

Fig. 1
7SV73 power supply unit (not to scale)

Application

The 7SV73 power supply unit is used for stations without a central DC voltage supply, i.e. stations too small to merit the use of a station battery. During normal operation, the power unit supplies the numerical protection relays with energy from the power supply unit while keeping the batteries fully charged. This energy is drawn either from the 100 V voltage transformer secondary circuit or from the 230 V station AC voltage. In the event of a fault, the power unit 7SV73 is able to maintain an uninterruptible supply to the protection relays and at the same time operate circuit-breaker coils, if necessary. This energy is provided by two series-connected batteries, i.e. all components must have a voltage input of $V_N = 24$ V.

Compatibility

Compatibel to previous device 7SV72.

CAUTION!

Please consider insignificant changes of technical data (e.g. page 4, insulation tests)

Design

The 7SV73 is installed in a 7XP20 housing (19 inch, $\frac{1}{6}$ wide). It is available for surface and for flush mounting.

The power to be supplied to the numerical relays or to operate the circuit-breaker coils is drawn from two external maintenance-free lead batteries.

The series-connected batteries are mounted in a separate battery trough. This battery trough can be mounted on a vertical wall and must be installed no further than 2 m from the charging module, i.e. when the unit is mounted in a cabinet the batteries must be installed in the cabinet too. To prolong their service life, we recommend mounting the battery trough as low as possible in the cabinet because of the temperature distribution. The three connecting cables (L+, L- and the central pick-off for monitoring the capacity of the batteries) from the charging module to the battery must contain 2.5 mm² copper wire. A charging module and a battery kit are supplied with the 7SV73 power supply unit. The battery kit contains the battery trough, two batteries and three connectors for connecting the batteries.

The charging module contains all automatic charging functions, incl. signal processing, optical visualization and exhaustive discharge protection

Functions

The 7SV73 power supply unit incorporates the following functions:

- Automatic battery connection in the event of a power failure (uninterruptible)
- For battery fault detection, the battery medium voltage is fed to the monitor via fuse F4
- Exhaustive discharge protection with battery disconnection on drop below limit voltage
- Optical display with 6 LED's on the front panel on the charging module
- One alarm relay with the group indication: battery operation and device fault
- Three-position LED seven-segment display.

Because of the large battery capacity, several protection relays can be powered and several circuit-breakers operated at the same time. The output power given in the technical data must be taken into account.

Power supply unit 7SV73

Method of operation

The line input voltage for the 7SV73 power supply unit is fed from the voltage transformer secondary circuit or from the station AC voltage via an input fuse (F1) to the switched-mode power supply. A varistor protects the switched-mode power supply unit from transient overvoltages. The input circuit in the charging module is an extended-range input of 90 to 264 V, i.e. no switchover is necessary. Its switched-mode power supply unit features a switch-on current limitation, clocks with a switching frequency of approximately 140 kHz and has a V/I charging characteristic. The output is short-circuit-proof and stable at no load. The output voltage is permanently set to 27.3 V or charging operation. For servicing, the charging module can also be operated without a battery module because the harmonic component of the switched-mode power supply unit is well below 6 %, which means that the ripple of ≤ 6 % required for the protection input voltage is adhered to. The charging voltage for the two maintenance-free batteries is displayed in the 7SV73 with a three-position green LED seven-segment display in the charging module. The operating states, such as operation, fault, battery failure, undervoltage and exhaustive discharge, are signalled by six LED's. An alarm relay with a group signal is available for remote signalling of „fault“ or „battery failure“. In the event of a battery failure, under-voltage or exhaustive discharge the left red LED „Fault“ also lights up. The „battery operation“ signal is triggered by line/module failure at approximately 25 V after a delay. The monitoring equipment of the charging module operates the exhaustive discharge protection relay K2 at a battery voltage of ≤ 19 V and disconnects the batteries. The two series-connected batteries with $V_N = 12$ V/6 Ah V/6 Ah each are loaded in continuous battery power supply. The switched-mode power supply unit in the 7SV73 charging module has a peak power of 30 W and a continuous power of 20 W. It loads the batteries and powers the connected loads with a continuous current of up to 0.7 A. It is important to note the continuous power output of the switched-mode power supply unit (20 W). If, for example, so many loads are connected that a load current of 0.6 A is flowing, only a current of 0.1 A would be available for charging the batteries (see Fig. 2). The current for the circuit-breaker coil is provided by the two batteries. For a duration of up to 100 ms, a current pulse of approximately 30 A is provided.

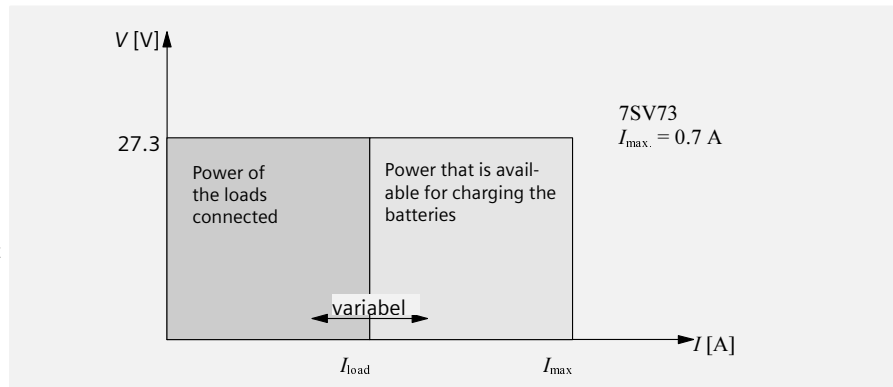


Fig. 2 Power output from the switched-mode power supply

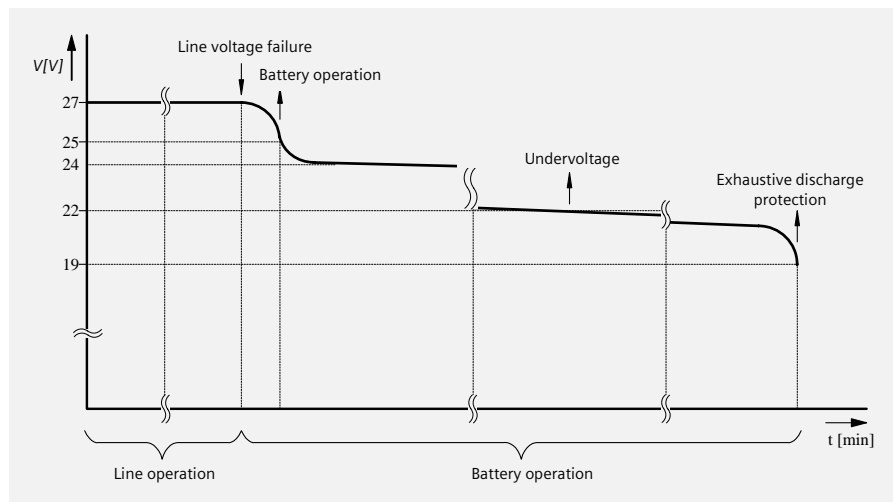


Fig. 3 Discharge curve of the 7SV73 battery module

Signalling on the charging module

The 7SV73 has LED's and alarm contacts to signal the various operating states. Multiple signalling of failure displays is possible. All LED's go off after switch-off in the event of exhaustive discharge.

The front panel of the charging module contains six LED's that signal the following operating states:

- LED left
- above LED green „Operation“
 - below LED red „Fault“
- LED right
- LED 1 red „Battery operation“
 - LED 2 red „Battery failure“
 - LED 3 red „Undervoltage“
 - LED 4 red „Exhaustive discharge“

The right-hand LED's 2, 3 and 4 indicate the type of fault to the user, i.e. each of these three LED's is permanently combined with the red „fault“ LED. LED 4 has been set in the factory so that the batteries are switched off immediately after it lights up for protection against exhaustive discharge. The two single indications „fault“ and „battery operation“ have been hardwired to the alarm relay MR1.

Meaning and response to visualization

- Signal: „**Battery operation**“, output voltage ≤ 25 V
Possible cause: The AC voltage supply has failed and the terminal voltage of the charging modules is falling from the charging voltage (27.3 V) to the battery voltage (approximately 24 V). Check the following: Line voltage present and within its limit values at the input terminals of the charging module? If not, ascertain the cause of the line voltage failure and remove it immediately.
The power supply to the protection must only be maintained for a limited time, depending on the power connected. The value given for the useful life of the battery module in the technical data is a guide.
If the voltage is present at the input terminals, check fuse F1 and replace it by a fuse of the same type if necessary! If the line voltage is present and fuse F1 is intact, return the charging module for servicing.
- Signal: „**Battery failure**“
If the batteries are missing or damaged, the signal „battery failure“ is displayed continuously; a battery failure is signalled with a time delay of approximately one second.
Check the following: Check fuses F2, F3 or F4 in the charging module and replace them by the same type if necessary!
Otherwise, the batteries are damaged and must be replaced in accordance with the service instructions (see below).
- Signal: „**Undervoltage**“, output voltage ≤ 22 V
Cause: The battery module has been in battery operation for too long and hardly has any energy stored in it (see „battery operation“ and „exhaustive discharge“).
- Signal: „**Exhaustive discharge**“, output voltage ≤ 19 V.

CAUTION!

To avoid destruction of the batteries by exhaustive discharge, the two batteries must be disconnected from all loads.
Possible cause: Battery operation continued too long or an overload due to the loads connected. Check the following: Examine the loads connected for power consumption. Otherwise, the same causes of error as for „battery operation“.

Battery exchange

Perform the following steps one after the other.

1. Carefully remove and isolate the plug connections on the batteries.

CAUTION!**DANGER OF SHORT-CIRCUIT**

2. Lift each battery out of the battery trough individually
3. Place the new batteries in the battery trough such that the connections face the centre of the housing.
4. Connect in series both batteries with connecting cables from which the central pick-off also departs.
5. Connect the remaining plug connectors to the terminals on the batteries with correct polarity.

CAUTION!

- Always replace defective lead batteries together!
- When connecting the new batteries, make sure the polarity is correct. If the polarity has accidentally been reversed on the batteries during mounting by the customer, the polarity reversal protection diodes V2a and V2b blow fuses F2 and F4 and thus prevent destruction of the charging unit.

CAUTION!

Defective batteries must be disposed of as special category waste.

Servicing the battery

The charging module signals any faults that might occur in the batteries.

We recommend replacing the batteries approximately every four years, depending on the climatic stress.

All batteries with the same technical and mechanical characteristics can be used.

Battery kit

The battery kit is required for the 7SV73 power supply unit for flush and surface mounting. It consists of a battery trough, two maintenance-free lead batteries, one jumpering cable with additional plug connector and four Faston connectors 2.5 mm².

All the electronics, including the exhaustive discharge protection relay, are mounted in the charging module.

Devices for Various Applications

Power supply unit 7SV73

Technical data

Line input	Input voltage range Input power Input frequency Current waveform	90 to 264 V AC (extended-range input) ≤ 1.25 x load, 38 W briefly during battery charging 45 to 400 Hz Peak factor ≤ 3
Output (no distinction between protection relay/circuit-breaker)	Output voltage Output power Characteristic Ripple Decoupling diode for failure detection	27.3 V DC, ± 1 % 20 W continuous, for 1 minute 30 W V / I charging characteristics ≤ 200 mV _{PP}
Alarm contacts	Number of relays (1 changeover contact) Make/break power Switching voltage (maximum) Permissible continuous current	1 relay 30 W/250 VA 30 V DC /250 V AC 1 A
Alarm function	Group alarm with the functions, fault, battery operation	1
Displays	Status LED's (left): LED above „Unit ready“ green LED below „Fault“ red Monitoring LED's (right): LED 1 „Battery operation“ red LED 2 „Battery failure“ red LED 3 „Undervoltage“ red LED 4 „Exhaustive discharge“ red LED seven-segment display, three-position	1 1 1 (permanently coupled with MR 1) 1 (permanently coupled with MR 1) 1 1 Battery voltage/charging voltage
Battery	Make Number/type Charging voltage Output voltage range Emergency supply time at 20 W Perm. pulse load	Panasonic, LC R 12 V 6.5 PD 2 batteries/12 V/6 Ah 27.3 V DC 19 to 27.3 V DC Approx. 7 h Max. 30 A for max. 100 ms
Monitoring (± 2 % tolerance)	Battery-operation Undervoltage indication Deep-discharge protection Supervision for symmetrical battery voltage	≤ 25 V DC ≤ 22 V DC Control contact for battery switch-off at ≤ 19 V DC Battery failure
Codes and standards, general	IEC 60255; DIN 57435 part 303	
CE-conformity, standards	This product is in conformity with the directives of the Council of the European Communities on the approximation of the laws of the Member States relating to the electromagnetic compatibility (EMC Council Directive 89/336/EEC) and concerning electrical equipment for use within specified voltage limits (low-voltage directive 73/23/EEC). The product conforms with the international standard IEC 60255 and the national standard DIN 57 435 part 303 (corresponding to VDE 0435 part 303).	Conformity is proved by tests performed by Siemens AG in line with article 10 of the Council Directives in accordance with the generic standards EN 50081 and EN 50082 for the EMC directive 89/336/EEC and standard 60255-6 for the low-voltage directive.
Insulation tests IEC 60 255-5, VDE 57 435 part 303	High-voltage test (routine test), contact at alarm relay against all other circuits line input against all other circuits output against earthing terminal Impulse voltage test (type test), all circuits, class III	2 kV (rms), 50 Hz 2.2 kV DC 0.7 kV DC 5 kV (peak), 1.2/50 μs, 0.5 J, 3 positive and 3 negative shots at intervals of 5s

Technical data (continued)

<p>EMC – tests; immunity (type test) Standards: IEC 60255-6 and –22 (international product standard) EN 50082-2 (generic standard) DIN 57435 part 303 (German product standard)</p>	<p>High-Frequency Test IEC 60255-22-1, Class III and VDE 0435 part 303, Class III</p> <p>Electrostatic Discharge IEC 60255-22-2, Class III and IEC 61000-4-2, Class III</p> <p>Irradiation with HF Field, amplitude modulated IEC 61000-4-3, class III IEC 60255-22-3, Class III</p> <p>Irradiation with HF Field, pulse modulated IEC 61000-4-3/ENV 50204, Class III</p> <p>Fast Transient Disturbance Variables/Burst IEC 60255-22-4 and IEC 61000-4-4 Class III</p> <p>High Energy Surge Voltages (SURGE), IEC 61000-4-5 Installation Class 3 Power Supply</p> <p>DC - Output</p> <p>Line Conducted HF, amplitude module IEC 61000-4-6, Class III</p> <p>Power System Frequency Magnetic Field IEC 61000-4-8, Class IV IEC 60255-6</p>	<p>2.5 kV (peak), 1 MHz, $\tau = 15 \mu\text{s}$, 400 Surges per s, Test Duration 2 s $R_i = 200 \Omega$</p> <p>4 kV contact discharge, 8 kV air discharge, both polarities, 150 pF, $R_i = 330 \Omega$</p> <p>10 V/m, 80 MHz to 1000 MHz, 80 %AM: 1 kHz,</p> <p>10 V/m, 900 MHz, repetition frequency 200 Hz, duty cycle 50 %</p> <p>2 kV, 5/50 ns, 5 kHz, burst length = 15 ms, repetition rate 300 ms, both polarities, $R_i = 50 \Omega$, Test duration 1 min</p> <p>common mode: 2 kV, 12 Ω, 9μF diff. mode: 1 kV, 2 Ω, 18 μF</p> <p>common mode: 0.5 kV, 12 Ω, 0.5 μF diff. mode: 0.5 kV, 2 Ω, 0.5 μF</p> <p>10 V, 150 kHz to 80 MHz, AM 80 %, 1 kHz</p> <p>30A/m continuous, 300A/m for 3 s, 50 Hz 0.5 mT; 50 Hz</p>
<p>EMC Tests For Noise Emission (type test) Standard: EN 50081-1 (Generic standard)</p>	<p>Radio Noise Voltage to Lines Only Power Supply Voltage IEC-CISPR 22</p> <p>Radio Noise Field Strength IEC-CISPR 22</p>	<p>150 kHz to 30 MHz Limit Class B</p> <p>30 MHz to 1000 MHz Limit Class B</p>
<p>Overload protection, fuses</p>	<p>Line fuse F1 Output switched–mode power supply unit F2 Output batteries F3 Symmetry monitoring F4</p>	<p>time-lag 2.0 A time-lag 2.0 A time-lag 15.0 A time-lag 0.1 A</p>
<p>Climatic stress tests (charging module) Standards: IEC 60255-6</p>	<p>permissible ambient temperature during service during storage during transport permissible humidity</p> <p>Store and transport the device with factory packaging</p>	<p>0 to +50 °C -15 to +60 °C -15 to +60 °C</p> <p>Annual average of $\leq 75 \%$ relative humidity; up to 93% relative humidity on 56 days a year, condensation not permissible</p>
<p>Climatic stress tests (batteries) Standards: IEC 60255-6</p>	<p>permissible ambient temperature during service during storage during transport permissible humidity</p> <p>Store and transport the device with factory packaging</p>	<p>0 to +40 °C -15 to +40 °C -15 to +40 °C</p> <p>Annual average of $\leq 75 \%$ relative humidity; up to 95% relative humidity on 30 days a year, condensation not permissible</p>

Devices for Various Applications

Power supply unit 7SV73

Technical data (continued)		
Vibration and Shock Stress During Operation Standards IEC 60255-21, IEC 60068	- Vibration IEC 60255-21-1, Class 2 IEC 60068-2-6 - Shock IEC 60255-21-2, Class 1 IEC 60068-2-27 - Seismic Vibration IEC 60255-21-3, Class 1 IEC 60068-3-3	Sinusoidal 10 Hz to 60 Hz: ± 0.075 mm Amplitude 60 Hz to 150 Hz: 1 g acceleration frequency sweep rate 1 Octave/min 20 cycles in 3 orthogonal axes. Half-sine shaped acceleration 5 g, duration 11ms, 3 shocks in each direction of 3 orthogonal axes Sinusoidal 1 Hz to 8 Hz, ± 3.5 mm Amplitude (horizontal axis) 1 Hz to 8 Hz, ± 1.5 mm Amplitude (Vertical axis) 8 Hz to 35 Hz, 1 g acceleration (horizontal axis) 8 Hz to 35 Hz, 0.5 g acceleration (Vertical axis) Frequency sweep rate 1 Octave/min 1 cycle in 3 orthogonal axes
Vibration and Shock Stress During Transport Standards IEC 60255-21, IEC 60068-2	Vibration IEC 60255-21-1, Class 2 IEC 60068-2-6 - Shock IEC 60255-21-2, Class 1 IEC 60068-2-27 - Continuous Shock IEC 60255-21-2, Class 1 IEC 60068-2-29	Sinusoidal 5 Hz to 8 Hz: ± 7.5 mm Amplitude 8 Hz to 150 Hz: 2 g acceleration Frequency sweep rate 1 Octave/min 20 cycles in 3 orthogonal axes Half-sine shaped Acceleration 15 g, duration 11ms, 3 shocks in each direction of 3 orthogonal axes Half-sine shaped Acceleration 10 g, duration 16ms, 1000 shocks in each direction of 3 orthogonal axes
Unit version (charging module)	Housing 7XP20 Weight Degree of protection to EN 60 529 housing terminals	1/6 x 19" approx. 3 kg IP 20 IP 21
Battery trough	Steel sheeting, RAL 7032, (W x H x D) Weight with batteries Degree of protection to EN 60 529	310 x 100 x 75 mm 5.5 kg IP 00
Mounting accessories	Jumpering cables with additional plug connector Faston connectors, 2.5 mm ²	1 relay 4 relays

Technical data (continued)

Maximum life for numerical protection relays The lives specified are basic values where the following has been assumed:	Protection relays power consumption		1 relay	2 relays	Max. no. of relays
	not energized	energized			
- Battery operation	7SJ60 2 W	4 W	<60 h	<30 h	8
- Protection relays are not energized continuously	7SJ511 7 W	11 W	<20 h	<10 h	2
- Constant temperature of 25 °C	7SJ512 7 W	13 W	<20 h	<10 h	2
- Life expectancy of the batteries is 4 years	7SA511 16 W	26 W	<8 h	-	1
	7SD511/512 11 W	20 W	<12 h	-	1
	7SD502/503 6 W	8 W	<23 h	<11 h	2
	7UT512 10 W	13 W	<14 h	-	1
	7UT513 14 W	22 W	<10 h	-	1
Circuit-breaker operation	Simultaneously At 1-minute intervals (for CB inspection)		Max. 3 (otherwise F3 blown) Max. 12		

Devices for Various Applications

Power supply unit 7SV73

Selection and ordering data

Power supply unit 7SV73 in 7XP20 housing Mechanical design (charging module)	Order no. 7SV7320 -	0	□	A	0	0
for switchboard surface-mounting, terminal connection on side (available soon) for switchboard flush-mounting, cubicle mounting			↑	B		
Battery set for replacement, two spare batteries (Panasonic, LC R 12V 6.5 PD)	7XV2200 -	2	A	A	0	0

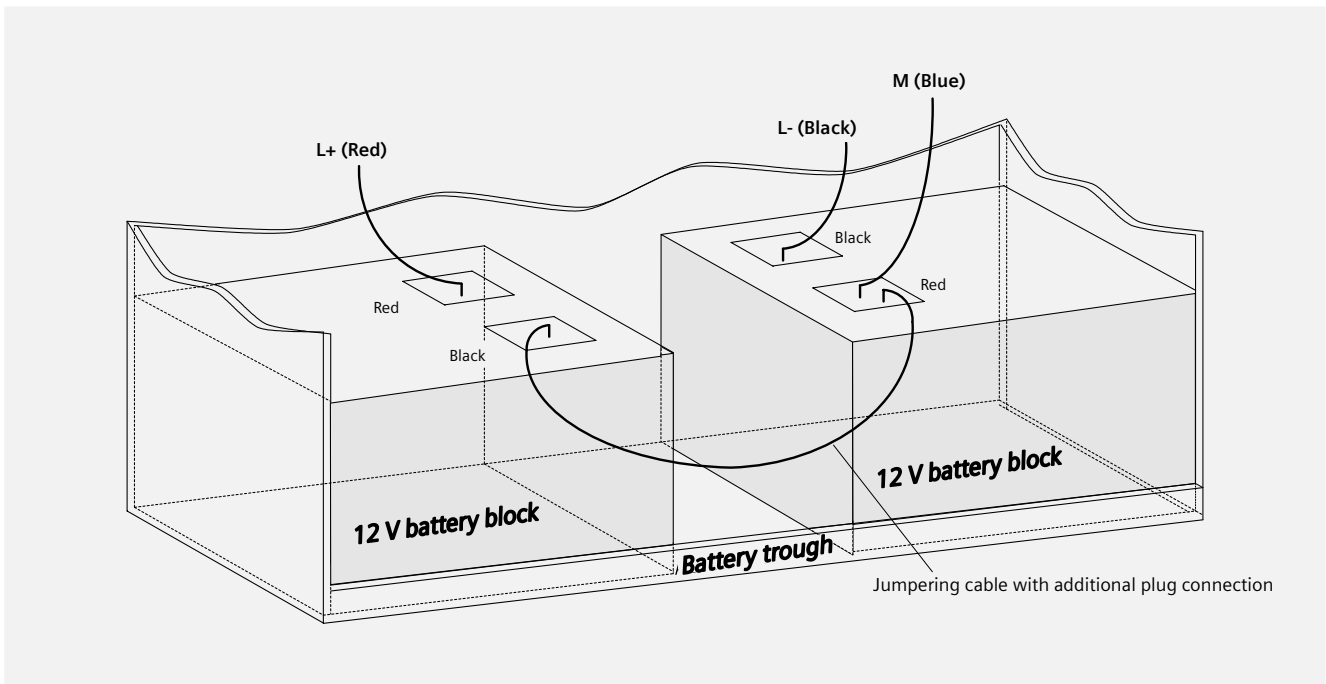


Fig. 4
Battery position in the battery trough in the 7SV73 (all cable cross-sections = 2.5mm²)

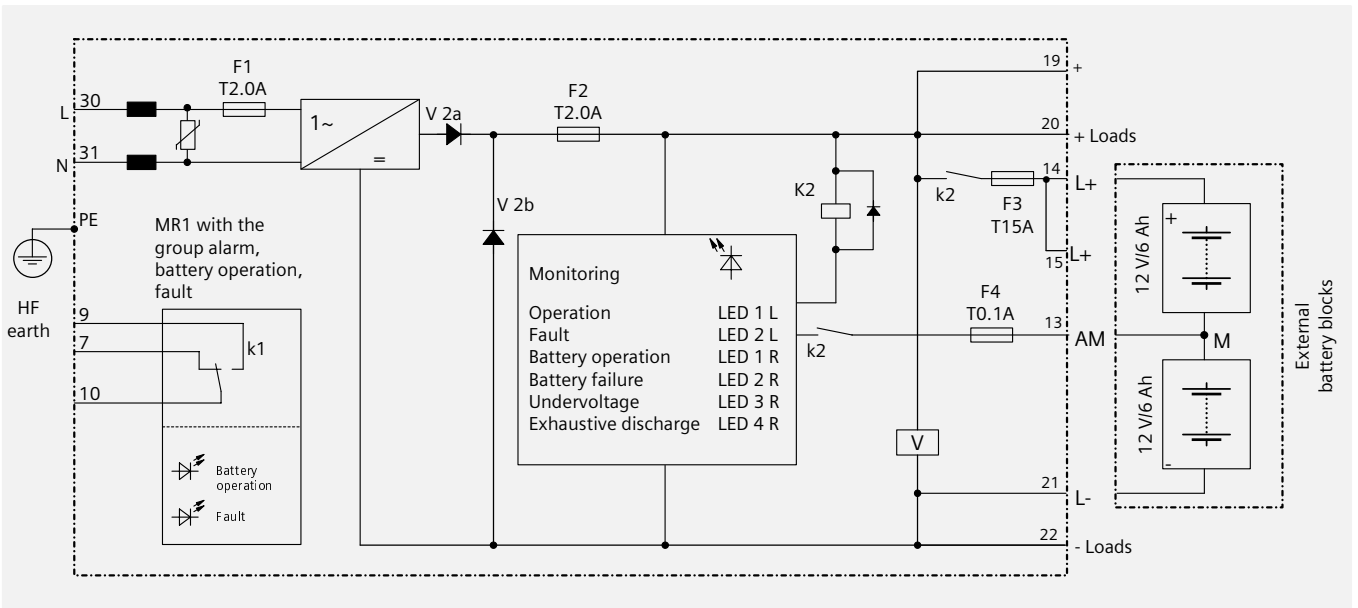


Fig. 5
Connection diagram of the 7SV73 charging module

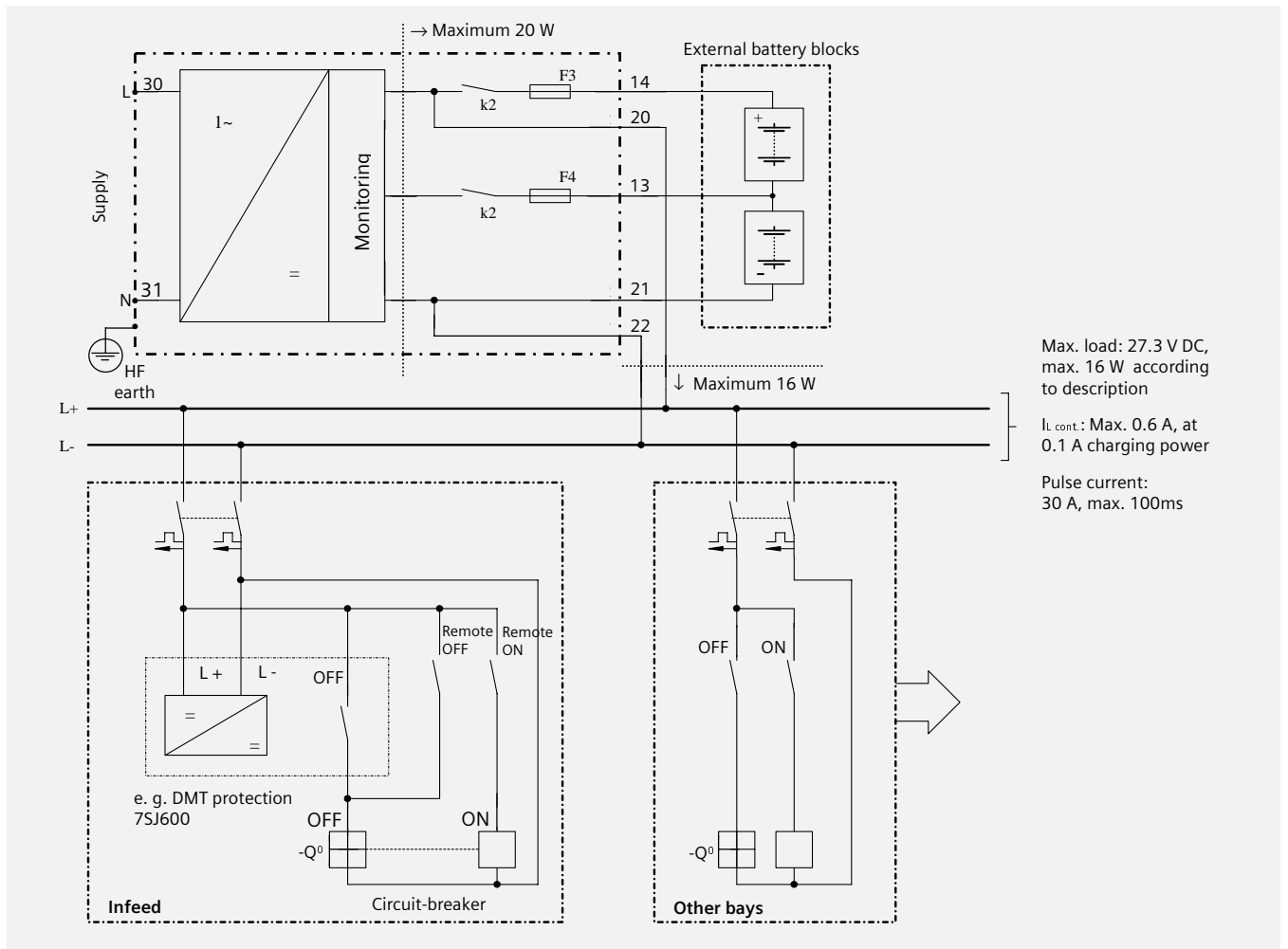


Fig. 6
Example of a connected 7SV73 (shown without signal processing)

Power supply unit 7SV73

Dimension drawings in mm and recommendation for mounting

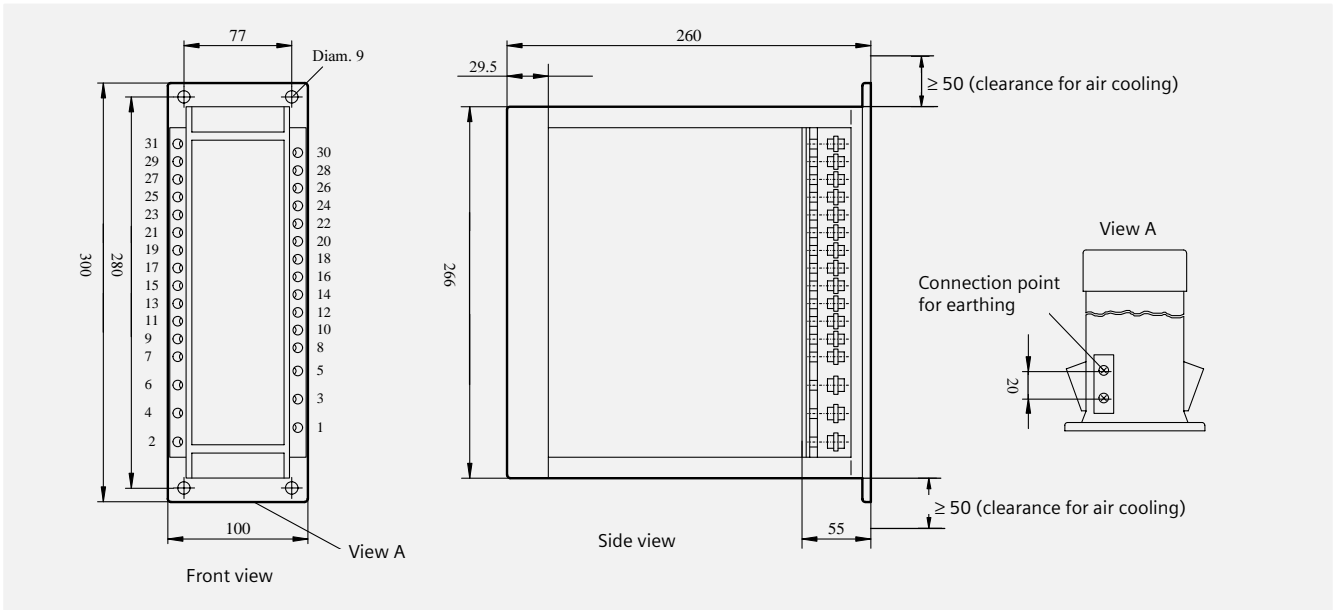


Fig. 7
7XP2020 housing (for panel surface mounting with terminals on side) for 7SV73

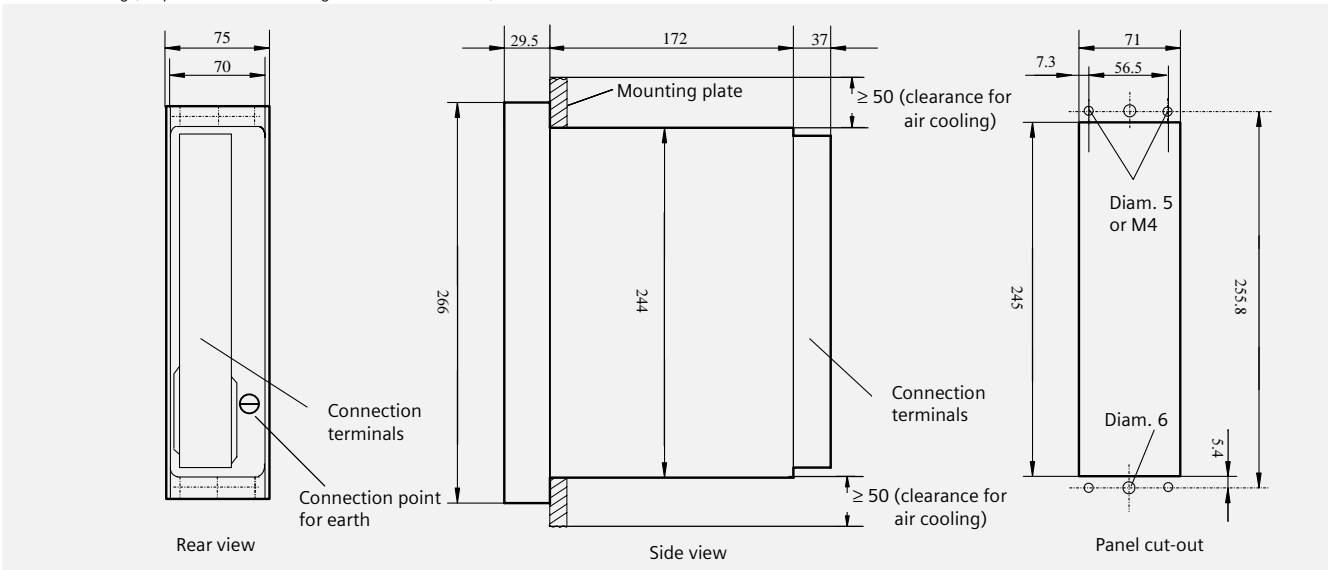


Fig. 8
7XP2020 housing (for panel flush mounting or cubicle mounting) for 7SV73

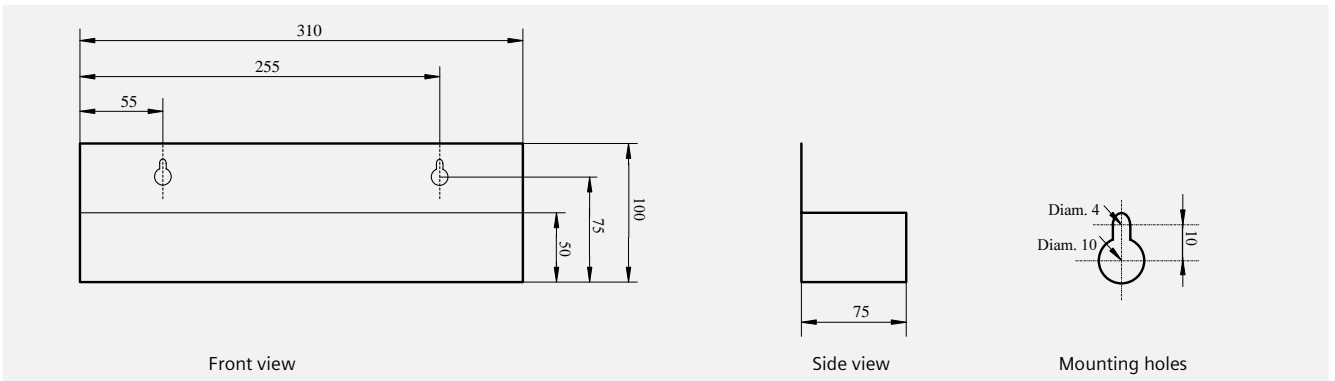


Fig. 9
Battery trough for 7SV73

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