



Dynamic Rating, Monitoring, Control and Communications

USER MANUAL

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INTRODUCTION

This manual provides the User with the appropriate instructions for Installation, Commissioning, Operation and Maintenance of the **DRMCC** microprocessor-based, **Dynamic Rating, Monitoring, Control and Communication (DRMCC)** system.

The quantity and model number of components and the interconnection of the system will vary for each installation to meet the User's requirements.

A system may consist of a number of the following components:

- ◆ the User's transformer(s) (to be controlled by the DRMCC) and associated monitoring and control devices,
- ◆ the **DRMCC**¹ fiber optic Converter (if fiber optic cable is used to communicate with a remote User Interface Module (UIM)),
- ◆ a number of **DRMCC** Serial Interface Control Module(s) (SICMs) SICM2 and SICM3 modules, with inputs from and outputs to the transformer(s),
- ◆ a **DRMCC** system Power Supply (for Converter and SICM's)
- ◆ a **DRMCC** User Interface Module, with intelligent menu driven display, user settings entry, system monitoring and control and with interface to User's SCADA system,
- ◆ the User's SCADA/monitoring/data logging system, and
- ◆ interconnecting wiring/cables.

Reference throughout this Manual is made to the separate supporting documents and drawings listed under 'SUPPORTING DOCUMENTATION'.



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¹ Note: The names SICM and DRMCC are registered trade marks of EnergeX Limited and Dynamic Ratings Pty Ltd respectively.

INSTALLATION

Prior to installation, the User/installer is advised to check all the **DRMCC** supplied equipment and verify that the correct components, including options and model numbers (for display, communication cable type, number of ports, User's power supply etc) have been supplied in accordance with the User's order.

The equipment should be unpacked and checked for any signs of damage (which should be reported to the supplier immediately).

*A listing of the **DRMCC** components, their Model numbers and options are given in the 'DRMCC TECHNICAL SPECIFICATION' document.*

PRE-INSTALLATION

The User Interface Module needs to have the transformer parameters and configuration files loaded using a PC connected to Port 7. This may be done before delivery; otherwise instructions for doing it will be included with the UIM (refer to '**DRMCC UIM-T1 OPERATIONS**'). A backup of these files should be made before installation.

MOUNTING

General

Drawings in supporting documents show the overall and mounting dimensions of all DRMCC components.

Ensure that the mounting arrangement provides suitable access for entry and exit of cabling, looming and termination of conductors, and access to the internals of each component. In particular, fiber optic cables require a minimum bending radius of 50mm.

Converter and SICMs

These components, including power supply if used, shall be installed within a marshalling cubicle mounted on or adjacent to the transformer.

They are designed for 35mm DIN rail mounting.

The cubicle degree of protection (IP) shall be appropriate for the environment. For outdoor situations IP66 is recommended for the basic cubicle giving an overall minimum of IP54 when the cubicle is fitted with breathers.

Approximate heat loads are:

Converter, 15 watts

SICM's, < 10 watts.

User Interface Module

The Module is designed for mounting either within the User's indoor Relay/Control Room or in a Control Cubicle at the Transformer; for example the Cubicle used for the Converter/SICMs (or a similar Cubicle).

The Module is designed for 19" rack mounting and use of this arrangement will provide for appropriate wiring access and ventilation.

CABLING AND WIRING

Drawings give the termination and interconnection details of each **DRMCC** component.

Recommended cable and wiring minimum requirements are as follows, subject to compliance with User's standard practice and local/national regulations:

- ◆ voltage & current signals: 2.5mm², PVC/PVC 0.6/1kV cable
- ◆ power supply (ac & dc) and other signal cables: 1.5mm², PVC/PVC 0.6/1kV cable,
- ◆ EIA-485 & RTD: Belden-M 9842 CM 2Pr24 Shielded, dual twisted pair cable with drain wire, Nominal Impedance 120 ohms,
- ◆ Fiber optic twin cable: glass optical fiber duplex multimode 62.5/125 microns with ST connectors.

CONNECTIONS

UIM

Rear views of the UIM with 4 and 8 Port Options are illustrated in supporting documents. Refer to separate drawing showing the terminations/port connections including the pin numbering of the DB9 connector used for EIA 232 Ports (4), 5, (6), and 7.

The Port allocation is normally as given in Table 1 but this may be configured differently according to requirements:

Port	Allocation	Comments
0	SICM's	
1 – 6	SCADA etc	User Definable
7	PC (Laptop)	Settings

Table 1 - UIM Port Allocation

SICM

Refer to the separate drawings, showing the terminal groups and wiring connections for the SICM2 and SICM3 modules.

TESTING & COMMISSIONING

A checklist covering checks and tests before and after power-up and commissioning is given in the supporting document '*SITE TESTING AND COMMISSIONING*'.

Note: when 'powered-on' all the led's should turn on and off, with only the 'POWER' led staying on. The system then takes a few minutes before the menu appears on the UIM Screen.

OPERATION

THE USER INTERFACE

Personnel interact with the DRMCC via the User Interface Module (UIM).

The UIM consists of:

- ◆ the LCD or VFD Screen,
- ◆ the cursor **UP** and **DOWN** arrow keys,
- ◆ the **ENT** (Enter) and **ESC** (Escape) keys, and
- ◆ the set of (LED) Indicator Lights.

The User may select any Menu page by scrolling with **UP** or **DOWN** cursor keys, then pressing the **ENT** (Enter) key to select the highlighted Menu page.

With a page displayed, the cursor keys are used to scroll to each available setting or selection. The cursor (seen as the underscore symbol **_**) will scroll down and across (left, right) to the next available setting/selection on pressing the **DOWN** keys. Likewise the cursor moves up and left/right on pressing the **UP** key.

With the cursor on a mode or setting input, the **UP** and **DOWN** cursor keys are used to toggle the mode condition or increment the settings value.

The Screen back light comes on when any key is pressed and goes off 10 minutes after the last key was pressed.

Main Page

The main page displays a list of all the pages accessible to the operator. To access any screen it is necessary to go through the main page first. Press the **ESC** key to return to this main page.

```
DRMCC-T1
TEMPERATURES/VOLTS/AMPS/TAPS
COOLING SETTINGS for CONTROL and ALARMS
COOLING CONTROL and STATUS
EMERGENCY LOADING
EMERGENCY LOADING LIMITS
TAP CHANGE CONTROL and STATUS
TAP CHANGE SETTINGS for MODES and TIMES
VOLTAGE SETTINGS for CONTROL and ALARMS
LDC/REVERSE REACTANCE SETTINGS
TAP CHANGE HISTORY 1..28
TAP CHANGE HISTORY 29..56
LOGIN, SAVE and RESTORE SETTINGS
EXTRAS
!*ACTIVE ALARMS LIST
!#ALARM LOG
```

Drmcc-T1

This screen gives a general overview of readings and the main operating settings, which are:

COOLING:

1. MANUAL
2. AUTO ~ NORMAL
3. AUTO ~ SMART (dynamic ratings)

OLTC:

1. MANUAL
2. AUTO ~ DEFINITE
3. AUTO ~ INVERSE N

```
DRMCC-T1
          yyyy mm dd   hh mm ss
          2000 7 14    13 6 12
Secondary Voltage      Secondary Current
33.371 kV              157.792 A
0.0 MWatts            0.0 MVars
Tap Number              WTI
5                       25.541
C

COOL MODE MANUAL NORMAL

OLTC MODE MANUAL DEFINITE
```

COOLING and OLTC modes of operation are classed as operational settings. This implies that modes may be changed on an operational level, meaning a formal login is **not** required to change the settings. Refer to '*SETTINGS AVAILABLE*' for an indication of which settings are operational and which are system settings. Note the 'Hydran Gas Reading' only applies to some installations and may not show a reading.

Temperatures/Volts/Amps/Taps

TEMPERATURES/VOLTS/AMPS/TAPS			
Reset Maximum/Minimums? NO			
Deg. C	PRESENT	MAXIMUM	MINIMUM
LV WTI	25.541	25.541	0.0
HV WTI	25.541	25.541	0.0
OTI	25.541	25.541	0.0
AMBIENT	25.541	25.541	0.0
Tap Number	5	17	1
LV Voltage	33.371	33.371	0.00
LV Current	157.792	157.792	0.0
AGEING	RATE PU	TODAY S	TOTAL Yrs
Age LV	5.88e-05	0.230	0.00e+00
Age HV	4.15e-05	0.168	0.00e+00

This screen details some present conditions as well as some history. Note that the MAXIMUM and MINIMUM values refer to the maximum and minimum readings after Reset. Hence, if MAX and MIN are to make sense you **must** know when 'Reset' was last pressed. Aging 'RATE PU' gives an indication of the current rate at which the transformer is aging (sec/sec). Limitations of the thermal model are according to AS 2374.7 / IEC 354.

Cooling Settings for Control

This screen is used to set temperatures which control all cooling operations including trips and alarms (refer to '*DRMCC LOGIC DIAGRAMS*'). It is only possible to adjust these settings if you have authority to do so (refer to 'Login, Save & Restore Settings'). Note the following:

- ~ **WTI** = 'Winding temperature indicator'
- ~ **OTI** = 'Oil temperature indicator'
- ~ **WTU** = 'Winding temperature ultimate'
- ~ **OTU** = 'Oil temperature ultimate'

COOLING SETTINGS for CONTROL and ALARMS		
	WTI	OTI
INSTANT TRIP TEMP. C	135.000	115.000
DELAYED TRIP TEMP. C	120.000	110.000
DELAYED TRIP TIME Mins		180
ALARM TEMP C	120.000	100.000
STANDARD COOLING SETTINGS		
	WTI	OTI
Fans on C	80.000	70.000
Fans on/off band C	10.000	10.000
Pump on C	75.000	65.000
Pump on/off band C	15.000	15.000
DYNAMIC COOLING SETTINGS		
	WTU	OTU
Fans on C	130.000	110.000
Fans on/off band C	15.000	10.000
Pump on C	140.000	115.000
Pump on/off band C	25.000	20.000

Cooling Control & Status

COOLING CONTROL and STATUS			
MODE MANUAL NORMAL			
	Start	Stop	
Manual Fan Control	___	___	
Pump Control	___	___	
Manual start cooling test	___	___	
STAT AVAILABLE SWITCH HOURS			
FANS OFF	NO	OFF	0.0
PUMP1 OFF	NO	OFF	0.0
PUMP2 OFF	NO	OFF	0.0
Periodic cooling test setup			
Start Hour (0..23)			12
Runs/year (0,1,2,3,4,6,12)			4
Duration (5..60) min			5
Last Run	0 / 0 / 0	AS DELIVERED	

Recall that cooling MODE may be set to:

1. MANUAL
2. AUTO – NORMAL
3. AUTO – SMART (most often)

In order to be able to activate any of the Start/Stop commands cooling control **must** be set to MANUAL. The screen also indicates FAN & PUMP status (on/off), availability (yes/no), switch signal (on/off), and 'HOURS' (states the number of hours the fan, or pump has been on in total).

The Periodic cooling test setup applies to 'AUTO-SMART' cooling mode. 'Start Hour', 'Runs/year', 'Duration' are all user operations and can be changed without logging in.

To manually initiate a cooling test set the cooling mode to 'AUTO'. Change 'Manual start cooling test' to 'START'. The 'Last Run' should change to 'PENDING'. The DRMCC will then begin the cooling test once FANs and PUMPs are switched off and are available. 'IN PROGRESS' will appear and the test will run for the specified 'Duration'. Possible outcomes are as follows:

1. 'PASSED', FANs and PUMPs operating as desired.
2. 'INTERRUPTED', this will occur if the cooling mode is changed during a test run or if the number of cooling 'Runs/year' is set to zero.
3. 'FAILED', this will occur if a pump or fan fail alarm occurs during the test run. (Refer to 'DRMCC LOGIC DIAGRAMS'.)

COOLING CONTROL and STATUS			
MODE MANUAL NORMAL			
		Start	Stop
Manual Fan Control	___	___	___
Pump Control	___	___	___
Manual start cooling test		START	
	STAT AVAILABLE	SWITCH	HOURS
FANS	ON YES	IN_SERVICE	1.118
PUMP1	OFF NO	IN_SERVICE	2.78E-04
PUMP2	OFF NO	OFF	0.0
Periodic cooling test setup			
Start Hour (0..23)			12
Runs/year (0,1,2,3,4,6,12)			4
Duration (5..60) min			5
Last Run	14/7 /2000	PASSED	

Refer to 'DRMCC LOGIC DIAGRAMS' to see how each mode effects cooling operations (check the section on 'FANs' and 'PUMPs').

Emergency Loading

This screen allows for some dynamic ratings where predictions are made based on current conditions and are according to the thermal model (AS 2374.7 / IEC 354).

With cooling mode in AUTO – SMART, the 'Time remaining hours' tells the operator how many hours before a trip will occur. (Note that '24' hours is the default maximum, it implies infinite time under present conditions.)

To perform a calculation, set the 'Tap position during emergency', and an 'Ambient temperature Deg.C'. Set 'Emergency Load Amps' to get the 'Time at emergency load' (hours). Set an

'Emergency Time Hours' to get 'Load Allowed'. Set 'Calculate now' to 'YES'. The example above reveals that at an ambient temp of 37 degrees Celsius, with tap position set to 14, a load of 514.4 A could run for 16 hours before a trip would occur. Similarly, given an emergency time of 6.3 hours the predicted safe load is 582.3 A.

EMERGENCY LOADING	
Cooling control to be in AUTO/SMART mode	
Present conditions	
Time remaining hours	24.00
Calculate now >	___
Emergency Load Amps >	514.400
Time at emergency load	16.039
Emergency Time Hours >	6.300
Load Allowed	582.322
Tap position during emergency >	14
Ambient temperature Deg.C	> 37.000

All inputs (and outputs) on this screen are operations only, therefore using this screen will **not** affect any **actual** system settings, refer to 'SETTINGS AVAILABLE'.

Emergency Loading Limits

EMERGENCY LOADING LIMITS			
		WTI	OTI
INSTANT TRIP TEMP.	C	135.000	115.000
DELAYED TRIP TEMP.	C	120.000	110.000
DELAYED TRIP TIME	HOURS		3.000
INSTANT TRIP CURRENT	pu		1.800
DELAYED TRIP CURRENT	pu		1.500

This screen details operational settings, which are used in the 'EMERGENCY LOADING' calculation. They are not actual system settings, however the operator should set the values the same as actual system settings (if they aren't already set). Refer to 'SETTINGS AVAILABLE'.

Tap Change Control & Status

```
TAP CHANGE CONTROL and STATUS
Tap change control MANUAL DEFINITE
Manual Raise Tap      _____
Manual Lower Tap     _____
OLTC control location LOCAL
Timers: Definite Inverse N
      0           0
Voltages: Reference Tolerance
      1.000      0.020
          Controlled Secondary
      1.011      1.011

Tap Position      5

Supervisory control      NO
Supervisory tap UP      DOWN
```

Recall that the TAP CHANGER may be set:

1. MANUAL
2. AUTO – DEFINITE
3. AUTO – INVERSE N

Refer to 'DRMCC LOGIC DIAGRAMS' to see how each setting effects OLTC operations. Note that to allow for MANUAL or AUTO control 'OLTC control location' must be set to 'REMOTE'. 'LOCAL' would mean the tap changer could only be controlled locally, that is, an operator would have to physically operate the tap changer.

In order to be able to initiate a manual raise/lower tap 'Tap change control' must be set to MANUAL. Voltage 'Reference' and 'Tolerance' are user definable system settings, 'Controlled' voltage is calculated and 'Secondary' is the actual reading in pu. 'Supervisory control' should read 'YES' if SCADA control is in operation, allowing for remote control (specific installations only).

Tap Change Settings

'TIME DELAY MODE' will either be 'DEFINITE' or 'INVERSE N'. The status of the present timer is displayed the screen 'TAP CHANGE CONTROL and STATUS'. Settings on this page are unlikely to change after installation. Refer to 'SETTINGS AVAILABLE' to check all setting ranges.

```
TAP CHANGE SETTINGS for MODES and TIMES
TIME DELAY MODE DEFINITE
INVERSE N TIME DELAY SETTINGS
1% TIME DELAY      100.000
EXPONENT N        1.000
DEFINITE TIME DELAY SETTINGS
INITIAL TAP DELAY  60
INTER-TAP DELAY    15
FAST TAP DOWN DELAY 15
ALARM TIME LIMIT Secs
VOLTAGE OUT OF TOLERANCE 180
```

Voltage Settings for Control

```
VOLTAGE SETTINGS for CONTROL and ALARMS
VOLTAGE SETTINGS
Reference Voltage pu      1.000
Voltage Tolerance pu      0.020
Voltage Reduction Mode Off
Voltage Reduction Stage 1 % 0.00
Voltage Reduction Stage 2 % 0.00
ALARMS AND TC BLOCKING
Under-Voltage limit pu    0.850
Over-Voltage limit pu     1.175
Over-current limit pu     1.500
```

This important screen shows the settings for voltage control and tap changer alarms and blocking. Refer to 'DRMCC LOGIC DIAGRAMS' and the section '**ON LOAD TAP CHANGER**' to see how these settings effect the tap changer.

Ldc/Reverse Reactance Settings

This screen details the settings effecting the amount of line drop compensation. The mode may be set to:

1. OFF (no compensation)
2. LDC (+X,+R)
3. REVERSE REACTANCE (-X,+R)

```

LDC/REVERSE REACTANCE SETTINGS
LDC Mode OFF
R pu 0.074
X pu 0.150
1 pu line current for X and R 757.500

Watts pu 5.57e-08
VARs pu 5.57e-08 1.39e-06 MVAR

Local Volts pu 0.0000
Remote Volts pu 0.0000

```

```

LOGIN, SAVE and RESTORE SETTINGS
Enter PIN to login
PIN NUMBER 0000
LOGOUT ____

Save User Settings> ____
Restore User Settings> ____
Restore Factory Settings> ____

Last File Action Result OK

```

In mode '2', 'Rpu' and 'Xpu' should be set to values close to the actual impedance of the transmission line, (the system will then operate similar to an LDC Box).

In mode '3', 'Rpu' and 'Xpu' should be set to give the desired voltage at the remote end. Here, settings can only be changed by operators who've logged on to the DRMCC and who are authorised to do so.

Tap Change History

This screen indicates the current tap position and details tap change history for each tap position. The first column simply states the tap position. The second column indicates the previous position, for example, if 'Tap #' is 7, 'from' will either read 6 or 8. The 'kA²' column is the cumulative sum of the load current squared which occurred during the tap change. This figure is displayed to give an indication of the 'wear' that has occurred over time. This will be of particular importance if no tap-changer-current diverter system is in place.

Login, Save & Restore Settings

Two levels of security exist:

1. **Operations** (no PIN required)
2. **System Settings** (PIN required)

It is therefore only necessary to log in if specific settings need to be changed. (Refer to '*SETTINGS AVAILABLE*' in supporting documentation). All settings will have been already established upon installation, however if you have authority to change certain settings and wish to do so, log in as follows:

- ◆ move the cursor to the 1st digit of the PIN number and then press **ENT**
- ◆ use the cursor **UP DOWN** keys to scroll to the correct digit and then press **ENT**.
- ◆ move the cursor to the 2nd of the PIN numbers and repeat the above process.
- ◆ Repeat this step for the 3rd and 4th digits.

Dynamic Ratings will only reveal a 'PIN' to appropriate delegates upon a customer's request. After changing any settings and proving their suitability it is recommend that these settings be **SAVED**.

To save settings:

- ◆ select 'Save User Settings'
- ◆ press **ENT**.

The message 'OK' should momentarily flash at the 'Last File Action Result' position (on the same menu page) indicating that the **SAVE** was satisfactory.

Similarly, the previously saved User settings or the Factory setting can be restored using the same menu page.

To Log-Out, move cursor to LOGOUT and toggle to YES and press **ENT**. The system automatically logs out when there has been inactivity of the cursor keys for ten minutes.

Extras

```
EXTRAS
ACV1i = 2760      TeSICM2i =0
ACV2i = 2760      TeSICM3i =0
ACV3i = 2760      TeAmbi = 1477
ACA1i = 646       TeTTOi = 3337
ACA2i = 646       HydranGasi =0
ACA3i = 646
NTapi = 2048
VARi = 0
Watti = 0
Freqi = 0

Hydran Gas Reading 0      ppm
```

The 'EXTRAS' page details information, which may be used for advanced diagnostics. Dynamic Ratings technical personnel may use this to help identify the source of any abnormalities.

Unacknowledged Alarms

```
UNACKNOWLEDGED ALARMS
AMBIENT_RANGE
TANK_TOP_OIL_RANGE
FAN_NOT_IN_SERVICE
FAN_FAILURE
PUMP1_NOT_IN_SERVICE
PUMP1_FAILURE
COOLING_FAIL
CURRENT_OUT_OF_BALANCE
UNDER_VOLTAGE
VOLTAGE_ALARM
COMMON_ALARM
```

Upon initiation of any alarm condition this page is automatically loaded onto the UIM Screen, irrespective of the present display. The Alarm (or Alarms) will be displayed on the Screen and these can be scrolled through (if necessary) with the **UP DOWN** cursor keys.

The cause of the Alarm should be checked-out and rectified **BEFORE** acknowledging the Alarm with the **ENT** button, as soon as possible.

If the cause of the Alarm cannot be promptly rectified, the User will need to arrange for the relevant equipment to be taken out-of-service or out of DRMCC control; e.g. Tap Changer locally switched to LOCAL, Fans or Pumps locally switched to OFF or TEST. This action is likely to initiate other (warning) alarms - e.g. FAN or PUMP NOT IN SERVICE.

The original and new Alarm(s) may then be acknowledged. Provided there are no Unacknowledged Alarms, the screen will return to the previous display after acknowledging the alarm(s).

A list of all the alarms is provided in the supporting document '*ALARMS & TRIPS*'. Each group of alarms on the list is headed by the common alarm, which is displayed both as an Indicator and on the UIM Screen.

!*Active Alarms List

This page details all active alarms. Ideally of course, there will be no active alarms, however, if an alarm is acknowledged but is not properly rectified, the alarm will appear on the active alarm list.

```
!*ACTIVE ALARMS LIST
TPI_RANGE
AMBIENT_RANGE
TANK_TOP_OIL_RANGE
FAN_NOT_IN_SERVICE
FAN_FAILURE
PUMP1_NOT_IN_SERVICE
PUMP1_FAILURE
COOLING_FAIL
CURRENT_OUT_OF_BALANCE
UNDER_VOLTAGE
VOLTAGE_ALARM
COMMON_ALARM
```

A comprehensive set of (Warning/1st Level) Alarms is provided for the User. Each Alarm is annunciated via the UIM screen and summarised by the (LED) Indicators on the left of the UIM screen; refer also to sub-clause **LED INDICATORS**.

Appropriate logic has been included in the Alarm software so that the Alarm annunciated has realistic conditions. For example, the Pump Oil Flow Low Alarm will only initiate if:

- ◆ the Pump motor contactor is energised, and
- ◆ the Pump motor circuit breaker is NOT tripped, and
- ◆ the oil flow is low, and
- ◆ the alarm has NOT already been acknowledged.

These design features should assist the User in rapidly locating the cause of an Alarm.

Abnormal WTI or Top Oil temperatures cause the DRMCC system to provide outputs to the User's installation to TRIP the transformer or provide a 2nd Level Alarm, depending on the User's preference.

Typically the TRIP may be used for an unsupervised substation, whereas the 2nd Level Alarm approach might be used at fully supervised substations.

No other conditions, e.g. gas, current, voltage etc, are included in the software to the TRIP outputs. This is the normal design arrangement of the DRMCC system although other arrangements can be considered on request.

The Owner/User must therefore include other relevant/appropriate trips in the transformer protection circuits.

(Warning/1st Level) Alarms will have occurred, prior to a TRIP, to warn Operations of the abnormal condition (provided that the Alarm and Trip settings have been appropriately set when setting the DRMCC).

The TRIPS are listed (with the (warning) Alarms) on the 'ALARMS & TRIPS' document, and shown in 'DRMCC LOGIC DIAGRAMS', in supporting documentation.

!#Alarm Log

```
!#ALARM LOG
TPI_RANGE
  06/21,12:03 ACTIVE
COMMON_ALARM
  06/21,12:03 ACTIVE
VOLTAGE_ALARM
  06/21,12:03 ACTIVE
UNDER_VOLTAGE
  06/21,12:03 ACTIVE
TANK_TOP_OIL_RANGE
  06/21,12:03 ACTIVE
AMBIENT_RANGE
  06/21,12:03 ACTIVE
CURRENT_OUT_OF_BALANCE
  06/21,12:03 ACTIVE
```

This page shows all alarm history, detailing the date and time when the alarm became active and when the alarm was cleared.

LED INDICATORS

The LEDs (Light Emitting Diodes) on the front of the UIM provide a summary of Status and Alarm conditions of the DRMCC; see Table 2.

If one of the Red or Amber Alarm lights (in Table 2) becomes illuminated detailed Alarms will also appear on the UIM screen to assist the User to interpret the abnormal condition.

Indicator		Comment
Colour	Title	
Red	Temperature Alarm	Check UIM Screen for other detailed Alarms
Amber	Cooling Fail Alarm	Check UIM Screen for other detailed Alarms
Green	Fans On	
Green	Pumps On	
Amber	Transformer General Alarm	Check UIM Screen for other Alarms
Amber	DRMCC Alarm	One of the Sensors is out of Range: Check UIM Screen for other alarms
Red	Voltage Alarm	Check UIM Screen for other detailed Alarms
Amber	TC Fail Alarm	Tap Changer, check UIM Screen for other detailed Alarms
Green	TC Pending	System timing out in preparation for Tap Change
Green	TC in Progress	Tap change in Progress
Green	DRMCC Healthy	

Table 2 - LED Indicators on UIM

MANUAL OPERATION

This section highlights the main operations for manual control only. The manual control will override the requirements of the DRMCC system whilst Manual is selected, but will return to the previous Auto condition when the equipment is returned to AUTO again.

A list of the Manual Controls is given in Table 3.

In general, the possible manual operations are:

- ◆ Fans and Pumps can be switched ON and OFF.
 - select menu page **COOLING CONTROL and STATUS**,
 - move cursor to **MODE** control, toggle to **MANUAL** and press **ENT**,

- move cursor to **PUMP** or **FAN CONTROL**, (which ever is required) and toggle to **START** and press **ENT**.

Similarly switch Fans or Pumps Off.

- ◆ The Tap Changer can be initiated to tap UP or DOWN (1 tap at a time).
 - select menu page **TAP CHANGE CONTROL, STATUS**,
 - move cursor to **Tap change control**, toggle to **MANUAL** and press **ENT**,
 - move cursor to **Manual Raise Tap**, toggle to **YES** and press **ENT**.

A similar process is used for tapping down.

Title	Selectable Modes	Function / Security
Manual Cooling Test, Start	---- YES	Operations
Start Fan Manually	---- START	Operations
Stop Fan Manually	---- STOP	Operations
Start Pump Manually	---- START	Operations
Stop Pump Manually	---- STOP	Operations
Tap Up Manually (1 Position)	---- YES	Operations
Tap Down Manually (1 Position)	---- YES	Operations
Mode for Cooling Control	MANUAL AUTO	Operations
Mode for Tap Changer Control	MANUAL AUTO	Operations
Control Mode for Line Drop Control	OFF +X, +R -X, +R	Operations
Reset Peaks & Dips	NO YES	Operations
Log out of User Interface	---- YES	Operations
Auto Cooling Control System	NORMAL SMART	System Settings
Tap Changer Control (Definite Min Time or Normal Inverse Time)	DEFINITE INVERSE N	System Settings
Restore Default Settings	---- RESTORE	System Settings
Restore Factory Settings	---- RESTORE	System Settings
Save Default Settings	---- SAVE	System Settings

Table 3- Manual Controls Available via the UIM Screen

DATA LOG

Measured and calculated data is recorded in the **DRMCC** file system. The log files may be uploaded to a PC plugged into the UIM Port 7. Separate instructions will be provided on this operation (refer to '*DRMCC UIM-T1 OPERATIONS*').

MAINTENANCE

INTRODUCTION

The DRMCC has various advanced design features; including:

- ◆ Alarms to indicate equipment out-of-range (RANGE Alarms), failure of power supplies and equipment (AUXILIARY VOLTAGE FAILURE, and MONITORING SYSTEM FAULT),
- ◆ "shakeproof" terminals for incoming and outgoing cables/wiring,
- ◆ tropicalisation of all internal components within the UIM and SICM's,
- ◆ extended industrial temperature range of components,
- ◆ highest quality industrial components.

These, plus the various other design features result in high uptime and low overall maintenance requirements.

GENERAL

Visual inspection of the system components should be carried out on an annual or bi-annual basis. This could be at the same time that the general inspection of the transformer installation is carried out.

Check each DRMCC component, after removing cover plates to access the internals, for the following:

- ◆ rigidity of mounting,
- ◆ cleanliness, (no build-up of dirt, oil etc),
- ◆ lack of moisture (water/oil),
- ◆ lack of evidence of excessive temperatures,
- ◆ tidy cabling installation.

Rectify any issue that results from the inspection.

BATTERY

The Battery maintains power to the clock when the normal power supply fails.

The clock adds the date and time to the output data.

Thus if the battery does fail but the normal power supply is operational, the DRMCC system will continue to operate and control the Transformer and auxiliaries, and provide data and alarm outputs but less the day/time stamp.

Battery life is expected to be in the order of 20 years under normal circumstances. This could be longer than the life of the plant and therefore it is anticipated that the User may never need to change the battery.

If the battery volts are low, an Alarm is initiated.

The battery is securely attached to a printed circuit board (PCB) inside the UIM.

To replace the battery the PCB needs to be replaced and this requires the UIM to be powered down. Thus the transformer/substation will need to be operated in fully manual condition, that is without DRMCC control, or shutdown whilst the battery PCB is changed.

Replacement

- Isolate the power to the UIM,
- remove the Phillips heads screws from the (one piece) top and back plate of the UIM and remove this plate,
- locate the battery PCB,
- remove the battery PCB plug from the main PCB,
- release the four clips on the battery PCB and remove the PCB and its cable,
- install the new battery PCB and close the four retaining clips,
- insert the plug into the main PCB,
- replace the UIM top/bottom plate and screws,
- switch on power to the UIM,
- reset the date and time on the initial screen.

DIAGNOSTICS

The DRMCC carries out many diagnostic tasks routinely and advises any abnormal conditions to the User.

For example:

- **TRANSFORMER GENERAL ALARM:**
This Alarm monitors the condition of Transformer hardware, that is, NOT the DRMCC and its associated equipment.

The individual abnormal condition is alarmed as well as this TRANSFORMER GENERAL ALARM, the latter both on the UIM screen and the Indicator.

- **DRMCC ALARM:**

This Alarm monitors the outputs of the various sensors and alarms when the signal from any of these devices is outside (above or below) an expected range.

The individual abnormal condition is alarmed as well as this DRMCC ALARM, the latter both on the UIM screen and the Indicator.

For a comprehensive insight into the program logic behind the DRMCC system refer to '*DRMCC LOGIC DIAGRAMS*' or '*ALARMS & TRIPS*'.

SUPPORTING DOCUMENTATION

SUPPORTING DOCUMENTS

- 134-0081P DRMCC Technical Specification
- DRMCC Uim-T1 Operations
- 134-0083P DRMCC Settings Available
- 134-0084P DRMCC Alarms & Trips
- 134-0085P DRMCC System Block Diagrams
- 134-0086P DRMCC Logic Diagrams
- 134-0087P DRMCC Modbus Addresses
- 134-0088P DRMCC Site Testing And Commissioning
- 134-0089P DRMCC Quick Instructions

DRAWINGS

General Arrangement Drawings

- 134-0101E DRMCC SICM2 module
- 134-0102E DRMCC SICM3 module
- 134-0103E DRMCC Converter module
- 134-0104E DRMCC Relay modules
- 134-0105E DRMCC User interface module

Circuit Diagrams

- 134-0106D DRMCC SICM2 module
- 134-0107D DRMCC SICM3 module
- 134-0108E DRMCC Converter module
- 134-0109E DRMCC Relay modules
- 134-0110D DRMCC User interface module