

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 shall be available.

CHECKS AND TESTS BEFORE POWER-UP

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

| Record serial numbers of each component | SN # |
|---|------|
| User Interface Module | |
| RS-485 Converter and SICM Power Supply | |
| SICM2 | |
| SICM3 | |

| Check all wiring for correct termination at each component - refer schematic diagrams | ✓ |
|---|---|
| User Interface Module | |
| RS-485 Converter and SICM Power Supply | |
| SICM2 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) | |
| SICM3 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: | |
| <ul style="list-style-type: none"> • 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 SICM 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 SICM2 | Measure | ✓ |
|--|----------------|----------|
| Input voltage and polarity are correct (the same as the power supply output) | V | |

| Energise SICM3 | 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 4 - 5 minutes 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 instructions | 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 if applicable.

Note: Please edit the following tables to match your system setup as per the setup spreadsheet.

| DI # | Terminals +ve, -ve | SICM2 Class 11/12 Digital Inputs - Operation | LED ✓ | UIM Screen Message |
|------|--------------------|--|-------|--------------------|
| 1 | 1, 2 | TCRemote | | |
| 2 | 3, 4 | TCInProg | | |
| 3 | 5,6 | TCMotTrip | | |
| 4 | 7,8 | AuxPwrFail | | |
| 5 | 9, 10 | Spare | | N/A |
| 6 | 11, 12 | Spare | | N/A |
| 7 | 13, 14 | Spare | | N/A |
| 8 | 15, 16 | Spare | | N/A |
| 9 | 17,18-19 | Reserved | | N/A |
| 10 | 20, 22 | Reserved | | N/A |
| 11 | 46, 47 | Spare | | N/A |
| 12 | 48, 49 | Spare | | N/A |
| 13 | 50, 51 | BuchholzGas | | |
| 14 | 52, 53 | TfOilLow | | |
| 15 | 54, 55 | TCOilLow | | |
| 16 | 56, 57 | Spare | | N/A |

| DI # | Terminals +ve, -ve | SICM3 Class 23 Digital Inputs - Operation | LED ✓ | UIM Screen Message |
|------|--------------------|---|-------|--------------------|
| 1 | 15, 16 | FanInService | | |
| 2 | 17,18 | FanTest | | |
| 3 | 19, 20 | FanCont | | |
| 4 | 21, 22 | FanTrip | | |
| 5 | 23, 24 | Spare | | N/A |
| 6 | 25, 26 | Spare | | N/A |
| 7 | 27, 28 | Spare | | N/A |
| 8 | 29, 30 | Spare | | N/A |
| 9 | 31, 32 | Spare | | N/A |
| 10 | 33, 34 | Spare | | N/A |
| 11 | 35, 36 | DispTeTOMax | | |
| 12 | 37, 38 | DispTeHSLV | | |
| 13 | 39, 40 | Spare | | N/A |
| 14 | 41, 42 | Spare | | N/A |

| DI # | Terminals +ve, -ve | SICM3 Class 23 Digital Inputs - Operation | LED ✓ | UIM Screen Message |
|------|--------------------|---|-------|--------------------|
| 15 | 43, 44 | Spare | | N/A |
| 16 | 45, 46 | Spare | | N/A |

Analog Inputs - check & calibration

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 spreadsheet.

| AI # | Terminals +ve, -ve | SICM2 Class 11 Analog Inputs - Operation | Signal low | UIM low | Signal high | UIM high |
|------|--------------------|---|------------|---------|-------------|----------|
| 1 | 32, 33 | AC Volts R-N | V | kV | V | kV |
| 2 | 34, 35 | AC Volts Y-N | V | kV | V | kV |
| 3 | 36, 37 | AC Volts B-N | V | kV | V | kV |
| 4 | 38, 39 | AC Amps R Phase | A | A | A | A |
| 5 | 40, 41 | AC Amps Y Phase | A | A | A | A |
| 6 | 42, 43 | AC Amps B Phase | A | A | A | A |
| 7 | 44, 45 | Analogue Tap P I 1->9ma scaled Tap 1->N | | # | | # |
| 1-6 | | Watts internally calculated from VT & CT inputs | W | MW | W | MW |
| 1-6 | | VARs internally calculated from VT & CT inputs | var | MVAr | var | MVAr |
| 1-6 | | Frequency (Internal) | Hz | Hz | - | - |
| - | - | SICM PCB Temperature (Internal) at ambient | - | °C | - | - |

| AI # | Terminals +ve, -ve | SICM3, Class 23 Analog Inputs - Operation | Signal low | UIM low | Signal high | UIM high |
|------|--------------------|---|------------|---------|-------------|----------|
| 1 | N/A | (Not available) | N/A | N/A | N/A | N/A |
| 2 | N/A | (Not available) | N/A | N/A | N/A | N/A |
| 3 | 6, 5 | Ambient temperature RTD simulator | °C | °C | °C | °C |
| 4 | 8, 7 | Top oil temperature RTD simulator | °C | °C | °C | °C |
| 5 | 10, 9 | (spare) | - | - | - | - |
| 6 | 56, 55 | (spare) | - | - | - | - |
| 7 | 58, 57 | (spare) | - | - | - | - |
| 8 | 60, 59 | (spare) | - | - | - | - |
| - | - | SICM 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.

| DO # | Terminals +ve, -ve | SICM2, Class 11 - Relay Outputs Operation | LED ✓ | UIM Screen Message |
|-------------|---------------------------|--|--------------|---------------------------|
| 1 | 70, 72 | OLTC Raise | | |
| 2 | 73, 75 | OLTC Lower | | |
| 3 | 76, 78 | Voltage Alarm | | |
| 4 | 79, 81 | Tap Change Fail Alarm | | |
| 5 | 82, 84 | (spare) | - | - |
| 6 | 85, 87 | (spare) | - | - |
| 7 | 88, 90 | (spare) | - | - |
| 8 | 91, 93 | (spare) | - | - |

| DO # | Terminals +ve, -ve | SICM3, Class 23 - Relay Outputs Operation | LED ✓ | UIM Screen Message |
|-------------|---------------------------|--|--------------|---------------------------|
| 1 | 70, 72 | Start Fans | | |
| 2 | 73, 75 | Stop Fans | | |
| 3 | 76, 78 | (spare) | | |
| 4 | 79, 81 | (spare) | | |
| 5 | 82, 84 | Common Alarm | | |
| 6 | 85, 87 | Temperature High Alarm | - | - |
| 7 | 88, 90 | Temperature High Trip | - | - |
| 8 | 91, 93 | SICM3 OK pulse | - | - |

Functional Tests on Complete DRMCC System

| Functional Test Before Energisation | UIM Screen Value | ✓ |
|---|-------------------------|----------|
| After checking all cabling connecting DRMCC to transformer control circuits | | |
| 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 | UIM Screen Value | ✓ |
|--|-------------------------|----------|
| Energise the transformer | | |
| 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 | UIM Screen Value | ✓ |
|---|-------------------------|----------|
| Energise the transformer and put on load | | |
| 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 $\sqrt{3} \cdot \text{kV} \cdot \text{kA}$ agrees with $\sqrt{(\text{MW}^2 + \text{MVAR}^2)}$ | MVA | |
| Change cooling setpoint below indicated winding temperature - starts cooling | °C | |
| Restore cooling setpoint to normal - stops cooling | °C | |

Tested by

Date