



Generic SCADA System

User manual

Ovak Technologies

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1. List of abbreviations

SCADA – Supervisory Control and Data Acquisition;

- GSS Generic SCADA System;
- RTU Remote Terminal Unit (terminal, device, controller);
- GUI Graphical User Interface;
- TP-Technological Process;
- DB Data Base;

OPC – OLE for Process Control family of software technologies, providing a single interface to manage objects and automation of technological processes;

SQL – Structured Query Language a formal non-procedural programming language used to create, modify and manage data in any relational database managed by the appropriate database management system.

2. Terms and Definitions

Complex - hierarchically organized set of geographically distributed software systems, the combined data transmission channels;

Scanning - cyclic sequential polling of group of Nodes with a certain time interval;

Client PC – computer on which the client software is running;

Server - part of a system that performs functions such as: customer service software, RTU poll, storage, processing, interaction with other systems, servers, operating in the complex;

Client (client software) - part of the system that runs on the user's computer, which provides a user interface and interaction with the server;

Module - program fragment that contains a set of software functions;

Information life cycle - time interval, after which the information is considered to be outdated and marked to overwrite;

Status parameter - parameter that is periodically polled by the server. The history for this type of parameter is recorded in the database;

Directory - virtual directory (folder) of the system.

3. Overview

The operator of Generic SCADA System(GSS) should familiarize with the following manuals that describe functionality and rules, be qualified as an experienced PC user, and have basic knowledge of working in Windows 7/10.

GSS is intended for the diagnosis, monitoring and changing settings of the work parameters of the Node in real-time, archiving data coming from the controllers, providing multi-user and multi-level access for technological and support staff to monitor and control Systems, including the automatic modes and setting changes of its work with controller.

Operator has access for the client part of GSS, which can be granted by connecting to the server. Connection is performed via web browser, by entering GSS IP address in address bar.

NOTE: To access the client on a computer that is running GSS server, enter in the web browser address bar localhost.

Regardless of where client interface is running, on server or on a separate computer, it performs the same function.

Before using the GSS for the understanding of its functionality, user should read the following terms and definitions:

- Web GUI Web interface is used to access information from server database, control Nodes.
- **Scanning** periodic data acquisition from Nodes. Administrator sets interval between periodic scanning. Default scan interval is 60 minutes, which means that after scanning a group of Nodes GSS waits for 60 minutes before starting a new scanning.
- **Session** –time during which the client interface is open and running. The session begins when user opens a Web browser and enters the IP address of the server, and ends when Web browser is closed or when the System exits at user command. Session also ends when user does not do anything for an hour. If user is using a workplace in parallel with other users, then, for safety reasons, it is recommended to end session after the work is finished.
- Security GSS provides several levels of security and user access to the server functions. Administrator should set the security level for each client. Server security is based on the client's login and password. If menu items or the screen is not available, contact your system administrator to change the permissions.
- Selected Node Node, that is selected from the tree of Nodes. When an object is selected, a web GUI uses the data obtained from it to fill in the information window.

4. Web GUI

The Web GUI is designed to display information from the controller, data recording, controller management and edit work settings of the Node, as well as graphically display various historical information.

The Web GUI is accessible from browser window when its connected to the GSS server.

4.1. Authentication window

When user open a Web GUI it displays a user authentication window. To log in, user must enter the username and password. These are given by local system administrator with a certain level of access.

When connection to a server is established, connect

animation disappears and the entry «Connected» is displayed. If waiting timer is expired, but connection to the server is not established, an error message is displayed. This error may also occur in the case of loss of communication with the server during operation, thus the GUI will switch back to the authentication window and will try to reconnect.

4.2. User main window

User main window provides a set of functions available to the user with specific access rights. Set of functions includes: browser of connected Nodes, a set of actions for the selected Node and Node data display area.

User main window provides ability to navigate GSS toolkit trough menu items:

 Objects tree – is intended to show logical groups of Nodes. Node grouping visualized by means of a tree structure, similar to one which is used by Windows Explorer, and providing navigation to select a group of Nodes or single Nodes. Right-click opens menu with the following functions: create a new folder,

delete the existing folder, rename the folder, add the Node into a specific folder, remove the Node.

Please Sign In	
Username	۵
Password	
	Log In
✓ Connected Please Login.	×

Figure 2 Authentication

window (Connected)

Please Sign In	
Username	4
Password	
- I	Log In
Oconnecting Connecting to server, please wait.	×

Figure 1 Authentication window (Connecting)

SCADA System	■ Node: – Last good retrieval time: Last	retrieval status: Operation state:			¢۳
Dbjects Tree <	Logs				
Page Navigation					
🕍 History <	Update Generate Report				
Register Panel	Date Interval:				
다 Group Status	0 12.9.2017 00:00:00 - 12.9.2017 24:00:00				
Setpoints <					
🕏 Reports	Display 10 v records			Search:	
Tags Configuration	Date U	Note	Type Select value T x	User ID	ţţ.
A Alarm Settings	No information available				
• Logs	Displaying o - o nom o records				Previous Next

Figure 3 User main window

- **History** opens window of parameter history browsing. Parameters displays in graphical and table forms.
- **Registers** provides ability to read and write all parameters of Node.
- Group browsing displays status of selected group of Nodes.
- **Setpoints** displays and allows to change setpoints for working parameters of Nodes and groups of Nodes.
- **Tag configuration** allows for user with certain permissions to link OPC tags with Modbus registers for selected Node.

NOTE: The default username and password are the same. Enter "admin" in both fields to access WEB GUI.

4.3. Objects tree

The object tree is a navigation tool for selection of single Node or a group of Nodes. This field is always available for browsing.

Object tree organizes Node in groups. The grouping of Nodes is based on user preferences. There are two types of object tree objects: folder and Node.



Figure 4 Objects tree

To display a list of Nodes or equipment listed in the group, click on button store to the right of the group name.

By right-click on the object tree, following functions are available:

- 1. New folder
- 2. New Node
- 3. Delete folder
- 4. Delete folder and contents
- 5. Rename folder
- 6. Move Nodes here



New folder – to create a new folder, use right-mouse click on the selected folder, and in opened menu enter the name of the new folder.

Figure 5 Creating new folder

NOTE: After creating a new folder, GSS server automatically provides full access rights to the folder for the user who created this folder.

Other users are not able to see or work with this folder. Description of how to manage the rights to access folders provided in the document "Administrator's Manual."

Delete folder – to delete an existing folder, use right-mouse click on the selected folder.

NOTE: After deleting folder all Nodes and equipment located in that folder, will be placed in the main directory.

Delete folder and **contents** – to delete an existing folder and all contents of this folder, use right-mouse click on the selected folder. In after this case. confirmation, all Nodes and equipment that located in this folder, and the folder itself will be permanently deleted.

Node Configuration	Tree
Controller Type	Folder_1
RTU1	Folder_2
Object Type	Folder_3
Object_9	Folder_4
Name	+ rolder_5
Node338	
OPC Templates	
OLD T	
Port	
GeolinkCOM8 T	
Mode	
RTU	
IP-Address	
5	
ModBus Address	
12	
TCP Port	
0	
Timeout	
10000	
Survey mode	
Il surveys 🔻	
Date of addition	
14.07.2016 11:35:24	
C Edit	

Rename folder - to

rename an existing folder, use right-mouse click on the selected folder. Field with editable current folder name will appear.

Figure 6 Add/modify Node

Place Node here – to move one or more Nodes in the current folder, use right-mouse click on the selected folder. Click on the Node(s) to move them to a new directory. Selected Nodes are marked with blue color.

New Node – to add new Node following steps must be complete:

- 1. In the object tree, right-click on any folder in which you want to add new Node and select «New Node» from the dropdown menu.
- 2. Enter individual name in «Node name» field. Name cannot be blank, cannot be used on other Node and cannot include symbols "/", "\".
- 3. In «Controller» section pick controller type, communications port and device address.

- 4. In «Polling» section pick one of the following modes:
 - Disable GSS will not poll this Node;
 - User only only user can poll controller, all automated polls, initiated by GSS will be disabled;
 - All polls all polls will be enabled on this Node.
- 5. After inputting all necessary parameters press button «Add» to add new Node.

NOTE: «Polling» option by default set to «Disabled for current Node ».

NOTE: To not create Node that will function in «All Call» mode, do not use "0" in Node address. «All Call» Node will transmit messages via radio, that can be received by all objects.

For existing Node available two following functions:

- 1. Modify Node
- 2. Delete Node

Modify Node – to edit the settings of an existing Node use right-mouse click on the selected Node and select «Modify Node» in drop-down menu. In opened window configuration parameters can be changed.

Delete Node – to delete an existing Node use right-mouse click on the selected Node and select «Delete Node», in that case all Node data, including configuration parameters and history will be lost.

4.4. History tab

History tab intended for browsing archive data for each parameter that was marked by user as «status». When changing Nodes in objects tree, the information is automatically updated for selected Node.

Navigation:

SCADA System	Node: Node16341 Last good retrieval til		Operation state:	۰+
Dbjects Tree 🤇	Graph			
Folder_1 <				
O Node338	₽ 🛛			
O Node4156	Update Generate Report			
O Madat166	Expand			
O Hodewice				* Carela
O Node5113	Description	Address	.↓↑ Status .↓↑	Graphs Q Show All
Folder_2 <	RTU1_P32501	32501	*	
O Node1111	RTU1 P32611	32611	2	
O Node16341	RTU1_P32614	32614	8	ක්ෂියා යන්තියක හා දිය යන්තියක් කරන්න කරන
O Node3711	RTU1_P42195	42195	2	
O Node7169			Description 1 March	
Eolder 2 c			Previous 1 Next	
Q Ned-2000	4		•	
U NOUEZZZZ				
Folder_4 <	All Parameters			
O Node130				
O Node424			Search:	
Page Navigation	1 Description	1 Address	.↓↑ Status .↓↑	
	RTU1_P32508	32508		
陆 History <	RTU1_P32509	32509		
Granh	RTU1_P32510	32510		
Table	RIU1_P32511	32511		
Table	RTU1 P32515	32515		
Register Panel	RTU1_P32516	32516		2000
Th a a	RTU1_P32518	32518		
Hut Group Status	RTU1_P32520	32520		
Setpoints <	RTU1_P32521	32521		1000
		Previous 1 21	22 23 85 Next	
Reports				
Solution	<		,	a Jul 28 Jul 24 Aug 01 Aug 00 Aug 16 Aug 24
Alarm Settings				RTU1_P41429 RTU1_P32508

- 1. Click on «History» menu
- 2. Click on «Graph» menu

To receive schedule of parameter change, select Node from the object tree, select parameter from list «Status» set the time interval to display.

GSS allows to browse multiple graphs by overlaying them on top of each other to analyze. Graphs are marked with different colors, and the name of the graph is displayed at the bottom left of the chart.

To scale graph move cursor on the desired part of the graph while holding down the left mouse button.

Displaying the historical data is available in the form of graphs, as well as tables. To view the data in tabular form, use sub-tab "Table" in which to choose Node from the object tree, select Status from the list of options and set the time interval to display.

SCADA System	■ Node: Node16341 Last good retrie				0.+
Dbjects Tree 🗸	Table				
Folder_1 <					
O Node338	C 🛛				
0	Update Generate Report				
O Node4156	45 Meacuption	+1 Muuress			
O Node4166	RTU1_P32501	32501	8	Status Parameters(by default)	
O Node5113	RTU1_P32610	32610	8		
Folder 2 <	RTU1_P32611	32611	8	Display 10 + records	Search:
0.000	RTU1_P32614	32614	2	Retrieval Date	Là Value
O Nodell11		32508	8	08.08.2016 14:04:54	6259
O Node16341	RTU1_P41429	41429	8	08.08.2016 14:06:27	3491
O Node3711			Previous 1 Next	08.08.2016 14:08:01	6511
O Node7169				08.08.2016 14:09:32	4017
	4		•	08.08.2016 14:11:05	4952
Folder_3 <				08.08.2016 14:12:44	6753
O Node2222	All Parameters			08.08.2016 14:14:15	5385
🖿 Folder 4 🛛 🗸				08.08.2016 14:17:21	7109
O 11-1-120			Search:	08.08.2016 14:18:52	3365
O NOGETIO					
O Node424	↓ Description	11 Address	.↓↑ Status .↓↑	Displaying 1 - 10 from 12,252 records	Previous 1 2 3 4 5 1226 Next
Dage Nucleation		32508	2		
ragemangation	RTU1_P32509	32509			
History	RTU1_P32510	32510			
	RTU1_P32511	32511			
Graph	RTU1_P32513	32513			
Table	RTU1_P32515	32515			
	RTU1_P32516	32516			
III Register Panel	RTU1_P32518	32518			
The cases parties	RTU1_P32520	32520			
Had Group Status	RTU1_P32521	32521			
E Setpoints	<	Previous 1 21	22 23 85 Next		
Reports	x				
Tags Configuration					



To display or hide graph use right click on a parameter. If graph is displayed in the tab, then near this graph corresponding icon will be shown.

GSS user with certain access rights can edit the list of status parameters for selected Nodes. To do this user shall put or remove check mark for the corresponding parameter in the column "status". Selected parameter will be added or removed from the table "Status parameters".

ate Ir	iterval:						
0	01.02.20	016 12:00:00 - 13.09.2017 12:	00:00				
Stat	us Para	meters					
						Search:	
	11	Description	lî.	Address	11	Status	
		RTU1_P32501		32501			
		RTU1_P32610		32610			
		RTU1_P32611		32611			
		RTU1_P32614		32614			
		RTU1_P42195		42195			
						Previous	1 Ne
_							



4.5. Registers tab

Registers tab allows to mark for polling registers that not set in GSS by default

Navigation:

 Click «Registers» menu

on

List of registers intended to select an address parameters. In the «Address» field user can enter or select registers addresses from list, that GSS must poll from Node. Nonadjacent registers must be separated by a comma, while adjacent registers

Objects Tree	Register Panel					
	List			Registers		
				32501	RTU1_P32501	
			Search:	32502	RTU1_P32502	
Node16341	Addeser	1 Description	11 Volue	32503	RTU1_P32503	
	Notifess	11 herothon	+ same	+1 32504	RTU1_P32504	
	No information available			32505	RTU1_P32505	
				32506	RTU1_P32506	
				32507	RTU1_P32507	
				32508	RTU1_P32508	
				32509	RTU1_P32509	
				32510	RTU1_P32510	
				32511	RTU1_P32511	
				32513	RTU1_P32513	
				32515	RTU1_P32515	
story				32516	RTU1_P32516	
				32518	RTU1_P32518	
				32520	RTU1_P32520	
				32521	RTU1_P32521	
rister Panel				32522	RTU1_P32522	
polo i urici				32523	RTU1_P32523	
				32525	RTU1_P32525	
ob searces				32528	RTU1_P32528	
				32529	RTU1_P32529	
ponts				32530	RTU1_P32530	
				32531	RTU1_P32531	
ports				32532	RTU1_P32532	
				32533	RTU1_P32533	
gs Configuration				32534	RTU1_P32534	
				32535	RTU1_P32535	
				32536	RTU1_P32536	
				32537	RTU1_P32537	
				32547	RTU1_P32547	
				32548	RTU1_P32548	
				21640	DTUS 021540	

must be separated by hyphens. To read entered or selected



registers, press the button "Read", in this case will be displayed, addresses, descriptions and values of polled registers.

- 1. For single register the register number is entered in full (eg, 41425);
- For a consecutive register numbers must be entered "first register" "last register" (eg, 41425-41430);
- 3. For non-consecutive register numbers must be entered by comma followed by a space (for example, 41425, 41428, 41430).

To change the value specified in the register, click a cell in the column «Value» for parameter that needs to be changed. The cell is opened in edit mode and user can enter the desired value. After pressing the «Record» button, new value will be loaded into the Node.

For convenience of copying the register map from one client computer to another, available possibility to save a list of the registers as a group. After the address of the register(s) entered in the «Address field», enter the group name and click button "Save".

If necessary, user can remove already created group by selecting the appropriate drop-down list and press the "Delete" button.

Save See	
New Template Name:	
🖋 Save	
Figure 11 Sav	/ing
registers se	et
Delete Set	
Delete Set Saved Templates:	

Figure 12 Deleting registers set

To download the appropriate registers group, select it from the drop-down list and click "Download" button. List of registers stored will be displayed in the field «Address», as shown in the figure 26.

4.6. Group Status tab

Group browsing tab is intended to display same parameters for multiple Nodes in tabular form.

Navigation:

1. Click on «Group Status» menu

To add a Node to the group view, select the Node and press «Add the selected Node» button. To add to the group view all

Load Set	
Saved Templates:	
test	
n Load	

Figure 13 Loading registers set

Nodes in the selected folder press "Add all the Nodes in the current folder" button. To delete the selected Nodes from the group view press "Delete selected Node" button.

SCADA System								¢۳
Objects Tree Folder_1 Folder_2 O Node1111	Group Status							
 Node16341 Node3711 Node7169 	Add/Delete Parameter	Param_42281 X Param_42285 X	Param_42384 .X					
Folder_3 <								
■ Folder_4 <							Coardy	
Folder_5 <							aearch	
Page Navigation	Node name	11 Comment	1 Param_42384	1 Param_42260	1 Not Used	1 Param_42285	↓↑ Param_42281	
📥 History 🗸	wew_test	comment1	Ū	Ū	0	•	U	
Graph	Node3333		0	0	0	0	0	
Table	Node_rs		0	0	0	0	0	
Register Panel		10						
다. Group Status	Test_Node		1.3996	3	0	232.156	198.12	
E Setpoints <	Yerevan office		0.8963	3	0	231.14	198.628	
🕃 Reports	Displaying 1 - 5 from 5 records							
Tags Configuration								
Alarm Settings								
1 Logs								

Figure 14 «Group Status» tab

After adding the Nodes to group view, user must define the parameters of group view. To do this user must select «options» from the dropdown list, and click on the "add selected item" button. For removing parameters of group view button "remove the selected item" is intended.

Parameters of the group view are displayed in a table. User can quickly search specific parameter by means of entering the Node name, parameter name or value.

After selecting periodic update parameters of the group view values Web GUI mode will periodically read the latest values and display them in the table.

4.7. Setpoints tab

Setpoints tab allows to read and write Nodes malfunction setpoints of single Nodes or groups, by selecting them in object tree. When changing Nodes in objects tree, the information is automatically updated for selected Node.

Navigation:

1. Click on «Setpoints» menu

This tab displays the Node controllers tuning registers grouped by criteria. After selecting controller or group GSS performs polling of Node controller and database, displaying values of the same parameters in the form of a table. User can update the databases values or Node values, in case of noticing values inequality.

SCADA System	■ Node: Noder16341 Last good retrieval time: Last retrieval status: Operation state:
Objects Tree <	Group
	C Update
D Node16341 D Node3711	Setpoint Parameters
	Display 10 + records Search: Display 10 + records Search:
	Group Name Iii Address Iii Description II Value in DB Value in RTU II Group_1 To information available To information available </td
	Group, 3 Displaying 0 - Othom 0 records Previous Next
	Group_5 Actions Group_1 Group_3 Group_5 1
	Displaying 1 - 9 from 9 records Previous 1 Next.
oints <	
Configuration	
ettings	

Figure 15 «Setpoints» tab

4.8. Tag configuration tab

Tag configuration tab intended to link Modbus registers with OPC tags. These tags serve as data source for the corresponding Node.

When changing Nodes in objects tree, the information is automatically updated for selected Node.

Navigation:

1. Click on «Tag configuration» menu

Configuration
5
Registers
Address
2
3
4
3
7
9
11
12
100
101
102
103
104
105
106
107
108
Actions
Search:
Argentice available
formation available

Figure 16 «Tag configuration» tab

When adding a new controller, GSS allows to use other OPC Server as a data source for this Node. To do this, user must configure controller registers by linking them with tags from available OPC servers in the network.

All of the available registers for the selected controller type are displayed together with all available tags in the network. In addition, user can view the available computers on the network, where OPC servers are running, and connect to an OPC client. All tags are displayed in a hierarchical form which allows user to connect them with the Node registers. After selecting a tag and register, press the button «Connect» to mark that the value of this register must be taken with a certain tag. All configured tags can be viewed at the bottom of the window. User can disconnect existing configuration by selecting the connection and pressing «Delete» button.

After configuration is complete, click on «Confirm» button to save all changes in GSS

NOTE: After linking Node controller register to the OPC server tag, this tag is marked green in the hierarchy of tags. Not recommended to associate tag with more than one register.

After linking registers for one Node, user can save configuration as a template to be applied to other Nodes using same OPC client. To do this, after clicking

Connections te	nplates for Current Controller Type	
Save Set		
New Template N	me:	
🖋 Save		
Load Set		
Saved Templates		
OLD		•
🔥 Load		
Delete Set		
Saved Templates		
OLD		٣
🚯 Delete		

«Confirm» button, click "Save Template" button. Figure 17 Connections

To apply template to Node user should do the following:

- 1. Select Node from object tree;
- Open «Tag configuration» menu and click «Load template» button, in the «Connections» field will automatically appear new connections for the current Node, taken from the template;
- 3. Click «Confirm» button.

NOTE: When clicking «Save Template» button, if connections not configured, GSS will ignore this command.

NOTE: User cannot use templates if controllers use different OPC servers.

4.9. Malfunctions tab

Malfunction tab intended to set criteria of alarm triggers for all working parameters of Node. To do it select Node from object tree and click on «Malfunctions» tab.

SCADA System	■ Node: Node16341	Last good retrieval time:	Last retrieval status:	Operation state:					۰*		
Dbjects Tree <	Malfunctions/Alar	ms									
 Folder_1 Folder_2 O Node1111 	2 Update										
O Node16341	Sea								Search:		
O Node3711	44	Consecutive Allowed	Consecutive Occurred	Cumulative Occurred	1 Limit 🗐	† Present	Normal Mode Enabled	Host Mode Enabled	Timed Mode Enabled		
O Node7169	Malf_1	NaN	NaN	NaN	NaN	NaN					
Eolder_4	Malf_2	NaN	NaN	NaN	NaN	NaN					
Folder_5 <	Malf_3	NaN	NaN	NaN	NaN	NaN					
Page Navigation	Malf_4	NaN	NaN	NaN	NaN	NaN					
ille History c	Malf_5	NaN	NaN	NaN	NaN	NaN					
	Malf_6	NaN	NaN	NaN	NaN	NaN					
Graph Table	Malf_7	NaN	NaN	NaN	NaN	NaN					
Register Panel	Malf_8	NaN	NaN	NaN	NaN	NaN					
	Malf_9	NaN	NaN	NaN	NaN	NaN					
Group Status	Malf_10	NaN	NaN	NaN	NaN	NaN					
E Setpoints <	Malf_11	NaN	NaN	NaN	NaN	NaN					
Group	Malf_12	NaN	NaN	NaN	NaN	NaN					
Malfunctions/Alarms	Malf_13	NaN	NaN	NaN	NaN	NaN					
Reports	Displaying 0 - 0 from 0 record	s									
Tags Configuration											
Alarm Settings									🖉 Sava		
-D Logs											

Figure 18 «Malfunctions» tab

1. Click on «Malfunctions» menu

To configure the criteria of malfunctions user should select parameter from the list and click on the "Add" button. Configuration window will appear with the following options:

- *Type* is a selected parameter with the following values: ==, >, <, !=. The selected option is located in the left side of the above operations.
- *Priority this parameter sets the level of importance of malfunction. GSS* using following types of priorities:
 - 1. Diagnostic;
 - 2. Low;
 - 3. Medium;
 - 4. High;
 - 5. Critical.
- Value when checking for the malfunctions this parameter located on the right side of the above operations.
- Description short description/commentary of this malfunction.

NOTE: Multiple criteria of malfunctions can be configured for a single parameter. If simultaneously several criterias are met, result will be the one with higher priority.

After setting malfunction criteria, to save results button «Save» is intended.

5. Support Information

For technical support, please, contact Ovak Technologies at: Phone: +1.281.506.0020 Email: <u>support@ovaktechnologies.com</u> Web: <u>www.ovaktechnologies.com</u>