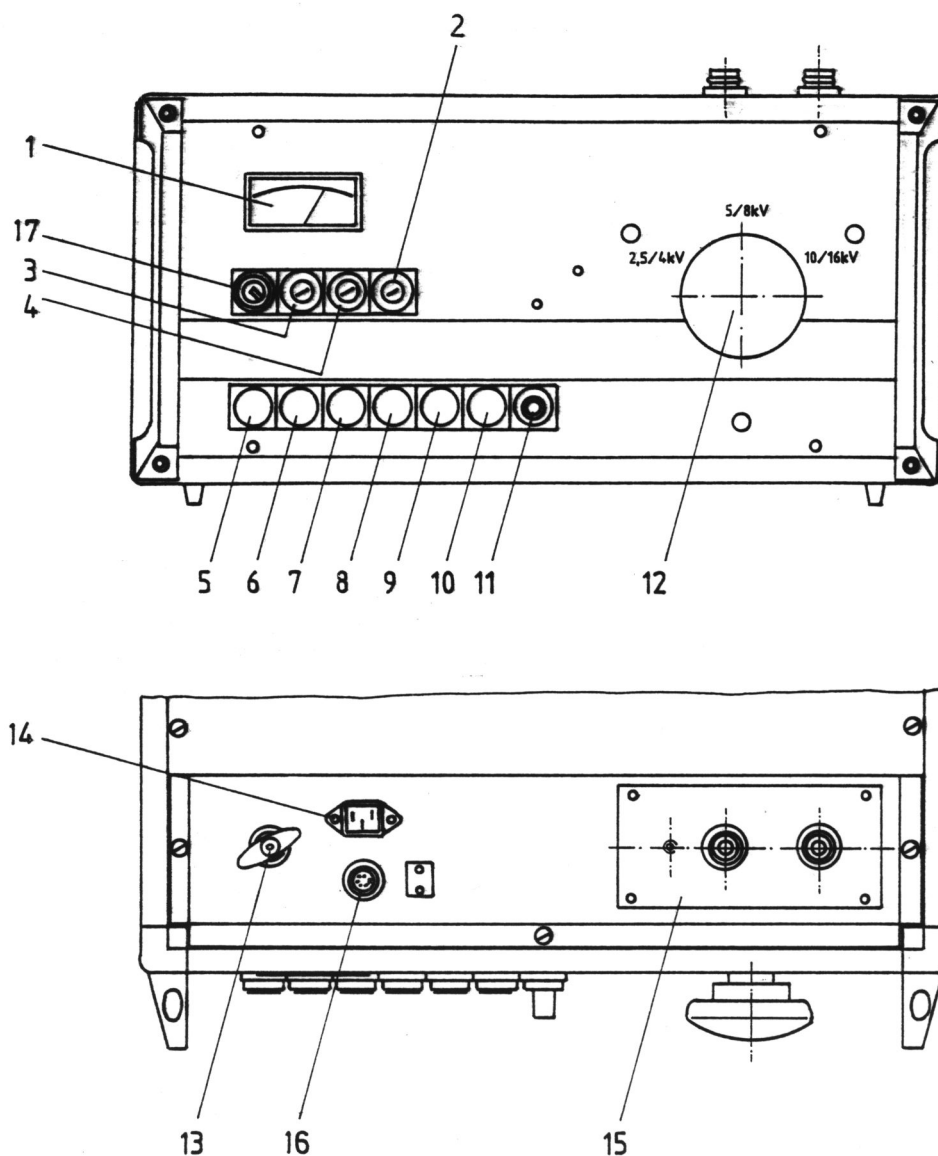


Figure 1 : Operating and connecting panel

- |                                      |  |
|--------------------------------------|--|
| (1) kV-meter :                       | 0 - 20 kV  |
| (2) Microfuse/Mains circuit :        | F3 (M0.8/250 C)                                      |
| (3) Microfuse/Mains circuit :        | F1 (T4/250 E)  |
| (4) Microfuse/Control circuit :      | F2 (T4/250 E)  |
| * (5) Luminous pushbutton<br>(red) : | "READY FOR SWITCHING<br>ON"<br>when operated : "OFF" |

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* (6) Luminous pushbutton (white) :	"READY FOR MAINS CONNECTION" when operated : "ON"
* (7) Luminous pushbutton (green) :	"READY FOR OPERATION" when operated : "H.V. ON"
(8) Luminous pushbutton (yellow) :	195 Ws at 2.5/5/10 kV
(9) Luminous pushbutton (yellow) :	500 Ws at 4/8/16 kV
(10) Pushbutton (blue) :	single-shot trigger
(11) Rotary switch :	Impulse sequence 1.5 - 6 s/pulse
(12) High voltage range selection switch :	2.5/5/10 - 4/8/16 kV
(13) Earthing terminal	
(14) Mains connection socket :	220 V, 45 - 60 Hz (or other voltages).
(15) High voltage output :	For the H.V. output leads.
(16) NAG connector	
(17) Key switch	

### \* IMPORTANT:

The illuminated pushbuttons 5/6/7 have dual functions

- a) Pushbutton for operation
- b) Pilot lamps for indication of the switching state of the instrument.



Tento symbol indikuje, že výrobek nesoucí takovéto označení nelze likvidovat společně s běžným domovním odpadem. Jelikož se jedná o produkt obchodovaný mezi podnikatelskými subjekty (B2B), nelze jej likvidovat ani ve veřejných sběrných dvorech. Pokud se potřebujete tohoto výrobku zbavit, obraťte se na organizaci specializující se na likvidaci starých elektrických spotřebičů v blízkosti svého působiště.



Dit symbool duidt aan dat het product met dit symbool niet verwijderd mag worden als gewoon huishoudelijk afval. Dit is een product voor industrieel gebruik, wat betekent dat het ook niet afgeleverd mag worden aan afvalcentra voor huishoudelijk afval. Als u dit product wilt verwijderen, gelieve dit op de juiste manier te doen en het naar een nabij gelegen organisatie te brengen gespecialiseerd in de verwijdering van oud elektrisch materiaal.



This symbol indicates that the product which is marked in this way should not be disposed of as normal household waste. As it is a B2B product, it may also not be disposed of at civic disposal centres. If you wish to dispose of this product, please do so properly by taking it to an organisation specialising in the disposal of old electrical equipment near you.



Този знак означава, че продуктът, обозначен по този начин, не трябва да се изхвърля като битов отпадък. Тъй като е B2B продукт, не бива да се изхвърля и в градски пунктове за отпадъци. Ако желаете да изхвърлите продукта, го занесете в пункт, специализиран в изхвърлянето на старо електрическо оборудване.



Dette symbol viser, at det produkt, der er markeret på denne måde, ikke må kasseres som almindeligt husholdningsaffald. Eftersom det er et B2B produkt, må det heller ikke bortskaffes på offentlige genbrugsstationer. Skal dette produkt kasseres, skal det gøres ordentligt ved at bringe det til en nærliggende organisation, der er specialiseret i at bortskaffe gammelt el-udstyr.



Sellise sümboliga tähistatud toodet ei tohi käidelda tavalise olmejäätmena. Kuna tegemist on B2B-klassi kuuluva tootega, siis ei tohi seda viia kohaliku jäätmekäitluspunkti. Kui soovite selle toote ära visata, siis viige see lähimasse vanade elektriseadmete käitlemisele spetsialiseerunud ettevõttesse.



Tällä merkinnällä ilmoitetaan, että kyseisellä merkinnällä varustettua tuotetta ei saa hävittää tavallisen kotitalousjätteen seassa. Koska kyseessä on yritysten välisen kaupan tuote, sitä ei saa myöskään viedä kuluttajien käyttöön tarkoitettuihin keräyspisteisiin. Jos haluatte hävittää tämän tuotteen, ottakaa yhteys lähimpään vanhojen sähkölaitteiden hävittämiseen erikoistuneeseen organisaatioon.



Ce symbole indique que le produit sur lequel il figure ne peut pas être éliminé comme un déchet ménager ordinaire. Comme il s'agit d'un produit B2B, il ne peut pas non plus être déposé dans une déchetterie municipale. Pour éliminer ce produit, amenez-le à l'organisation spécialisée dans l'élimination d'anciens équipements électriques la plus proche de chez vous.



Cuireann an siombail seo in iúl nár cheart an táirgeadh atá marcáilte sa tsíle seo a dhíúscairt sa chóras fuíoll teaghlaigh. Os rud é gur táirgeadh ghnó le gnó (B2B) é, ní féidir é a dhíúscairt ach oiread in ionaid dhíúscairthe phobail. Más mian leat an táirgeadh seo a dhíúscairt, déan é a thógáil ag eagraíocht gar duit a sainfheidhmiú in ndíúscairt sean-fhearas leictrigh.



Dieses Symbol zeigt an, dass das damit gekennzeichnete Produkt nicht als normaler Haushaltsabfall entsorgt werden soll. Da es sich um ein B2B-Gerät handelt, darf es auch nicht bei kommunalen Wertstoffhöfen abgegeben werden. Wenn Sie dieses Gerät entsorgen möchten, bringen Sie es bitte sachgemäß zu einem Entsorger für Elektrogeräte in Ihrer Nähe.



Αυτό το σύμβολο υποδεικνύει ότι το προϊόν που φέρει τη σήμανση αυτή δεν πρέπει να απορρίπτεται μαζί με τα οικιακά απορρίματα. Καθώς πρόκειται για προϊόν B2B, δεν πρέπει να απορρίπτεται σε δημοτικά σημεία απόρριψης. Εάν θέλετε να απορρίψετε το προϊόν αυτό, παρακαλούμε όπως να το παραδώσετε σε μία υπηρεσία συλλογής ηλεκτρικού εξοπλισμού της περιοχής σας.



Ez a jelzés azt jelenti, hogy az ilyen jelzéssel ellátott terméket tilos a háztartási hulladékokkal együtt kidobni. Mivel ez vállalati felhasználású termék, tilos a lakosság számára fenntartott hulladékgyűjtőbe dobni. Ha a terméket ki szeretné dobni, akkor vigye azt el a lakóhelyéhez közel működő, elhasznált elektromos berendezések begyűjtésével foglalkozó hulladékkezelő központhoz.



Questo simbolo indica che il prodotto non deve essere smaltito come un normale rifiuto domestico. In quanto prodotto B2B, può anche non essere smaltito in centri di smaltimento cittadino. Se si desidera smaltire il prodotto, consegnarlo a un organismo specializzato in smaltimento di apparecchiature elettriche vecchie.



Št zíme noráda, ka izstrādājumu, uz kura tā atrodas, nedrīkst izmest kopā ar parastiem mājsaimniecības atkritumiem. Tā kā tas ir izstrādājums, ko cits citam pārdod un lieto tikai uzņēmumi, tad to nedrīkst arī izmest atkritumos tādās izgāztuvēs un atkritumu savāktuvēs, kas paredzētas vietējiem iedzīvotājiem. Ja būs vajadzīgs šo izstrādājumu izmest atkritumos, tad rīkojieties pēc noteikumiem un nogādājiet to tuvākajā vietā, kur īpaši nodarbojas ar vecu elektrisku ierīču savākšanu.



Šis simbolis rodo, kad juo paženklinto gaminio negalima išmesti kaip paprastų buitinių atliekų. Kadangi tai B2B (verslas verslui) produktas, jo negalima atiduoti ir buitinių atliekų tvarkymo įmonėms. Jei norite išmesti šį gaminį, atlikite tai tinkamai, atiduodami jį arti jūsų esančiai specializuotai senos elektrinės įrangos utilizavimo organizacijai.



Dan is-simbolu jindika li l-prodott li huwa mmarkat b'dan il-mod m'ghandux jintrema b'hal skart normali tad-djar. Minhabba li huwa prodott B2B , ma jistax jintrema wkoll f'centri civici ghar-rimi ta' l-iskarik. Jekk tkun tixtieq tarmi dan il-prodott, jekk jogh'g bok ghamel dan kif suppost billi tiehdu ghand organizzazzjoni fil-qrib li tispeccjalizza fir-rimi ta' taghmir qadim ta' l-elettriku.



Dette symbolet indikerer at produktet som er merket på denne måten ikke skal kastes som vanlig husholdningsavfall. Siden dette er et bedriftsprodukt, kan det heller ikke kastes ved en vanlig miljøstasjon. Hvis du ønsker å kaste dette produktet, er den riktige måten å gi det til en organisasjon i nærheten som spesialiserer seg på kassering av gammelt elektrisk utstyr.



Ten symbol oznacza, że produktu nim opatrzonego nie należy usuwać z typowymi odpadami z gospodarstwa domowego. Jest to produkt typu B2B, nie należy go więc przekazywać na komunalne składowiska odpadów. Aby we właściwy sposób usunąć ten produkt, należy przekazać go do najbliższej placówki specjalizującej się w usuwaniu starych urządzeń elektrycznych.



Este símbolo indica que o produto com esta marcação não deve ser deixado fora juntamente com o lixo doméstico normal. Como se trata de um produto B2B, também não pode ser deixado fora em centros cívicos de recolha de lixo. Se quiser desfazer-se deste produto, faça-o correctamente entregando-o a uma organização especializada na eliminação de equipamento eléctrico antigo, próxima de si.



Acest simbol indică faptul că produsul marcat în acest fel nu trebuie aruncat ca și un gunoi menajer obișnuit. Deoarece acesta este un produs B2B, el nu trebuie aruncat nici la centrele de colectare urbane. Dacă vreți să aruncați acest produs, vă rugăm să-o faceți într-un mod adecvat, ducând-ul la cea mai apropiată firmă specializată în colectarea echipamentelor electrice uzate.



Tento symbol znamená, že takto označený výrobek sa nesmie likvidovať ako bežný komunálny odpad. Keďže sa jedná o výrobok triedy B2B, nesmie sa likvidovať ani na mestských skládkach odpadu. Ak chcete tento výrobok likvidovať, odneste ho do najbližšej organizácie, ktorá sa špecializuje na likvidáciu starých elektrických zariadení.



Ta simbol pomeni, da izdelka, ki je z njim označen, ne smete zavreči kot običajne gospodinjске odpadke. Ker je to izdelek, namenjen za druge proizvajalce, ga ni dovoljeno odlagati v centrih za civilno odlaganje odpadkov. Če želite izdelek zavreči, prosimo, da to storite v skladi s predpisi, tako da ga odpeljete v bližnjo organizacijo, ki je specializirana za odlaganje stare električne opreme.



Este símbolo indica que el producto así señalado no debe desecharse como los residuos domésticos normales. Dado que es un producto de consumo profesional, tampoco debe llevarse a centros de recogida selectiva municipales. Si desea desear este producto, hágalo debidamente acudiendo a una organización de su zona que esté especializada en el tratamiento de residuos de aparatos eléctricos usados.



Den här symbolen indikerer att produkten inte får blandas med normalt hushållsavfall då den är förbrukad. Eftersom produkten är en så kallad B2B-produkt är den inte avsedd för privata konsumenter, den får således inte avfallshanteras på allmänna miljö- eller återvinningsstationer då den är förbrukad. Om ni vill avfallshandla den här produkten på rätt sätt, ska ni lämna den till myndighet eller företag, specialiserad på avfallshandtering av förbrukad elektrisk utrustning i ert närområde.