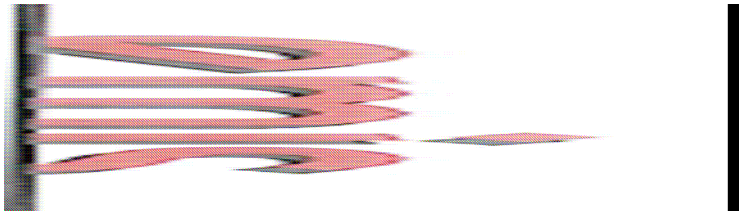

SALES 2002 (Pty) Ltd
Reg. Nr 2002/021650/07

becker
MINING SYSTEMS

EMIS ProLoc II
Motor Protection Relay

User Manual

Revision 2b
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1. Abstract

The ProLoc II relay is an ISO9001:2008 compliant local designed and manufactured three phase motor protection relay. The ISO registration covers the Quality Management System for the design, development, manufacture, distribution and repair of electronic motor protection relays.

The ProLoc II relay is a micro-controller based precision instrument with protection, control logic, starter logic and communication functions. It is designed for the low voltage motor protection market and is available in different current models. The current transformers are integrated into the relay while the core balance current transformer is external. External interposing current transformers can be used to extend the operating range from 100 to 400A.

The relay is fully configurable with the aid of front-end software or a man machine interface unit (MMI). Event records can also be down loaded via the MMI (iRDA -infra red link) for further analysis. All the settings are password protected. The relay has an on board database where time and date stamped event and fault records are kept. The event records are read only while the fault records are granted full access rights. The front-end is also equipped with a data recorder which could be used to monitor motor performance.

The relay detects earth leakage currents with the aid of the external core balance current transformer and is configurable to operate in inverse definite minimum time (IDMT) or instantaneous definite time (IDT) mode.

The relay is packed with useful control features and starter logic. The control logic consists of timers, logic functions, real time clock, latch and comparators. Two starter types are also selectable namely: Direct On Line and Forward / Reverse. Prestart warning and spin back timers are standard features. The relay and the MMI together provide the full functionality with four digital field inputs and five relay outputs (potential free change over contacts).

A unique useful feature is added to the relay in the form of simulation. This feature could be used for process modeling, training or relay functionality testing.

2. Specifications

2.1 Measurements

2.1.1 Current

- Three phase current
- Range: 1 Amp to 50 Amps (internal CTs)
- Models: PL 1 (1 Amp), PL 5 (5 Amp), PL 25 (25Amp) and PL 50 (50 Amp).
- Dynamic range: 0% to 1000%
- Interposing CTs can be used together with models PL 1 and PL 5 to extend the operating range of the relay.

2.1.2 Voltage

- Range: 110v, 380v, 400v, 525v, 550v, 680v, 950v and 1k1v (For 1k1v an additional attenuator circuit is required)
- Range selection: Manual or Automatic selection at power up. (Automatic range selection only for 110v, 400v and 525v)

2.1.3 Frequency

- Range: 40Hz to 70Hz

2.1.4 Power Factor

- Range: 0 to 100% leading / lagging

2.1.5 Power Dissipation

- Type: Apparent power and real power (calculated from measured voltage and current values – only displayed on front-end)
- Range: 0 to 420 kVA / kWatt
- Resolution: Steps of 100 VA / Watt

2.1.6 Earth Leakage

- Range: 30mA to 3 Amps
- Trip time delay: Inverse Definite Minimum Time (IDMT) / Instantaneous Definite Time (IDT)

2.1.7 Real Time Clock

- 24 hour clock (Year, month, date, hours and minutes)

- Battery backup (5 days by a 1 Farad super capacitor)
- Time and date stamping (Fault and event records)

2.1.8 Breaker Fault Clearance Time

- Measurement range: 10 ms to 1000ms
- Resolution: 10ms.

2.1.9 Insulation Resistance

- Measurement range: 1 to 199 kOhm
- Resolution: 1 kOhm steps.

2.1.10 Digital Field Inputs

- Optical isolated on the MMI unit (4x)
- Input voltage: 24 – 230Vac/dc.

2.2 Protection Features

(All resets are subjected to sufficient thermal capacity gain and reset authorization.)

2.2.1 Over Current (Overload) Detection

- Curve class settings: 3 to 40 seconds
- IEC 60255-8 specification
- Motor full load setting (MLC): 2% to 100% (on front panel)
- Reset: Manual or three automatic resets per hour (when selected)
- Reset threshold setting: Fixed at 70% thermal capacity or dynamic threshold adjustment determined over 10 last restarts.

2.2.2 Undercurrent (Minimum load) Detection

- Trip level adjustment: 10% to 100% (on front panel)
- Selection: Current level or power factor
- Trip delay time: 1 to 10 seconds
- Start-up delay: 1 to 200 seconds (To facilitate pump priming)
- Reset time: Manual or 10 seconds to 6 hours (9 steps)
- Feature selectable

2.2.3 Unbalance Phase Currents Detection

- Trip level adjustment: 0 to 50%

- Trip delay time: 1 to 10 seconds
- Feature selectable
- Reset: Manual

2.2.4 Single Phasing (Phase lost) Detection

- Trip delay time: 1 second fixed
- Feature selectable
- Reset: Manual

2.2.5 Run-Stall Detection

- Stall current trip level adjustment: 110% to 300%
- Stall trip delay time: 0 to 120 seconds adjustable
- Feature selectable
- Reset: Manual

2.2.6 Vectorial-Stall Detection

- Trip: Static or decreasing power factor
- Trip delay: 33% of curve class setting.
- Feature selectable
- Reset: Manual

2.2.7 Starts per Hour Control

- Starts setting: 1 to 30 starts adjustable
- Consecutive starts: 1 to 3 starts per interval adjustable
- Feature selectable
- Reset: Automatic

2.2.8 Short Circuit Detection

- Articulated detection: If (I_{LOAD} > 950% and Power factor < 85%) or (I_{LOAD} > 300% and Power factor > 85%)
- Trip delay time: 1 second fixed
- Reset: Manual

2.2.9 Voltage Symmetry Detection

- Trip delay time: 10 seconds fixed
- Trip level adjustment: 70% to 100%
- Feature selectable

- Reset: Manual

2.2.10 Overvoltage Detection

- Trip delay time: 10 seconds fixed
- Trip level: Factory settings
- Feature selectable
- Reset: Manual

2.2.11 Under Voltage Detection

- Trip delay time: 10 seconds fixed
- Trip level: Factory settings
- Feature selectable
- Reset: Manual

2.2.12 High or Low Frequency Detection

- Trip delay time: 10 seconds fixed
- Trip level: Factory settings (45Hz to 55Hz)
- Feature selectable
- Reset: Manual

2.2.13 Voltage Phase Rotation

- Detection only while motor is not running with phase voltages present
- Trip delay time: 400ms
- Auto reset once fault is fixed
- Feature selectable (forward, reverse, none)

2.2.14 Insulation Failure Detection

- Detection: Only in static state (motor not running)
- Trip delay time: 1 second fixed
- Trip level: Resistance < 20 kOhm (fixed)
- Feature selectable
- Reset: Manual

2.2.15 Breaker Failure (Vacuum loss) Detection

- Detection: Only in static state (motor not running)
- Trip delay time: 1 second fixed
- Trip level: Leakage resistance < 1M Ohm

- Reset: Automatic on power up

2.2.16 Earth Leakage Detection (I_{EL} < 2A)

- Selection between Instantaneous Definite Time or Inverse Definite Minimum Time.
- Instantaneous Definite Time (100 ms ≥ t ≥ 1000 ms), (50 ms steps)
- Inverse Define Minimum Time (t ≥ 130 ms)
- Harmonic filtering (suitable for variable speed drives and soft starters)
- Trip level: Adjustable
- Feature selectable
- Reset: Manual

2.2.17 Earth Fault Detection (I_{EL} ≥2A)

- Harmonic filtering (suitable for variable speed drives and soft starters)
- Trip delay time: 1 second fixed
- Trip level: 2A fixed
- Feature selectable
- Reset: Manual

2.3 Control logic

- Configurable inputs can be connected with signals listed in the table below:

Zero ('0')	RunStall_tf	TripFlag	! LogicFunc_6	DigFld_Inp_3
One ('1')	I_Unbal_tf	TmrA_Mon	Restart	! DigFld_Inp_3
InService	SinglePhase_tf	! TmrA_Mon	StatusReporter	DigFld_Inp_4
! InService	EarthFault_tf	TmrA_Bi	Flasher	! DigFld_Inp_4
VoltPresentF	EarthLeak_tf	! TmrA_Bi	Comp_A_Hi	Starter_OP_1
OverCrnt_af	MinLoad_tf	TmrB_Mon	! Comp_A_Hi	Starter_OP_2
ShortCirc_af	OverVolt_tf	! TmrB_Mon	Comp_A_Win	Starter_OP_3
RunStall_af	UnderVolt_tf	TmrB_Bi	! Comp_A_Win	Starter_OP_4
I_Unbal_af	VoltSym_tf	! TmrB_Bi	Comp_A_Lo	PLC_bit 0
SinglePhase_af	HiFreq_tf	RTClock	! Comp_A_Lo	PLC_bit 1
EarthFault_af	LoFreq_tf	! RTClock	Comp_B_Hi	PLC_bit 2
EarthLeak_af	InsuLockOut_tf	LogicFunc_1	! Comp_B_Hi	PLC_bit 3
MinLoad_af	VacuumLoss_tf	! LogicFunc_1	Comp_B_Win	PLC_bit 4
OverVolt_af	PhaseRot_tf	LogicFunc_2	! Comp_B_Win	PLC_bit 5
UnderVolt_af	StartsPerHr_tf	! LogicFunc_2	Comp_B_Lo	PLC_bit 6
VoltSym_af	FrozenCntct_tf	LogicFunc_3	! Comp_B_Lo	PLC_bit 7
HiFreq_af	System_tf	! LogicFunc_3	Latch	Pulse Gen
LoFreq_af	Execution_tf	LogicFunc_4	! Latch	! Pulse Gen
InsuLockOut_af	FeedBack_tf	! LogicFunc_4	DigFld_Inp_1	
VacuumLoss_af	UnAuthCrnt_tf	LogicFunc_5	! DigFld_Inp_1	
OverCrnt_tf	E_Stop_tf	! LogicFunc_5	DigFld_Inp_2	
ShortCirc_tf	ExtStop_tf	LogicFunc_6	! DigFld_Inp_2	

2.3.1 Timers

- Timer A and Timer B
- Time setting: 0 to 50 minutes
- Start input: Configurable (Positive edge detected)
- Reset / Inhibit input: Configurable (Level detected)
- Output: Mono stable and bi stable outputs

2.3.2 Real Time Clock (24 Hour)

- Start time: Hours and minutes configurable
- Stop time: Hours and minutes configurable

2.3.3 Logic Function Blocks

- Logic function 1, 2, 3, 4, 5 and 6
- Three fully configurable inputs per logic function block
- Sum of product or product of sums operation

2.3.4 Latch

- Set input: Configurable (Positive edge detected)
- Reset input: Configurable (Level detected)

2.3.5 Comparators

- Comparator A and B
- Input signal selector: Load current / Power factor / Thermal capacity / Current unbalance / Voltage symmetry
- High level setting (1 – 99%)
- Low level setting (1 – 99%)
- Output signals: High level, Window (inside) and Low level

2.3.6 Emergency Stop

- Input: Configurable (Negative level detected – active low)
- Function: Detected as a non mask able fault condition

2.3.7 Status Reporter

- Function: Detects operation status of the relay and output pulse / state sequence according to condition.
- Output:

2.3.8 Pulse Generator

- Function: Generates a pulse with variable duty cycle and period settings.
- Adjustment: Duty cycle - 1 to 99%. Period – (1 to 99 minutes)

2.3.8 Relay 1 and 2 (On the ProLoc relay)

- Input: Configurable (Protection relay mode: Relay 1 is Main Trip Relay)
- Single set of potential free switch-over contacts

2.3.9 Relay 3, 4 and 5 (On the ProLoc MMI)

- Input: Configurable
- Single set of potential free switch-over contacts

2.4 Starter Logic

2.4.1 Starter Types

- Range: Configurable - Protection relay, Direct On line starter and Forward / Reverse starter.

2.4.2 Starter Input

- Inputs: Configurable – Feedback, Start, Stop and Interlock

2.4.3 Starter Outputs

- Outputs: Starter_OP_1 to Starter_OP_4 (The outputs are assigned to Prestart warning, Main, Forward, Reverse and Backspin depending on the starter type that was selected).

2.5 Communication Interface

2.5.1 Protocol: None, Profibus and Modbus.

2.5.2 Communication address: 1 to 126

2.5.3 Baud rate: 1200 b/s to 38400 b/s. (Applicable to Modbus)

2.6 Statistical Data Capturing

2.6.1 Running hours: Adjustable (0 to 65535 hours)

2.6.2 Start-up counter: Adjustable (0 to 65535)

2.6.3 Trip counter: Adjustable (0 to 65535)

2.6.4 Power consumption counters: Resettable (0 to 65535)

- Apparent power consumption measured in KVAh
- Real power consumption measured in kWatt.h

2.7 Trip Fault Recording

2.7.1 Database capacity: 50 last faults

2.7.2 Trip fault record content:

- Status: (Actual / simulated)
- Date: Year, month, date
- Time: Hour, minute
- Fault description
- Run hours
- Max trip current
- Minimum trip voltage
- Breaker fault clearance time.

2.8 Event Recording

2.8.1 Database capacity: 1764 last events

2.8.2 Event record content:

- Status: Actual, Simulated, Settings adjust, Power up, Calibration
- Date: Year, month, date
- Alarm flags
- Trip flags
- Run hours
- Max trip current

- Min trip voltage

2.8.3 Down load control:

- Last events: 1 to 1764 selectable for down load.
- Quick event viewer (last 200events)
- Front-end will creates a spread sheet type of file (Viewable with MS Excel ™ or equivalent software)

2.9 Physical dimensions

2.9.1 Size of foot print: 100mm x 60mm (DIN Rail mount / screw fix mount)

2.9.2 Length: 150 mm

2.9.3 Mass: 425 gram

2.10 Auxiliary power supply

2.10.1 Voltage requirements: 110 Vac ± 10% or 230 Vac ± 10%

2.10.2 Power requirements: 2,2 Watt

2.11 Operating environment

2.11.1 Temperature: 0 – 50° Celsius

2.11.2 Relative humidity: < 85%

3. Definitions and Terminology

Apparent power consumption	The amount of energy consumed over a period of one hour. It is expressed in kV.A.h.
Apparent power dissipation	$P = \sqrt{3} \times V_L \times I_L$ kVA.
Breaker clearance time	It is the time taken by the breaker to clear the fault by interrupting the supply current to the motor. It can be seen as breaker response time and is useful information for breaker maintenance.
Consecutive starts	The amount of starts allowed during a time interval created by the starts per hour setting. (See also starts per hour)
Core balance current transformer	A current transformer used to detected possible current leakage to earth from one or more of the phases. (Earth leakage detection)
Earth fault	It is leakage current above 2 amps and a severe form of an earth leakage condition. (See also core balance current transformer)
Earth leakage fault	It is leakage current up to 2 amps exceeding a trip level setting. (See also core balance current transformer)
Full load current	Current drawn by the motor at full load operation (90% to 100%)
IDMT	Inverse Definite Minimum Time (Calculated earth leakage trip time)
IDT	Instantaneous Definite Time (Earth leakage fixed trip time selection)
In Service	Phase current above 10% of full load current
Interposing current transformer	Primary C.T. current = CT Ratio x Model number. (If a CT with a ratio of 100:5 and a KE 1 relay is used together the primary current is: 100 / 5 x 1 = 20 Ampere)
Isolation lockout / Insulation failure	The insulation resistance of the motor is measured while in a static (not in service) condition. If the resistance drops below 20 kOhm the relay will trip and will prevent a start.
MMI	It is a man machine interface unit that could be mounted on the door of the cubical. It is equipped with a display screen and push buttons. It enables the operator to view actual parameters, settings and change settings. The push buttons enable the operator to select and change settings according to requirements.
Motor full load setting (MLC)	Adjustment of the relay current sensitivity. This is where the current level measurement is adjusted to read just below 100% when the motor operates at full load.
Non volatile memory	It is memory that will maintain data even when power is switched off for long periods. (see also volatile memory)

Over current (Overload)	Current level above 100% of full load current
Phase rotation	Normal phase rotation is Red, white and blue. Reverse rotation is blue, white and red.
Power factor %	It is die relationship between real power and apparent power Power factor % = $((1.7321 \times V_L \times I_L \times \text{Cos}\varnothing) / (1.7321 \times V_L \times I_L)) \times 100\%$ Power factor = Cos$\varnothing$
Reactive power dissipation	It is the difference between apparent power dissipation and real power dissipation. (It could be seen as power lost)
Real power consumption	Same as apparent power consumption but with power factor taken into account.
Real power dissipation	$P = \sqrt{3} \times V_L \times I_L \times \text{Cos}\varnothing$ kWatt.
Run-Stall	The motor went through the normal start procedure and the current level return to normal full level. If the rotor jam and the current rise above the stall setting (110% to 300%) then it is recognized as a Run-Stall fault condition.
Starts per hour	Starts per hour define the time interval in which a restricted amount of starts are allowed. (See also consecutive starts)
Thermal capacity	It is a temperature related quantity expressed in percentage, which also takes in consideration the physical size, mass, construction, type of material used etc. of the motor. It is normally indicated as capacity used unless otherwise stated.
Undercurrent (Minimum load)	Current level when motor run at no load condition or below acceptable threshold.
Vacuum loss (Breaker failure)	It is a condition in which one of the contactor poles fails to open or has a high resistance leakage path across the contactor pole when the contactor is de energized. The full phase voltage will appear on one of the output socket pins this can result in a flash over to earth when the operator withdraws the plug from the socket. It is a hazardous condition and could cause fatal accidents.
Vectorial-Stall	It is detected during the start-up procedure of the motor. A motor normally start-up with a low power factor and gradually improve it as full speed is approached. If no power factor improvement (increase) is detected for longer then 33% of the curve class time the motor is tripped to prevent thermal and mechanical damage.
Volatile memory	It is memory that will not retain data during a power supply inter-ruption. (see also non volatile memory)

4. Functional Description

The ProLoc Mk2 relay is controlled by a micro-controller. The three phase currents, voltages and earth leakage current are detected by current transformers, attenuator circuits and a core balance current transformer respectively. The current and voltage signals are conditioned by appropriate analogue circuits and converted to 0 to 5 volt analogue signals. The analogue signals are digitized to 10 bit resolution.

The micro-controller has non volatile and volatile memory. The non volatile memory contains a boot loader program which is used to upload the system software program of the relay. The uploading is done from a personal computer or laptop via the RS232 port. This feature also enables the user to do future software upgrades without factory assistance.

Front-end software is included that runs on MS Windows™. The RS232 port is used as the communication port. The purpose of the front-end is to configure and select the required functionally of a specific application. The setup adjustments required at the installation phase will be discussed in the next chapter dealing with installation instructions.

The relay will monitor the parameters of the motor for the duration of auxiliary power supply. The auxiliary power supply is selectable (110Vac or 230Vac). When a trip condition occurs, the main trip relay is activated. It will be energized or de-energized (non fail save or fail save respectively) depending on what mode of operation that was selected. A time and date stamped trip record is also generated and saved in non volatile memory for later retrieval. Memory space for 60 trip records is allocated. The layout of the trip record is discussed in chapter 2 (specifications).

Event records are also time and date stamped. It is more comprehensive and saved in non volatile memory. Only read access rights are given to the user. This information could be used in the event of insurance claims and liability cases. The layout of the event record is discussed in chapter 2 (specifications).

Six fault indication light emitting diodes (red) are placed on the front panel. The green light emitting diode will come on only if the relay is in a healthy state. A healthy state signifies that the motor could be static or in operation within it’s save operating parameters. The fault indications are displayed on the front panel as follows:

Name of Fault	**Indication LED used**	**Display mode**
Over current	Overload	Solid on
Short circuit	Overload	Solid on
Minimum load	Min Load	Solid on
Phase Rotation	Phase Rotation	Solid on
Unbalance Phase Currents	Unbalance	Solid on
Single Phasing	Unbalance	Solid on
Insulation Failure	Insulation failure	Solid on
Vacuum loss (beaker fail)	Insulation failure	0,5 sec on, 0,5 sec off
Run-Stall	Overload	Solid on
Vectorial-Stall	Overload	Solid on
Earth leakage	Earth leakage	Solid on
Earth fault	Earth leakage	Solid on
Over voltage	Phase rotation	3 sec on, 1 sec off
Under voltage	Phase rotation	1 sec on, 3 sec off
Voltage symmetry	Phase rotation	1 sec on, 1 sec off
Starts per hour	Overload & Healthy	Both 1 sec on, 1 sec off
High frequency	Unbalance	3 sec on, 1 sec off
Low frequency	Unbalance	1 sec on, 3 sec off
Emergency stop	• Unbalance MinLoad Overload • Phase Rotation Insulation failure Earth Leakage	0,5 sec on, 0,5 sec off 0,5 sec off, 0,5 sec on
System failure	Relay Healthy	0,5 sec on, 0,5 sec off
Execution fault	• Unbalance • MinLoad • Overload	0,5 sec on 0,5 sec on 0,5 sec on, off
Feedback fault	• Overload • MinLoad • Unbalance	0,5 sec on 0,5 sec on 0,5 sec on, off
Unauthorized current	• Unbalance Earth Leakage • Overload Phase rotation	0,5 sec on, 0,5 sec off 0,5 sec off, 0,5 sec on

The reset button is used to acknowledge and reset trip faults. A reset will only take affect if sufficient thermal capacity is regained during the cooling period, no phase current flows and the reset is authorized (see - master reset, reset mask and dongle key) . If the reset button is pressed during the cooling cycle the Overload LED will start flashing (1 second on, 1 second off) to signify cooling. Once the required thermal capacity level is reached, the relay will reset.

The real time clock is running from a super capacitor which is continuously charged by the auxiliary power supply. The real time clock should be able to run for another 5 days without the presence of the auxiliary supply. The real time clock provides time and date for record keeping and also participates in the control functions.

In protection relay mode:
Relay 1 = Main Trip Relay (not configurable)
Relay 2 to 5 = Configurable (available to participate in control operation)

In starter mode (Direct On Line or Forward / Reverse):
Relay 1 to 5 = Configurable (available to participate in control operation)

Only Relay 1 and Relay 2 are on the relay while Relay 3,4 and 4 are on the MMI. The digital field inputs are also on the MMI unit.

5. Installation Instructions

5.1 Front-end requirements

A Pentium personal computer or laptop is required to setup the ProLoc relay. The computer must be equipped with a RS232 port. If only USB ports are available an USB to RS232 converter should be used. The operating system software requirement is MS Windows 2000, MS Windows XP or later versions. The front-end software is free but remains the property of NewElec (Pty) Ltd. It is supplied with the purchase of new relays.

5.2 Setup procedure of the relay

Once the wiring has been done and checked by qualified personnel, the relay is ready to be configured. The two most important front-end screens is the settings (diagram 6.4) and control logic screen (diagram 6.5). These two screens enable the user to set parameters, select protection functions and determine control strategy. These two screens are also linked and when settings are saved to disk or retrieved from disk.

When setting changes are made it has to be transmitted to the relay to become effective. Changes on the control logic screen can only be made when off line is selected. When on line is selected again, the settings are transmitted to the relay. Relays are shipped to the user with a set of default settings and may be appropriate in some cases.

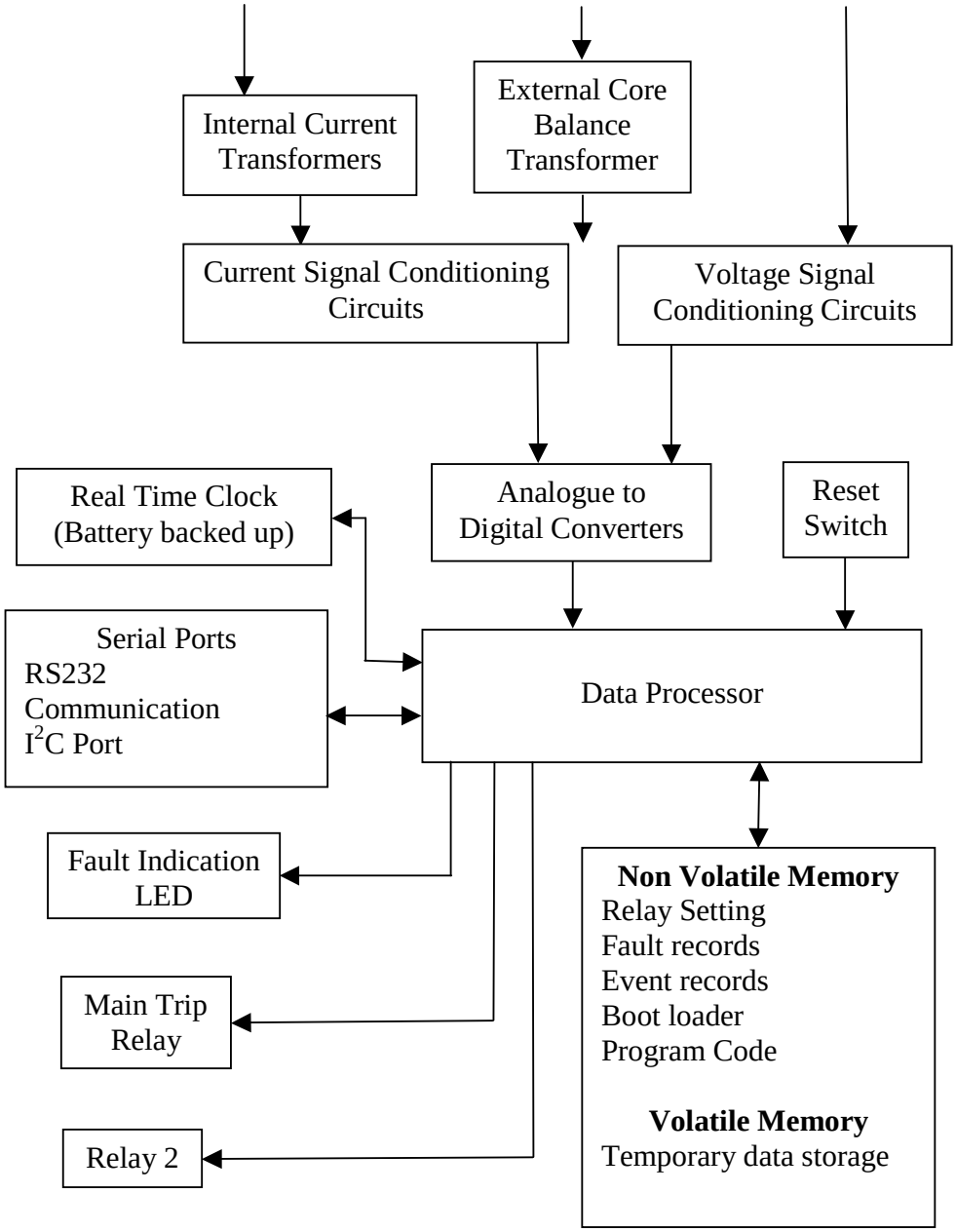
To determine the full load current setting the motor has to be started and allowed to run at full load capacity. Use the front-end software and go to settings. Select a MLC value (motor full load setting) that will allow a load current level of 90 to 95%. The minimum load setting adjustment (motor run with no load) is done in a similar way. The option is provided to use a current trip level or a power factor trip level. Motors with no load tend to run at a lower load current and a lower power factor. Power factor is in most cases more desirable due to better sensitivity. (Hint: MLC and Curve Class settings could also be calculated with the calculator)

The real time clock should be checked and adjusted to the correct time setting. The fault history can also be erased to start afresh.

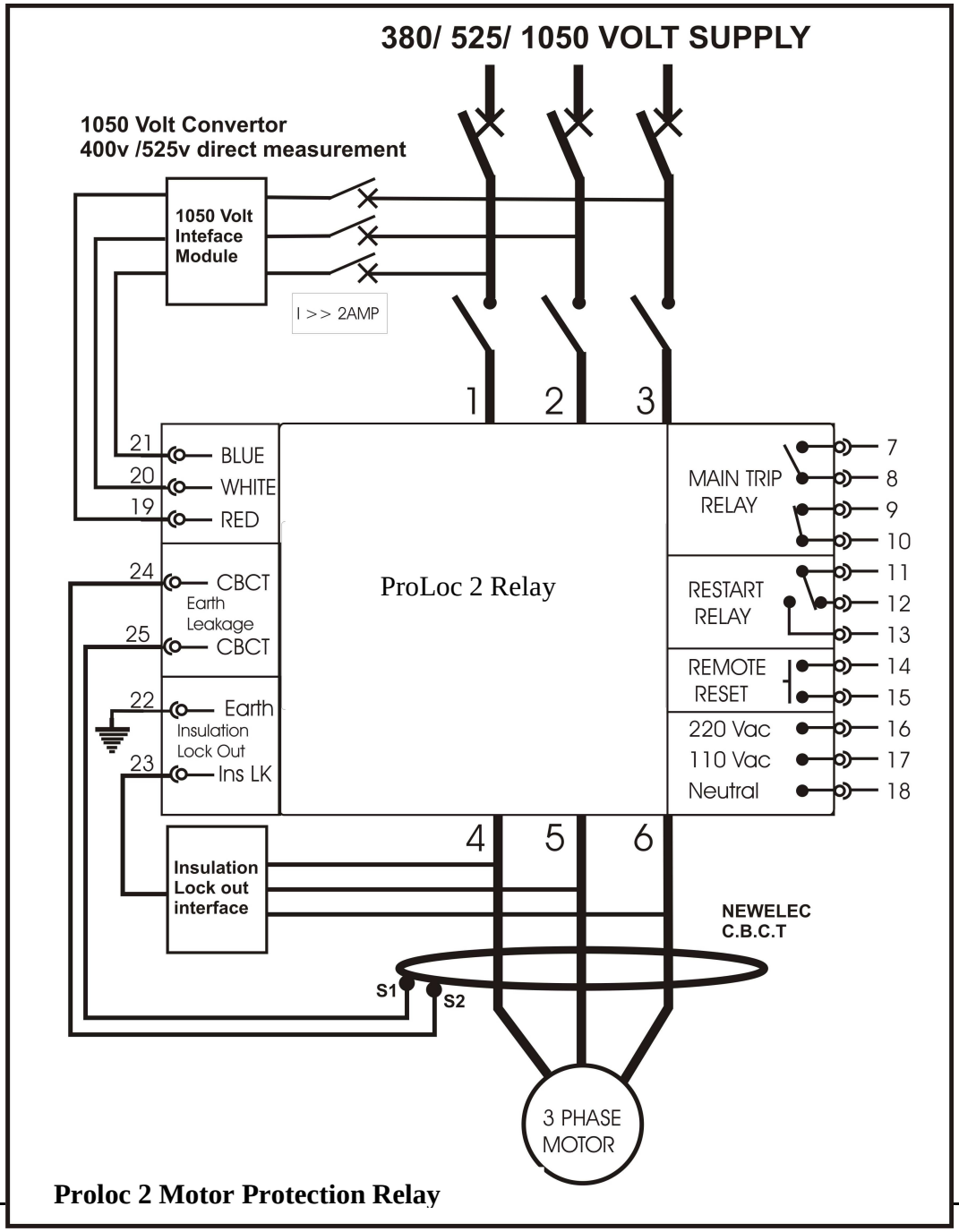
6. Diagrams

6.1 Physical layout of the ProLoc Relay

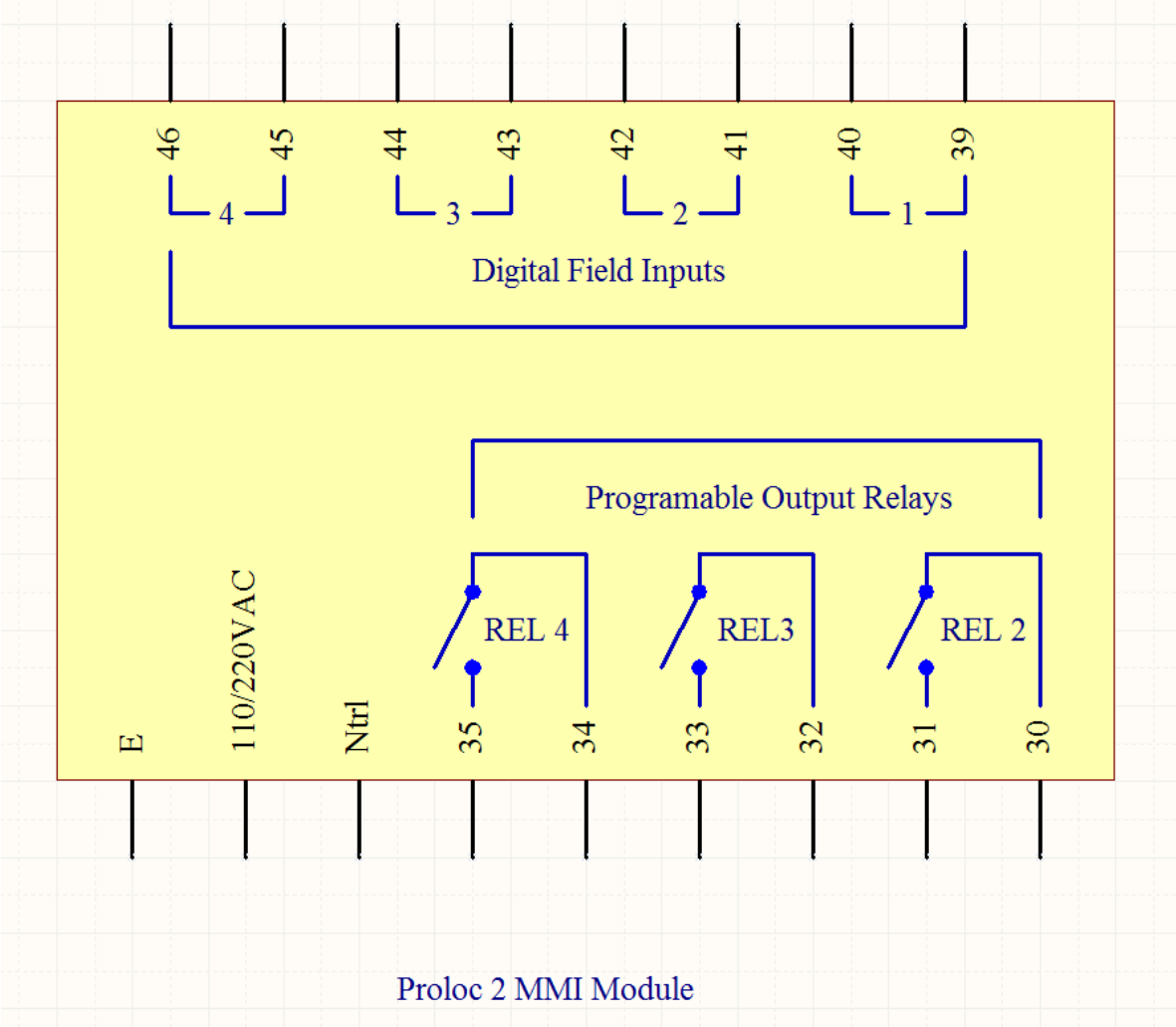
6.2 Block diagram of the ProLoc-Relay



6.3 Wiring diagram of the ProLoc II Relay

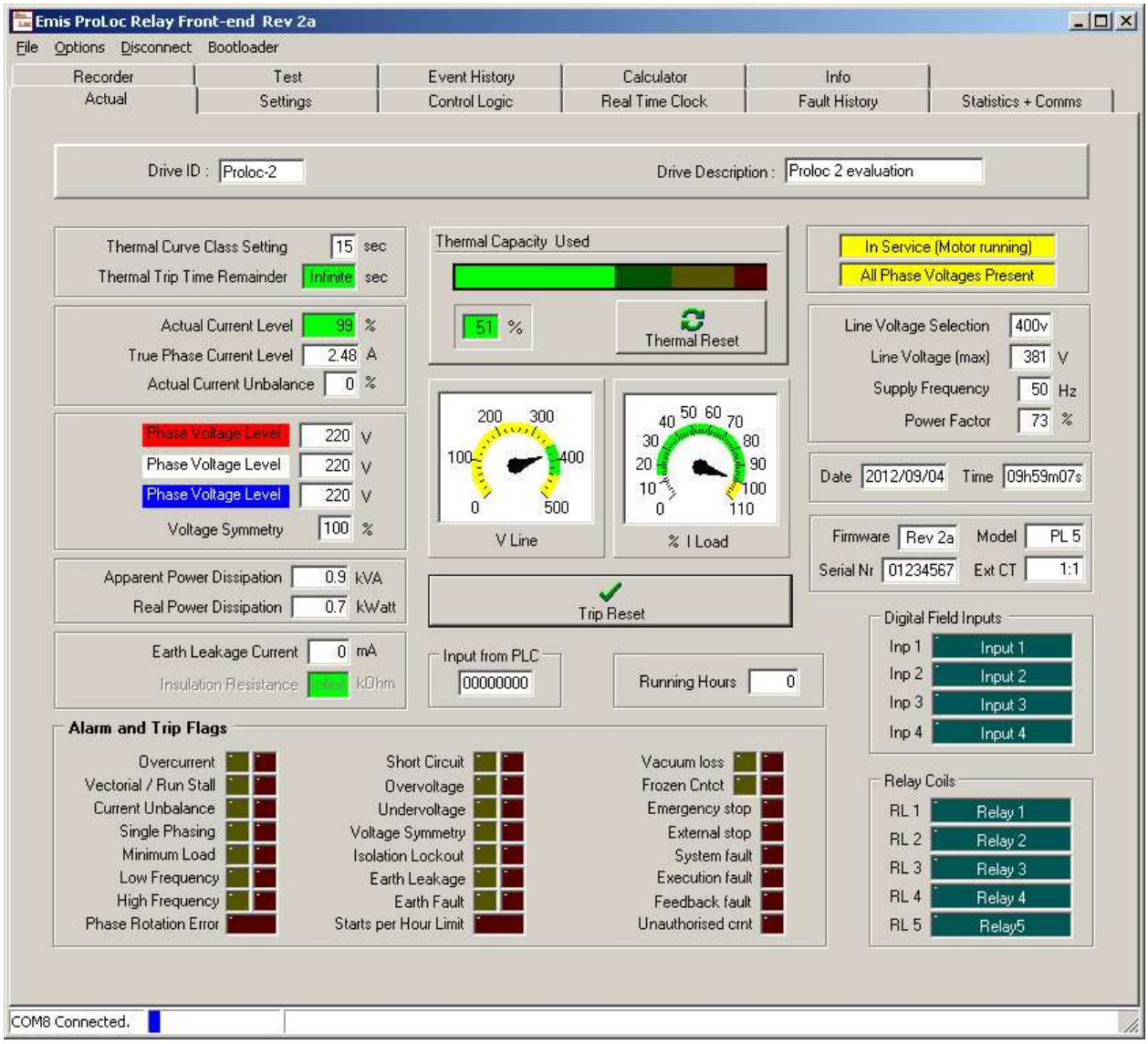


Proloc 2 Motor Protection Relay

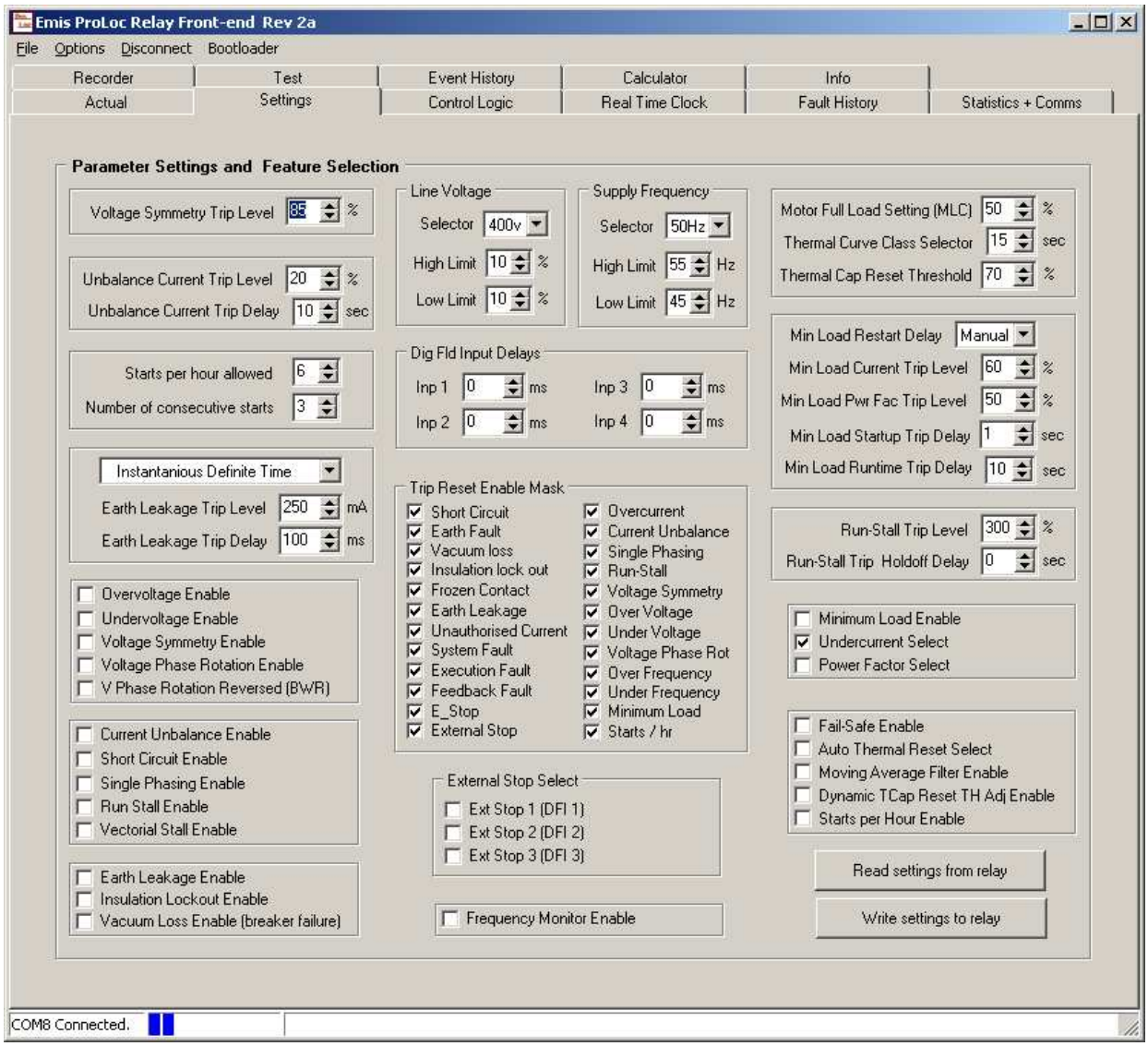


Proloc 2 MMI Module

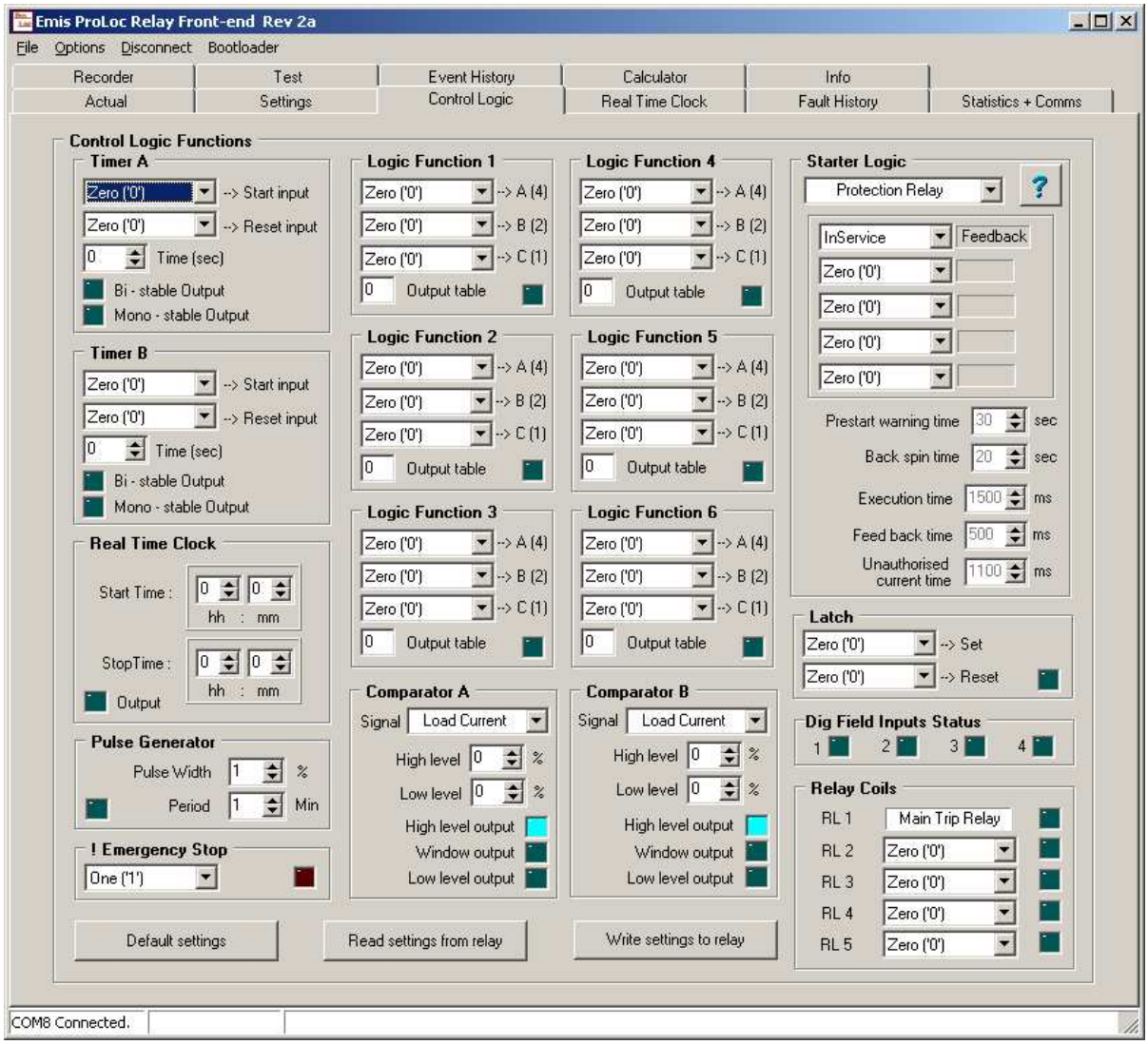
6.4 Front-end Actual Screen



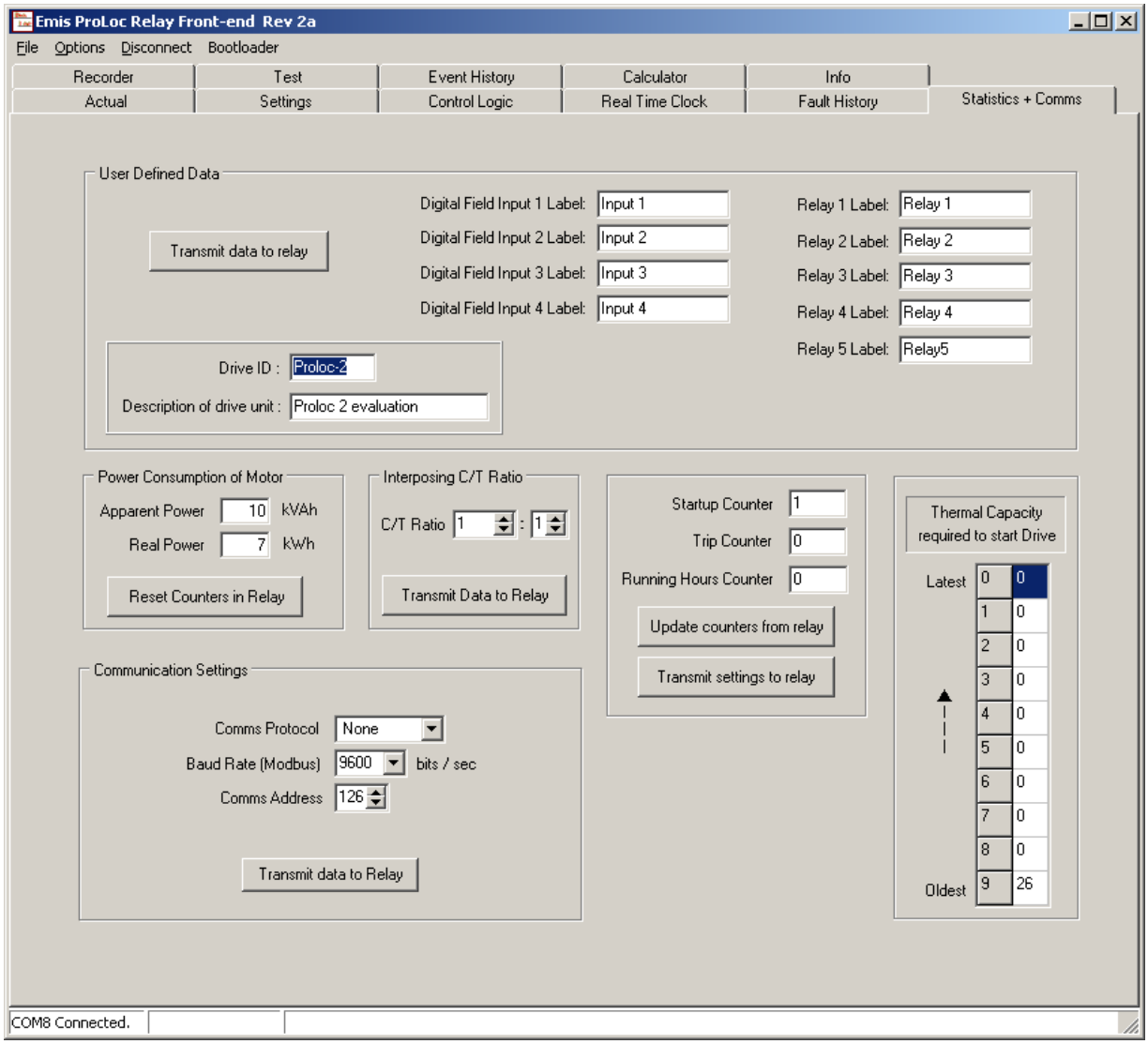
6.5 Front-end Settings Screen



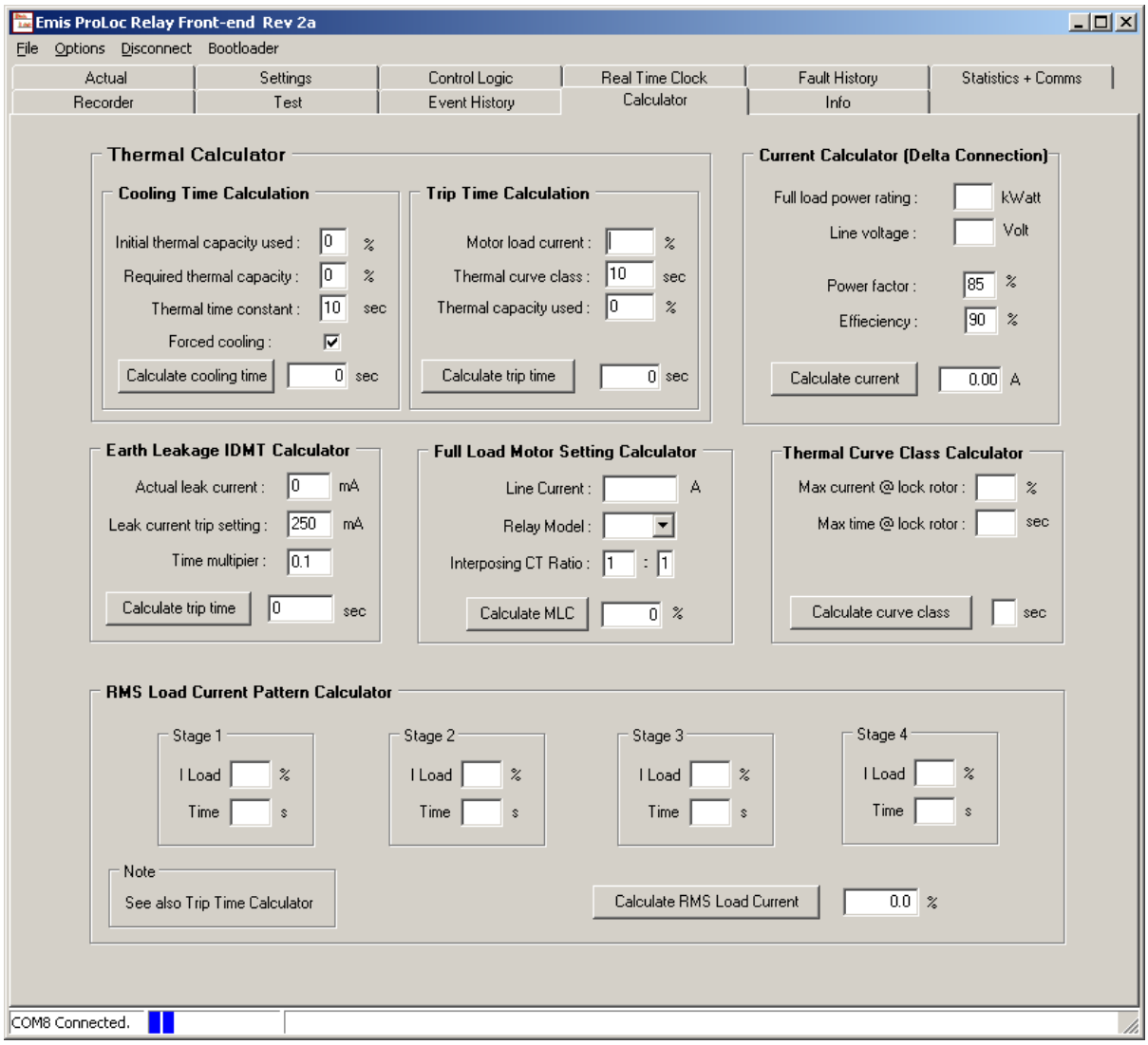
6.6 Front-end Control Logic Screen



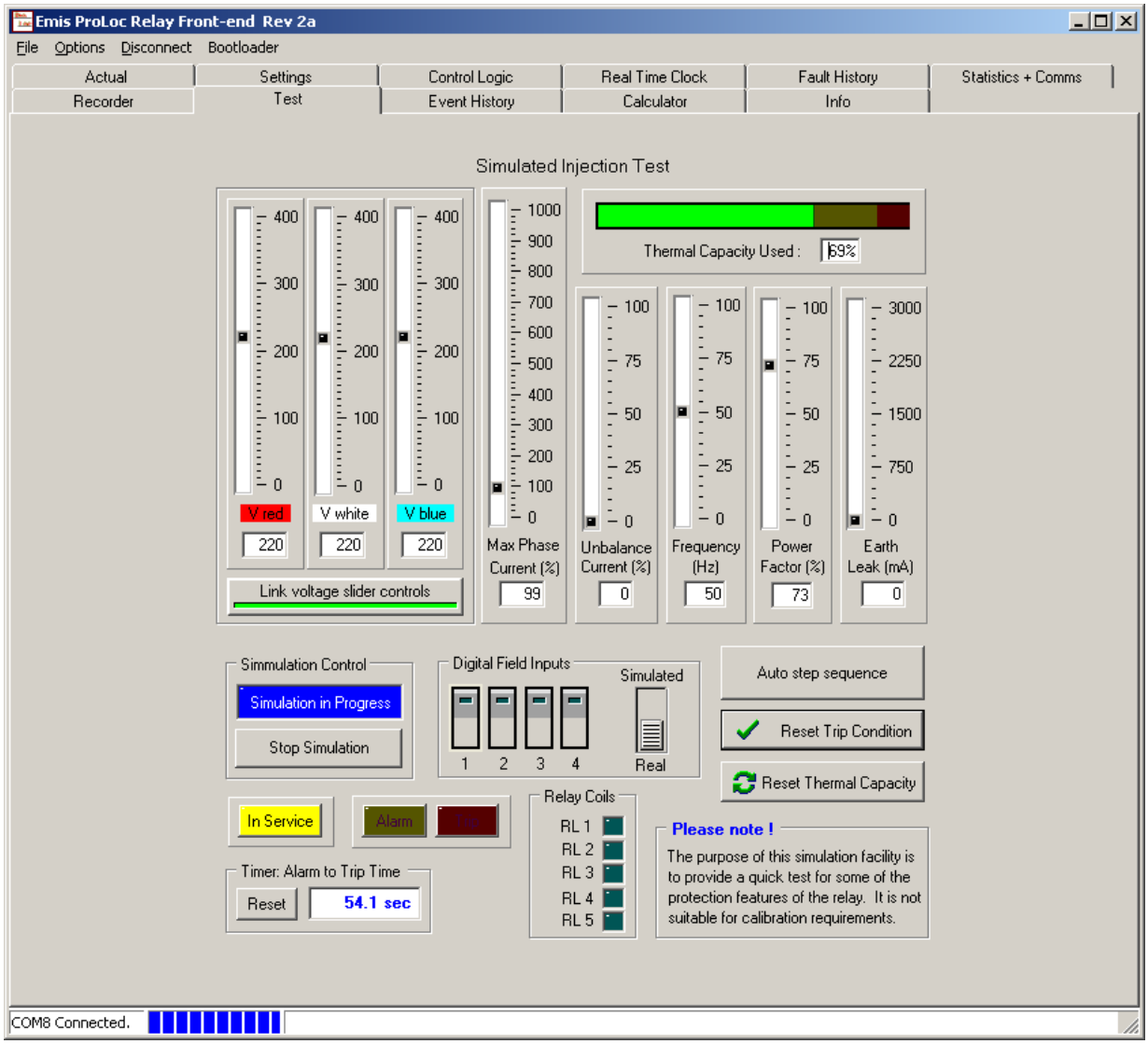
6.7 Front-end Statistics Screen



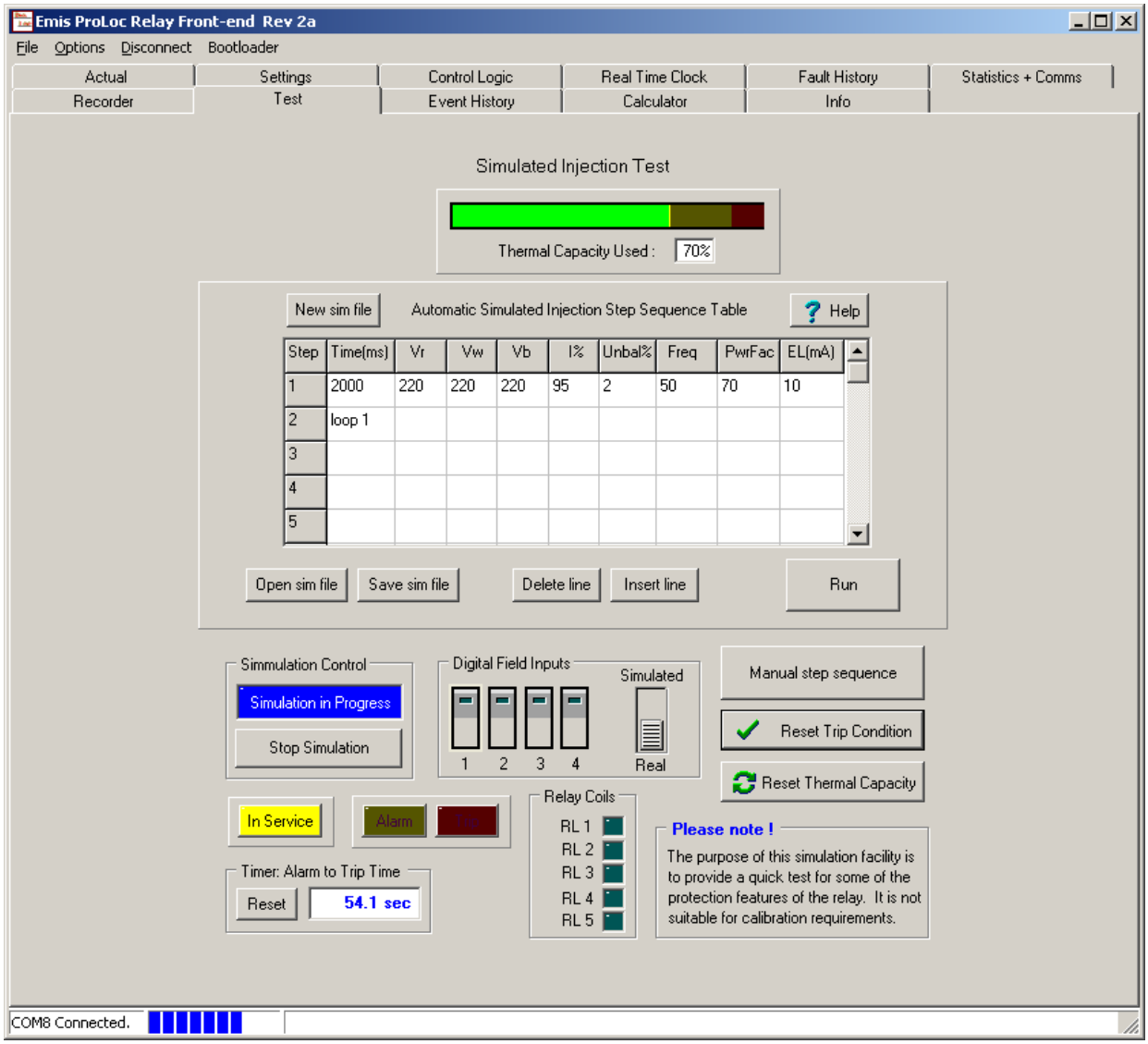
6.8 Front-end Calculator Screen



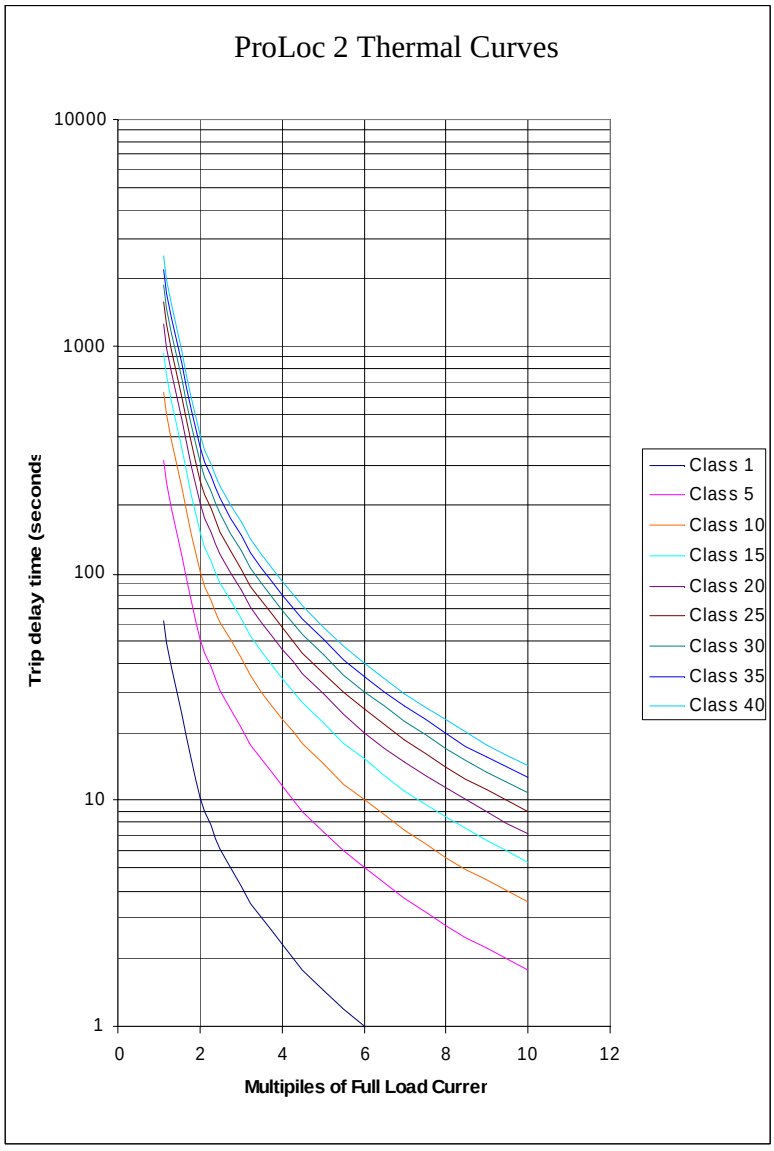
6.9.1 Front-end Test Screen (Manual Control)



6.9.2 Front-end Test Screen (Automatic Control)



6.10 Relay Trip Times



6.11 Relay setting ranges and default settings

Parameter	Settings Range	Factory Default
Unbalance Current Trip Level	5 to 50%	15%
Unbalance Current Trip Delay	1 to 10 seconds	10 seconds
Run-Stall Trip Level	110 to 300% I fl	300%
Run-Stall Trip Level Trip Hold Off Delay	1 to 10 seconds	0 Sec
Voltage Symmetry Trip Level	85 to 100%	85%
Line Voltage Selector	110; 380; 525 or 1000 V a.c	Auto
Earth Leakage Curve Selection	DMT OR IDMT	DMT
Earth Leakage Trip Level	30 to 1000 mA	250 mA
Earth Leakage Trip Delay	100 ms to 1 second	150 ms
Thermal Curve Class Selector	5 to 40 seconds	15 seconds
Thermal Capacity Reset threshold	10 to 50 %	70%
Minimum Load Trip Level	10 to 100%	33%
Minimum Load Start Up Trip Delay	1 to 200 seconds	1 second
Minimum Load Run Time Trip Delay	1 to 10 seconds	10 seconds
Starts per hour allowed	1 to 30	6
Number of consecutive starts allowed	1 to 3	3

Feature Selection	Factory Preset
Overvoltage Disable	No
Undervoltage Disable	No
Voltage Symmetry Disable	No
Voltage Phase Rotation Disable	No
Reverse Voltage Phase Rotation BWR	No
Current Unbalance Disable	No
Short Circuit Disable	Yes
Single Phasing Disable	No
Run Stall Disable	No
Vectorial Stall Disable	No
Frequency Monitor Disable	Yes
Fail Safe Disable	No
Low Pass filter Disable	No
Dynamic T Cap Reset / Th adjust disabled	Yes
Starts per hour disabled	Yes
Earth Leakage Dissable	No
Isolation Lockout Disable	Yes
Minimum Load Disable	No
Under Current Selector	Yes
Power Factor Selector	No

6.14 MMI (Man Machine Interface)

7. Accessories

7.1 IrDA interface

This an infra red link that can be used in an intrinsically safe environment where isolation is required between the relay and external devices like remote display units (RDU), man-machine interface units (MMI), laptops etc.

The MMI has an infrared transmitter on board. It requires a receiver cable to connect it to a laptop. This is part number CAB 0103 , finished product code FPR 0201 having on one end the IRDA device and on the other end, an RS 232 female connection.

7.2 The MMI

In the case of the ProLoc relay the MMI is a necessary component of the protection system as it includes 3 programmable output relays and 4 digital inputs. The unit may be door mounted and requires an auxiliary supply of either 110 or 220 volt a.c . The ordering part number for the MMI is:

ProLoc 2 MMI FPR 0511

The MMI is supplied with a rear removable dongle [which, when inserted into the MMI allows full editing of the settings] , however if this is lost the ordering code for a new one is CAB 0027

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