

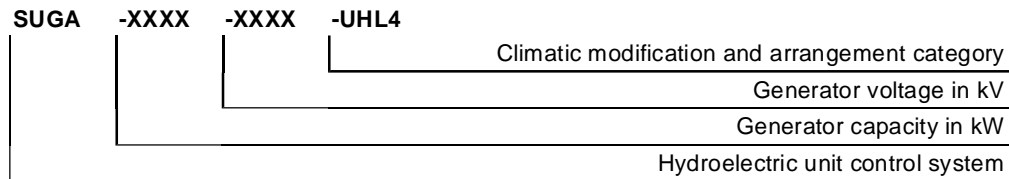


## AUTOMATIC CONTROL SYSTEM FOR HYDROELECTRIC UNIT

### APPLICATION

SUGA-1100-6,3UHL4 automatic control system for hydroelectric unit is produced for Kislaya Guba tidal power station and designed for controlling orthographic hydroelectric unit connected via a synchronous generator with a multiplying gear.

### LEGEND STRUCTURE



SUGA is produced in UHL climatic modification, arrangement category 4 in accordance with GOST 15150 and GOST 15543.1 with the following influencing factors:

- ambient temperature from +1 up to +40 °C;
- height above sea level up to 1000 m;
- relative humidity not more than 80% at temperature +25 °C;
- environment – non-explosive, not containing current-conducting dust in concentration reducing insulation level to impermissible limits.

On operational conditions regarding mechanical factors, SUGA has mechanical performance class M13 in accordance with GOST 17516.1-90.

### SPECIFICATIONS

No.	Name of parameter	Value
1	Nominal power supply voltage for alternating current circuits, V	220
2	Nominal power supply voltage for operative direct current circuits, V	110
3	Permissible variation range of power supply voltage for alternating current circuits, V	85...264
4	Permissible variation range of power supply voltage frequency for alternating current circuits, Hz	45...55
5	Permissible variation range of power supply voltage frequency for direct current circuits, Hz	72...144
6	Power consumption on alternating current circuits, W, not more than	150
7	Power consumption on direct current circuits, W, not more than	150
8	Nominal voltage on circuits of the stator voltage measurement, V	105
9	Nominal current on circuits of the stator current measurement, A	5
10	Power consumption from current measuring transformers, per phase, VA, not more than	2
11	Power consumption from voltage measuring transformers, per phase, VA, not more than	2



12	Mass, kg	142
13	Overall dimensions, mm	1,800x600x500
14	Service life, years	30
15	Error-free running time, hours, not less than	1,800
16	Climatic modification and arrangement category	UHL4

**Fig. 1** Automatic control system for hydroelectric unit

## CHARACTERISTICS

Automatic control system for hydroelectric unit, produced for Kislaya Guba tidal power station, provides operation of the orthographic hydroelectric unit and the generator in the following modes:

- | hydroelectric unit start-up in the presence of necessary difference in water level between sea and basin;
- | hydroelectric unit acceleration to the nominal rotation speed due to the presence of necessary difference in water level between sea and basin;
- | idling;
- | switching on to the network by precise dynamic synchronization method;
- | switching off from the network;
- | operational stop;
- | emergency stop.

### SUGA provides:

- | Realization of the following types of the generator protection:
  - | Current-differential protection;
  - | Protection from line-to-ground short circuits in the rotor winding;
  - | Protection from cross-country short circuits, one of which occurred in the rotor winding and the another one – in the external network;
  - | Overcurrent protection;
  - | Protection from negative-sequence currents overload;
  - | Protection from the stator winding symmetric overload;
  - | Protection from the stator winding overload by excitation current;
  - | Protection from asynchronous mode with excitation loss;
  - | Protection from increased rotation frequency;
  - | Protection from decreased rotation frequency;
  - | Protection from overheating of the generator active parts;
- | Measurement of:
  - | Stator voltage;
  - | Stator current frequency;
  - | Stator current in one phase;
  - | Active capacity;
  - | Reactive capacity;
  - | The generator and the hydroelectric unit active parts temperature;
  - | Water level in sea;
  - | Water level in basin;
  - | Hydroelectric unit rotation frequency;
- | Signaling on:
  - | Failure
  - | Operating mode
  - | Synchronization mode;
  - | Excitation mode;
  - | Protection condition;
  - | Generator switch position;
  - | Water level in sea and basin;
  - | Water level difference;

SUGA provides a possibility of information transmission to the top level of the automatic control system by the standard communication protocol MODBUS RTU through RS485 interface.

Application of the operator's sensor panel in SUGA structure allows significant reducing the number control units on the cabinet, increasing the amount of displayed information about the hydroelectric unit condition, making work with the device convenient and easy. The operator's sensor panel allows realizing multilevel access to information about the current system parameters, the event log with records of all the system parameters at the moment of the event happening, and also carrying out the parameters adjustment by field services and/or engineering personnel, thus providing reliability in operation and convenience in maintenance of SUGA.

Settings flexibility allows easy adapting of SUGA for controlling hydroelectric units of various types.

