Dynamic Rating, Monitoring, Control and Communications

DRMCC-T2

TESTING & COMMISSIONING

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CONTENTS

INTRODUCTION

It is recommended that the tests listed below be done before commissioning a DRMCC system, either in the factory for new transformers or at site. Before starting tests, schematic diagrams for the project should be available.

CHECKS AND TESTS BEFORE POWER-UP

The following Checks and Tests, as a minimum, should be carried out prior to energising of any power supplies

Record serial numbers of each component	**SN #**
User Interface Module	
RS-485 Converter	
SICM2B	
SICM3B	

Check all wiring for correct termination at each component - refer schematic diagrams	✓
User Interface Module	
RS-485 Converter	
SICM2B and associated analog and digital circuits	
Interposing CTs - check number of turns (1 for 5A, 5 for 1A main CT) and polarity ("flick" test with battery)	
SICM3B and associated analog and digital circuits	

Insulation tests on auxiliary wiring **Except for the circuits listed below**, the UIM power circuits and SICM inputs and outputs may be subjected to the tests specified in AS 2374.3 (IEC 60076-3) Clause 10 as follows:	✓
60-second power frequency withstand test in the factory at maximum 2 kV rms to ground	
Insulation test on site using a megohm meter at maximum 1 kV to ground	
Exception: Circuits with rated voltage up to 75 V DC or rms shall be tested at not more than 350 V rms for 60 seconds withstand or 500 V DC for insulation resistance. These circuits include: Communications circuits such as RS-232 and RS-485 Power supply circuits with rated voltage up to 75 V DC or rms AC	

POWER-UP CHECKS

Refer to DRMCC Cable Termination Details drawing and Schematic Diagram (specific to the Project) for power terminals and polarity. Disconnect all power plugs. Energise each unit in sequence as follows by reconnecting appropriate plug. Check the following:

Energise DRMCC Power Supply	**Measure**	✓
Input voltage is correct (refer specs)	V	
Output from power supply: voltage and polarity are correct (refer specs)	V	

Energise RS-485 / fibre optic Converter	**Measure**	✓
Input voltage and polarity are correct (the same as the power supply output)	V	
Output from controller (to SICMs): voltage and polarity are correct (the same as the power supply output)	V	

Energise SICM2B	**Measure**	✓
Input voltage and polarity are correct (the same as the power supply output)	V	

Energise SICM3B	**Measure**	✓
Input voltage and polarity are correct (the same as the power supply output)	V	

Energise UIM	**Measure**	✓
Input voltage and polarity are correct (refer specs)	V	
Power up the UIM. It takes 1 minute to boot. Once booted up, the menu will be displayed, and several alarms may appear.	N/A	
If not already done, upload the UIM configuration files - refer UIM Operations.	N/A	

ESTABLISH COMMUNICATIONS WITH THE SICMs Note: If the system has a remote UIM, the SICMs shall be connected via fibre optic cables. If UIM is local then connection may be via RS485.	✓
The UIM should be polling the SICMs - the UIM Tx LED on Port 0 should flash regularly	
If the connection from UIM to SICM(s) is via fibre optic cable, the Rx LED on the 'Fibre Optic to RS485 Converter' should flash also. If Rx LED not flashing, check the fibre optic cable connections	
The Rx LED on each SICM in the system should flash	
If all is OK the Tx LED on each SICM will flash a response.	
The response will also be seen at the Fibre Optic to RS485 Converter Tx LED (if fibre optics are used).	
The UIM Rx LED will flash to show that the signal has been received.	

FUNCTIONAL TESTS ON INDIVIDUAL CIRCUITS

After the above communications tests are OK, the functional testing can commence. Check that all inputs are correctly connected and operational, starting with the digital inputs. When simulating inputs, attempt to do so by operating the actual initiating device, alternatively simulate at the device terminals in order to check all cabling as well as operation of the devices.
Note that the SICM analog and digital inputs and outputs are configurable. Before using this form as a checklist for testing, the descriptions for each I/O should be filled in. These must agree with the configuration files created using the configuration spreadsheet and uploaded into the UIM and with the control schematic diagrams and actual wiring. For the analog I/O the scaling information on this form must agree with that in the configuration files.

DIGITAL INPUTS

Operate (or simulate operation of) each device, in turn. Check that the relevant LED illuminates. Check UIM Screen Message or raw input if applicable.
Note: Please edit the following tables to match your system setup as per the setup spreadsheet.

SICM2B DIGITAL INPUTS

DNP Pt	Terminals +ve, -ve	Description	LED ✓	UIM ✓	SCADA ✓
0	1, 2				
1	3, 4				
2	5,6				
3	7,8				
4	9, 10				
5	11, 12				
6	13, 14				
7	15, 16				
8	17,18-19				
9	22, 20				
10	47,48				
11	50, 51				
12	52, 53				
13	54, 55				
14	56, 57				
15	58, 59				

SICM3B DIGITAL INPUTS

DNP Pt	Terminals +ve, -ve	Description	LED ✓	UIM ✓	SCADA ✓
0	9, 10				
1	11, 12				
2	13, 14				
3	15, 16				
4	17,18				
5	19, 20				
6	21, 22				
7	23, 24				
8	25, 26				
9	27, 28				
10	29, 30				
11	31, 32				
12	33, 34				
13	35, 36				
14	37, 38				
15	39, 40				

ANALOG INPUTS

Check that the analog inputs are correctly connected and are operational. Apply analog signal at device or cubicle terminals, and measure magnitude. Check magnitude on UIM Screen and compare with signal. Repeat for a low signal (< 0.5 full scale) and a high value (near full scale).
Note: Please edit the following tables to match your system setup as per the setup software. DNP points for SICM2B vary according to class (class 136 displayed here)

SICM2B ANALOG INPUTS

DNP Pt	Terminals +ve, -ve	Description	Signal low	UIM low	Signal high	UIM high
0	32, 33	AC Volts	V	kV	V	kV
1	34, 35	AC Volts	V	kV	V	kV
2	36, 37	AC Volts	V	kV	V	kV
3	38, 39	AC Amps	A	A	A	A
4	40, 41	AC Amps	A	A	A	A
5	42, 43	AC Amps	A	A	A	A
6	44, 45	Analogue Tap P (1->9ma)		#		#
7	-	SICM2B PCB Temperature (Internal)	-	°C	-	-
8		Frequency (Internal)	Hz	Hz	-	-
9		Watts 1 calculated from VT & CT	W	MW	W	MW
10		VARs 1 calculated from VT & CT	var	MVAr	var	MVAr
11		Watts 2 calculated from VT & CT	W	MW	W	MW
12		VARs 2 calculated from VT & CT	var	MVAr	var	MVAr
13		Watts 3 calculated from VT & CT	W	MW	W	MW
14		VARs 3 calculated from VT & CT	var	MVAr	var	MVAr

SICM3 ANALOG INPUTS

DNP Pt	Terminals +ve, -ve	Description	Signal low	UIM low	Signal high	UIM high
0	49, 50	Ambient temperature	°C	°C	°C	°C
1	51, 52	Top oil temperature	°C	°C	°C	°C
2	53, 54		mA		mA	
3	55, 56		mA		mA	
4	57, 58		mA		mA	
5	59, 60		mA		mA	
6	61, 62		mA		mA	
7	63, 64		mA		mA	
8	-	SICM3B PCB Temperature (Internal)	-	°C	-	-

DIGITAL OUTPUTS

Operation: Now that all inputs are sensed correctly, check the digital outputs. Use the UIM Menu manual controls to initiate the appropriate output. The Alarms and Trips will need to be initiated by simulating the appropriate input eg the Temperature Alarms can be simulated using a RTD simulator.
Note: Please edit the following tables to match your system setup as per the setup spreadsheet.

SICM2B RELAY OUTPUTS

DNP Pt	Terminals NO, NC, COM	Description	LED ✓	UIM ✓	SCADA ✓
1	70, 71, 72				
2	73, 74, 75				
3	76, 77, 78				
4	79, 80, 81				
5	82, 83, 84				
6	85, 86, 87				
7	88, 89, 90				
8	91, 92, 93				

SICM3B RELAY OUTPUTS

DNP Pt	Terminals NO, NC, COM	Description	LED ✓	UIM ✓	SCADA ✓
0	70, 71, 72				
1	73, 74, 75				
2	76, 77, 78				
3	79, 80, 81				
4	82, 83, 84				
5	85, 86, 87				
6	88, 89, 90				
7	91, 92, 93				

ANALOG OUTPUTS

Operation: Now that all inputs are sensed correctly, check the analog outputs. Temperatures can be simulated using a RTD simulator.
Note: Please edit the following tables to match your system setup as per the setup spreadsheet.

SICM2B RELAY OUTPUTS

DNP Pt	Terminals +ve, -ve	Description	mA	Display
0	2, 1			
1	3, 4			
2	5, 6			
3	7, 8			

FUNCTIONAL TESTS ON COMPLETE DRMCC SYSTEM

Functional Test Before Energisation After checking all cabling connecting DRMCC to transformer control circuits	**UIM Screen Value**	✓
Indicated temperatures are consistent with ambient temperature	°C	
Manual start and stop cooling from UIM	-	
Initiate and stop cooling test	-	
Indicated tap position agrees with mechanical indicator - check over range	#	
Manual raise and lower tap position from UIM	-	
Simulate each alarm condition in turn and check UIM alarm indication	-	

Functional Tests After Energisation on Site Energise the transformer	**UIM Screen Value**	✓
Volts agree with other substation instrumentation	kV	
Change voltage setpoint so that indicated voltage is outside range - changes tap	#	
Restore voltage setpoint to normal - tap changes back to previous	#	
If more than one transformer, check correct parallel operation	-	

Functional Tests On Load Energise the transformer and put on load	**UIM Screen Value**	✓
Indicated temperatures are consistent with ambient temperature and load	°C	
Volts and amps agree with other substation instrumentation	kV	
Amps agree with other substation instrumentation	kA	
MVA Calculated from $\sqrt{3}$. kV . kA agrees with $\sqrt{}$ (MW^2 + $MVAR^2$)	MVA	
Change cooling setpoint below indicated winding temperature - starts cooling	°C	
Restore cooling setpoint to normal - stops cooling	°C	

Tested by		Date	