

**Mikro**[®]



X10

**EARTH LEAKAGE
RELAY**

USER MANUAL

PREFACE

Before You Start

Please read this manual thoroughly before installation, operation and maintenance of the relay.

Disclaimer

Mikro shall not be liable for errors contained herein including any incidental and/or consequential damages arising from the use of this material. Mikro also reserves the right to vary the product from that described in this material without prior notice.

Precautions

Please observe the following safety precautions before and during the installation of the relay:

Only competent and trained personnel should install, operate, service and maintain this device.

Disconnect ALL power sources to the relay before performing installation, inspection, tests and maintenance.

Do not perform megger, hi-pot or any high voltage stress test with the relay connected to the system.

Install in a suitable enclosure where relay connections are inaccessible with sufficient clearance from other live parts.

Please note that incorrect installation may impair the operation or even damage the relay. There is no user servicable part in the relay. Tampering with it may damage the relay, result in injury and also voiding any warranty.

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1. Introduction

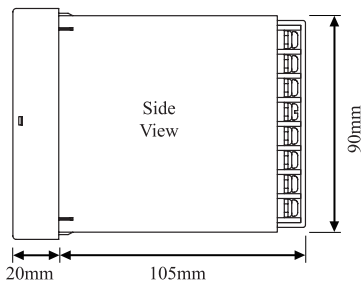
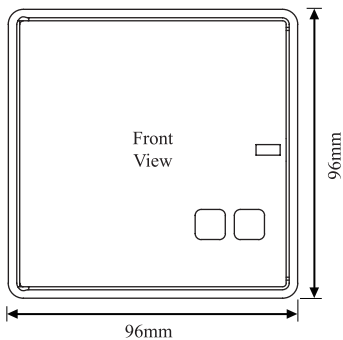
The purpose of this manual is to provide information necessary to install, operate and maintain the X10 earth leakage relay. It has two configurable output relays, one IRF relay, one configurable logic input and **MUST** operate together with Mikro's ZCT. Using the front panel keys, the user can easily navigate through the user-friendly menu, read measurements, status and change settings. The alarm/trip records are displayed on the back-lit LCD. There is a RS485 port on the rear terminals. Using MODBUS-RTU protocol, most information can be read or modified through the serial communication port.

1.1 Symbols and Definitions

In this manual and on the relay, unless otherwise specified, the following symbols and abbreviations shall apply throughout:-

AC	: Alternating current	OFL	: Overflow
Ack	: Acknowledge	Pnl	: Panel
ADC	: Analog converter	Prot	: Protection
Addr	: Address	Rcrd	: Record
Alrm	: Alarm	Rem	: Remote
Cal	: Calibration	RL	: Relay
Chg	: Change	Rst	: Reset
Clr	: Clear	RTC	: Real-time clock
Cmd	: Command	Tst	: Test
Comm	: Communication	Thres	: Threshold
DC	: Direct current	Wdog	: Watchdog
Dly	: Delay	ZCT	: Zero phase current transformer
Err	: Error		
ELR	: Earth Leakage Relay		
Grp	: Group		
In1	: Leakage 1		
In2	: Leakage 2		
Ip	: Input		
IRF	: Internal relay fault		
LED	: Light emitting diode		

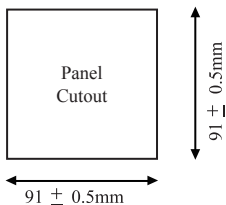
1.2 Case dimension



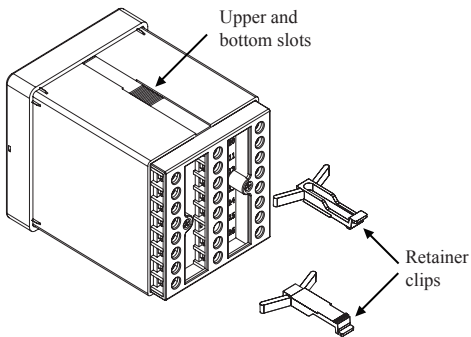
2. Installation Guide

2.1 Mounting

Cut a square hole on the panel. The recommended hole size is 91mm x 91mm. Insert the relay through the pre-cut hole.



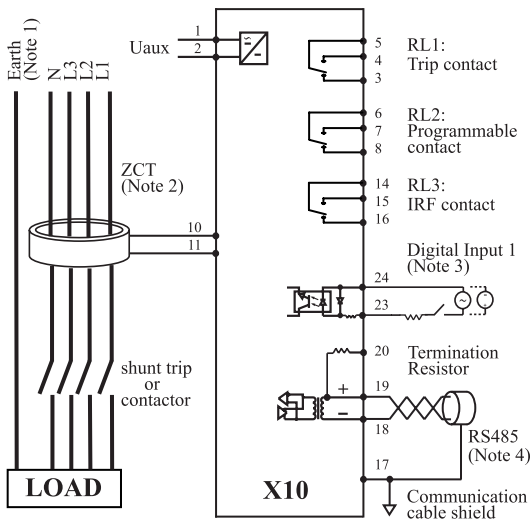
Slide the retainer clip along the slots on both sides of the relay until the relay is tightly secured on the panel. The retainer clips can be removed by lifting the tab lightly at the handle end.



2.2 Rear Terminal Description

Terminal	Function Description
1	Auxiliary supply input
2	Auxiliary supply input
3	Normally closed contact for RL1, Trip contact
4	Normally open contact for RL1
5	Common contact for RL1
6	Common contact for RL2, Programmable contact
7	Normally open contact for RL2
8	Normally closed contact for RL2
9	Not used
10-11	ZCT input (no polarity)
12	Not used
13	Not used
14	Common contact for RL3, IRF contact
15	Normally open contact for RL3
16	Normally closed contact for RL3
17	RS485 common terminal
18	RS485 negative terminal
19	RS485 positive terminal
20	Termination resistor for RS485 (jumper shorting to terminal 18)
21	Reserved
22	Not used
23-24	Digital Input (no polarity)

2.3 Wiring



Note 1: The EARTH wire must not pass through the ZCT

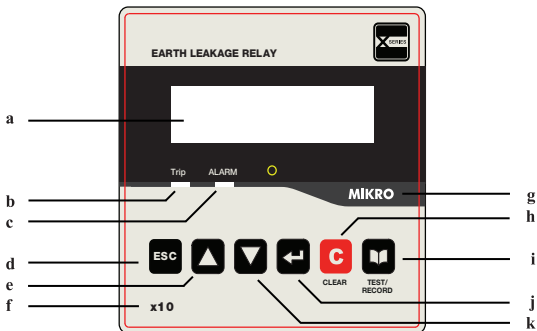
Note 2: The relay must work together with Mikro's ZCT

Note 3: External series resistor 18k ohm, 2W is required for input voltage greater than 94Vac or 132Vdc

Note 4: Short terminals 18 and 20 for communication data lines termination. Applicable only for relays located at the head and tail ends of the communication lines

3. Front Panel

3.1 Description



a. 2x16-digit LCD with back light display

b. Trip LED

c. Alarm LED

d. “ESC” key

e. “UP” key

f. Model no

g. Mikro logo and power on indicator

h. “CLEAR” key

i. “TEST/RECORD” key

j. “ENTER” key

k. “DOWN” key

3.2 Keypad

Keypad	Description
ESC	a) To exit from menu and submenu (Note 5) b) To cancel setting value change
UP	a) Scroll up the menu b) Increase the setting value
DOWN	a) Scroll down the menu b) Decrease the setting value
ENTER	a) To enter submenu b) To confirm setting value change
CLEAR	a) To clear/reset the user resettable alarm b) When the alarm record is empty, press to scroll through dedicated parameter. (Note 5)
TEST/ RECORD	a) To display alarm records. b) To display successive records, press the RECORD key again. c) If there's no alarm, press and hold the RECORD key for 5 seconds to run the test function

Note 5: Press and hold either the ESC or CLEAR keys for 1.5 seconds to return to the default display from any submenu. Subsequent press the CLEAR key to scroll through the real-time relay status and active group of protection setting. Refer to section 4.3.3.4 for more details.

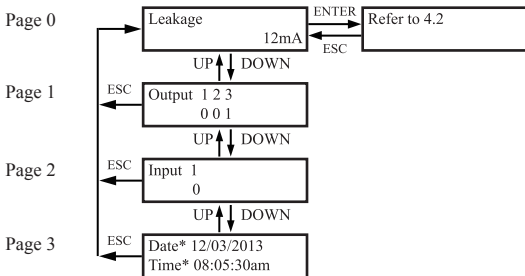
3.3 LEDs

Trip LED : Indicates tripping.

Alarm LED : Blinks to indicate unacknowledge alarm and continuous on when the alarm is acknowledged by pressing any key.

4. Menu

4.1 Default Display



Default display is splitted into 4 pages. The menu can be navigated through using the ESC, UP, DOWN and ENTER keys.

Page 0: Displays real-time leakage current. Type of current displayed is according to the sensing parameter set at section 4.3.3.1.

Page 1: Displays real-time output contact physical status.

Output 1 is trip contact

Output 2 is programmable contact

Output 3 is IRF contact

0=Output contact is de-activated

1=Output contact is activated

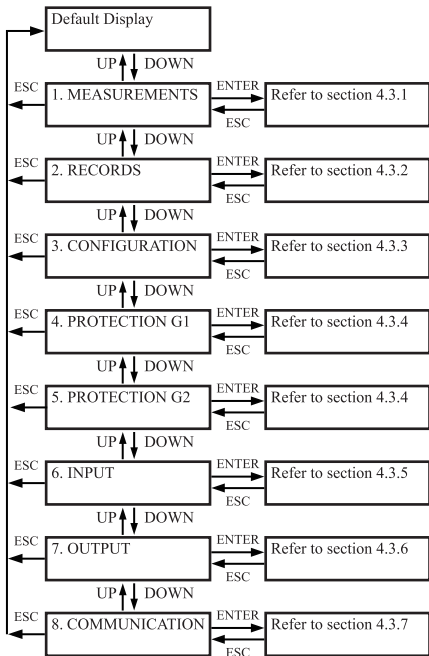
Page 2: Displays real-time input port physical status.

0=Input port is open

1=Input port is energised

Page 3: Displays real-time date and time. Date and time format is configurable. Refer to section 4.3.3.2 for more information.

4.2 Main Menu



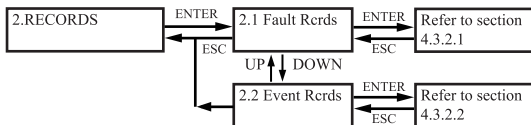
4.3 Sub Menu

4.3.1 MEASUREMENT Menu

Shows the real-time leakage measurement.

Display	Description
RMS	Measures the real-time RMS leakage current
Fundamental	Measures the real-time fundamental leakage current

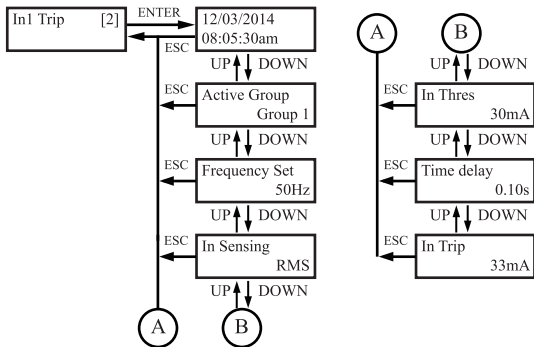
4.3.2 RECORDS Menu



4.3.2.1 Fault Record

Whenever a leakage fault trips, the event is recorded in the fault record. The information about the fault type, fault current, date, time and the protection setting at the time of trip is recorded.

The user can view the details of the fault record by navigating to the desired record and pressing the ENTER key followed by the UP or DOWN key to scroll through the details of the record or the ESC key back to fault display.

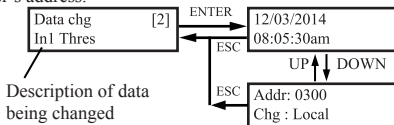


4.3.2.2 Event Record

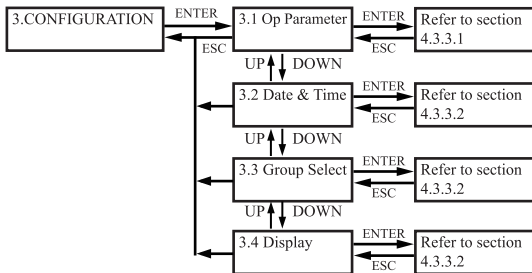
Whenever any event happened to the relay, the event is recorded in the event record. The information about the type of event, event status, date and time is recorded. User can view the event date and time by pressing the ENTER key or press the ESC key to return.



For setting data changes, additional information is recorded, the user can view the changes made at the relay front panel (local) or through the remote communication together with the correspondance Modbus register's address.



4.3.3 CONFIGURATIONS Menu



4.3.3.1 Op Parameter Menu

Display	Description
Password	Password to unlock the setting of parameters. Refer to section 5.0 for explanation
Description	Model name for relay
Firmware	Firmware version for relay
Frequency	Sets the nominal value for the line frequency
Sensing	Sets the leakage current sensing method
Active Group	Current active protection group setting

4.3.3.2 Date and Time Menu

Display	Description
Date	Sets the date
Date Format	Sets the date format for display. DD/MM/YYYY or MM/DD/YYYY

Display	Description
Time	Set the time (hh:mm:ss)
Time Format	Set the time format for display. For the 12-hours format, am/pm is added immediately after the seconds' digit

4.3.3.3 Group Select Menu

Display	Description
Chg Group by..	Sets whether the protection group setting is changed by Menu or Input. Select either Menu or Input. If Input is selected, the input function must be set to 'Select Group', otherwise the "Setting Conflict" alarm is shown
Setting Group	Only configurable if Chg Group by... is set to Menu. Select either 1 or 2 for the active protection group

4.3.3.4 Display Menu

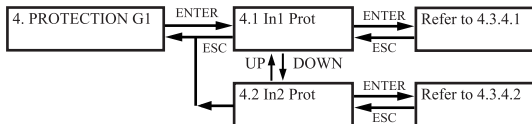
Display	Description
LCD On Time	Sets how long the LCD backlight remains on after no key is pressed
LCD Brightness	Sets brightness of the LCD backlight
"CLEAR" Scroll?	Set if CLEAR key can be used to scroll through a list of real-time status and current protection setting parameters. Refer to section 4.3.3.5 for the list. To start-up the scrolling, press and hold the CLEAR key for 3 seconds to reset the display to page 0. Sub-sequent press will scroll through the display. This function is only accessible when the alarm record is empty.

4.3.3.5 List of Parameter Displayed During Display Scroll:

Display	Description
Leakage	Real-time protection current display
Output	Real-time output contact physical status
Input	Real-time input port physical status
Date, Time	Real-time display the current date and time
Frequency	Nominal frequency setting
Sensing	Protection sensing current setting
Active Group	Active protection group setting
In1 Prot?	In1 protection enable status setting
In1 Trip Rst	In1 protection trip reset method setting
In1 Thres	In1 protection threshold setting
In1 Time Dly	In1 time delay setting
In1 Alrm?	In1 protection alarm enable status setting
In1 Alrm Rst	In1 alarm reset method setting
In1 Alrm Thres	In1 alarm threshold setting
In2 Prot?	In2 protection enable status setting
In2 Trip Rst	In2 protection trip reset method setting
In2 Thres	In2 protection threshold setting
In2 Time Dly	In2 time delay setting
In2 Alrm?	In2 protection alarm enable status setting
In2 Alrm Rst	In2 alarm reset method setting
In2 Alrm Thres	In2 alarm threshold setting

4.3.4 PROTECTION G1/G2 Menu

The contents for PROTECTION G1 menu and PROTECTION G2 menu are identical. The selection of Protection G1 or G2 is determined by the protection group setting. Refer to sections 4.3.3.3 and 4.3.5 for more details.



4.3.4.1 In1 Prot Menu

Display	Description
In1 Prot?	Set Yes to enable the protection
In1 Trip Rst	Sets the trip reset method. Set Manual for user reset and set Auto for internal self-reset (Note 6)
In1 Thres	Sets the sensitivity setting. Protection pickup at 85% of the sensitivity setting
In1 Time Dly	Sets the trip time delay setting
In1 Alm?	Set Yes to enable the alarm function
In1 Alm Rst	Sets the alarm resetting method. The alarm only can be reset if the leakage current drops to 5% below the alarm threshold setting
In1 Alm Thres	Sets the alarm threshold

Note 6: The self-reset is carried out if the leakage current drops to 50% below the sensitivity setting. It only self-resets the trip function and trip alarm. For output contact to synchronise with the trip function, the reset method for output contact must be set to Auto. Refer to section 4.3.6.1 and 4.3.6.2 for details.

4.3.4.2 In2 Prot Menu

In2 Prot menu has a similar content as the **In1 Prot** menu. It is applicable to the second set of the protection settings.

4.3.5 INPUT Menu

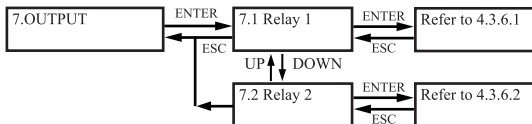
4.3.5.1 Input 1

Display	Description
Ip1 Func	Sets function of Input 1. Refer to section 4.3.5.2 for details
Ip1 Type	Selects the input port 1 activation logic. Active High is when voltage is applied to the input terminals. Active Low is when input terminals are open
Aux timer	Sets the auxiliary tripping timer. Only configurable if the input function is set to Aux

4.3.5.2 Input Function

Option	Description
None	Nothing is selected
Aux	If Aux is assigned, the input will generate an Aux Trip signal after the Aux time delay
Test	Tests the relay through input port
Sync Clock	Sets the real-time clock to the nearest second
Select Group	Refer to section 4.3.3.3 for details
Blocking	Enable the external blocking signal to block the leakage protection function from running
Reset	Select the alarm reset options among: (a) protection alarm, (b) protection trip and/or (c) unlatch output contacts

4.3.6 OUTPUT Menu



4.3.6.1 Relay 1

Display	Description
Failsafe	Sets the relay activation logic: No (Normal), Yes (Inverse)
Reset	Sets the relay reset method: Manual (latched), Auto (Unlatched)
Trip function	
ZCT fault?	Assigns the ZCT fault trip to RL1 (Note 7)
In1 trip?	Assigns the In1 trip to RL1 (Note 7, 8)
In2 trip?	Assigns the In2 trip to RL1 (Note 7, 8)
Pnl tst trip?	Assigns the front panel test trip to RL1 (Note 7)
Ip tst trip?	Assigns the input test trip to RL1 (Note 7)
Rem trip?	Assigns the remote command trip to RL1 (Note 7)
Aux trip?	Assigns the Aux input trip to RL1 (Note 7)

4.3.6.2 Relay 2

Display	Description
Failsafe	Refer to section 4.3.6.1
Reset	Refer to section 4.3.6.1
Trip function	
ZCT fault?	Assigns the ZCT fault trip to RL2
In1 trip?	Assigns the In1 trip to RL2 (Note 8)

In2 trip?	Assigns the In2 trip to RL2 (Note 8)
Pnl tst trip?	Assigns the front panel test trip to RL2
Ip tst trip?	Assigns the input test trip to RL2
Rem trip?	Assigns the remote command trip to RL2
Aux trip?	Assigns the Aux input trip to RL2
Alarm function	
In1 alm?	Assigns the In1 alarm to RL2
In2 alm?	Assigns the In2 alarm to RL2
Block alm?	Assigns the blocking alarm to RL2
Setting conflict?	Assigns the setting conflict alarm to RL2. Happens when the protection group setting is set to input but the input port is not assigned to this function. Refer to sections 4.3.3.3 and 4.3.5.1 for more details

Note 7: Item not editable. Permanently set to “Yes”.

Note 8: Once triggered, it is only resettable when the measured leakage current drops below 50% of the sensitivity setting

4.3.7 COMMUNICATION Menu

Display	Description
Communication?	Set Yes to enable MODBUS RTU communication
Remote Set?	Set Yes to enable remote read and write to the relay. Set No to only allow remote read of the relay
Baud Rate	Sets the baud rate in bits per second (bps)
Parity	Sets the parity in the data frame
Stop Bits	Sets the number of stops bit in the data frame
Relay Address	Sets the address of relay in the MODBUS network

5. Password

Password Protection

Relay settings can be viewed anytime but locked from being changed. A password is required for changing the settings. The password consists of four digits. The factory default password is 0000.

The programming mode is indicated with the letter “P” on the right hand side of the display. The letter “P” remains displayed as long as the password is active. This mode is exited if no key is pressed for 2 minutes.

Password Entry

The password is requested as soon as the modification of a parameter is initiated. The user enters each one of the 4 digits by using the UP or DOWN key and validates each digit by pressing the ENTER key. If the ESC key is pressed in between, the password entry is terminated.

“Password OK” is shown if the correct password is entered. “Password ERROR” is shown if the wrong password is entered.

The display returns to the point of the preceding menu. Press the ENTER key again to modify the setting. If no key is pressed after 2 minutes, the settings are locked. A new password request must be initiated for any subsequent setting change.

Changing Password

To change the password, go to the Op Parameter → Password menu. Enter the current password to unlock, after which the display shows the current password. Press the ENTER key again to enter the new password.

6. Alarm

Alarm Type

Alarms are divided into two categories: user resettable and non-resettable types.

For the user non-resettable type, the alarm is self reset by the relay once the alarm condition is removed.

For the user resettable type, the user must ensure the cause of the alarm is removed before the alarm can be cleared.

Eg: To clear “ZCT fault” alarm, the user must resolve the hardware ZCT connection problem before the alarm can be cleared.

Alarm Condition

During an alarm condition, the alarm LED blinks and the alarm record pops up. Press any key to acknowledge the alarm. Once acknowledged, the alarm LED will be changed to continuous on.

Alarm Viewing

Press the RECORD key once. Press the RECORD key again to view successive records. Alternatively, in the alarm, press the UP or DOWN key to scroll through the records.

Alarm Clearing

To clear a single alarm, use the RECORD key to navigate to the desired alarm and press the CLEAR key. To clear all records, use the RECORD key to navigate until the display shows “Clear all alarm?” and press the CLEAR key.

7. Technical Data

<i>PROTECTION</i>	
Setting group	Group 1 or Group 2
Setting sub-group	In1 or In2
Frequency	50Hz or 60Hz
Current sensing	True RMS or Fundamental
<i>EARTH LEAKAGE PROTECTION</i>	
Leakage?	Yes or No
Sensitivity setting	30mA, 0.05 to 1.00A (step=0.05A), 1.00 to 10.0A (step=0.25A)
Time delay setting	Instantaneous, 0.1-3.0s (step=0.1s)
<i>ALARM</i>	
Alarm?	Yes or No
Alarm reset	Manual or Auto
Alarm threshold	50-80% (step=5%)
<i>TEST</i>	
Test	Panel key, input port, remote command
<i>MISCELLANEOUS PROTECTION</i>	
Blocking logic	Yes or No
Auxiliary trip	Yes or No
Auxiliary timer	0 to 600s (step=0.01s)
<i>RECORDS</i>	
Alarm records	Up to 30 records
Event records	Up to 250 records
Fault records	Up to 50 records
<i>COMMUNICATION</i>	
Hardware interface	Isolated RS485
Protocol	Modbus-RTU
ID	1 to 255
<i>REAL-TIME LEAKAGE CURRENT DISPLAY</i>	
Range	10mA to 12.0A
<i>ZERO PHASE CURRENT TRANSFORMER (ZCT)</i>	
ZCT type	Mikro standard type ZCT

<i>AUXILIARY POWER SUPPLY</i>	
Rated voltage	100~240VAC or 140~340VDC
Operating voltage	85~265VAC or 110~370VDC
Rated frequency	50 or 60Hz
Power consumption	6VA max
<i>INDICATORS</i>	
Display	2x16-digit LCD
Trip	Red indicator
Alarm	Yellow indicator
<i>LOGIC INPUT</i>	
Input type	Optically isolated
Rated voltage	50-270VAC or 20-380VDC External series resistor 18k ohm, 2W required for voltage greater than 94VAC or 132VDC
<i>OUTPUT CONTACT</i>	
Rated voltage	240VAC
Contact arrangement	Change-over
Continuous carry	5A, AC1
Expected electrical life	50,000 operations at rated load
Expected mechanical life	5,000,000 operations
<i>MECHANICAL</i>	
Mounting type	Front panel flush mounting
Dimension (mm)	96W x 96H x 125L
Enclosure protection	IP63 at panel. IP30 at body
Approximate weight	0.6kg (excluding ZCT)
<i>TEMPERATURE</i>	
Pollution degree	2
Operating temperature	-10°C to +55°C
Storage temperature	-20°C to +70°C
Humidity	5% to 95%, non condensing

<i>PRODUCT REFERENCE STANDARD</i>	
IEC 60947-2	Annex M
<i>ELECTROMAGNETIC COMPATIBILITY</i>	
IEC 61000-4-2 Electrostatic discharge	8kV, air discharge 8kV, contact discharge
IEC 61000-4-3 Radiated RF immunity	10V/m, 80MHz to 1GHz
IEC 61000-4-4 Electrical fast transient	4kV power port 2kV signal port
IEC 61000-4-5 Surge	4kV power port 2kV signal port
IEC 61000-4-6 Conducted RF immunity	10Vrms, 0.15 to 80MHz
IEC 61000-4-8 Power frequency magnetic	100A/m, 1s
IEC 61000-4-11 Voltage interruption	100% 200ms
IEC 61000-4-18 Damped oscillatory wave	2.50kV common mode 1.25kV differential mode
CISPR 11 Conducted emission	0.15-30MHz, 56-66dB
CISPR 11 Radiated emission	30-230MHz, 30dB, 10m 230-1000MHz, 37dB, 10m
<i>SAFETY TEST</i>	
IEC 60255-5 Insulation	2kV high voltage dielectric test 5kV high voltage impulse test
<i>ENVIRONMENT</i>	
IEC 60068-2-6	

8 MODBUS

8.1 MODBUS Protocol

The RS485 port is located at the rear terminals and uses the MODBUS -RTU protocol. The communication setting is set in the COMMUNICATION Menu from the front panel or RS485 port. When changes are made through the RS485 port, modifications are restricted to the communication protocol registers or addresses ranging from 0211h to 0214h. The changes take place immediately after the acknowledge message is sent.

Most of the MODBUS database registers can be modified through the RS485 port except the following:

- a) relay status registers, address ranging from 0000h to 001Fh.
- b) communication function enable/disable register, address=0210h.
- c) front panel access password register, address=0215h.
- d) RL1 or relay 1 trip option, address=0270h.

Items (b) & (c) can only be modified through the front panel. Reading the password register will always return 0000h.

Prior to writing data to the database, the user **MUST** ensure that the relay front panel access password is not active. Otherwise, the data write is void. The front panel access password status can be checked by reading the database interlocking bit on the relay status register or bit 10 of address 0010h. Reading of the database registers is not affected.

The MODBUS communication address 0 is a broadcast command to all slave devices. The slave devices will not respond to a broadcast command.

8.2 MODBUS Functions

0x03/0x04, Read Input/Holding Registers

Request		
Communication address	1 byte	0 to 255 (Note 9)
Function code	1 byte	0x03/0x04
Starting address	2 bytes	0x0000 to 0xFFFF
Quantity of registers	2 bytes	0x0001 to 0x007d (N)
CRC	2 bytes	2-byte CRC
Response		
Communication address	1 byte	1 to 255
Function code	1 byte	0x03/0x04
Byte count	1 byte	2 x N
Quantity of registers	Nx2 bytes	Value
CRC	2 bytes	2-byte CRC
Error		
Communication address	1 byte	1 to 255
Error code	1 byte	0x83/0x84
Exception code	1 byte	0x01, 02, 03 or 04
CRC	2 bytes	2-byte CRC

0x06, Write Single Register

Request		
Communication address	1 byte	0 to 255 (Note 9)
Function code	1 byte	0x06
Starting address	2 bytes	0x0000 to 0xFFFF
Register value	2 bytes	Value
CRC	2 bytes	2-byte CRC
Response		
Communication address	1 byte	1 to 255
Function code	1 byte	0x06
Register value	2 bytes	Value
CRC	2 bytes	2-byte CRC

Error		
Communication address	1 byte	1 to 255
Error code	1 byte	0x90
Exception code	1 byte	0x01 or 02 or 03 or 04
CRC	2 bytes	2-byte CRC

0x10. Write Multiple Registers

Request		
Communication address	1 byte	0 to 255 (Note 9)
Function code	1 byte	0x10
Starting address	2 bytes	0x0000 to 0xFFFF
Quantity of registers	2 bytes	0x0001 to 0x007d (N)
Byte count	1 byte	2 x N
Register values	N x 2 bytes	Value
CRC	2 bytes	2-byte CRC
Response		
Communication address	1 byte	1 to 255
Function code	1 byte	0x10
Quantity of registers	2 bytes	0x0001 to 0x007d (N)
CRC	2 bytes	2-byte CRC
Error		
Communication address	1 byte	1 to 255
Error code	1 byte	0x90
Exception code	1 byte	0x01 or 02 or 03 or 04
CRC	2 bytes	2-byte CRC

Note 9: 0 is a broadcast command to all slave devices. The slave devices will not respond to a broadcast command.

8.3 MODBUS Registers

Addr (Hex)	Parameter	Format	Unit	Range
Product information. Read only. Function 03h or 04h				
0000	Device type - main	F1	ASCII	'00'
0001		F1	ASCII	'06'
0002		F1	ASCII	'00'
0003	Device type - sub	F1	ASCII	'00'
0004	Version number - main	F1	ASCII	'00'
0005		F1	ASCII	'01'
0006	Version number - sub	F1	ASCII	'00'
0007		F1	ASCII	'00'
0008- 000F	Reserved	---	---	--
Measurement and relay status. Read only. Function 03h or 04h				
0010	Relay status	F2	Bit field	
0011	LED status	F3	Bit field	Bit: 0-1
0012	Input status	F4	Bit field	Bit 0
0013	Output status	F5	Bit field	Bit: 0-2
0014	Active group	F6	---	0=Grp1, 1=Grp2
0015	Leakage current	F7	mA	0-12000 (0-12.0A), 32767 (7FFF hex) for values greater than 12.0A
0016	Alarm status	F15	Bit field	Bit: 0-3
0017	Trip status	F16	Bit field	Bit: 0-6
0018- 001F	Reserved	---	---	---
Remote command. Write only. Function 06h				
0100	Remote cmd	F19	Integer	
General setting. Read/Write. Function 03h, 04h, 06h or 10h				
0200- 0203	Reserved	---	---	
0204	Frequency	F6	---	0=50Hz, 1=60Hz
0205	Sensing	F6	---	0=RMS, 1=Fundamental

Addr (Hex)	Parameter	Format	Unit	Range
0206	Year	F7	year	0-199 (as 2xxx)
0207	Month, Day	F10	month, day	1-12, 1-31
0208	Hour, Minute	F11	hour, min	0-23, 0-59
0209	Milliseconds	F7	ms	0-59999 (0-59.999s)
020A	Date & time format	F12	data, time	Date: 0-1, Time: 0-1
020B	Change group by...	F13	---	0=menu, 1=input
020C	Setting group	F6	---	0=Grp1, 1=Grp2
020D	LCD backlight on time	F7	minute	1-60
020E	LCD backlight brightness	F6	---	0=low, 1=medium, 2=high
020F	Clear key to scroll setting	F6	---	0=No, 1=Yes
0210	Communication?	F6	---	0=No, 1=Yes
0211	Baudrate	F7	bps	0=2400, 1=4800, 2=9600, 3=19200, 4=38400
0212	Parity	F6	---	0=none, 1=odd 2=even
0213	Stop bits	F6	---	0=1bit, 1=2bits
0214	MODBUS address	F6	---	1-255
0215	Password	F1	---	0000 (read only)
0216	Remote set parameters	F6	---	0=No, 1=Yes
0217-023F	Reserved	---	---	---
0240	Input 1 function	F14	level, option	0-1, 0-6
0241	Input 1 reset option	F18	Bit field	Bit: 0-2
0242	Input 1 Aux delay	F8	1/100sec	0-60000 (600s)
0243-026F	Reserved	---	---	---

Addr (Hex)	Parameter	Format	Unit	Range
0270	RL1 function	F17	Bit field	Bit: 0-1
0271	RL1 trip options	F16	Bit field	Bit: 0-6 (read only)
0272-0274	Reserved	---	---	---
0275	RL2 function	F17	Bit field	Bit 0-1
0276	RL2 trip options	F16	Bit field	Bit 0-6
0277	RL2 alarm options	F15	Bit field	Bit 0-3
0278-027F	Reserved	---	---	---
Protection Group 1. Read/Write. Function 03h, 04h, 06h or 10h				
0300	Leakage 1 (In1)?	F6	---	0=Disable, 1=Enable
0301	In1 trip reset	F6	---	0=Manual, 1=Auto
0302	In1 sensitivity	F9	mA	30-10000 (0.03-10A)
0303	In1 time delay	F8	ms	0-3000 (step=100)
0304	In1 alarm?	F6		0=Disable, 1=Enable
0305	In1 alarm reset	F6		0=Manual, 1=Auto
0306	In1 alarm threshold	F7	%	50-80 (step=5)
0307	Reserved	---	---	---
0308	Leakage 2 (In2)?	F6	---	0=Disable, 1=Enable
0309	In2 trip reset	F6	---	0=Manual, 1=Auto
030A	In2 sensitivity	F9	mA	30-10000 (0.03-10A)
030B	In2 time delay	F8	ms	0-3000 (step=100)
030C	In2 alarm?	F6		0=Disable, 1=Enable
030D	In2 alarm reset	F6		0=Manual, 1=Auto
030E	In2 alarm threshold	F7	%	50-80 (step=5)
031F	Reserved	---	---	---
Protection Group 2. Read/Write. Function 03h, 04h, 06h or 10h				
0400-041F	Same as Protection Group 1 except addresses are 04xx instead of 03xx			

Addresses 0000-001F, 0210, 0215, 0216 and 0271 are read only. Writing on them has no effect.

Addr (Hex)	Parameter	Format	Unit	Range
Fault Records. Read only. Function 03h or 04h				
1000	Fault record 1			
:	:			
1031	Fault record 50			
Event Records. Read only. Function 03h or 04h				
2000	Event record 1			
:	:			
20F9	Event record 250			
Alarm Records. Read only. Function 03h or 04h				
3000	Fault record 1			
:	:			
301D	Fault record 30			

8.4 MODBUS Event Record

Each event record consists of 6 words:

Word	Description	Format	Units	Range
1	Year	F7	year	0-199 (as 2000-2199)
2	Month, day	F10	month, day	1-12, 1-31
3	Hour, minute	F11	hour, min	0-23, 0-59
4	Milliseconds	F7	ms	0-59999
5	Record code	See below		
6	Record value	See below		

Event Record Code and Event Record Value

Word number 5:		Word number 6:	
Code	Code Description	Data Description	
1	In1 alarm status	0=Alarm reset	1=Alarm pickup
2	In2 alarm status	0=Alarm reset	1=Alarm pickup
3	ZCT fault	0=Fault reset	1=ZCT fault
4	In1 protection status	0=Dropoff	1=Pickup
5	In2 protection status	0=Dropoff	1=Pickup
6	In1 trip status	0=Trip reset	1=Leakage trip
7	In2 trip status	0=Trip reset	1=Leakage trip
8	Panel button test trip	0=Trip reset	1=Test trip
9	Input test trip	0=Trip reset	1=Test trip
10	Remote command trip	0=Trip reset	1=Rem cmd trip
11	Aux trip	0=Trip reset	1=Aux trip
12	Blocking alarm	0=Alarm reset	1=Block alarm
13	Relay 1 status	0=De-energise	1=Energise
14	Relay 1 latch status	0=Unlatch	1=Latch
15	Relay 2 status	0=De-energise	1=Energise
16	Relay 2 latch status	0=Unlatch	1=Latch
17	IRF relay status	0=De-energise	1=Energise
18	Input 1 status	0=Switch open	1=Switch closed
19	Powerup	---	---
20	Watchdog startup	0=Alarm cleared	1=Alarm pickup
21	Firmware updated	0=Alarm cleared	1=Alarm pickup
22	Default data	0=Alarm cleared	1=Alarm pickup
23	Setting conflict	0=Alarm cleared	1=Alarm pickup

Word number 5:		Word number 6:	
Code	Code Description	Data Description	
22	Default data	0=Alarm cleared	1=Alarm pickup
23	Setting conflict	0=Alarm cleared	1=Alarm pickup
24	Calibration data error	0=Alarm cleared	1=Alarm pickup
25	ADC error	0=Alarm cleared	1=Alarm pickup
26	EEPROM error	0=Alarm cleared	1=Alarm pickup
27	RTC data lost	0=Alarm cleared	1=Alarm pickup
28	RTC error	0=Alarm cleared	1=Alarm pickup
29	Synchronise clock	---	---
30	Group change	0=Active grp 1	1=Active grp 2
31	Frequency change	0=50Hz	1=60Hz
32	Panel data change	Address of setting being changed	
33	Remote data change	Address of setting being changed	
34	Password reset	0=Local	1=Remote
35	Acknowledge alarm	0=Local	1=Remote

8.5 MODBUS Alarm Records

Each alarm record consists of 6 words:

Word	Description	Format	Units	Range
1	Year	F7	year	0-199 (as 2000-2199)
2	Month,day	F10	month, day	1-12, 1-31
3	Hour, minute	F11	hour, min	0-23, 0-59
4	Milliseconds	F7	ms	0-59999
5	Record code	See below		
6	Reserved	Reserved		

Alarm Record Code

Word number 5:		Word number 6:
Code	Code Description	Data Description
1	In1 alarm	---
2	In2 alarm	---
3	ZCT fault	---
4	In1 trip	Trip fault current
5	In2 trip	Trip fault current
6	Panel button test trip	---
7	Input test trip	---
8	Remote command trip	---
9	Aux trip	---
10	Blocking alarm	---
20	Relay 1 ON	---
21	Relay 1 latched	---
22	Relay 2 ON	---
23	Relay 2 latched	---
24	IRF relay OFF	---
25	Watchdog reset	---
26	Calibration data error	---
27	ADC error	---
28	EEPROM error	---
29	RTC data lost	---
30	RTC error	---
31	Firmware updated	---
32	Default data	---
33	Setting conflict	---

Alarm codes 32 and 33 are non-resettable. Others are resettable.

8.6 MODBUS Fault Records

Each fault record consists of 6 words:

Word	Description	Format	Units	Range
1	Year	F7	year	0-199 (as 2000-2199)
2	Month, day	F10	month, day	1-12, 1-31
3	Hour, minute	F11	hour, min	0-23, 0-59
4	Milliseconds	F7	ms	0-59999
5	Record code	See below (Fault record code)		
6	Protection group set	F6	---	0=Group 1 1=Group 2
7	High byte: Frequency set	F6	---	0=50Hz 1=60Hz
	Low byte: Sensing set	F6	---	0=RMS 1=Fundamental
8	Sensitivity set	F9	mA	30-10000 (0.03-10.0A)
9	Time delay set	F8	ms	0-3000 (0-3.0s)
10	In trip	F7	mA	0-12000 (0-12.0A) or 32767 (7FFF hex) for values greater than 12.0A

Fault Record Code

Word number 5:	
Code	Code Description
0	None
1	In1 trip
2	In2 trip

8.7 MODBUS Mapping Format

Code	Description
F1	2 bytes ASCII character
F2	Unsigned integer - Relay status. Bit 0: EEPROM data failure Bit 1: Calibration data failure Bit 2: RTC data lost Bit 3: RTC error Bit 4: ADC error Bit 10: Modbus database registers interlocking status Bit 11: Rear port (RS485) unread fault record Bit 14: Rear port (RS485) unread alarm record
F3	Unsigned integer - LED status. Bits 0-1: Trip LED (1=ON, 2=blink) Bits 2-3: Alarm LED (1=ON, 2=blink)
F4	Unsigned integer - Input status. Bit 0: Input 1 (0=Open, 1=Closed)
F5	Unsigned integer - Output status. Bit 0: Relay 1 or Trip contact (0=Off, 1=On) Bit 1: Relay 2 or Programmable contact (0=Off, 1=On) Bit 2: Relay 3 or IRF contact (0=Off, 1=On)
F6	Unsigned integer - Miscellaneous. A numeric value representation of certain options or functions. Refer to the 'range' column of the register for details
F7	Unsigned integer - A numeric value of certain units. Refer to the individual register 'Unit' and 'Range' for details E.g. 50 may represent 50% or 50 seconds
F8	Unsigned integer - A scaled numeric of certain units Refer to the individual register 'Unit' and 'Range' for details E.g. 125 may represent 1.25A or 12.5s
F9	Unsigned integer - Sensitivity setting and the unit is mA. Valid data: 30, 50-1000 (step=50), 1000-10000 (step=250) E.g. 500 is 500mA or 2000 is 2.0A

Code	Description
F10	Unsigned integer. High byte: month Low byte: day
F11	Unsigned integer. High byte: hour (24-hour format). Low byte: minute
F12	Unsigned integer - Date and time format for relay display. High byte: Date format. 0=DD/MM/YYYY; 1=MM/DD/YYYY Low byte: Time format. 0=12 hours; 1=24 hours
F13	Unsigned integer - Change Group by... 0=Change group by menu 1=Change group by level of digital input
F14	Unsigned integer - Input function. High byte - integer data 0: Active low or when no power is applied 1: Active high or when power is supplied to the input port Low byte - integer data 0: None 1: Trip reset 2: Blocking logic 3: Group select 4: Sync clock 5: Remote test 6: Aux
F15	Unsigned integer - Relay alarm status. Bit 0: In1 alarm Bit 1: In2 alarm Bit 2: Blocking alarm Bit 3: Setting conflict alarm

Code	Description
F16	Unsigned integer - Relay trip status. Bit 0: ZCT fault Bit 1: In1 trip Bit 2: In2 trip Bit 3: Panel button test trip Bit 4: Input test trip Bit 5: Remote command trip Bit 6: Aux trip
F17	Unsigned integer - Relay operation status. Bit 0: Latch status (0=manual/latched, 1=auto/unlatched) Bit 1: Failsafe function (0=No, 1=Yes)
F18	Unsigned integer - Input reset option. Bit 0: Alarm reset Bit 1: Trip reset Bit 2: Output contact reset
F19	Unsigned integer - remote command. High byte: 1: Reset alarm/trip 2: Acknowledge alarm/trip 3: Reset display to default menu page 6: Remote trip 10: Delete alarm record Low Byte: For high byte=3, set to display page 0-3, refer to section 4.1 for the page assignments, . For high byte=10, 0=delete all record, n=delete record n

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