Dynamic Rating, Monitoring, Control and Communications

T1 USER MANUAL

CONTENTS

INTRODUCTION

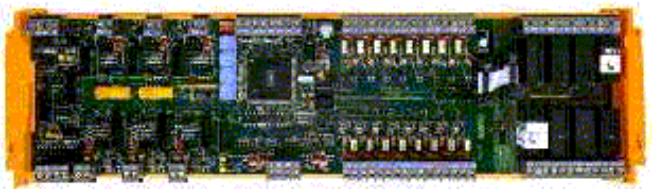
This manual provides the User with the appropriate instructions for Installation, Commissioning, Operation and Maintenance of the **DRMCC** microprocessor-based, **Dynamic Rating, Monitoring, Control and Communication** (**DRMCC-T1)** system.

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 SIMC3 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'.



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

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INSTALLATION

Prior to installation, the User/installer is advised to check all the **DRMCC** equipment supplied 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 *'DRMCC SITE TESTING AND COMMISSIONING'*.

Note: when 'powered-on' all the LEDs 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

COOLING CONTROL

The DRMCC can be used for manual or automatic on/off control of fans and pumps if fitted. There may be zero, one or two groups of fans. With two groups one or both groups can be switch on, or neither. There may be one or two pumps. If there are two, only one or the other or neither may run at a time.

OLTC CONTROL AND AVC

DRMCC provides for manual and automatic OLTC control for a single transformer or a group of transformers in parallel. Refer *to 'DRMMC OLTC Control'* for more information.

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 Menu

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
OLTC CONTROL PANEL
COOLING CONTROL PANEL
OPERATION OVERVIEW
EMERGENCY LOADING
LOGIN, SAVE and RESTORE SETTINGS
CONTRAST CONTROL
!*ACTIVE ALARMS LIST
!#ALARM LOG
```

DRMCC-T1

```
DRMCC-T1
           yyyy mm dd   hh mm ss
           2000 7  14   13 6  12
Secondary Voltage      Secondary Current
33.3     kV               0.0      A
0.0      MWatts           0.0      MVArs
Tap Number          OTI         WTI
5                   20.6        25.5     C

Cooling modes
MANUAL NORMAL

OLTC modes
INDEPENDENT AUTO REV. REACT. LDC ON
```

This screen gives a general overview of readings and the main control modes.

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 '*DRMCC SETTINGS AVAILABLE*' for an indication of which settings are operational and which are system settings.

OLTC CONTROL PANEL

```
CONTROL
MASTER/FOLLOWER STATUS
CONTROL MODES
OLTC TIMING MODES & SETTINGS
VOLTAGE CONTROL SETTINGS
ALARMS AND OLTC BLOCKING
LDC & REVERSE REACTANCE SETTINGS
```

CONTROL

```
CONTROL

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
```

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.

Voltage 'Reference' and 'Tolerance' are user definable system settings, 'Controlled' voltage is calculated and 'Secondary' is the actual reading in pu.

MASTER/FOLLOWER STATUS

This screen shows the status of the OLTC Modbus Master/Follower.

If Modbus communications fail, or there is no Master present, the values contained here will not be refreshed, and should be considered invalid.

```
MASTER/FOLLOWER STATUS
This controller ID #2   Tap to  8

Master comms OK
Modes of operation for all controllers
     #1          #2          #3
Stat Off line    Off line    Off line
Mode Follower    Follower    Master
Tap  8           8           8
IQ   0           0           0
I1pu 757         0           875
```

'Stat' indicates the availability of a follower. If the follower come Out of Step with the master, an Out of Step alarm is raised at the follower, and all Modbus M/F OLTC control to that follower is inhibited.

CONTROL MODES

When 'M/F Control' is in FOLLOWER the DRMCC controls the OLTC by following the MASTER tap number. In MASTER mode the DRMCC calculates when to change tap and instructs all followers to tap to the same tap number. When in INDEPENDENT mode the DRMCC is considered to not be a part of a Master Follower control system.

```
CONTROL MODES
M/F Control          INDEPENDENT
OLTC Control         AUTO
AVR Mode             REV. REACT.
LDC                  ON


INDEPENDENT AUTO REV. REACT. LDC ON
```

'AVR Mode' denotes the voltage control system. The systems implemented are:

- BUS VOLTS, uses the bus voltage as controlled voltage,
- REV. REACT, Reverse Reactance is a form of parallel control, which does not require interconnection between transformer controllers. It is a variant of Line Drop Compensation.

With 'LDC' turned off, no Line Drop Compensation is applied to the bus voltage. If 'LDC' is turned on, the Controlled Voltage is calculated from the Bus Volts plus a voltage, which models the transmission line voltage drop. As Reverse Reactance is a form of LDC, when Reverse Reactance is selected, LDC automatically turns on.

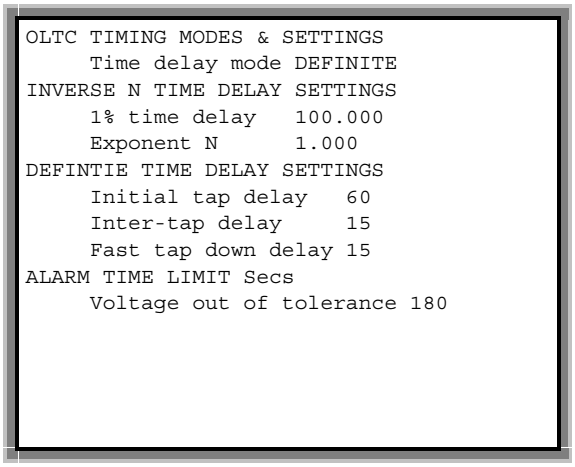
In order to be able to initiate a manual raise/lower tap 'M/F Control' must be in MASTER or INDEPENDENT, and 'OLTC Control' must be set to MANUAL.

The control modes operate in a hierarchial fashion. That is a selection of 'OLTC Control' to MANUAL has no meaning if 'M/F Control' is in FOLLOWER. Table 2 illustrates the OLTC hierarchy.

M/F Control	OLTC Control	AVR Mode	LDC Mode
Follower			
Master	Manual		
	Auto	Bus Volts	LDC Off
			LDC On
		Reverse Reactance	LDC On
Independant	Manual		
	Auto	Bus Volts	LDC Off
			LDC On
		Reverse Reactance	LDC On

Table 2 - OLTC Hierachy

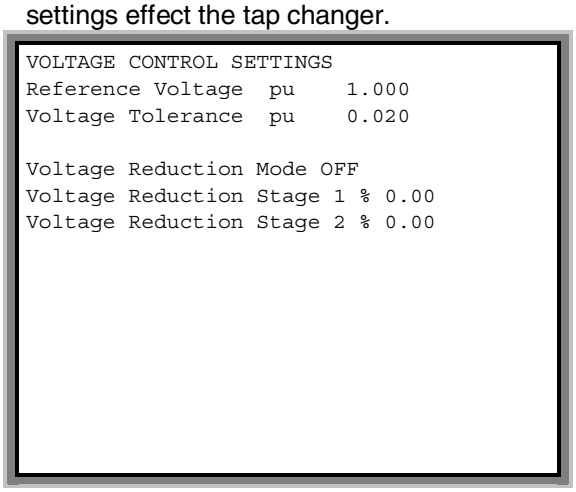
OLTC TIMING MODES & SETTINGS



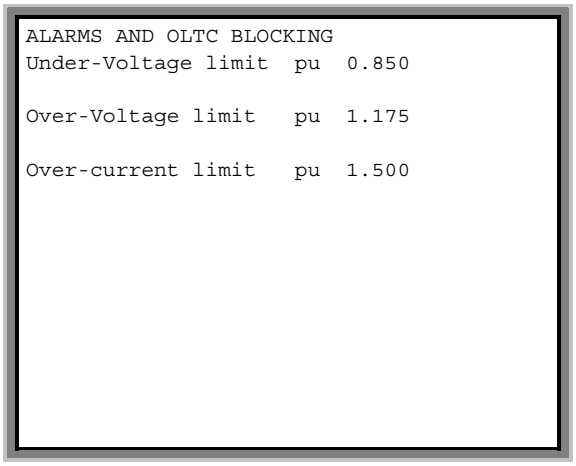
'TIME DELAY MODE' will either be 'DEFINITE' or 'INVERSE N'. The status of the present timer is displayed on the 'CONTROL' screen. Settings on this page are unlikely to change after installation. Refer to '*DRMCC SETTINGS AVAILABLE'* to check all setting ranges.

VOLTRAGE CONTROL SETTINGS

This screen shows the settings for voltage control. 'Voltage Reduction Mode' allows an operator to reduce the controlled voltage, for example when load needs to be shed. Refer to *'DRMCC SETTINGS AVAILABLE'* and *'DRMCC ALARM & TRIP LOGIC'* to see how these settings effect the tap changer.

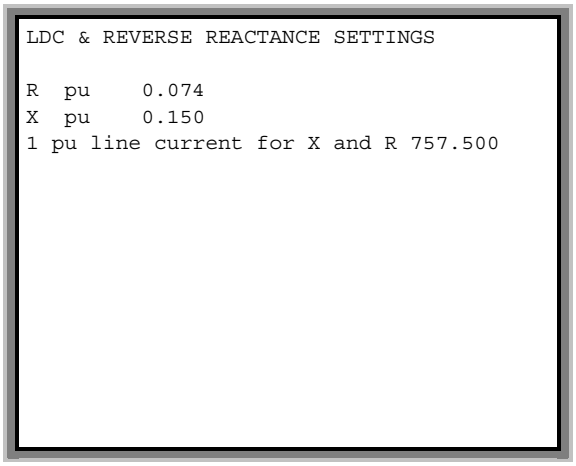


ALARMS AND OLTC BLOCKING



This important screen shows the settings for voltage alarms and OLTC blocking. Refer to *'DRMCC ALARM & TRIP LOGIC'* to see how these settings effect the tap changer.

LDC & REVERSE REACTANCE SETTINGS



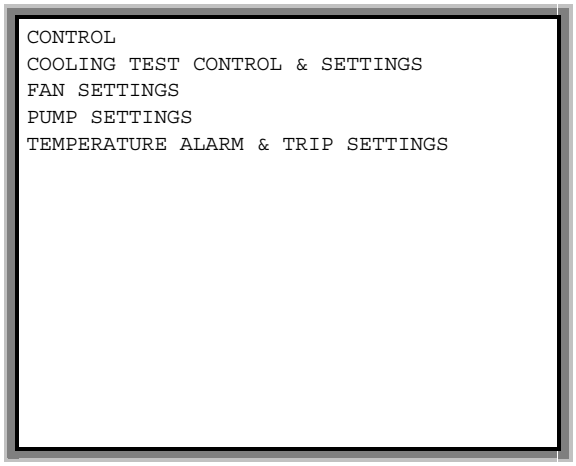
This screen details the settings effecting the amount of line drop compensation. The mode may be set to:

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

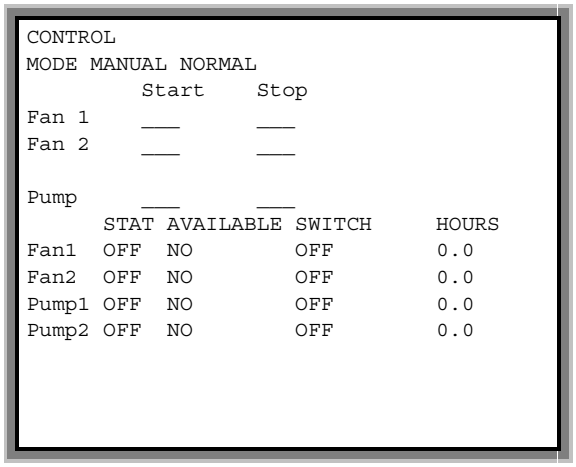
In mode '2', 'Rpu' and 'Xpu' should be set to values close to the actual impedance of the transmission line, (the system will then operate similar to an LDC Box).

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.

COOLING CONTROL PANEL



CONTROL



Recall that cooling MODE may be set to:

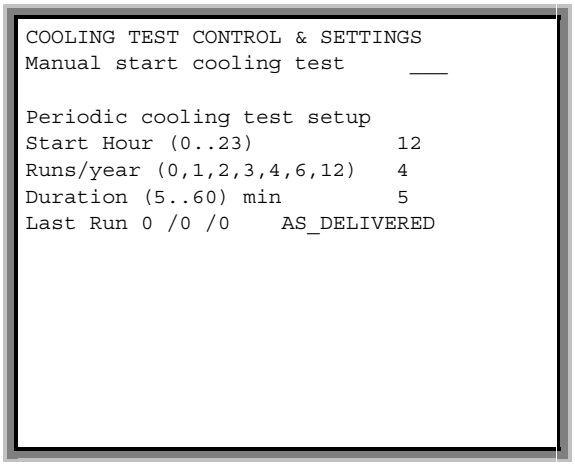
1. MANUAL (NORMAL / SMART not applicable)
2. AUTO – NORMAL
3. AUTO – SMART (most often)

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.

Refer to '*DRMCC ALARM & TRIP LOGIC'* to see how each mode affects cooling operations.

COOLING TEST CONTROL & SETTINGS

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



To manually initiate a cooling test set 'Manual start cooling test' to 'START'. The 'Last Run' should change to 'PENDING'. The DRMCC will then begin the cooling test once Fan's and Pump's 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', Fan's and Pump's 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.
2. 'FAILED', this will occur if a pump or fan fail alarm occurs during the test run. (Refer to *'DRMCC ALARM & TRIP LOGIC'*.)

FAN SETTINGS

```
FAN SETTINGS
STANDARD COOLING SETTINGS  WTI     OTI
Fan1 on C                  70      60
Fan1 on/off band C         10      10

Fan2 on C                  80      70
Fan2 on/off band C         10      10

DYNAMIC COOLING SETTINGS   WTU     OTU
Fan1 on C                  100     90
Fan1 on/off band C         30      20

Fan2 on C                  110     90
Fan2 on/off band C         30      20
```

PUMP SETTINGS

```
PUMP SETTINGS
STANDARD COOLING SETTINGS  WTI     OTI
Pump on C                  65      60
Pump on/off band C         15      10

DYNAMIC COOLING SETTINGS   WTU     OTU
Pump on C                  100     90
Pump on/off band C         30      20
```

TEMPERATURE ALARM & TRIP SETTINGS

```
TEMPERATURE ALARM & TRIP SETTINGS
                           WTI     OTI
Instant trip temp. C       140     110
Delayed trip temp. C       120     100
Delayed trip time mins        180
Alarm temp. C              120     100
```

These screens are 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'

If the temperature reaches the delayed trip settings a timer will start, and will continue to run as long as the temperature remains above the setting. The trip contact will close when the tier times out. If the temperature drops momentarily below the setting the timer resets. Note that the delayed and instant "trip" contacts may be used for stage 2 alarm instead of tripping, according to user's requirements.

OPERATION OVERVIEW

```
Overview
DETAILED LIVE DATA
OLTC HISTORY 1..28
OLTC HISTORY 29..56
RAW ANALOG INPUTS - ELECTRICAL
RAW ANALOG INPUTS - TEMPERATURES+
RAW DIGITAL INPUTS #1
RAW DIGITAL INPUTS #2
COMMUNICATIONS STATUS
```

Overview

```
Overview
Reset Maximum/Minimums? NO
Last reset 2001 5  17
Deg. C      PRESENT  MAXIMUM  MINIMUM
WTI         60.0     60.0     25.0
OTI         60.0     60.0     25.0
Ambient     25.0     25.0     12.0

Tap Number  5        17       1
Sec Voltage 33.371   33.371   0.00
Sec Current 157.792  157.792  0.0

AGEING      RATE PU  TODAY S  TOTAL Yrs
Age 4       0.125    4519     0.001
Age 2       0.125    4519     0.001
Age 1       0.125    4519     0.001
```

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.

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. 'TODAY S' is the ageing today in seconds since midnight.

OLTC HISTORY

These screens indicate the current tap position and details tap change history for each tap position. The first column simply states the tap position. The 'kA^2' 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.

RAW ANALOG INPUTS - ELECTRICAL

```
RAW ANALOG INPUTS - ELECTRICAL
A1ai 1200    V1ai 1200    Watt1i0
A1bi 1200    V1bi 1200    VAr1I 0
A1ci 1200    V1ci 1200
A2ai 1200    V2ai 1200    Watt2I
A2bi 1200    V2bi 1200    VAr2I 0
A2ci 1200    V2ci 1200
A3ai 1200    V3ai 1200    Watt3i0
A3bi 1200    V3bi 1200    VAr13 0
A3ci 1200    V3ci 1200
A4ai 1200       Freqi 0
A4bi 1200       NTapi 0
A4ci 1200
```

RAW ANALOG INPUTS - TEMPERATURES+

```
RAW ANALOG INPUTS - TEMPERATURES+
TeAmbi     0       TeCBOi 0
TeSICM2i   0       TeCTOi 0
TeSICM3i   0       TeTTOi 0
TeFO1i     0
TeFO2i     0
TeFO3i     0
TeFO4i     0

HydranGasi 0
```

RAW DIGITAL INPUTS #1

```
RAW DIGITAL INPUTS #1
TCRemote    REMOTE    MiscAlm5    1
TCInProg    0         MiscAlm6    0
TCMotTrip   0         TfGasPressu0
AuxPwrFail  0         TfBuchholzS0
TPI0        0         TfBuchholzG0
TPI1        0         TfPRD       0
TPI2        0         TfOilLow    0
TPI3        0         TCOilLow    0
TPI4        0         TCPressureS0
TPI5        0         HydranFail  0
MiscAlm0    0         HydranGasHi0
MiscAlm1    0         HydranGasHi0
MiscAlm2    0         ModeAOBit0  0
MiscAlm3    0         ModeAOBit1  0
MiscAlm4
```

RAW DIGITAL INPUTS #2

```
RAW DIGITAL INPUTS #2
Fan1InService 1      Pump1InService 1
Fan1Test      0      Pump1Test      0
Fan1Cont      OPEN   Pump1Cont      OPEN
Fan1Trip      NO     Pump1Trip      NO
Fan2InService 1      Pump2InService 1
Fan2Test      0      Pump2Test      0
Fan2Cont      OPEN   Pump2Cont      OPEN
Fan2Trip      NO     Pump2Trip      NO
Fan1VSDrv1SRR 0      OilFlowLow     LOW
Fan1VSDrv2SRR 0
Fan2VSDrv1SRR 0
Fan2VSDrv2SRR 0
```

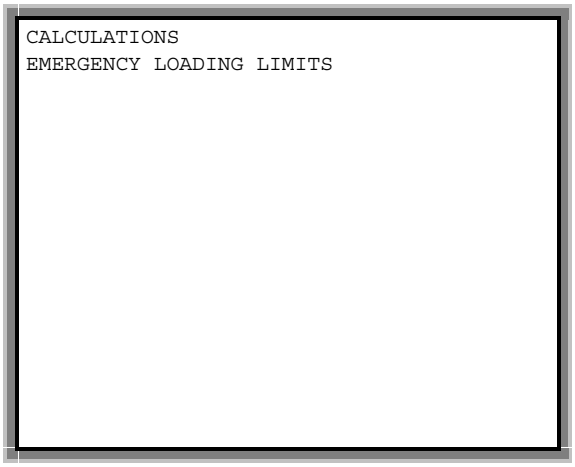
The 'RAW INPUTS' pages detail information, which may be used for advanced diagnostics. Dynamic Ratings technical personnel may use this to help identify the source of any abnormalities.

COMMUNICATIONS STATUS

```
COMMUNICATIONS STATUS
DNPAddress           0
DNPLine              0
mb_err_device        0
mb_err_unit          0
mb_err_code          0
mb_request_errno     0
mb_error_count       0
mb_op_state          0
dr_err_device        0
dr_err_unit          0
dr_err_code          0
dr_request_errno     19279
dr_error_count       0
dr_op_state          0
```

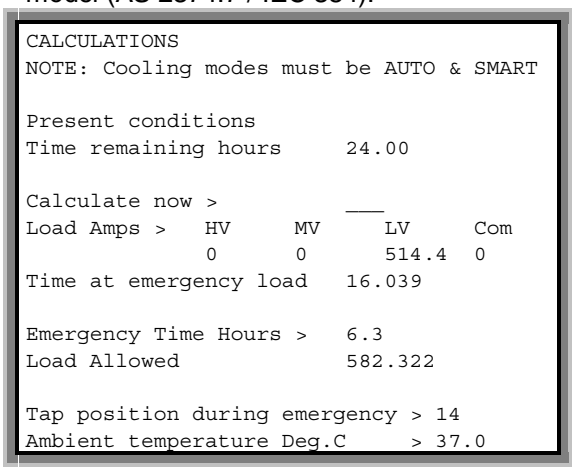
This screen displays the slave address of the last Modbus error (mb for SCADA, dr for MASTER/FOLLOWER), and a count of total Modbus errors. A small amount of Modbus errors are to be expected, especially in noisy sub-stations. If the error count is rapidly increasing, there is a definite problem with the Modbus connection and further investigation is recommended.

EMERGENCY LOADING



CALCULATIONS

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).



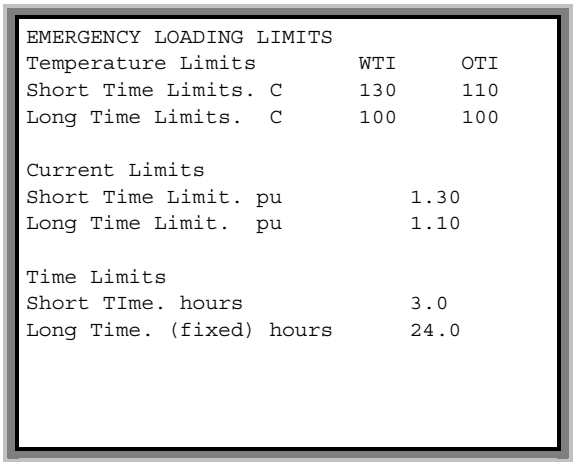
With cooling mode in AUTO – SMART, the 'Time remaining hours' tells the operator how many hours before a trip will occur. (Note that '24' hours is the default maximum, it implies infinite time under present conditions.)

To perform a calculation, set the 'Tap position during emergency', and an 'Ambient temperature Deg.C'. Set '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.

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

EMERGENCY LOADING LIMITS

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 *'DRMCC SETTINGS AVAILABLE'*.



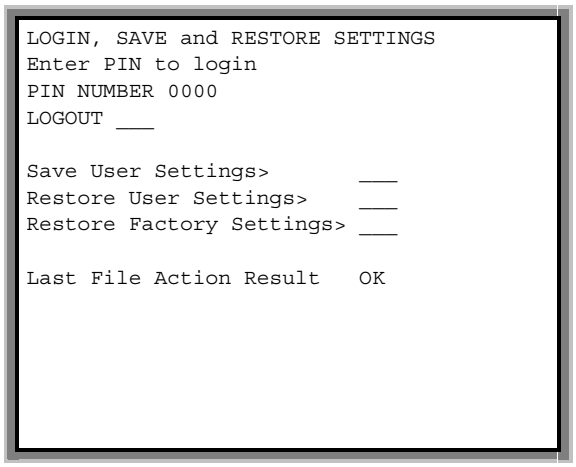
LOGIN, SAVE & RESTORE

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 '*DRMCC 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:

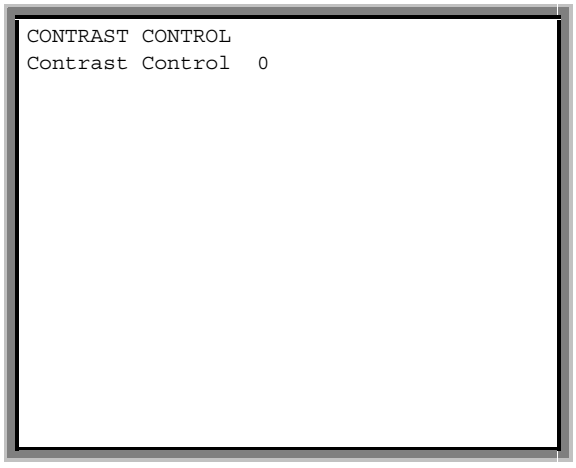
- select 'Save User Settings'
- press **ENT.**

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.

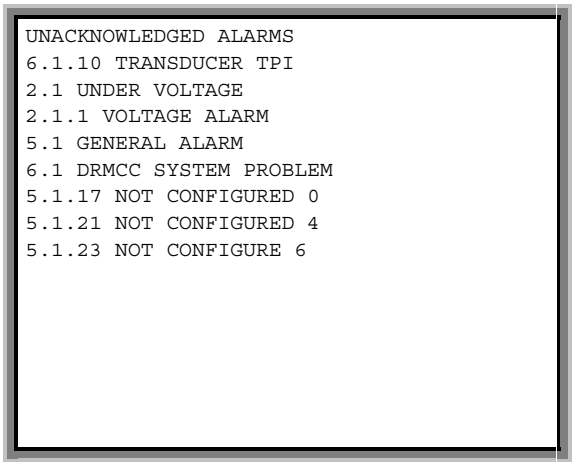
To Log-Out, move cursor to LOGOUT and toggle to YES and press **ENT.** The system automatically logs out when there has been inactivity of the cursor keys for ten minutes.

CONTRAST CONTROL



Contrast control on the UIM is automatically scaled with temperature. If you find the display difficult to read you may adjust the settings. The setting vary from -2 ⇔ 0 ⇔ +2, with 0 being the center position.

UNACKNOWLEDGED ALARMS



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.

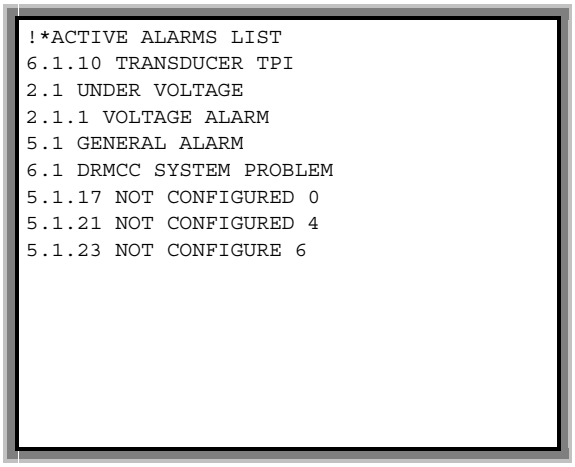
The cause of the Alarm should be checked-out and rectified as soon as possible. Acknowledge the Alarm with the **ENT** button.

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 '*DRMCC ALARM & TRIP LOGIC'*. 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.

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.

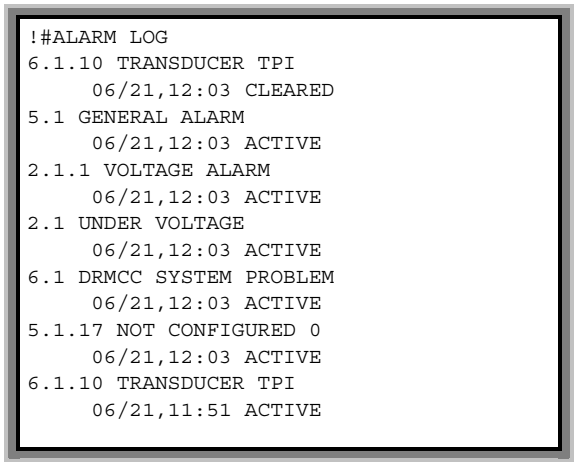
No other conditions, e.g. gas, current, voltage etc, are included in the software to the TRIP outputs. This is the normal design arrangement of the DRMCC system although other arrangements can be considered on request.

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 '*DRMCC ALARM & TRIP LOGIC*' document.

!#Alarm Log



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 3.

If one of the Red or Amber Alarm lights (in Table 3) 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	Power	UIM Power Supply on
Green	DRMCC Healthy	

Table 3 - 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 4.

In general, the possible manual operations are:

- Fans and Pumps can be switched ON and OFF.
  - select menu **COOLING CONTROL PANEL**,
  - select sub-menu **CONTROL**,
  - move cursor to **MODE** control, toggle to **MANUAL** and press **ENT**,
  - move cursor to **PUMP** or **FAN CONTROLS,** (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 **OLTC CONTROL PANEL,**
  - select sub-menu **CONTROL MODES,**
  - move cursor to **OLTC control**, toggle to **MANUAL** and press **ENT**,
  - press **ESC** to return to **OLTC CONTROL PANEL** menu,
  - select sub-menu **CONTROL,**
  - 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 Raise Tap	----- YES	Operations
Manual Lower Tap	----- YES	Operations
Cooling Control Mode	MANUAL AUTO	Operations
M/F Control Mode		
OLTC Control Mode	MANUAL AUTO	Operations
AVR Control Mode		
LDC Control Mode	OFF +X, +R -X, +R	Operations
Start Fan 1	----- START	Operations
Stop Fan 1	----- STOP	Operations
Start Fan 2	----- START	Operations
Stop Fan 2	----- STOP	Operations
Start Pump	----- START	Operations
Stop Pump	----- STOP	Operations
Manual Start Cooling Test	----- YES	Operations
Reset Maximum/Minimums	NO YES	Operations
Calculate Emergency Loading	----- YES	Operations
Logout of System Settings	----- YES	Operations
OLTC Time Delay Mode	DEFINITE INVERSE N	System Settings
Automatic Cooling Control System	NORMAL SMART	System Settings
Save User Settings	---- SAVE	System Settings
Restore User Settings	---- RESTORE	System Settings
Restore Factory Settings	---- RESTORE	System Settings

Table 4 - 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 20years 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 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 PCD 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 at 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 ALARM & TRIP LOGIC'.*

SUPPORTING DOCUMENTATION

SUPPORTING DOCUMENTS

- T1-001 DRMCC Technical Specification
- T1-002 DRMCC T1 User Manual
- T1-003 DRMCC Settings Available
- T1-004 DRMCC Alarms & Trip Logic
- T1-005 DRMCC Uim-T1 Operations
- T1-007 DRMCC Modbus User Guide
- T1-008 DRMCC Site Testing And Commissioning
- T1-009 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