

Application Note

Testing Schneider Electric Easergy relays with sensor inputs for LPCTs and LPVTs

Author Jakob Siemayr | *jakob.siemayr*@omicronenergy.com

Date Feb 11, 2021

Related OMICRON Product CMC test sets, CMLIB A, LLX1

Application Area Protection testing

Keywords Sensors, low power instrument transformers (LPITs), LPCT, LPVT

Version 1.0

Document ID ANS_21005_ENU



General information

OMICRON electronics GmbH, including all international branch offices, is henceforth referred to as OMICRON.

The product information, specifications, and technical data embodied in this Application Note represent the technical status at the time of writing and are subject to change without prior notice.

We have done our best to ensure that the information given in this Application Note is useful, accurate and entirely reliable. However, OMICRON does not assume responsibility for any inaccuracies which may be present.

OMICRON translates this Application Note from the source language English into a number of other languages. Any translation of this document is undertaken for local requirements, and in the event of a dispute between the English and a non-English version, the English version of this note shall govern.

All rights, including translation, reserved. Reproduction of any kind, for example, photocopying, microfilming, optical character recognition, and/or storage in electronic data processing systems, requires the explicit consent of OMICRON. Reprinting, wholly or partly, is not permitted.

© OMICRON 2021 All rights reserved. This Application Note is a publication of OMICRON.



Table of content

1	Safe	ty inst	ructions	4
2	Intro	ductio	n	5
3	Con	nectio	ns at the relay	6
4	Test	equip	ment	8
	4.1	With C	CMC 356, CMC 256plus and CMC 353 test sets	8
		4.1.1	Required equipment	8
		4.1.2	Test setup example	10
	4.2	With C	CMC 430 test sets	11
		4.2.1	Required equipment	11
		4.2.2	Test setup example	12
5	Test	config	juration	. 13
	5.1	Test o	bject	13
	5.2	Hardw	/are configuration	13
		5.2.1	With CMC 356, CMC 256plus and CMC 353 test sets	13
		5.2.2	With CMC 430 test sets	16
		5.2.3	Routing of analog outputs	19
6	List	of liter	ature	. 20



1 Safety instructions

This Application Note may only be used in conjunction with the relevant product manuals which contain all safety instructions. The user is fully responsible for any application that makes use of OMICRON products.

Instructions are always characterized by a > symbol, even if they are included in a safety instruction.

NOTICE

Equipment damage or loss of data possible

- Carefully read and understand the content of this Application Note as well as the manuals of the systems involved before taking them into operation.
- Please contact OMICRON support if you have any questions or doubts regarding the safety or operating instructions.
- Follow each instruction listed in the manuals, especially the safety instructions, since this is the only way to avoid the danger that can occur when working on high voltage or high current systems.
- Only use the equipment involved according to its intended purpose to guarantee safe operation.
- Existing national safety standards for accident prevention and environmental protection may supplement the equipment's manual.
- > Before starting a test always check that the test signals are suitable for your system under test.

Only experienced and competent professionals that are trained for working in high voltage or high current environments may implement this Application Note. Additionally, the following qualifications are required:

- Authorized to work in environments of energy generation, transmission or distribution, and familiar with the approved operating practices in such environments.
- Familiar with the five safety rules.
- Good knowledge/proficient in working with CMC test sets, CMLIB A and LLX1.



2 Introduction

Protection relays of Schneider Electric's Easergy range are available in different versions concerning their analog inputs:

- 1. for conventional instrument transformers (VT, CT)
- 2. for LPCTs/LPVTs (low power CT, low power VT)

This application note explains the required equipment for testing the LPCT/LPVT version of these relays and how to configure such a test.



3 Connections at the relay

The sensor inputs of Schneider Electric Easergy relays use RJ45 connectors. As can be seen in the following picture on slot A there are five RJ45 connectors for connecting sensors.



Figure 1: Easergy P5U20 rear panel (LPCT/LPVT version)

The LPCTs for IL1, IL2 and IL3 are connected directly to RJ45-1, RJ45-2 and RJ45-3.

V1, V2 and V3 are combined to one single RJ45 connection (**RJ45-4**). To achieve this the three LPVTs are connected to a so-called LPVT hub, which then is connected to RJ45-4 using a single connection.





Figure 2: Easergy P5U20 (LPCT/LPVT version) rear terminal designations



Figure 3: LPVT hub connector connected to Easergy P5 protection relay



4 Test equipment

4.1 With CMC 356, CMC 256plus and CMC 353 test sets

4.1.1 Required equipment

These test sets have six (12 with Option LLO-2) built-in low level outputs on the LL out 1 - 6 interface connector that can be found on the back panel of the test set.



Figure 4: Back panel of a CMC test set with interfaces "LL out 1 - 6" and "LL out 7 - 12"

A CMLIB A and Easergy cable with corresponding pin assignment of the RJ45 connector are used to connect the low-level outputs of the CMC to the sensor inputs of a Schneider Electric Easergy relay.





Figure 5: CMLIB A



Figure 6: Easergy cable for CMLIB A



4.1.2 Test setup example



Figure 102 - Connection diagram for testing the LPCT and LPVT measurement accuracy

Figure 7: Connection diagram for testing from Easergy P5 User Manual

The generically shown voltage generator in the picture above is replaced by the CMC test set with CMLIB A and connections are made with the Easergy cables:



Figure 8: Test setup with CMLIB A and Easergy cables



4.2 With CMC 430 test sets

4.2.1 Required equipment

LLX accessory units are used to expand CMC 430 test sets with six low level outputs. They are connected to one of the CMC 430s expansion ports, which powers and controls them.

LLX1 is the right choice for testing devices with sensor inputs (such as Schneider Electric Easergy protection relays). A wide range of cables are available for easily connecting LLX1 to different devices that have specific connectors and pinouts.



Figure 9: LLX1 accessory unit

Cable type	Suitable for	Connector type	Order no.
LAB1	ABB Relion	RJ45	VEHK0306
LAB2	ABB REF542plus	2 x Twin-BNC	VEHK0307
LSI1	Siemens Siprotec Compact	RJ45	VEHK0308
LSE2	Schneider Electric Easergy	2 x RJ45	VEHK0311

Cable type LSE2 is available for testing Schneider Electric Easery protection relays:



Figure 10: LSE2 test cable



4.2.2 Test setup example

LSE2 test cables have two ends with RJ45 connectors in order to connect to the separate LPVT and LPCT input connectors of the respective phases:



Figure 11: Test setup with LLX1 and LSE2 test cables



5 Test configuration

5.1 Test object

While with conventional VTs and CTs it is very common to work in secondary voltages and currents, this is not the case when working with sensors. Instead it is recommended to work completely with primary values. Therefore set "V nom (secondary)" and "I nom (secondary)" to the same value as the primary counterparts. Do not forget to adapt the limits to primary values as well!

Device	Nominal Values		Other Device Properties	
lame/description:	Number of phases:	O 2 💿 3	Drop-out time:	20,000 ms
lanufacturer:	fnom:	50,000 Hz	-Limits	
			V max:	20,000 kV (L-L
evice type:	V nom (secondary):	20,000 kV (L-L)	I max:	1,000 k
evice address:		11,547 kV (L-N)	- Overload Detection Sensitivity	
			High O Custom	50,000 m
erial/model number:	V primary:	20,000 kV (L-L)	○ Low ○ Off	
		11,547 kV (L-N)	Dahayaan Daatish Cibara	
			Debounce time:	3,000 m
dditional information 1:	I nom (secondary):	400,000 A	Deglitch time:	0,000
dditional information 2:	I primary:	400,000 A		
ubstation		Factors]	
ame:	VLN/ VN:	1,732		
ddress:	IN / I nom:	1,000		
ay				
lame:				
ddress:				

Figure 12: Device settings with configured Nominal Values and Limits

5.2 Hardware configuration

5.2.1 With CMC 356, CMC 256plus and CMC 353 test sets

► First, it is recommended to deactivate the voltage and current outputs of the test set. To do so hit the button "Configure..." next to the test set and then set the outputs to "<not used>":

Hardware Configuration				
General Analog Outputs Binary / Analog	g Inputs Binary Outputs DC Ana	log Inputs		
CMC356	Configure	Voltage Outputs:	3x300V; 85VA @ 85V; 1Arms	
No extension device	 Configure 	Aux. DC:	5x52A; +50VA @ 25A; 25Vrms 115,0V	



Configure Device	×
CMC356 Voltage Outputs 4x300V; 85VA @ 85V; 1Arms 3x300V; 85VA @ 85V; 1Arms 1x300V; 150VA @ 75V; 2Arms 3x300V; 50VA @ 75V; 660mArms; VE automatic 1x600V; 250VA @ 200V; 1,25Arms Constant of 150V , 250MB Constant of 150V , 250MB	Voltage Factorn/a
Connect VT Remove VT	Fan Mode Automatic Max.
CMC356 Current Outputs 3x32A; 430VA @ 25A; 25Vrms; IE automatic 3x64A; 860VA @ 25A; 55Vrms; IE automatic 3x54A; 860VA @ 25A; 50Vrms 1x32A; 1,74kVA @ 25A; 50Vrms 1x128A; 1kVA @ 50A; 50Vrms 1x128A; 1kVA @ 50A; 50Vrms 1x128A; 1VVA @ 40A; 25Vrms 1x64A; 500VA @ 40A; 25Vrms 1x32A; 870VA @ 20A; 50Vrms 1x32A; 870VA @ 20A; 50Vrms	
<not used=""> Connect CT Remove CT</not>	Fan Mode Automatic Max.

Then you can configure the voltage and current sensors at "Amplifier(s) / Low Level Outputs / Sensor Simulation". Click the first drop-down and select "Add voltage sensor":

<none></none>	-	Configure
<none></none>	1	
CMA 56 (??001?)		
CMA 56 (??002?)		Configure
CMA156 (??001?)	1	conngarenn
CMA156 (??002?)		
CMS156 (??001?)		
CMS156 (??002?)		Configure
Add voltage amplifier		
Add current amplifier		
Add voltage sensor		C . C
Add current sensor		Configure
Add standard low level outputs		



► The dialog for configuring the voltage sensor will open. At "Low level output" select "LL out 1-3" and enter the ratio of the LPVT:

Configure Voltage Sensor	Simulation		×
Low level output:	LL out 1-3	Use correction factors	
Display value (RMS):	20,00 kV		
Output value (RMS):	3,25 V		
		Or Court	Delate
		UK Cancel	Delete

► The configuration of the current sensor is done in a very similar way. Click the second drop-down and select "Add current sensor":

/oltage Sensor 1	•	Configure
<none></none>	-	Configure
<none> CMA 56 (??001?) CMA 56 (??002?) CMA156 (??001?) CMA156 (??002?)</none>		Configure
CMS156 (??001?) CMS156 (??002?) /oltage Sensor 1	[Configure
Add voltage amplifier Add current amplifier Add voltage sensor		
Add current sensor		
Add current sensor Add standard low level outputs	-	

► The dialog for configuring the current sensor will open. At "Low level output" select "LL out 4-6" and enter the ratio of the LPCT. Additionally, select the sensor type "Linear":



Configure Current Sensor	Simulation			×
Low level output:	LL out 4-6	Use correction factors		
Display value (RMS):	100,00 A			
Output value (RMS):	22,50 mV			
Sensor type:	Linear			
		OK Cancel	Delete	Help

5.2.2 With CMC 430 test sets

► First, it is recommended to deactivate the voltage and current outputs of the test set. To do so hit the button "Configure..." next to the test set and then set the outputs to "<not used>":

Hardware Configuration				
General Analog Outputs Binary / Analog Inputs	Binary Outputs DC Analo	og Inputs		
Test Set(s)	<u> </u>			
CMC430	 Configure 	/oltage Outputs:	6x150V; 25VA @ 100V; 250mArms	
		Current Outputs:	3x12,5A; 96VA @ 8A; 12Vrms	
No extension device	Configure	Aux. DC:	115,0V	



Configure Device	x
CMC430 Voltage Outputs 6x150V; 25VA @ 100V; 250mArms 3x150V; 25VA @ 100V; 250mArms 3x150V; 25VA @ 100V; 250mArms 3x150V; 25VA @ 100V; 250mArms 1x300V; 50VA @ 200V; 250mArms 5x500V; 50VA @ 200V; 250mArms 5x50V = 20	- Voltage Factor
Connect VT Remove VT CMC430 Current Outputs 2112 54.051/4 @ 04: 17/mm	Fan Mode
3x12,5x; 50VA @ 8A; 12Vrms 1x37,5A; 150VA @ 16A; 12Vrms Arrow Box Interset	
Connect CT Remove CT	Fan Mode Automatic Max. OK OK Cancel

Then you can find LLX1 at "Amplifier(s) / Low Level Outputs / Sensor Simulation". Click the first drop-down next to it and select "Add voltage sensor":

LLX1	-	<none></none>	-	Configure
		<none></none>		
		Add voltage sensor		Configure
		Add current sensor Add standard low level outputs		
<none></none>	*	<none></none>	*	Configure
		<none></none>	•	Configure
<none></none>	*	<none></none>	•	Configure
		<none></none>	I	Configure



▶ The dialog for configuring the voltage sensor will open and you can enter the ratio of the LPVT:

Configure Voltage Sense	or Simulation		×
Low level output:	LL out 1-3	Use correction factors	
Display value (RMS): Output value (RMS):	20,00 kV 3,25 V		
Residual channel			
		OK Cancel	Delete Help

► The configuration of the current sensor is done in a very similar way. Click the second drop-down and select "Add current sensor":

LX1	*	Voltage Sensor 1	-	Configure
		<none></none>	•	Configure
<none></none>	*	<none> Voltage Sensor 1 Add voltage sensor</none>		Configure
	l	Add current sensor Add standard low level outputs		Configure
<none></none>	*	<none></none>	-	Configure
		<none></none>	-	Configure

The dialog for configuring the current sensor will open and you can enter the ratio of the LPCT. Additionally, select the sensor type "Linear". For the signal type "Single-ended" is the correct choice for Schneider Electric Easergy devices:



Configure Current Sensor	Simulation	x
Low level output:	LL out 4-6 Use correction factors	
Display value (RMS):	100,00 A	
Output value (RMS):	22,50 mV	
Sensor type:	Linear 🔹	
Signal type:	Single-ended *	
Residual channel		
	OK Cancel Delete Help	

5.2.3 Routing of analog outputs

Don't forget to go to the Analog Outputs tab to check if all your defined sensor outputs are routed properly:

d w eral	Analog Outputs	Binary / Analog I	nputs Binary Out	iputs I	DC Anal	og Input	ts				
				Voltage Sensor 1 V			١V	Current Sensor 1 I			
	Test Module Output Signal	Display Name	Connection Terminal	1	2		N	1	2		N
	V L1-E 🗸	VL1-E		Х							
	V L2-E	V L2-E			Х						
	V L3-E	V L3-E				Х					
	IL1	IL1						Х			
	1 L2	1L2							Х		
	1 L3	1 L 3								Х	



6 List of literature

[1] Schneider Electric, 2019, Easergy P5 User Manual, Version P5/EN M/22A



Support

When you are working with our products we want to provide you with the greatest possible benefits. If you need any support, we are here to assist you.



24/7 Technical Support – Get Support

www.omicronenergy.com/en/support

At our technical support hotline, you can reach competent, well-educated technicians for all of your questions. Around the clock and free of charge.

Make use of our 24/7 international technical support hotline:

Europe / Middle East / Africa	+43 59495 4444	
Americas	+1 713 830-4660	+1 800-OMICRON
Asia-Pacific	+852 3767 5500	

Additionally, on our website you can find our Service Center or Sales Partner closest to you.



Customer Portal – Stay Informed

https://my.omicronenergy.com/

The Customer Portal on our website is an international knowledge exchange platform. Download the latest software updates for all our products and share your own experiences in our user forum.

Browse through the knowledge library and find application notes, conference papers, articles about daily working experiences, user manuals and much more.

OMICRON Academy – Learn More



www.omicron.academy

Learn more about your product in one of the training courses offered by the OMICRON Academy.

For more information, additional literature, and detailed contact information of our offices worldwide please visit our website.