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Certificate

No.: 20201011 Rev. 01

Manufacturer:	**«Prosoft-Systems» Ltd** **Volgogradskaya Str., 194a** **620102 Yekaterinburg** **Russian Federation**	**ООО «Прософт-Системы»** **ул Волгоградская, 194а** **620102 г. Екатеринбург** **Российская Федерация**
Product:	**Programmable Logic Controller**	**Контроллер программируемый логический**
Type:	**REGUL R500S**	**REGUL R500S**
Application:	Various	

Test Results:

The programmable logic controller REGUL R500S (PLC) is recommended as a logic solver for building fault-tolerant Safety Instrumented Systems (SIS) in accordance with the requirements of international standards:

IEC 61508 Part 1 – 7: 2010
IEC 61511 Part 1-3: 2016
IEC 62061:2005+AMD1:2012+AMD2:2015

which are identical to national standards in the Russian Federation:

ГОСТ Р МЭК 61508-2012 Части 1,2,4-7
ГОСТ Р МЭК 61508-2018 Часть 3
ГОСТ Р МЭК 61511-2018 Части 1-3
ГОСТ Р МЭК 62061-2015

The product is qualified for its intended use for

SIL 1-3 / УПБ 1-3

applications.

For detailed results of the assessment refer to Assessment (certifying) Report: AR20201011 Version 1.0, dated October 10, 2020

Results are summarized on page 2.

Date of Issue:
10.10.2020

FSCP TÜV SÜD www.tuv-sud.com FSProfessional SIS ID. TP08050192

Assessor:

Horst Kuntscher
Certified Functional Safety Professional

The PLC comprises:

- safe state of programmable logic controller – de-energized state;
- safety functions with low, high, continuous;
- application of electronic components proven in safe use more than 2 years;
- SIL 3 integrated microcontroller (certified in accordance with IEC 61508: 2010) in central processor modules and in each input and output module to guarantee the validity of data and diagnostic of communication error between modules;
- SIL 3 communication protocol (certified in accordance with IEC 61508: 2010);
- SIL 3 Real-Time operating system (certified in accordance with IEC 61508: 2010);
- 1oo2D channel architecture in each input and output module;
- redundancy of PLC;
- two independent data buses with diagnostic of hardware failures in redundant PLC;
- availability of two field power buses with diagnostic of hardware failures;
- safety programming with limited variability language – FBD in Epsilon LD development environment

PLC REGUL R500S consists of input modules, central processor modules, output modules as listed in Table 1.

Type of module	Identification of module
Central Processor Module	R500S CU 00 821
	R500S CU 00 831
Digital Input Module	R500S DI 16 831
	R500S DI 28 811
Analog Input Module	R500S AI 04 841
	R500S AI 04 861
	R500S AI 08 851
	R500S AI 08 881
Digital Output Module	R500S DO 16 811
	R500S DO 08 821

Table 1: REGUL R500S modules

Version of Embedded software of Central Processor Module RegulSRTS is 2.0.0.0.

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Summary of test results:

Module REGUL R500S	λ_{DU}, $\times 10^{-9}$ 1/h	λ_{DD}, $\times 10^{-9}$ 1/h	λ_{SU}, $\times 10^{-9}$ 1/h	λ_{SD}, $\times 10^{-9}$ 1/h	PFH, $\times 10^{-9}$ 1/h	PFDavg, $\times 10^{-4}$ 1/year (TI=5 years)	$MTBF_D$ [1)], $\times 10^{8}$ h
CU 00 821	0,0482	0,530	1210	2200	0,578	0,011	17,3
CU 00 831	0,0482	0,570	1210	2250	0,6182	0,011	16,18
DI 16 831	3,04	30,500	1840	943	33,54	0,666	0,3
DI 28 811	3,24	30,400	1860	899	33,64	0,710	0,3
AI 04 841	2,11	22,800	2170	1170	24,91	0,462	0,4
AI 04 861	2,11	22,800	2170	1170	24,91	0,462	0,4
AI 08 851	2,28	22,600	2340	1150	24,88	0,499	0,4
AI 08 881	2,41	25,100	2380	1160	27,51	0,528	0,36
DO 16 811	3,18	30,300	1330	1400	33,48	0,696	0,3
DO 08 821	3,72	39,500	1100	1670	43,22	0,815	0,23

Notes:
1) $MTBF_D$ – Mean time between dangerous failures

Table 2: Modules failure rate data

Input Module	Central Processor Module	Digital Output Module	PFH ×10-9 1/h	PFDavg (10-4/year) (TI=5 years)
AI 04 841	CU 00 821	DO 08 821	68,708	1,287
		DO 16 811	58,968	1,169
	CU 00 831	DO 08 821	68,708	1,287
		DO 16 811	59,008	1,169
AI 04 861	CU 00 821	DO 08 821	68,708	1,287
		DO 16 811	58,968	1,169
	CU 00 831	DO 08 821	68,748	1,287
		DO 16 811	59,008	1,169
AI 08 851	CU 00 821	DO 08 821	68,678	1,325
		DO 16 811	58,938	1,206
	CU 00 831	DO 08 821	68,718	1,325
		DO 16 811	58,978	1,206
AI 08 881	CU 00 821	DO 08 821	71,308	1,353
		DO 16 811	61,568	1,235
	CU 00 831	DO 08 821	71,348	1,353
		DO 16 811	61,608	1,235
DI 16 831	CU 00 821	DO 08 821	77,338	1,491
		DO 16 811	67,598	1,373
	CU 00 831	DO 08 821	77,378	1,491
		DO 16 811	67,638	1,373
DI 28 811	CU 00 821	DO 08 821	77,438	1,535
		DO 16 811	67,698	1,417
	CU 00 831	DO 08 821	77,478	1,535
		DO 16 811	77,478	1,535

Table 3: PFH and PFD_{avg} values of one channel of PLC configuration

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Input module	PFH (1oo3D) $\times 10^{-9}$ 1/h	PFH (1oo2D) $\times 10^{-9}$ 1/h	PFH (2oo2D) $\times 10^{-9}$ 1/h	PFH (2oo3D) $\times 10^{-9}$ 1/h	PFDavg (1oo3D) (10^{-4}/year) (TI=5 years)	PFDavg (1oo2D) (10^{-4}/year) (TI=5 years)	PFDavg (2oo2D) (10^{-4}/year) (TI=5 years)	PFDavg (2oo3D) (10^{-4}/year) (TI=5 years)
AI 04 841	0,021	0,48	4,22	0,022	0,0046	0,0048	0,92	0,0047
AI 04 861	0,021	0,48	4,22	0,022	0,0046	0,0048	0,92	0,0047
AI 08 851	0,023	0,48	4,56	0,023	0,005	0,0052	1	0,0051
AI 08 881	0,024	0,53	4,82	0,025	0,0053	0,0056	1,06	0,0054
DI 16 831	0,03	0,64	6,08	0,032	0,0067	0,0072	1,33	0,0068
DI 28 811	0,032	0,64	6,48	0,034	0,0071	0,0077	1,42	0,0069

Table 4 – Redundancy of input modules

Central processor module	PFH (1oo2D) $\times 10^{-9}$ 1/h	PFH (2oo2D) $\times 10^{-9}$ 1/h	PFDavg (1oo2D) (10^{-4}/year) (TI=5 years)	PFDavg (2oo2D) (10^{-4}/year) (TI=5 years)
CU 00 821	0,83	0,097	0,00011	0,021
CU 00 831	0,64	0,097	0,00011	0,021

Table 5 – Redundancy of central processor modules

Output module	PFH (2oo2D) $\times 10^{-9}$ 1/h	PFH (1oo2D) $\times 10^{-9}$ 1/h	PFH (1oo3D) $\times 10^{-9}$ 1/h	PFDavg (2oo2D) (10^{-4}/year) (TI=5 years)	PFDavg (1oo2D) (10^{-4}/year) (TI=5 years)	PFDavg (1oo3D) (10^{-4}/year) (TI=5 years)
DO 08 821	7,44	0,83	0,037	1,63	0,0087	0,0081
DO 16 811	6,36	0,64	0,032	1,39	0,0074	0,007

Table 6 – Redundancy of output modules