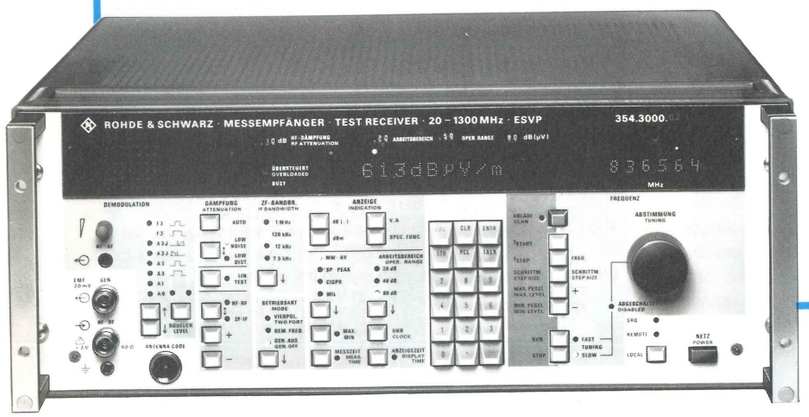
ESVP

Test Receiver ESVP ♦ 20 to 1300 MHz
−20 to +137 dBµV



- Programmable test receiver for selective voltage measurements and twoport measurements in laboratories and test departments
- Field-strength measurements with test antennas
- RFI measurements to CISPR, VDE and FCC
- Interference measurements to MIL and VG standards
- Radiomonitoring
- AC supply and battery operation

IEC 625 Bus

The **Test Receiver ESVP** measures and demodulates AM double-sideband, single-sideband, pulse-modulated and FM signals as well as narrowband and broadband interference. High overload capacity, a wide dynamic range and manifold evaluation capabilities make the ESVP suitable for

selective voltage and twoport measurements – in automatic test systems too –

and all applications in the field of radiomonitoring and EMC measurements.

In its frequency-related characteristics and application capabilities the ESVP is very similar to the ESV (page 296), in measurement convenience, intelligence and system compatibility to the ESH 3 (page 292); its frequency range overlaps and extends that of the ESH 3.

Different ESVP models are available for the **main fields of application:**

Model	Frequency (MHz)	Bandwidths (kHz)	Application
52	20 to 1300	7.5/12/120/1000	Radiomonitoring/CISPR, VDE/MIL, VG standards
53	20 to 1300	7.5/12/120/200	Radiomonitoring, FM radio/CISPR, VDE
54	20 to 1000	7.5/12/120/1000	same as model 52
55	20 to 1000	7.5/12/120/200	same as model 53
56	20 to 1300	10/100/120/1000	CISPR, VDE/MIL, DEF STAN, VG standards

Special features of ESVP

- Synthesizer; frequency resolution 1 kHz, with SSB 100 Hz
- High measurement accuracy (error <1 dB)
- Wide dynamic range:
  noise figure typically 8 dB (preamplifier on)
  3rd-order IP typically +20 dBm (preamplifier off)
- Automatic gain correction in the whole frequency range after calibration
- Measurement of voltage, field strength, current, spectral density and attenuation constant with display of physical unit; conversion and bandwidth correction factors are automatically taken into account.
- Additional evaluation capabilities for radiomonitoring: modulation-depth and frequency-deviation measurements, remote frequency and frequency-offset measurements thanks to internal IF counter, connection of radiomonitoring recorders (maximum of five ZSG 3), SSB demodulator, AF filter, squelch with programmable threshold, indication of date and time of day.
- Storage of 10 complete device settings and of 5 data sets for automatic frequency scanning
- Special functions for frequency scanning with a set of up to 50 freely selectable fixed frequencies
- Special functions for fast field-strength measurements in a moving vehicle

Further characteristics, uses

Selective voltage measurement With its measurement range −20 to +137 dBµV the ESVP on its own is an automatic high-precision selective voltmeter for laboratory, testing and servicing applications. RF currents in the frequency range 20 to 300 MHz can be measured in conjunction with the VHF Current Probe ESV-Z1. Excellent receiver selectivity permits the measurement of adjacent-channel power and of nonharmonic spurious signals of generators. Other important applications are the measurement of intermodulation, crossmodulation and distortion and the determination of noise figures.

Frequency-response/attenuation measurement with calibration generator The calibration generator output of 90 dBµV into 50 Ω is ideally suited for frequency-response measurements on amplifiers and filters; attenuation can be measured up to 105 dB and gain up to 47 dB. The VHF Current Probe ESV-Z1 facilitates the measurement of shielding effectiveness on cables and connectors and a VSWR bridge can be used for return-loss measurements on two-terminal networks (e.g. antennas) and twoports.

Remote control The IEC-bus interface possesses all standard listener and talker capabilities. Commercial controllers without parallel poll capability can be used.

Signal evaluation capabilities
Four switch-selected IF bandwidths:
Models 52 and 54: 7.5/12/120/1000 kHz
Models 53 and 55: 200 kHz instead of 1000 kHz
Model 56: 10 and 100 kHz instead of 7.5 and 12 kHz

Average and peak indication, pulse weighting to CISPR 2 and 4 with programmable measurement times

Demodulation of commonly used FM and AM modes, SSB (USB, LSB) included

Broadband IF output of 10.7 MHz for panoramic display and spectrum analyzer

Narrowband IF output for oscilloscope

AM and FM demodulator outputs

Recorder outputs for level and frequency offset

Digital readout of modulation depth, frequency offset and frequency deviation

Trigger input for level and frequency measurement of short signals.

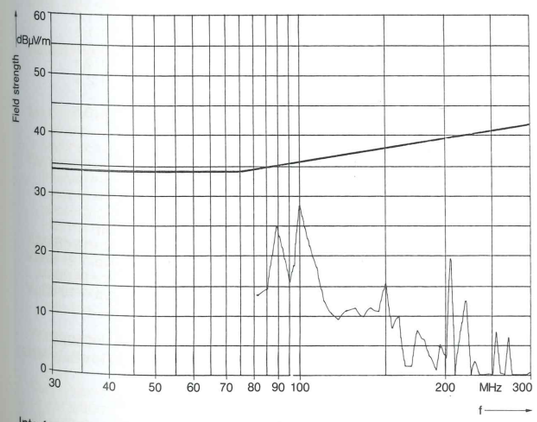
Recording Harmonic, nonharmonic and sideband noise spectra, gain and attenuation curves can be readily plotted on an XY recorder. The start and stop frequencies and the maximum and minimum levels set on the ESVP define the recorder writing area. The frequency scale can be linear or logarithmic. Chart paper complying with VDE/FCC/FTZ/MIL/VG can be used.

Special applications of ESVP

EMI measurements Programmable automatic frequency scanning with direct printer/recorder control gives the ESVP a considerable advantage over earlier test receivers. The following accessories are available for measuring interference voltages, currents and field strengths in line with the relevant standards (CISPR, VDE, MIL, VG):

– V-network (5 µH || 50 Ω)	ESH 3-Z6
– VHF Current Probe (20 to 300 MHz)	ESV-Z1
– Absorbing Clamp (30 to 1000 MHz)	MDS 21
– Broadband Dipole (20 to 80 MHz)	HUF-Z1
– Biconical Antenna (20 to 200 MHz)	HUF-Z2
– Log-periodic Antenna (200 to 1000 MHz)	HUF-Z3
– Conical Log-spiral Antenna (200 to 1000 MHz)	HUF-Z4
– Log-periodic Broadband Antenna (80 to 1300 MHz)	HL 023 A1

Field strength



Interference field strength of a motor vehicle: automatic frequency scanning of ESVP with 50 fixed frequencies

Further advantages of ESVP in interference measurements:

- Automatic consideration of correction factors of any probes and indication of physical unit (eg dBµA, dBµV, dBµV/m, dBpW)
- Suitable bandwidths for measurements to MIL-STDs provided by model 56 (also in line with SAE draft for MIL-STD 462 B), British DEF STAN 59-4 and VG standards
- Bandwidth correction factors considered in measurement of spectral pulse density to MIL and VG: readout of measured data in dBµV/MHz, dBµA/MHz, dBµV/m MHz
- Frequency range 20 Hz to 1.3 GHz together with ESH 3 and EZM
- Bandwidth factors are taken into account in measurements of spectral density to MIL and VG
- Peak indication with programmable hold time for narrowband and broadband interference measurements to MIL and VG
- Average indication with programmable integration time for narrowband interference measurements
- Indication to CISPR with determination of maximum within the programmed measurement time

Radiomonitoring, propagation and coverage measurements Thanks to its outstanding RF characteristics, switch-selected IF bandwidths and types of demodulation, the wide range of available test antennas and its programmability, the ESVP is ideal for use in radiomonitoring with remote frequency measurement, determination of frequency-band occupancy and for propagation and coverage measurements. It offers the following possibilities:

- Graphical representation of field strength in particular of frequency bands, in the form of line spectra or segmented curves, on an XY recorder, with additional output of field-strength levels and, eg frequency offset on a printer
- Measurement of the variation range of field-strength level within a preset time (1 to 1000 s)
- Recording of field strength as a function of time for plotting antenna radiation patterns, for example in helicopters, and for measurement of channel occupation
- Recording of frequency-band occupancy as a function of time, using the Radiomonitoring Recorder ZSG 3
- Reduction of data volume in automatic scanning mode: only signal levels above the preset threshold are taken to the computer.
- Trigger functions: “internal” for automatic monitoring of intermittent carriers; “at time x” and every x seconds, minutes, hours for exact observation of occupancy and level variations
- Special functions for field-strength statistics in moving vehicles: fast binary data output or internal field-strength classification with the output of 15 field levels that are exceeded by predetermined percentages of individual values; triggering independent of speed through external displacement transducers
- Automatic frequency scanning with a maximum of 50 fixed frequencies to be entered at choice
- Use in automatic field-strength test systems

ESVP

The parallel use of several receivers is of particular interest for **radiomonitoring.**

The controller instructs each ESVP (and ESH 3) to permanentyl scan a particular frequency range and to issue an SRQ when the programmed level is exceeded – whereupon the controller identifies the calling receiver by a serial poll and accepts the measured data – or to answer a parallel poll of the controller.

Automatic field-strength test sets furnish the data for statistical evaluation of spatial and time-dependent field-strength variations thus providing **fundamental data for transmitter planning.** In an industrial environment it is necessary to permanently **check the coverage** by all radio communication services (sound and TV broadcasting, car telephone, European radiopaging and non-public services). The **fast field-strength measurement in moving vehicles** with statistical evaluation (ESVP with special function Fast A/D, with or without internal classification) is particularly important for mobile radio networks in the VHF-UHF range, where strong spatial field-strength variations may occur due to scattering, diffraction and reflection. A pulse displacement generator triggers each individual measurement in the ESVP (trigger rate up to 1 kHz), whereupon the measurement rate is independent of the speed of the vehicle. In computer-controlled **in-flight measurements on transmitting antennas** (usually from helicopter) the high measurement speed of the ESVP is a great advantage: it takes only 0.2 s for one measurement at three different frequencies. Vertical patterns are determinded in an ascending flight, horizontal patterns in a circular flight. The graphical representation of the results – circular diagram, standardization of the field strength in the direction of maximum radiation etc. – is carried out by the computer immediately on completion of the measurements.

Calibration By a short or long stroke of the calibration button, function 1 or 1 plus 2 is initiated:

1 Adjustment of IF gain and frequency offset to the rated value at 100 MHz, followed by a check of the level measurement at the set frequency.

2 Measurement and storage of all calibration correction values that are constant over a long time: frequency response, gain differences between IF bandwidths and demodulator linearity.

During operation the IF gain is adjusted each time a new frequency and IF bandwidth is set, so the rated levels are obtained at the IF and recorder outputs.

Thanks to this method, calibration of individual functions is very seldom necessary and automatic measurements take much less time than would be required if a calibration were performed at each new frequency.

Storage A non-volatile memory in the ESVP can store the last and nine more complete device settings. It also stores all the correction values response, IF bandwidths and demodulator characteristics.

Specifications

Frequency range	20 to 1300 (1000) MHz		
Frequency setting	1. in 1 kHz/100 kHz steps with knob; least increment in SSB mode: 100 Hz 2. keyboard entry 3. in steps of any preset size 4. automatic scanning		
Indication	8-digit LED display		
Resolution	1 kHz/100 Hz (SSB)		
Setting error (freq. prop.)	$<5\times10^{-6}$ (max. 5 kHz at 1 GHz)		
With Oven-controlled Crystal Oscillator Option ESVP-B1			
Setting error in temperature range +5 to +45 °C	$<1\times10^{-9}$/°C		
Warmup time	<10 min at 5 °C/<5 min at 25 °C		
Aging	$\leq1\times10^{-9}$/day		
Pulling range of oven-controlled crystal oscillator	$\geq1\times10^{-6}$		
RF input	Z_{in} = 50 Ω, N female connector		
VSWR	<1.2 with RF attenuation ≥10 dB <2 with RF attenuation 0 dB		
Oscillator reradiation at RF input without preamplifier and with RF attenuation 0 dB (with preamplifier 15 dB less)	<10 dBµV for f_{in} = 20 to <520 MHz <20 dBµV for f_{in} = 520 to <1020 MHz typ. 40 dBµV (f_{o1}) } for f_{in} = typ. 50 dBµV ($2\times f_{o1}$) } 1.02 to 1.3 GHz		
Preamplifier	can be switched into circuit between RF attenuator and input filter: ≈+10 dB		
Input filters	10 tracking filters		
Maximum input level at RF atten.	0 dB	≥10 dB	
DC voltage	7 V	7 V	
Sinewave AC voltage	130 dBµV	137 dBµV (at ≥10 dB)	
Max. pulse voltage		150 V	
Max. pulse energy (10 µs)		1 mWs	
Interference rejection, non-linearities	**preamplifier off**	**preamplifier on**	
Image frequency rejection			
20 to 1020 MHz		80 dB, typ. 100 dB	
1020 to 1300 MHz		>70 dB, typ. 100 dB	
Rejection of spurious responses in range 1.02 to 1.3 GHz for frequencies $2\times f_{in}-932.1$ MHz	typ. 30 to 80 dB		
IF rejection	>80 dB, typ. 100 dB		
Intercept point d_3	>+13 dBm, typ. +20 dBm	>+1 dBm, typ. +8 dBm	
Intercept point k_2	>+40 dBm, typ. +50 dBm	>+20 dBm typ. +40 dBm	
Desensitization (typical, frequency-dependent)			
An interfering signal spaced >2 MHz from the receive frequ. varies the indication of the measured signal by <1 dB (RF attenuation 0 dB) at a level of	110 dBµV	100 dBµV	
RF shielding			
Voltage indication at a field strength of 3 V/m	<0 dBµV	0 dBµV	
Radio interference from internal microcomputer etc.	below the limits to VDE 0876 and MIL-Std. 461 A and B		
IF frequencies			
1st IF f_{in} <520 MHz	810.7 MHz		
f_{in} >520 MHz	310.7 MHz		
2nd IF	10.7 MHz		
IF bandwidths (for average and peak values)			
Nominal bandwidth	−3 dB (±20%)	−6 dB (±10%)	typ. ratio 6/60 dB
7.5 kHz (models 52 to 55)	7.5 kHz	8.3 kHz	1:1.8
10 kHz (model 56)	9 kHz	10 kHz	1:1.8
12 kHz (models 52 to 55)	12 kHz	13.4 kHz	1:1.8
100 kHz (model 56)	90 kHz	100 kHz	1:2.1
120 kHz (all models)	110 kHz	120 kHz	1:2.1
200 kHz (models 53, 55)	200 kHz (±10%)	225 kHz (±20%)	1:2.5
1 MHz (models 52, 54, 56)	0.8 MHz	1 MHz	1:3.5
IF BW (−6 dB) for radio interference measurements to CISPR Publ. 16) and VDE 0876 Part 1	120 kHz		
IF BW (−3 dB) for SSB demodulation (aural) monitoring only)	2.4 kHz		
Noise indication	**preamplifier off**	**preamplifier on**	
Average value, B = 7.5 kHz			
20 to <520 MHz	<−10 dBµV, typ. −13 dBµV	<−16 dBµV, typ. −21 dBµV	
520 to 1300 MHz	<−8 dBµV, typ. −11 dBµV	<−14 dBµV, typ. −19 dBµV	
Peak value (typ. increase as against average value)	+11 dB		
CISPR	typ. +4 dBµV	typ. −4 dBµV	
MIL (B_{IF} = 1 MHz)	typ.+20 dBµV/MHz	typ. 14 dBµV/MHz	
Voltage measurement range (with preamplifier)			
Lower limit	3 dB above noise level (see noise indication)		
Upper limit	137 dBµV (RF attenuation ≥10 dB)		
Inherent spurious responses	<−5 dBµV (equivalent input voltage)		
Readout			
digital in dBµV, dBm	4 digits max., resolution 0.1 dB		
in µV, mV, V	3 digits		
analog	LED row (31 LEDs) over operating range of IF rectifier and with digital display of range limits		
Operating ranges of IF rectifier	20, 40, 60 dB		
Display modes	average value (progr. averaging time) peak value (progr. hold time) spectral density measurements to MIL, CISPR (Publ. 2 and 4); programmable averaging, hold and measuring times: 5 ms to 100 s		
Measurement of maximum and minimum levels	the maximum and minimum levels are determined from individual measurements of 0.1 s duration each; progr. measuring time: 1 to 1000 s		
Measuring error (level indication)			
Average indication for unmodulated sinewave signal ≥16 dB above noise indication	<1 dB		
Additional error in operating ranges 40 und 60 dB	typ. <0.5 dB		
Level calibration facility			
Average/peak	tracking generator (sinewave)		
CISPR, MIL in addition	pulse generator		
Error of analog level indication			
Operating range 20 dB	typ. <2 dB		
40, 60 dB	typ. <4 dB		
Frequency offset	indication: digital in kHz, resolution 0.1 to 100 Hz, analog with LED row		
Measuring times	10 ms to 10 s		
Frequency deviation (+/−, peak)	indication in kHz, 4 digits, resolution 0.1/0.01 kHz		
Measurement range	1 to 400 kHz		
Measuring error for S/N ≥40 dB, f_{mod} ≤1 kHz (mod. meas. filter switched in)			
at B_{IF} = 7.5/12 kHz, deviation < $B_{IF}/2$	< 0.5 kHz (typ.)		
at B_{IF} = 100/120 kHz, deviation < $B_{ZF}/2$	< 2 kHz (typ.)		
at B_{IF} = 200 kHz, deviation <100 kHz	<5 kHz (typ.)		
at B_{IF} = 1 MHz, deviation < 400 kHz	< 5 kHz + 0.02 × deviation/kHz (typ.)		
Modulation depth (AM)	indication in %, 3 digits, resolution 0.1%		
Measurement range	≈1 to 99% (150% pos. peak)		
Measuring error for S/N ≥40 dB	<5 absolute (typ.)		
Gain measurement	indication in dB, 4 digits, resolution 0.1 dB		
Measurement range	−110 to +47 dB		
Error	<1 dB, <0.5 dB typ.		
Demodulation modes	N0N (A0, zero beat) A1A (A1, 1-kHz beat note) A3E (A3, double-sideband AM) J3E (A3J, LSB, USB) F3E (F3, frequency modulation)		
Squelch	carrier squelch, threshold adjustable −20 to +137 dBµV		
Date, time of day	internal clock module, permanently in operation from internal battery		
Remote control	interface to IEC 625-1 (IEEE 488), 24-contact Amphenol connector; functions: AH1, L4, SH1, T5, SR1, PP1, DC1, DT1, RL1, C0		
Max. data rate			
Talker mode	approx. 25 Kbyte/s		
Listener mode	approx. 20 Kbyte/s		
Setting times			
Internal frequency, e.g. scan mode in steps <100 MHz	typ. 20 to 40 ms		
exceeding a 100-MHz digit	typ. 70 ms		
Internal RF level switch	25 ms/step		
Max. measuring rate with PUC, measuring time 5 ms with automatic frequency scanning	16 measurements/s		
with measurement at one frequ.	30 measurements/s		
with special function Fast A/D	1000 measurements/s		
Front-panel outputs			
Generator output (switch-selected)	Z_{out} = 50 Ω, N female connector		
EMF	96 dBµV ±0.3 dB		
Connector for supply and coding of test antennas, etc.	12-contact Tuchel female connector		
AF output	Z_{out} = 10 Ω, telephone jack JK34		
EMF	adjustable up to 3.5 V		
Rear-panel outputs			
IF 10.7 MHz			
wide (B ≈2 MHz)	Z_{out} = 50 Ω, BNC female connector		
gain ref. to RF input (RF attenuation 0 dB)	typ. 7.5 dB (without preamplifier) typ. 17.5 dB (with preamplifier)		
narrow (B = IF bandwidth)	Z_{out} = 50 Ω, BNC female connector		
EMF in range of analog level indication			
Operating range 20 dB	10 to 100 mV		
40 dB	10 to 1000 mV		
60 dB	1 to 1000 mV		
AM demodulator	Z_{out} = 330 Ω, BNC female connector		
EMF / $B_{-3\,dB\,max}$	1 V at m = 50% / ≥0.3 MHz		
FM demodulator	Z_{out} = 330 Ω, BNC female connector		
EMF at IF BW 7.5/10/12 kHz	±1 V/±1 kHz offset		
100/120/200/1000 kHz	±1 V/±100 kHz offset		
$B_{-3\,dB\,max}$	≥0.3 MHz		
Analog recording outputs			
Frequency offset	Z_{out} = 10 kΩ, BNC female connector		
EMF at IF bandw.			
7.5/10/12 kHz	±1 V/±1 kHz offset		
0.1/0.12 MHz	±1 V/±10 kHz offset		
0.12/0.2 MHz (model 53)	±1V/±20 kHz offset		
1 MHz	±1 V/±100 kHz offset		
Level 1 in AV, PEAK, CISPR, MIL modes	+4 V for max. analog indication		
Level 2 in CISPR mode	+2 V for max. analog indication (includes LP filter simulating meter response, to CISPR 2 and 4)		
Recorder output	24-contact Amphenol female connector; includes X and Y analog outputs for D/A-converted signal for recording of scanning process X = 0 V: start frequency = 10 V: stop frequency Y = 0 V: MIN. level = 10 V: MAX. level; pen lift control: (L = pen up); formatted paper feed for ZSKT (H pulse, duration 10 ms); connecting of five Radiomonitoring Recorders ZSG 3 possible		
Rear-panel inputs			
Ext. trigger	Z_{in} ≥3 kΩ, BNC female connector		
Trigger threshold	TTL (H ≥2 V, L ≤0.8 V hysteresis), switch-selected positive or negative slope		
Ext. reference frequency	Z_{in} = 50 Ω, BNC female connector		
Required level	EMF = 1 V from 50 Ω, sinewave		
Frequency	5/10 MHz (switch-selected)		

General data

Rated temperature range	+5 to +45 °C
Storage temperature range[1]	−25 to +70 °C
Power supply/AC supply	100/120/220/240 V ±10%, 47 to 440 Hz (90 VA)
Battery	22 to 32 V, 3 A at 24 V
Dimensions, weight	492 mm×205 mm×514 mm, 29 kg

Ordering information

Order designation	▶ Test Receiver ESVP	
Frequency range	20 to 1300 MHz	20 to 1000 MHz
B_{IF} = 7.5/12/120/1000 kHz	354.3000.52	354.3000.54
B_{IF} = 7.5/12/120/200 kHz	354.3000.53	354.3000.55
B_{IF} = 10/100/120/1000 kHz	354.3000.56	
Accessories supplied	Power cord, battery cable	
Option		
Oven-controlled Crystal Oscillator	ESVP-B1	358.1119.02
Recommended extras		
VHF Current Probe (20 to 300 MHz)	ESV-Z1	353.7019.02
Applications Software		
ESH 3/ESVP with PUC	ESVP-K1	397.6018.02
with PCA 5	ESVP-K2	399.9014.02
Absorbing Clamp (30 to 1000 MHz)	MDS-21	194.0100.50
Adapter BNC/N		118.2812.00
Broadband Dipole (20 to 80 MHz)	HUF-Z1	358.0512.52
Log-periodic Broadband Antenna (80 to 1300 MHz)	HL 023 A1	577.8017.02
Tripod	HFU-Z	100.1114.02
Mast (for tripod)	HFU-Z	100.1120.02
RF connecting cable (7 m)	HFU 2-Z5	252.0055.55
Headphones		110.2959.00
Service Kit	ESVP-Z1	358.1019.02
V-network 5 µV || 50 Ω	ESH 3-Z6	836.5016.52

Other accessories
XYT Recorder ZSKT/ZSK 2, Radiomonitoring Recorder ZSG 3, Universal Printer PUD 2 or PUD 3, Spectrum Monitor EZM (in this catalog).

[1]) The ESVP is fitted with a lithium battery for buffering the CMOS-RAMs. Storage at high temperatures over extended periods curtails the lifetime of the battery.