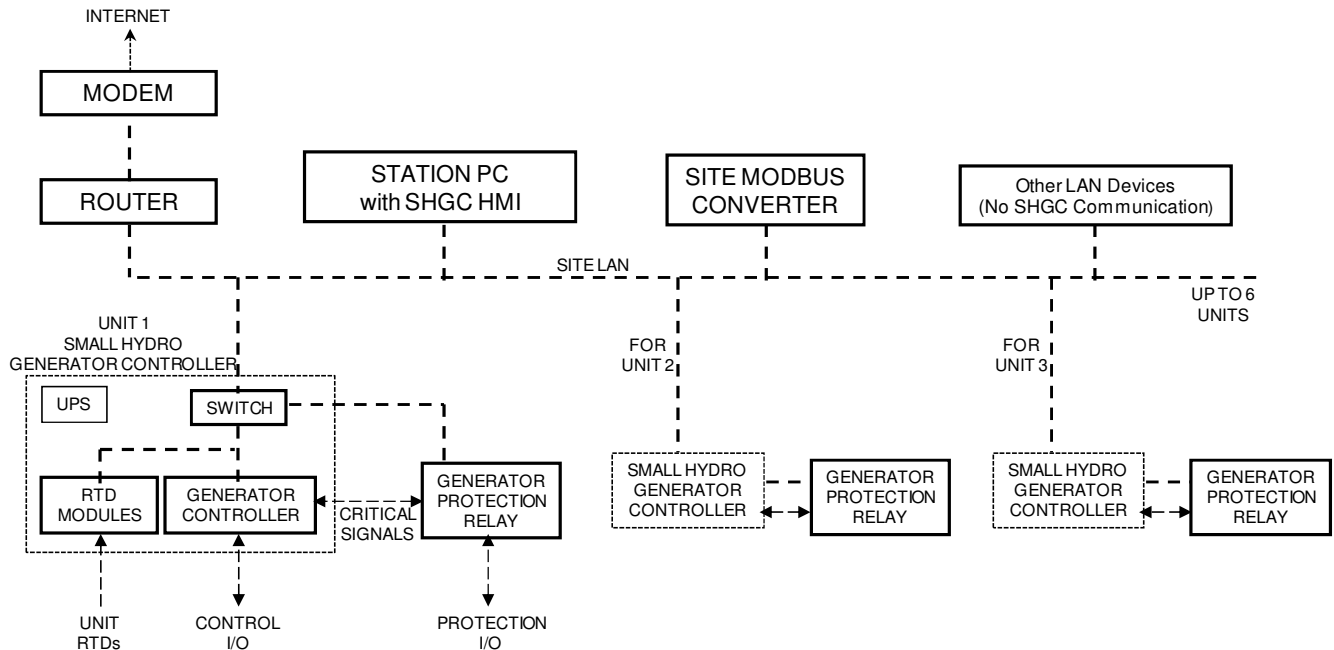


Small Hydro Generator Control System

The Small Hydro Generator Control System protects and controls the generators of a Hydro-Electric Generating Facility, and is designed for systems up to 5MW. It has a modular design, and communicates through the Site Local Area Network (LAN).



The Small Hydro Generator Control System has four main components:

- Small Hydro Generator Controller (SHGC) containing programmed PLC, Ethernet Switch, RTD modules and Uninterruptable Power Supply (UPS)
- Human-Machine Interface (HMI) hosted on the Station PC
- Generator Protection Relay (GPR) – Utility-grade relay with oscillograph facility
- Site Modbus Converter – converts site inputs such as water levels to Modbus format.

Features:

- Automated Start-Stop sequences with comprehensive fault detection and response
- User configurable for a wide range of options
- Available for single or double regulated turbines; On-Off or Proportional Hydraulic Valves; induction or synchronous generators
- Direct wicket gate control, or via head-level or power/speed regulation
- Allows low-head auto-shutdown with high-head auto-restart
- Facilitates smooth synchronization based on sustained speed match
- HMI offers real-time display and control, event logging, data logging and graphing
- HMI covers up to 6 generators per site
- Remote access to HMI to facilitate unmanned site operation
- Uses cUL/CSA approved off-the-shelf components
- Contains an embedded plant simulator allowing operator training and ‘what if’ studies.
- Available in a cabinet, or custom panel mounted for retrofit applications.

External Interfaces

- The standard SHGC has 25 Boolean inputs, 12 relay outputs, 4 transistorized 24Vdc outputs, inductive tachometer input, 4x4-20mA 16-bit analog inputs, 7 RTD 16-bit temperature inputs and 24Vdc UPS.
- Optional hardware modules can be added for 7 additional RTD inputs; and two analog outputs for proportional valve control

<u>SHGC Analog Inputs (4-20mA, 16-bit, analog filter)</u>	<u>SHGC Analog Outputs (±10V/0-20mA, 16-bit)</u>
Gates position*	Gates Hydraulics servo-valve
Blades position	Blades Hydraulics servo-valve
HPU pressure	Spare
Vibration monitor	Spare
<u>SHGC Boolean Inputs (24Vdc)</u>	<u>SHGC Relay Outputs (24Vdc)</u>
Tachometer pulse*	Trip GCB & open HDV
Generator Breaker (GCB) status*	Close GCB*
Capacitor Breaker 1 status	Close HDV and Close GCB enable*
Capacitor Breaker 2 status	Open/Close capacitor breaker 1
Hydraulic Dump Valve (HDV) status*	Open/Close capacitor breaker 2
HPU pressure OK	HPU AC Pump On/Off Command
GCB Close Permissive from GPR	Open gates pulse (for on-off Hydraulic valve)
Start Inhibit	Close gates pulse (for on-off Hydraulic valve)
Cabinet pushbutton Emergency Stop*	Open blades pulse (for on-off Hydraulic valve)
User Emergency Stop	Close blades pulse (for on-off Hydraulic valve)
GPR Alarm	Forward trip (to GPR)
User Shutdown	SHGC alarm (to GPR)
HPU Oil Level OK	
User Alarm	<u>SHGC Transistorized Outputs (24Vdc)</u>
Spare (12)	Spare(4)

<u>SHGC 16-bit Modbus over Ethernet Inputs</u>	
Temperatures 1-7 – from PT100 sensors	Temperatures 8-14 – from PT100 sensors

<u>Site Modbus Converter Inputs (16-bit Modbus over Ethernet)</u>	
Headpond level – from 4-20mA input*	Spare analog (3) – from 4-20mA inputs
Trashrack level – from 4-20mA input	Spare Boolean (2) – from 24Vdc
Tailrace level – from 4-20mA input	

<u>GPR Analog Inputs</u>	<u>Type</u>	<u>GPR Boolean Inputs (24Vdc)</u>	<u>GPR Boolean Outputs (24Vdc)</u>
Phase A or AB voltage*	120V	GCB status*	Trip Generator CB*
Phase B or BC voltage*	120V	Capacitor Breaker 1 status	Trip Main CB
Phase C or CA voltage*	120V	Capacitor Breaker 2 status	GPR Alarm - to SHGC
Phase A bus current*	5A	SHGC Forward Trip – from SHGC	Close_GCB_OK – to SHGC
Phase B bus current*	5A	SHGC Alarm – from SHGC	Spare (7)
Phase C bus current*	5A	Spare (4)	
Phase A stator current	5A		
Phase B stator current	5A		
Phase C stator current	5A		

* = Mandatory External Signal