RELION® PROTECTION AND CONTROL

615 series ANSI

Type Test Certificate

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Section 1 General

Product/type	Protection and control product series 615
Result	The equipment under test has been tested according to the relevant parts of the standards and it has fulfilled the specified requirements in all parts of the type test. No erroneous operation or malfunction occurred, and no electrical damage could be observed.
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References	ANSI publications	
	Application Manual, RED615	1MAC807603-MB
	Application Manual, REF615	1MAC109016-MB
	Application Manual, REG615	1MAC859072-MB
	Application Manual, REM615	1MAC254299-MB
	Application Manual, RET615	1MAC206062-MB
	Cyber Security Deployment Guideline, 615 series	1MAC052704-HT
	DNP3 Communication Protocol Manual, 615 series	1MAC052479-MB
	DNP3 Point List Manual, 615 series	1MAC059432-MB
	Engineering Manual, 615 series	1MAC108982-MB
	IEC 61850 Engineering Guide, 615 series	1MAC053584-RG
	Installation Manual, 615 series	1MAC051065-MB

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Modbus Communication Protocol Manual, 615 series	1MAC057386-MB
Modbus Point List Manual, RED615	1MAC807817-MB
Modbus Point List Manual, REF615	1MAC105331
Modbus Point List Manual, REG615	1MAC856516-MB
Modbus Point List Manual, REM615	1MAC252756
Modbus Point List Manual, RET615	1MAC203705
Operation Manual, 615 series	1MAC054853
Technical Manual, 615 series	1MAC059074
Type Test Report, 615 series	1MRS081892

Section 2 Test objects

Table 1: Test objects

Type designation	Order number for hardware
RED615	HBDDFEADNLA1BMD11G
REF615	HBFNAEFCNHA1AQB21G
REG615	HBGDBDADNBA1BFG11G

The tests are valid also for other products of 615 series.

Table 2: Basic modules

Description	Type number	PWB version
HBDDFEADNLA1BMD11G		
CPU0007, CPU module	2RCA031146A0001	2RCA024978
PSM0004, PS_H/BO, Power supply module	2RCA025059A0001	2RCA024582
BIO0005, 8BI + 4BO, Binary I/O module	2RCA025501A0001	2RCA024986
AIM0016, 4I + 4BI (I_{L1} - I_{L3}, I_o), Analog input module	2RCA007128A0001	2RAA005401
AIM0003, 1 mA + 2RTD + 5U (U_{L1B}, U_{L1} - U_{L3}, U_o), Analog input module	2RCA025048A0001	2RAA005576
DIS0012, LHMI IEC, Large, LHMI module	2RCA025340A0001	2RAA005579
COM0035, COM LDM (SM LC + 2 × MM LC), Communication module	2RCA034393A0001	2RCA006780
BPL0001, Backplane module	2RCA006836A0001	2RAA005308
HBFNAEFCNHA1AQB21G		
CPU0007, CPU module	2RCA031146A0001	2RCA024978
PSM0003, PS_L/BO, Power supply module	2RCA025058A0001	2RCA024582
BIO0007, 8BI + 3BO, Binary I/O module	2RCA026772A0001	2RCA026480
AIM0016, 4I + 4BI (I_{L1}- I_{L3}, I_o), Analog input module	2RCA007128A0001	2RAA005401
AIM0006, 5U + 4BI (U_{L1B}, U_{L1}- U_{L3}, U_o), Analog input module	2RCA021397A0001	2RCA013877
DIS0011, LHMI IEC , Small, LHMI module	2RCA025209A0001	2RAA005579
COM0032, COM REDY (2 × LC + RJ-45 + FO-UART + ARC), Communication module	2RCA025693A0001	2RCA006780
BPL0001, Backplane module	2RCA006836A0001	2RAA005308
HBGDBDADNBA1BFG11G		
Table continues on next page		

Description	Type number	PWB version
CPU0007, CPU module	2RCA031146A0001	2RCA024978
PSM0004, PS_H/BO, Power supply module	2RCA025059A0001	2RCA024582
BIO0005, 8BI + 4BO, Binary I/O module	2RCA025501A0001	2RCA024986
AIM0015, 7I (I_0 0.2/1 A, I_{L1} - I_{L3}, I_{L1B} - I_{L3B}), Analog input module	2RAA005920A0004	2RAA005786
AIM0006, 5U + 4BI (U_{L1b}, U_{L1} - U_{L3}, U_o), Analog input module	2RCA021397A0001	2RCA013877
DIS0012, LHMI IEC , Large, LHMI module	2RCA025340A0001	2RAA005579
COM0005, COM IEC (RJ-45 + ARC), Communication module	2RAA005844A0001	2RAA005402
BPL0001, Backplane module	2RCA006836A0001	2RAA005308

Type tests are performed on IEC LHMI module DIS0012. The test results are also applicable for ANSI LHMI module DIS0014, since the PCBA is the same in both ANSI and IEC LHMI.

Section 3 Type tests

Table 3: Inspection of mechanical structure

Description	Reference	Result
Markings and mechanical structure	IEC 60255-1 IEC 60255-27	OK
Enclosure class (flush-mounted)	IEC 60529	IP 54 front side IP 10 rear side, connection terminals
Clearances and creepage distances	IEC 60255-5 IEC 60255-27	OK

Table 4: Overload and input tests

Description (IEC 60255-1 and IEC 60255-27)	Requirement	
Rated current, I_n	0.2/1 A[1)]	1/5 A[2)]
Thermal withstand capability • Continuously • For 1 s	4 x I_n=4 A 100 x I_n=100 A	4 x I_n=20 A 100 x I_n=500 A
Dynamic current withstand • Half-wave value	250 x I_n=250 A	250 x I_n=1250 A
Input impedance	< 100 mΩ	< 20 mΩ
Rated voltage, U_n	60...210 V AC	
Burden	< 0.05 VA	
Voltage withstand • Continuously • For 10s	240 V AC 360 V AC	
Current sensor input, rated voltage (in secondary side) Continuous voltage withstand Input impedance at 50/60 Hz	75...2812.5 mV 125 V 2-3 MΩ	
Voltage sensor input, rated voltage	6...30 kV	

Table continues on next page

Description (IEC 60255-1 and IEC 60255-27)	Requirement
Continuous voltage withstand	50 V
Input impedance at 50/60 Hz	3 MΩ
Binary inputs	
• Operational range	19.2...300.0 VDC
• Current drain	1.6...1.9 mA
• Power consumption	31.0...570.0 mW

1) Residual current
2) Residual current and/or phase current

Table 5: Power supply module tests

Test	Description	Result
Auxiliary voltage		
(IEC 60255-1, IEEE C37.90-2005)		
• PS_H	38...300 VDC 38...264 VAC	No influence No influence
• PS_L	12...72 VDC	No influence
Immunity to voltage dips (IEC 60255-11)		
• PS_H	Residual voltage 0%:	
	38...300 VDC	0...50 ms, normal operation >50 ms, restart
	Residual voltage 40%:	
	38 VDC 300 VDC	200 ms, restart 200 ms, normal operation
	Residual voltage 70%:	
	38 VDC 300 VDC	500 ms, restart 500 ms, normal operation
	Residual voltage 0%:	
	38 VAC	0...46 ms, normal operation >46 ms, restart
	residual voltage 0%:	
	48...264 VAC	0...58 ms, normal operation >58 ms, restart
	Residual voltage 40%:	
	38 VAC 264 VAC	200 ms, restart 200 ms, normal operation
	Residual voltage 70%:	
	38 VAC 264 VAC	500 ms, restart 500 ms, normal operation

Table continues on next page

Test	Description	Result
• PS_L	Residual voltage 0%: 19.2...72 VDC Residual voltage 40%: 19.2 VDC 72 VDC Residual voltage 70%: 19.2 VDC 72 VDC	 0...50 ms, normal operation >50 ms, restart 200 ms, restart 200 ms, normal operation 500 ms, normal operation 500 ms, normal operation
Interruptions of auxiliary power supply voltage (IEC 60255-11) • PS_H • PS_L	 38 VDC, 5 s 300 VDC, 5 s 38 VAC, 5 s 264 VAC, 5 s 19.2 VDC, 5 s 72 VDC, 5 s	 Shutdown and correct restart Shutdown and correct restart Shutdown and correct restart Shutdown and correct restart Shutdown and correct restart Shutdown and correct restart
Ripple in the DC auxiliary voltage (IEC 60255-11)	Max. 15%, $f=2xf_n$	No influence
Gradual shutdown and start-up (IEC 60255-11)	Shut-down ramp: 60 s Power off period: 300 s Start-up ramp: 60 s	Shutdown and correct restart
Reversal of DC power supply polarity (IEC 60255-11)	Duration 60 s	Correct operation after the test
Power consumption • PS_H • PS_L	 VDC VAC VDC	 ~12.3 W (nominal)/~ 18.0 W (max.) ~13.5 W (nominal)/~ 19.3 W (max.) ~11.7 W (nominal)/~ 16.9 W (max.)

Table 6: Contact tests

Contact type	Test (IEC 60255-1 and IEEE C37.90-2005)	Requirement
Double-pole power outputs with TCS function	Making capacity:	
	• Continuous carry	8 A
	• Make and carry 3 s	15 A
	• Make and carry 0.5 s	30 A
	Breaking capacity when L/R ≤40 ms, two contacts connected in series:	
	• 48 V DC	5 A
	• 110 V DC	3 A
	• 220 V DC	1 A
	Mechanical withstand capability	10 000 operations
Single-pole power outputs	Making capacity:	
	• Continuous carry	8 A
	• Make and carry 3 s	15 A
	• Make and carry 0.5 s	30 A
	Breaking capacity when L/R ≤40 ms:	
	• 48 V DC	5 A
	• 110 V DC	3 A
	• 220 V DC	1 A
	Mechanical withstand capability	10 000 operations
Table continues on next page		

Contact type	Test (IEC 60255-1 and IEEE C37.90-2005)	Requirement
Signal output X100:S01	Making capacity: • Continuous carry • Make and carry 3 s • Make and carry 0.5 s	 5 A 15 A 30 A
	Breaking capacity when L/R ≤40 ms: • 48 V DC • 110 V DC • 220 V DC	 1 A 0.25 A 0.15 A
	Mechanical withstand capability	10 000 operations
Signal outputs and IRF output	Making capacity: • Continuous carry • Make and carry 3 s • Make and carry 0.5 s	 5 A 10 A 15 A
	Breaking capacity when L/R ≤40 ms: • 48 V DC • 110 V DC • 220 V DC	 1 A 0.25 A 0.15 A
	Mechanical withstand capability	10 000 operations

Table 7: Electromagnetic compatibility tests

Description	Type test value	Reference
1 MHz/100 kHz burst disturbance test • Common mode • Differential mode	 2.5 kV 2.5 kV	IEC 61000-4-18 IEC 60255-26, class III IEEE C37.90.1-2002
3 MHz, 10 MHz and 30 MHz burst disturbance test		IEC 61000-4-18 IEC 60255-26, class III

Table continues on next page

Description	Type test value	Reference
• Common mode	2.5 kV	
Electrostatic discharge test • Contact discharge • Air discharge	 8 kV 15 kV	IEC 61000-4-2 IEC 60255-26 IEEE C37.90.3-2001
Radio frequency interference test	10 V (rms) f = 150 kHz...80 MHz 10 V/m (rms) f = 80...2700 MHz 10 V/m f = 900 MHz 20 V/m (rms) f = 80...1000 MHz	IEC 61000-4-6 IEC 60255-26, class III IEC 61000-4-3 IEC 60255-26, class III ENV 50204 IEC 60255-26, class III IEEE C37.90.2-2004
Fast transient disturbance test • All ports	4 kV	IEC 61000-4-4 IEC 60255-26 IEEE C37.90.1-2002
Surge immunity test • Communication • Other ports	1 kV, line-to-ground 4 kV, line-to-ground, 2 kV, line-to-line	IEC 61000-4-5 IEC 60255-26
Power frequency (50 Hz) magnetic field immunity test • Continuous • 1...3 s	300 A/m 1000 A/m	IEC 61000-4-8
Pulse magnetic field immunity test	1000 A/m 6.4/16 µs	IEC 61000-4-9
Damped oscillatory magnetic field immunity test • 2 s • 1 MHz	100 A/m 400 transients/s	IEC 61000-4-10
Voltage dips and short interruptions	30%/10 ms 60%/100 ms 60%/1000 ms >95%/5000 ms	IEC 61000-4-11
Table continues on next page		

Description	Type test value	Reference
Power frequency immunity test • Common mode • Differential mode	Binary inputs only 300 V rms 150 V rms	IEC 61000-4-16 IEC 60255-26, class A
Conducted common mode disturbances	15 Hz...150 kHz Test level 3 (10/1/10 V rms)	IEC 61000-4-16
Emission tests • Conducted 0.15...0.50 MHz 0.5...30 MHz • Radiated 30...230 MHz 230...1000 MHz 1…3 GHz 3…6 GHz	 <79 dB (µV) quasi peak <66 dB (µV) average <73 dB (µV) quasi peak <60 dB (µV) average <40 dB (µV/m) quasi peak, measured at 10 m distance <47 dB (µV/m) quasi peak, measured at 10 m distance <76 dB (µV/m) peak <56 dB (µV/m) average, measured at 3 m distance <80 dB (µV/m) peak <60 dB (µV/m) average, measured at 3 m distance	EN 55011, class A IEC 60255-26 CISPR 11 CISPR 12

Table 8: Insulation tests

Description	Type test value	Reference
Dielectric tests	2 kV, 50 Hz, 1 min 500 V, 50 Hz, 1 min, communication	IEC 60255-27 IEEE C37.90-2005
Impulse voltage test	5 kV, 1.2/50 µs, 0.5 J 1 kV, 1.2/50 µs, 0.5 J, communication	IEC 60255-27 IEEE C37.90-2005
Insulation resistance measurements	>100 MΩ, 500 V DC	IEC 60255-27
Protective bonding resistance	<0.1 Ω, 4 A, 60 s	IEC 60255-27

Table 9: Mechanical tests

Description	Requirement	Reference
Vibration tests (sinusoidal)	Class 2	IEC 60068-2-6 (test Fc) IEC 60255-21-1
Shock and bump test	Class 2	IEC 60068-2-27 (test Ea shock) IEC 60068-2-29 (test Eb bump) IEC 60255-21-2
Seismic test	Class 2	IEC 60255-21-3
Mechanical durability	• 200 withdrawals and insertions of the plug-in unit • 200 adjustments of protection relay's setting controls	IEEE C37.90-2005

Table 10: Environmental tests

Description	Type test value	Reference
Dry heat test	• 96 h at +55ºC • 16 h at +85ºC[1)2)]	IEC 60068-2-2 IEEE C37.90-2005
Dry cold test	• 96 h at -25ºC • 16 h at -40ºC	IEC 60068-2-1 IEEE C37.90-2005
Damp heat test	• 6 cycles (12 h + 12 h) at +25°C…+55°C, humidity >93%	IEC 60068-2-30
	• +55°C, Rh = 95%, 96h	IEEE C37.90-2005
Change of temperature test	• 5 cycles (3 h + 3 h) at -25°C...+55°C	IEC60068-2-14
Storage test	• 96 h at -40ºC • 96 h at +85ºC	IEC 60068-2-1 IEC 60068-2-2 IEEE C37.90-2005

1) For relays with an LC communication interface the maximum operating temperature is +70ºC
2) For RED615 +70ºC, 16 h

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