KG/KH-RTU

User Manual

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1 Definitions, Conventions and Terminology

Term	Abbreviation	Description
Apparent power consumption	kVA.h	It is the amount of energy consumed. The power factor is not taken into account and is measured in kV.A.h
Apparent power dissipation	kVA	It is the product of voltage and current. The power is excluded and it is measured in kV.A
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)
Digital field input		A signal generated by an external switch that could have an effect on the relay operation depending on the logic configuration.
Earth fault	EF	It is leakage current above 2 amps to 30 amps and a severe form of an earth leakage condition. (See also core balance current transformer)
Earth leakage fault	EL	It is leakage current up to 2 amps exceeding a trip level setting. (See also core balance current transformer)
Full load current	In	Current drawn by the motor at full load operation (90% to 100%)
Fundamental harmonic frequency	f1	50Hz in South Africa and 60Hz elsewhere.
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	I> / OC	Current level above 100% of full load current
Phase rotation		Normal phase rotation sequence is red (L1), white (L2) and blue (L3). Reverse rotation sequence is blue, white and red.
Power factor	cosØ	It is die relationship between real power and apparent power Power factor % = ((V x I x cosØ) / (V x I)) x 100% Power factor = cosØ
Real power consumption	kW.h	It is the amount of energy consumed. The power factor is taken into account and is measured in kWatt.h
Real power dissipation	kW	It is the product of voltage and current. The power factor is included and it is measured kWatt.

Term	Abbreviation	Description
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%) it is recognized as a Run-Stall fault condition.
Running hours		The amount of time the motor was in an in-service state.
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	TC	It is a temperature related quantity expressed in percentage, which also takes in consideration the physical size, mass, construction, type of material etcetera used of the motor. It is normally indicated as capacity used unless otherwise stated.
Thermal curve class		It is the thermal curve derived from the unitary (one second) thermal curve. It is also the curve that goes through the points where maximum lock rotor current and maximum lock rotor time of the particular motor is specified.
Undercurrent	UC	Current level when motor run at no load condition.
Vectorial-Stall		It is detected during the startup procedure of the motor. A motor normally startup with a bad power factor and gradually improve it as full speed is approached. If no power factor improvement is detected for longer then 33% of the curve class time the motor is tripped to prevent thermal and mechanical damage.

2 Overview

Figure 2.0: KG/KH-RTU overview

The KG/KH-RTU Relay is an ISO 9001:2008 compliant, local designed and manufactured three phase motor protection relay. It is a micro-controller-based precision instrument with protection, advanced control features and starter logic. The relay is designed to cater for the low voltage motor protection and feeder supply market and is available in different current models.

The KG/KH-RTU Relay is fully configurable with the aid of front-end software or a man machine interface unit (MMI). Event records can also be downloaded with the aid of the front-end onto a memory stick for further analysis. All the settings are password protected. The relay has an on-board database where time and date stamped records are kept. Two types of records are kept namely fault records (208 last faults) and event records (882 events). In the case of event records, the user has limited access rights (read only). The front-end also has a data recorder and a spectrum analyser, which could be used to analyse motor performance and supplied power quality respectively. The spectrum analyser can detect harmonics up to the 31st harmonic on any of the three phase currents and voltages

A unique feature is added to the relay in the form of simulation. This function could be used for personnel training or relay functionality testing.

The relay offers a Modbus-RTU communication interface for two RJ11 connectors. The RJ11 connection point can be used to communicate to a PLC or the front-end.

Bluetooth connection can also be made from a smart device with Android. The KG/KH-RTU application is available from the Android Play Store. The KG/KH-RTU Application offer the same functionality as the front-end.

3 Technical Specifications

General Data	Dimensions (No MMI)	79 (W) mm x 141 mm (H) x 62 mm (D)
	Dimensions (With MMI)	79 (W) mm x 166 mm (H) x 62 mm (D)
	Auxiliary supply	85 Vac/dc ~ 264 Vac/dc 50Hz / 60Hz
	Mounting	Din rail or panel.
Field Inputs	Amount	3 common field inputs
	Input Voltage Range	24Vac/dc to 220Vac/dc
Outputs	Amount	1 x NO and NC in depended relay (DPST). 1 x NO and NC change over relay (SPDT).
	Rating	5 Amps at 220Vac 5 Amps at 30 Vdc
Relay model range	KG-RTU 1 (FPR1200) KH-RTU 1 (FPR1206)	0.001 Amp to 10 Amp MLC 10%, 100% load 0.1 Amp MLC 100%, 100% load 1 Amp
	KG-RTU 5 (FPR1201) KH-RTU 5 (FPR1207)	0.005 Amp to 50 Amp MLC 10%, 100% load 0.5 Amp MLC 100%, 100% load 5 Amp
	KG-RTU 10 (FPR1202) KH-RTU 10 (FPR1208)	0.01 Amp to 100 Amp MLC 10%, 100% load 1 Amp MLC 100%, 100% load 10 Amp
	KG-RTU 25 (FPR1203) KH-RTU 25 (FPR1209)	0.025 Amp to 250 Amp MLC 10%, 100% load 2.5 Amp MLC 100%, 100% load 25 Amp
	KG-RTU 50 (FPR1204) KH-RTU 50 (FPR1210)	0.05 Amp to 500 Amp MLC 10%, 100% load 5 Amp MLC 100%, 100% load 50 Amp
	KG-RTU 100 (FPR1205) KH-RTU 100 (FPR1211)	0.10 Amp to 1000 Amp MLC 10%, 100% load 10 Amp MLC 100%, 100% load 100 Amp
Line Voltage on CT's	Direct Measurement	110Vac to 550Vac Line
	Voltage Transformer	3K3Vac to 110Vac Line 6K6Vac to 110Vac Line 11K0Vac to 110Vac Line
Earth leakage	CBCT in ME100 and 300 Fault Level	0.03 Amps to 3 Amps
	External core that can be used	57mm ID core. 63mm ID core. 104mm ID core. 150mm ID core.
Insulation lockout	Ohm reading	1 to 199 kOhm.
	Incremental	1 kOhm.
Communication interfaces	Communication interface	Modbus-RTU.
	Bluetooth low energy	GATT

Table 3.0 : Technical specification

4 Parts and Dimensions

4.1 KG/KH-RTU

- FPR1200 – FPR1211

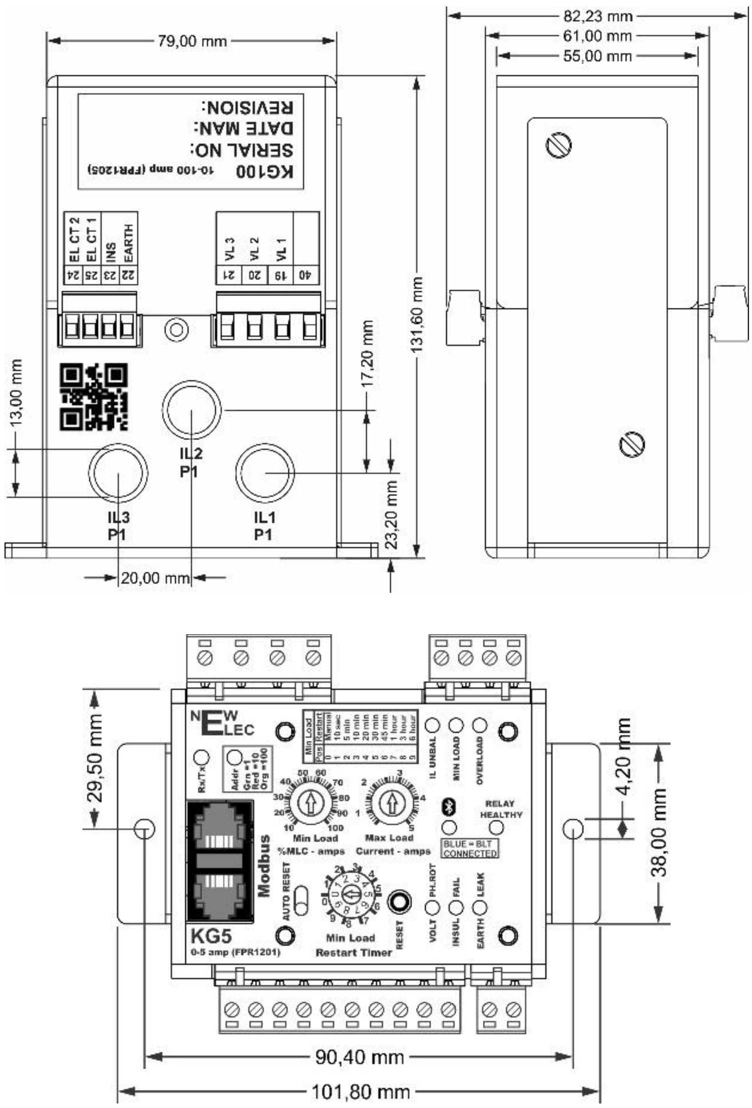


Figure 4.1: KG/KH-RTU dimensional drawing

4.2 RS-485 communication cable

- CAB0112 – RS-485 communication cable 1 meter in length.

Figure 4.2.a: RS-485 communication cable (CAB0112) image.

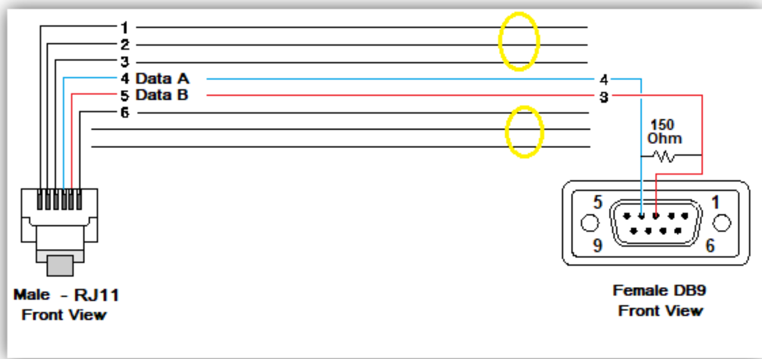


Figure 4.2.b: RS-485 communication cable (CAB0112) wire diagram.

4.3 USB to RS-485 converter

- CAB0113 – USB to RS-485 converter.

Figure 4.3: USB to RS-485 converter (CAB0113) with RS-485 communication cable (CAB0112).

5 Installation

5.1 Guidelines for the safety of the user and of the product

This manual provides information for the use of the KG/KH-RTU relay. The manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows;

a) Any engineer who is responsible for the planning, design and construction of automatic equipment using the product associated with this manual should be of a competent nature, trained and qualified to the local and national standards required to fulfil that role. These engineers should be fully aware of all aspects of safety with regards to automated equipment.

b) Any commissioning, plant or service engineer must be of a competent nature, trained and qualified to the local and national standards required to fulfil that job. These engineers should also be trained in the use and maintenance of the relay and all modules associated with the relay. This includes being completely familiar with all associated documentation for the said product. All maintenance should be carried out in accordance with established safety practices.

c) All operators of the KG/KH-RTU relay and associated modules should be trained to use that product in a safe and coordinated manner in compliance to established safety practices. The operators should also be familiar with documentation which relates to the actual operation of the relay and associated modules.

Notes on the Symbols used in this Manual

At various times throughout this manual certain symbol will be used to highlight points of information which are intended to ensure the users personal safety and protect the integrity of equipment. Whenever any of the following symbols are encountered its associated note must be read and understood. Each of the symbols used will now be listed with a brief description of its meaning.

Hardware Warnings

1) Indicates that the identified danger **WILL** cause physical and property damage.

2) Indicates that the identified danger could **POSSIBLY** cause physical and property damage.

3) Indicates a point of further interest or further explanation.

Software Warnings

4) Indicates special care must be taken when using this element of software.

5) Indicates a special point which the user of the associate software element should be aware of.

6) Indicates a point of interest or further explanation.

5.2 Mounting of product

With panel mount or DIN-rail mount ensure a 20 mm clearance around product.

5.2.1 Panel Mounting

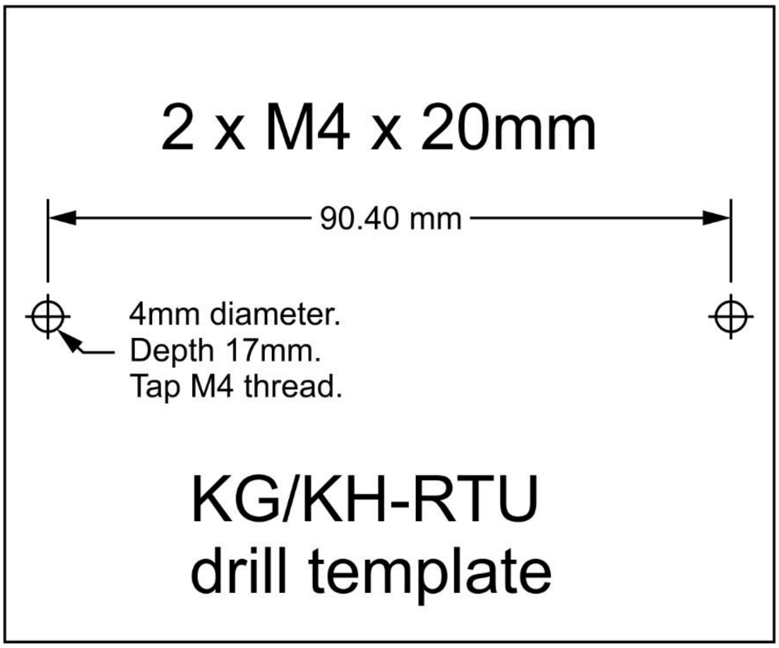


Figure 5.2.1.a: KG/KH-RTU drill template for panel mount.

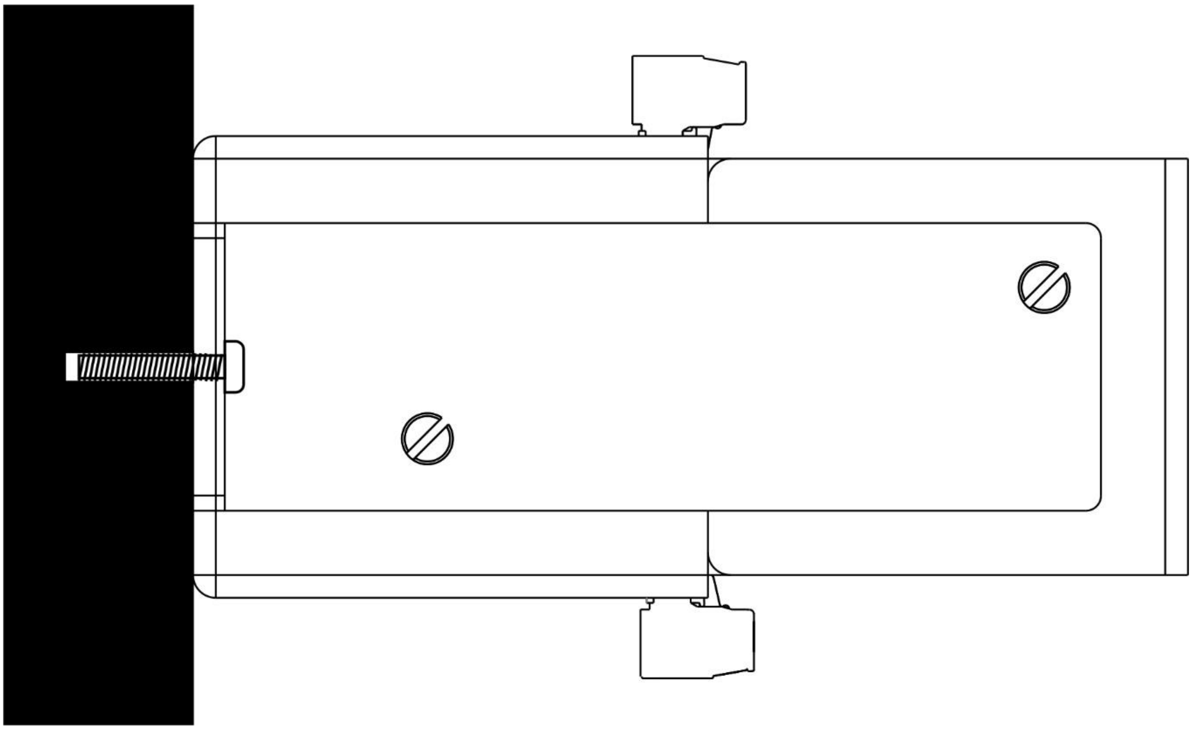


Figure 5.2.1.b: KG/KH-RTU panel mounted.

5.2.2 DIN rail mount

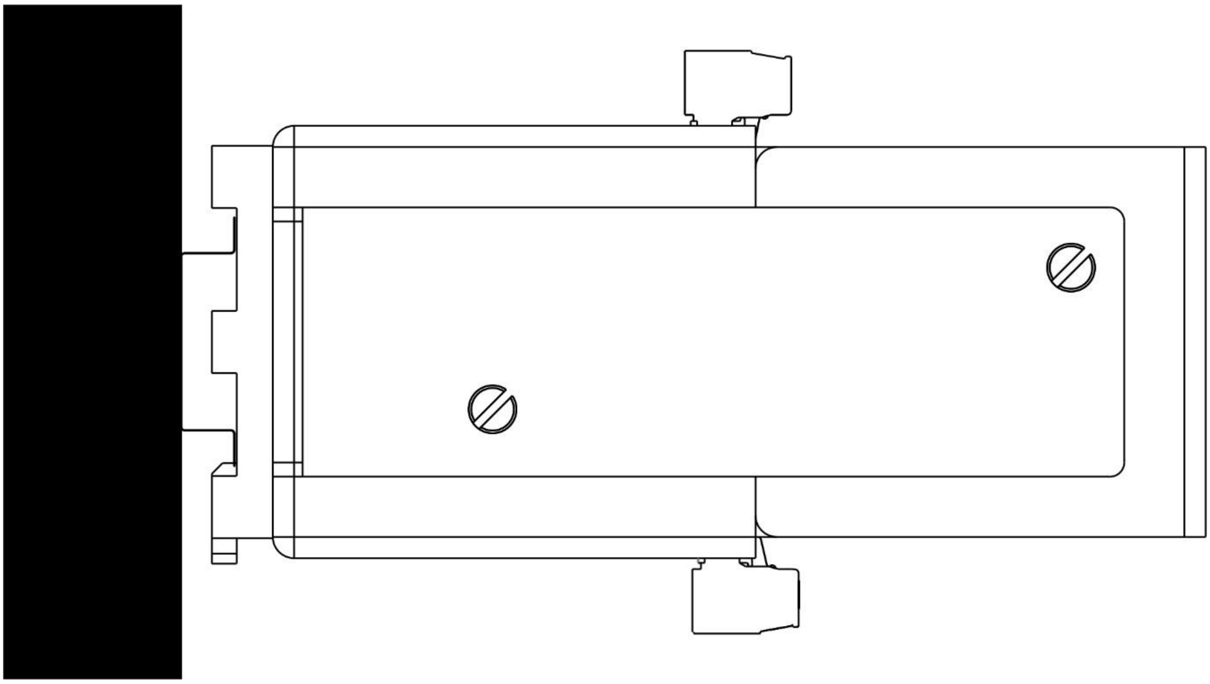


Figure 5.2.2: KG/KH-RTU DIN rail mount with 45mm DIN rail.

6 Wiring

6.1 Motor or feeder protection wire diagram

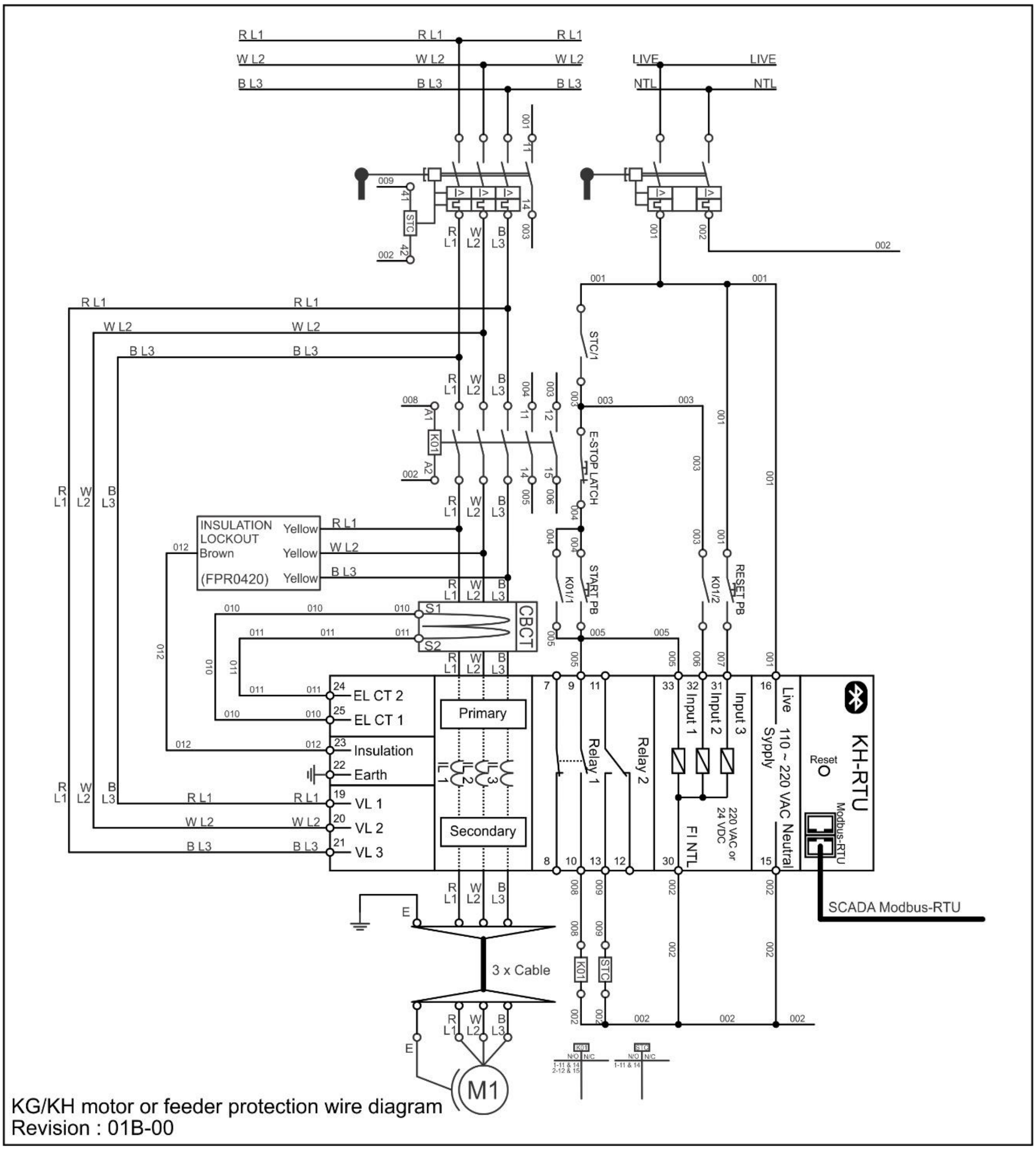


Figure 6.1: Motor or feeder protection wire diagram.

6.2 DOL wire diagram

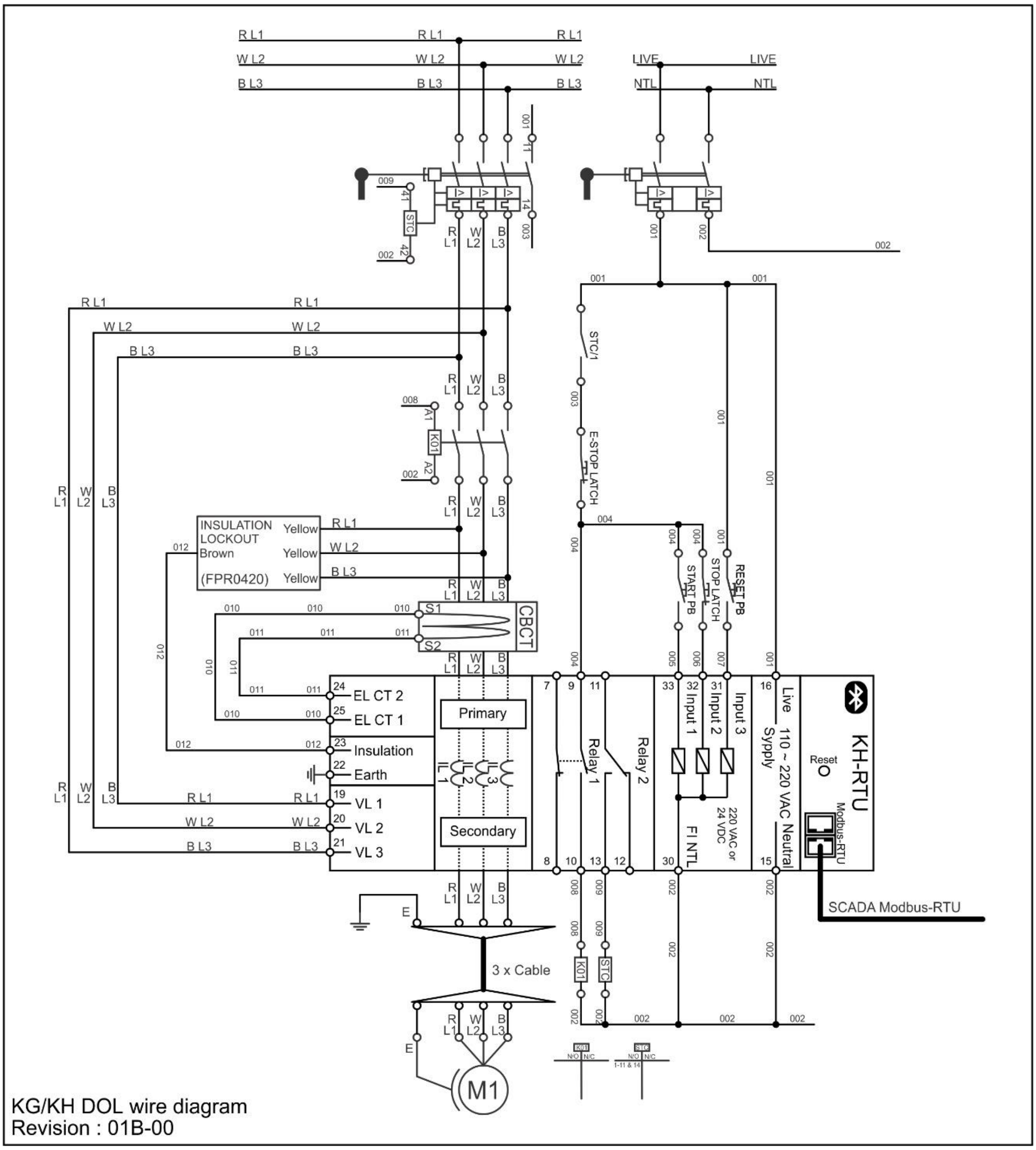


Figure 6.2: DOL wire diagram.

6.3 Feeder wire diagram

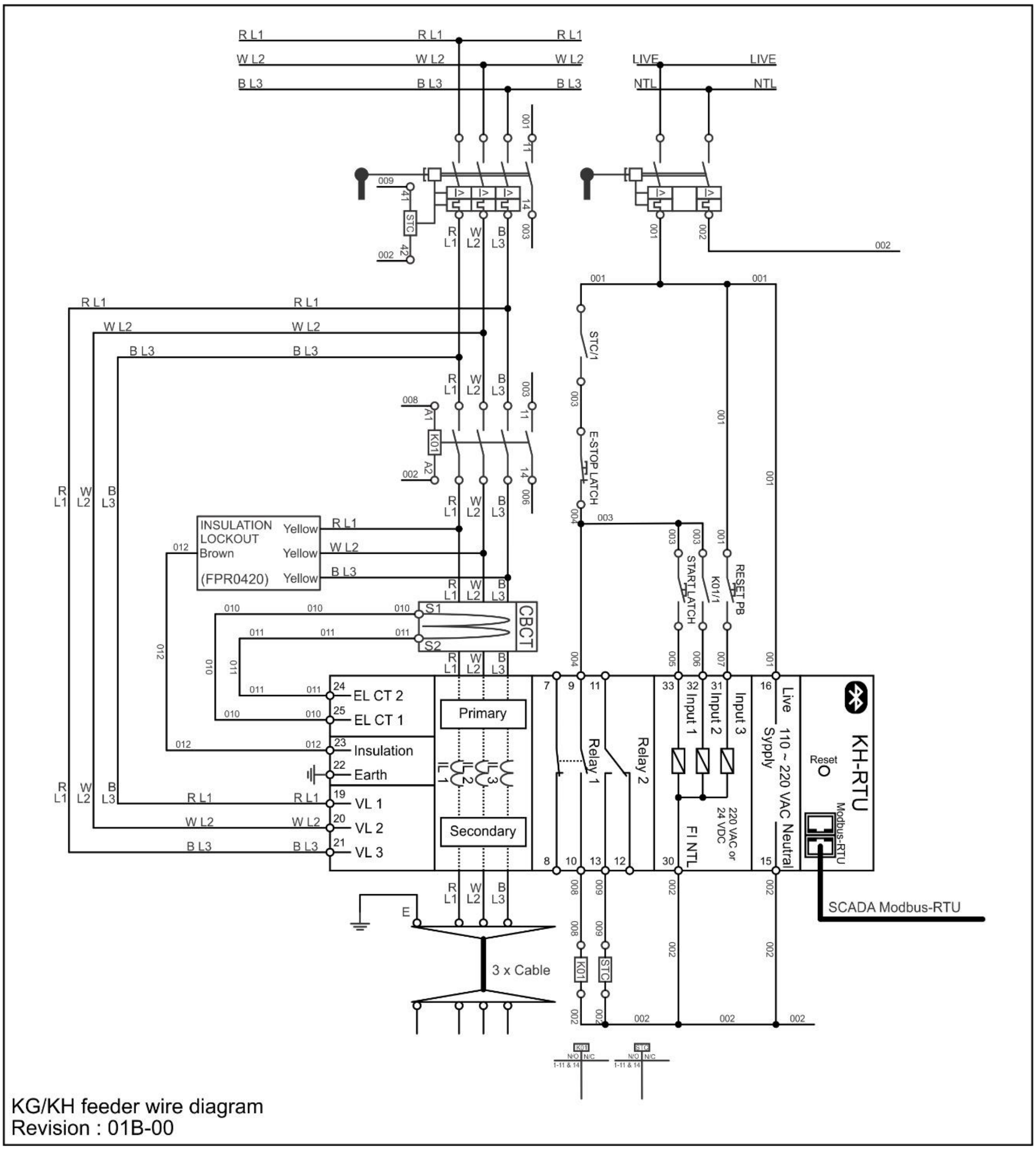


Figure 6.3: Feeder wire diagram.

7 Features

7.1 Protection features

Protection feature	ANSI code
Under voltage	27
Phase under current or power	37
Phase negative sequence or unbalance	46
Phase sequence voltage or phase-balance voltage	47
Machine or transformer thermal	49
Accidental energizing	50/27
Negative sequence instantaneous overcurrent	50_2
Breaker failure	50BF
Ground instantaneous overcurrent	50G
Phase instantaneous overcurrent	50P
Negative sequence timed overcurrent	51_2
Timed ground instantaneous overcurrent	51G
Lock rotor during running	51LR
Lock rotor during start-up (Vectorial stall)	51LS
Phased timed overcurrent	51P
Over voltage	59
Insulation lockout	64
Starts per hour	66
Trip circuit / control circuit monitor (Frozen contact)	74TC
Over frequency	81O
Under frequency	81U
Lockout	86
Voltage loss of power	78V
Custom trip	
External reset mask	
Shunt reset mask	

Table 7.1: Protection features

7.2 Logic features

Logic feature	Amount
4 x input and 1 output logic table	6
Comparators	2
Thermal comparators	1
Count up and down counters	2
Latches	2
Alarm mask	1
Trip mask	1
Pulse generator	1
RTC start and stop time	1
Timers	2
Low voltage switch gear	1

Table 7.2: Logic features

7.3 Monitor features

Monitor feature	Units
IL 1, IL 2 and IL 3	%
VL 1, VL 2 and VL 3	VAC phase
I unbalance	%
V unbalance	%
I2 negative sequence	%
V2 negative sequence	%
EL	mA
I0 zero sequence	%
Insulation	kOhm
Phase 1, phase 2 and phase 3 power factor	CosPI %
Phase 1, phase 2 and phase 3 apparent power	kVA
Phase 1, phase 2 and phase 3 real power	kW
Phase 1, phase 2 and phase 3 reactive power	kVAr
Phase 1, phase 2 and phase 3 apparent power consumed	kVA.h
Phase 1, phase 2 and phase 3 real power consumed	kW.h
Phase 1, phase 2 and phase 3 reactive power consumed	kVAr.h
Running hours: • Drive available • Trip active • Running • Running with load	Hours
Counters: • Power ups • Trips accumulated • Start-up attempts • Successful starts	
Motor start-up • Maximum IL • Maximum thermal capacity used • Last thermal capacity used	

Table 7.3: Monitor features

Monitor feature - continue	Units
Maximum recordings:	
• IL 1, IL 2 and IL 3	Amps
• VL 1, VL 2 and VL 3	VAC phase
• VL frequency	Hz
• Phase 1, phase 2 and phase 3 apparent power	VA
• Phase 1, phase 2 and phase 3 real power	Watt
• Phase 1, phase 2 and phase 3 reactive power	Var
• Phase 1, phase 2 and phase 3 power factor	CosPI
Minimum recordings:	
• IL 1, IL 2 and IL 3	Amps
• VL 1, VL 2 and VL 3	VAC phase
• VL frequency	Hz
• Phase 1, phase 2 and phase 3 apparent power	VA
• Phase 1, phase 2 and phase 3 real power	Watt
• Phase 1, phase 2 and phase 3 reactive power	Var
• Phase 1, phase 2 and phase 3 power factor	CosPI
Harmonics:	
• IL 1, IL 2 and IL 3 1st to 31st harmonic level	%
• VL 1, VL 2 and VL 3 1st to 31st harmonic level	%
• IL 1, IL 2 and IL 3 maximum harmonic level	%
• VL 1, VL 2 and VL 3 maximum harmonic level	%
• IL total harmonic distortion	%
• VL total harmonic distortion	%

Table 7.3: Monitor features - continue

7.4 Communication protocol

Protocol	
Modbus-RTU	RS-485
GATT	BLE

Table 7.2: Logic features

8 Quick Factory Start

8.1 KG/KH-RTU Frontend Configuration Software

KG/KH-RTU frontend is a PC Windows^{TM} environment application that is used to configure the KG/KH-RTU relay. The KG/KH-RTU frontend can communicate via the serial communication port connected with a RS-485 converter or Bluetooth.

8.1.1 KG/KH-RTU Frontend System Requirements

- Window^{TM} operating system.
- CPU: Pentium II 1 Ghz.
- RAM: 512Mb
- Hard drive space: 50Mb
- CD drive x 2 speed.
- Screen resolution:
  - 1920 x 1080 recommended.
  - 800 x 600 minimum.
- Serial communication.
  - On board RS-232 serial port.
  - Or USB to RS-485 converter.
    - See manufacturers installation manual to install device drivers.
    - The product used must reflect as a serial communication port.
    - MOXA Uport 1130 is a recommended and tested device to use.
- Bluetooth communication (**Only when using the Bluetooth connection**)
  - Windows^{TM} 10.2 and upwards.
  - Bluetooth 4.0 onboard or USB to Bluetooth dongle.
  - Bluetooth LE generic attribute Service.

8.1.2 Installing KG/KH-RTU Frontend

Insert the product CD or USB memory stick and follow the following steps:

1. The KG/KH-RTU Frontend is stored in the following directory “***KG-KH-RTU\Configuration Software\Frontend***”.
2. Double click and run the file “***KG_KH-RTU_vXXX-XX.exe***”.
3. Follow the instructions on the screen.

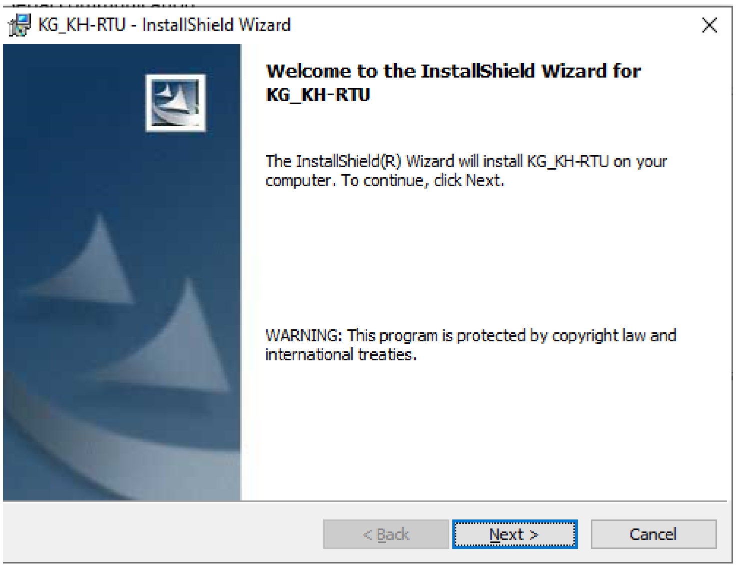


Figure 8.1.2: KG/KH-RTU frontend installation screen.

4. Driver installation
   a. Install the USB to RS-485 converter drivers according to manufacturer specification. If the serial communication port will be used.
   b. Install the USB to Bluetooth converter drivers according to manufacturer specification if Bluetooth communication will be used.
5. Running the KG/KH-RTU Frontend:
   a. PC **without** Bluetooth support run “***KG_KH-RTU vXXX-XX***” from the start-up menu NewElec -> KG_KH-RTU.
   b. PC with Bluetooth support run “***KG_KH-RTU-BLE vXXX-XX***” from the start-up menu NewElec -> KG_KH-RTU.

8.1.3 Starting KG/KH-RTU Frontend via Modbus-RTU

1. Disconnect the KG/KH-RTU from SCADA network. This is due to that only 1 Modbus-RTU master can be on the bus.
2. Connect the PC to the KG/KH-RTU communication port as shown in Figure 8.1.3.a.
    a. Item 1: USB to RS485 converter.
    b. Item 2: RS-485 communication cable CAB0112.
    c. Item 3: KG/KH-RTU communication port. Any of the 2 communication ports can be used.

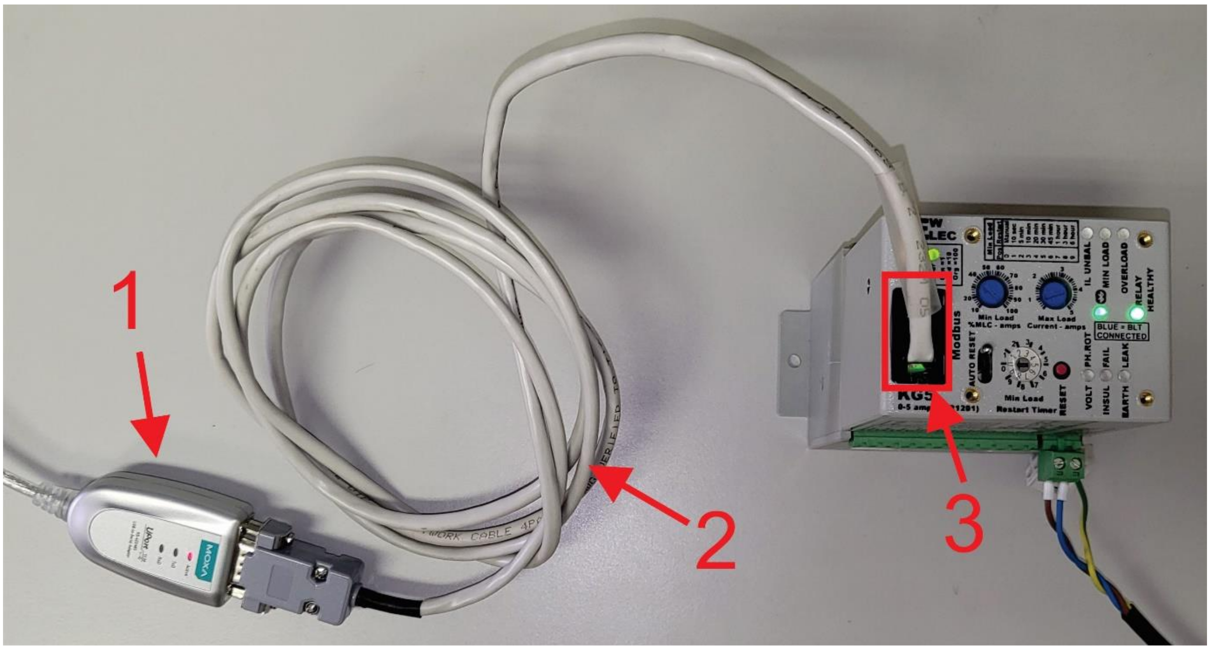


Figure 8.1.3.a: KG/KH-RTU frontend installation screen.

3. Select the communication port by selecting the **comport** button  or via the menu bar Communication -> Port Setup (Shortcut key: F5).
4. Select the port from the drop down list and click the **OK** button.

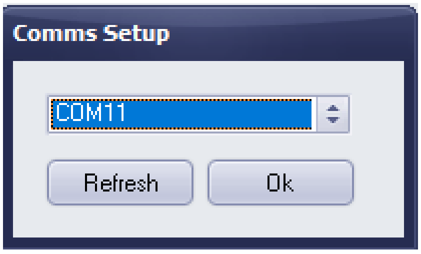


Figure 8.1.3.b: KG/KH-RTU frontend communication port selection.

5. Click the **open port** button  or via the menu bar Communication -> Connect (Shortcut key: F6)

6. If the baud rate of the KG/KH-RTU is unknown, then follow the following steps:
    a. Click the **find relay** button.  A Scan Network window will show (Figure 8.1.3.c).

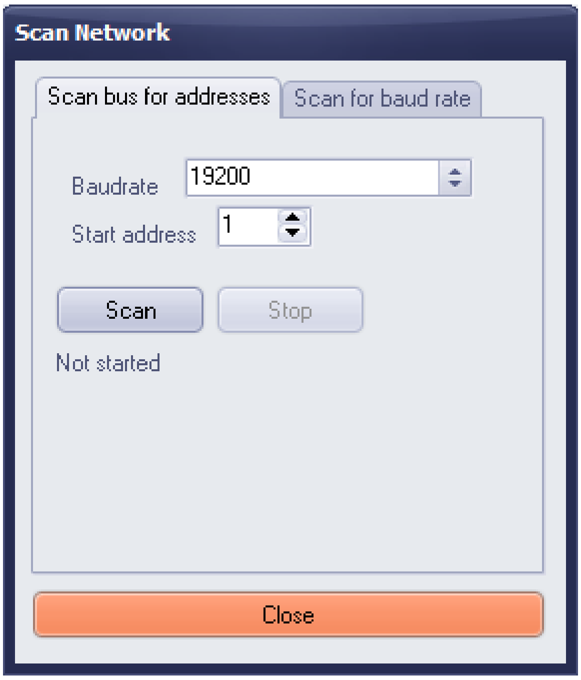


Figure 8.1.3.c: KG/KH-RTU frontend scan network window.

    b. Click on the **Scan for baud rate** tab.
    c. Select the unit address as being flashed by the KG/KH-RTU **Addr** LED.
        i. Each green flash is for 1.
        ii. Each red flash is for 10.
        iii. Each orange flash is for 100.
        iv. 3 x Green + 2 x Red + 1 x Orange = Address 123.

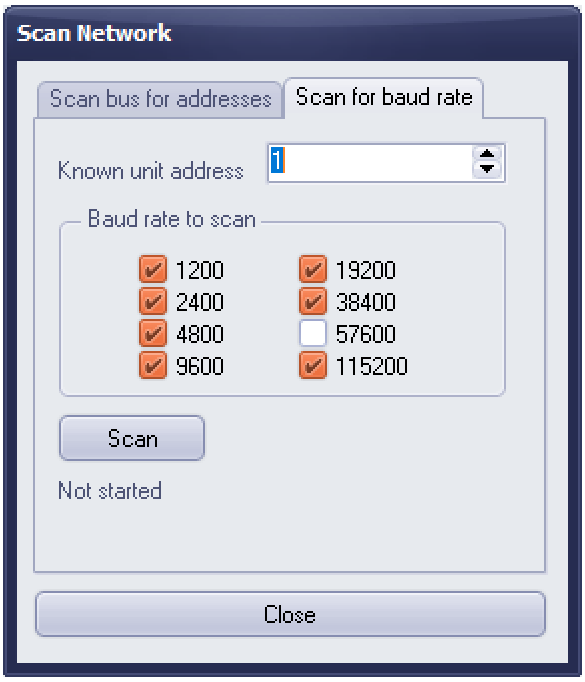
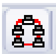


Figure 8.1.3.d: KG/KH-RTU frontend scan baud rate.

d. Select the baud rates to be scanned.
e. Press the **Scan** button.
f. The KG/KH-RTU with the selected address will then indicate the baud rate.
g. Proceed with step 7.b.

7. If the baud rate is of the KG/KH-RTU is known follow the following steps:

    a. Click the find relay button.  A Scan Network window will show (Figure 8.1.3.c).
    b. Select the correct baud rate.
    c. Enter the starting scan address.
    d. Press the **Scan** button.
    e. The KG/KH-RTU device list will fill up as the scanning continues.

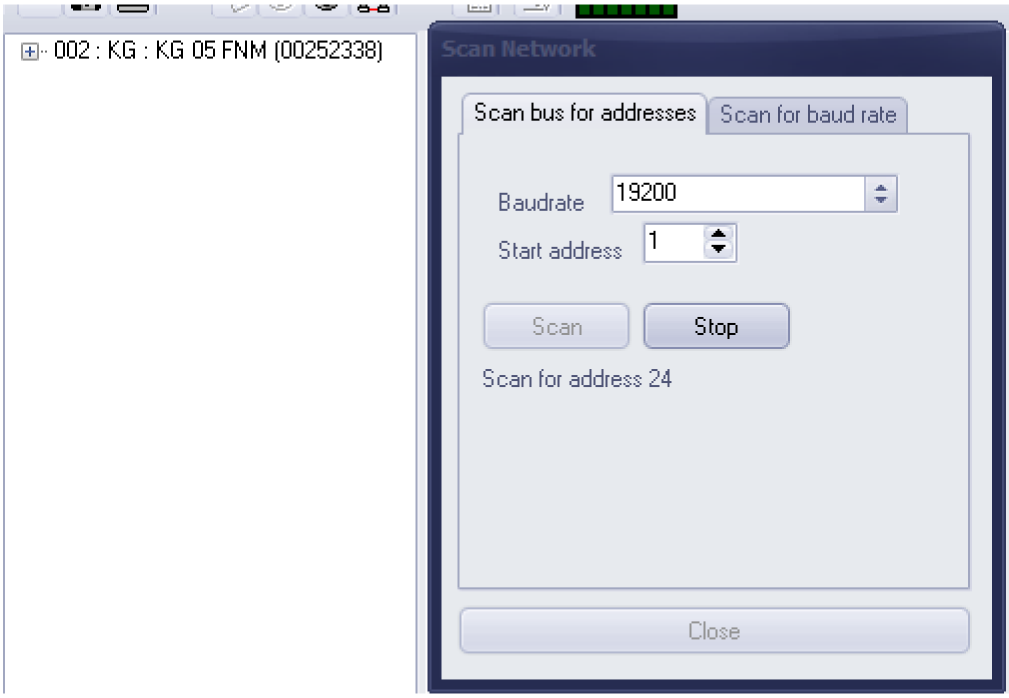


Figure 8.1.3.e: KG/KH-RTU frontend KG/KH-RTU device list filling up.

f. Up to address 255 will be scanned for. But if all the KG/KH-RTU units have been found the click the **Stop** button.

g. Click the **Close** button.

8. Click on the KG/KH-RTU unit name to expand the tree list (Figure 8.1.3.f).

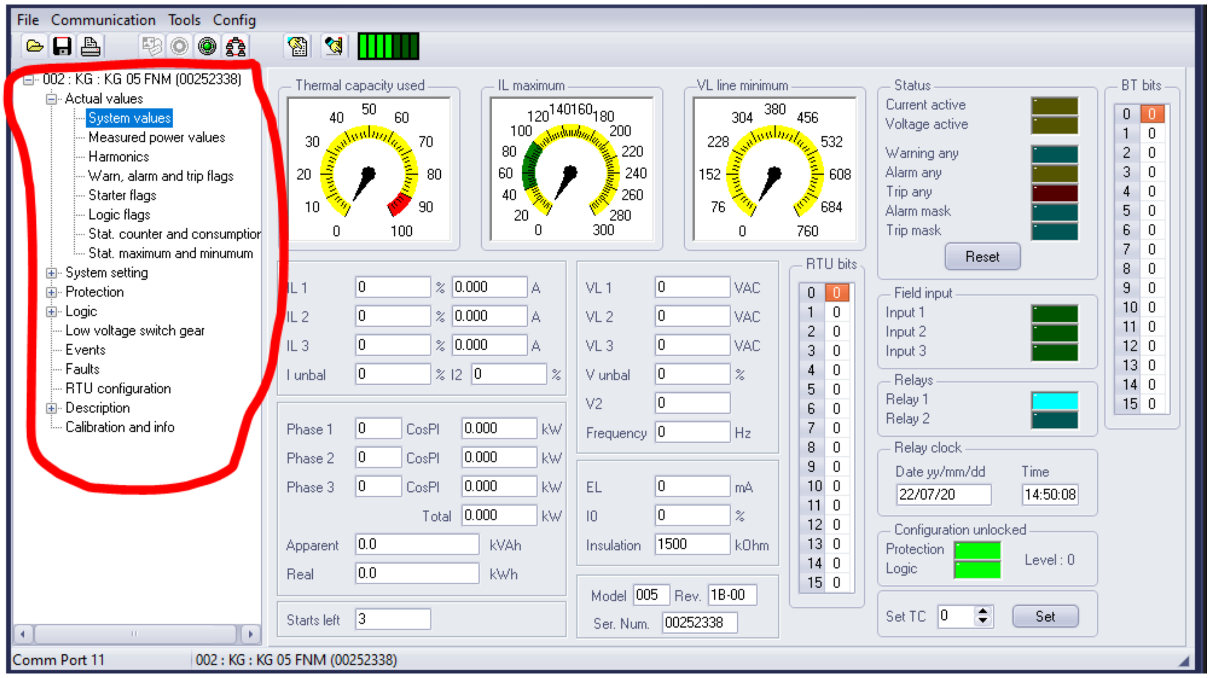


Figure 8.1.3.f: KG/KH-RTU frontend KG/KH-RTU device tree list with actual expanded.

9. The communication progress bar  must cycle green from left to right to show that valid messages are being received from the KG/KH-RTU.

10. To disconnect click the **close comport**  button or via the menu bar Communication -> Disconnect (Shortcut key: F6).
11. It is recommended to read the setting from the KG/KH-RTU relay first. See chapter 8.1.5.

8.1.4 Starting KG/KH-RTU Frontend via Bluetooth

1. Click the **BLE**  button or via the menu bar Communication -> BLE (Shortcut key: F4).
2. A Bluetooth window (Figure 8.1.4.a) will popup.

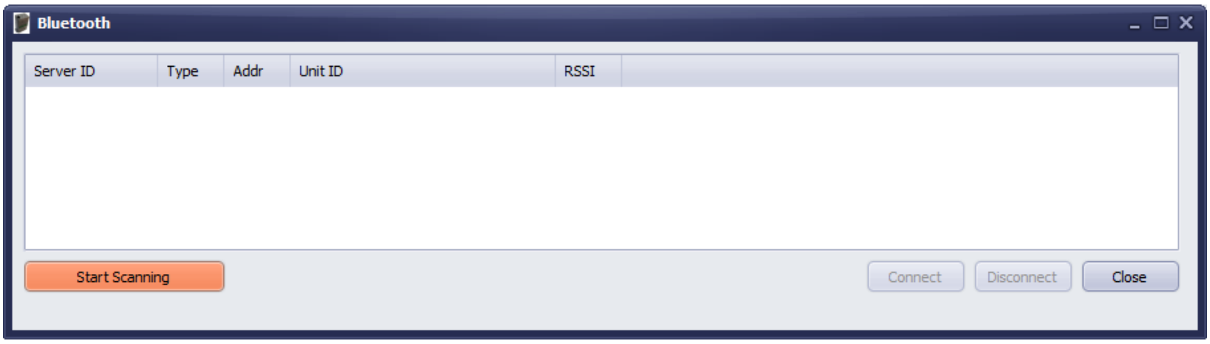


Figure 8.1.4.a: KG/KH-RTU frontend BLE empty scan window.

3. Click the **Start Scanning** button.
4. The list of KG/KH-RTU relays will start filling the list box (Figure 8.1.4.b).

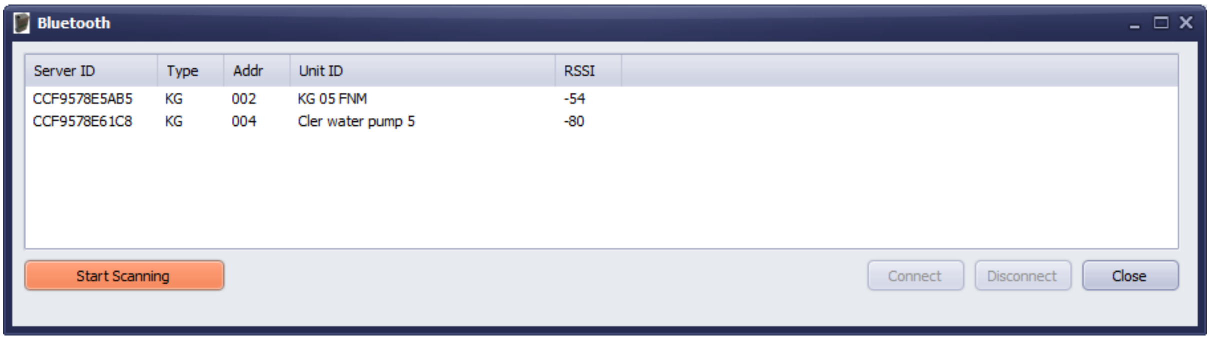


Figure 8.1.4.b: KG/KH-RTU frontend BLE scan window with KG/KH-RTU relays listed.

5. Click on a KG/KH-RTU relay unit in the list, then click the **Connect** button.
6. The KG/KH-RTU Bluetooth LED will go from green to a blue state (Figure 8.1.4.c). The blue state will flash when data is being transmitted.

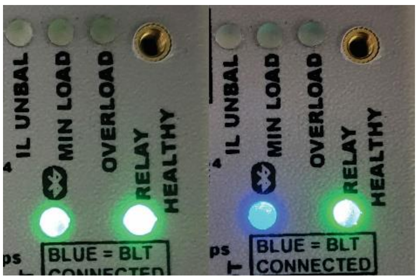


Figure 8.1.4.c: KG/KH-RTU relay Bluetooth status LED from disconnected to connected.

7. The window will automatically close.
8. When required to disconnect:

   a. Open the Bluetooth search window and click the **Disconnect** button.
   b. Then click the **Close** button.
9. It is recommended to read the setting from the KG/KH-RTU relay first. See chapter 8.1.5.

8.1.5 Read Settings Using the KG/KH-RTU Frontend

Recommended step is to first read up the settings from the KG/KH-RTU relay. This can be achieved via a read all or read settings per block.

Reading all the settings from the KG/KH-RTU relay by:

1. Selecting the KG/KH-RTU relay in the device tree list.
2. Click the **Read settings from relay**  button.
3. A progress bar will popup indicating the reading of the setting group.
4. Note that only the selected KG/KH-RTU relay settings will be read up.

Reading settings per block is achieved by selecting a feature in the device tree list. Then by clicking on the **Read setting from relay** 

button on the panel. Only the selected panels settings will be read from the KG/KH-RTU relay.

8.1.6 Write Settings Using the KG/KH-RTU Frontend

After alterations of settings, it can then be written to the KG/KH-RTU relay. This can be done via a write all or write settings per block.

Writing all the settings to the KG/KH-RTU relay by:

1. Selecting the KG/KH-RTU relay in the device tree list.
2. Click the **Write settings to relay**  button.
3. A write settings selection box will popup (Figure 8.1.6).

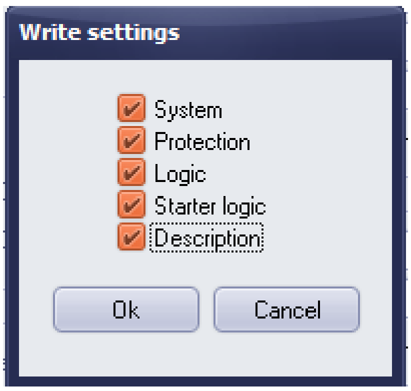


Figure 8.1.6: KG/KH-RTU frontend write settings selection box.

4. Select the settings group that need to be written to the relay and press the **Ok** button.
5. A progress bar will popup indicating the writing progress of each setting group.

6. Note that only the selected KG/KH-RTU relay settings will be written to.

Writing settings per block is achieved by selecting a feature in the device tree list. Then by clicking on the **Write setting from relay** Write setting to relay button on the panel. Only the selected panel's settings will be written to the KG/KH-RTU relay.

8.1.7 Open File Setting Using the KG/KH-RTU Frontend

Saved settings file can be opened and viewed in a blank new unit (See chapter 8.1.10) or in the selected KG/KH-RTU relay in the device tree list.

Select the KG/KH-RTU new or relay in the device tree list. Then click the **open settings** button or via the menu bar File -> Open (Shortcut key: Ctrl + O). The open file dialog browser will popup. Navigate to the location where the settings file is stored. Select the file by clicking on the file name and click the **Open** button.

The settings will now be loaded into the selected KG/KH-RTU new or relay in the device tree list. Settings can now also be written to the KG/KH-RTU relay (See chapter 8.1.6) using the write all settings method.

8.1.8 Save Settings File Using the KG/KH-RTU Frontend

Saving the settings of a blank new unit (See chapter 8.1.10) or from the selected KG/KH-RTU relay in the device tree list.

Select the KG/KH-RTU new or relay in the device tree list. Then click the **save settings** button or via the menu bar File -> Save (Shortcut key: Crtl + S). The save file dialog browser will popup. Navigate to the location where the settings file must get stored. Enter a file name and press the **Save** button.

The settings of the selected KG/KH-RTU in the device tree list will now be saved. The settings file can only be viewed by the KG/KH-RTU frontend.

To have a readable version of the KG/KH-RTU relay use the print settings (See chapter 8.1.9) feature that can be used to print out an Acrobat reader (pdf) document.

8.1.9 Print Settings Using the KG/KH-RTU Frontend

The printed settings document consists of 13 pages. It is recommended, if possible, to rather do an Acrobat reader (pdf) document to protect the environment.

Select the KG/KH-RTU new or relay in the device tree list. Then click the **print settings** button or via the menu bar File -> Print (Shortcut key: Crtl + P).

8.1.10 Blank New Device Using the KG/KH-RTU Frontend

Blank new device allows to view or create a settings file without being connected to a KG/KH-RTU relay.

To create a blank new device, select File -> New (Shortcut key: Crtl + N) via the menu bar. A new blank KG/KH-RTU will appear in the device tree list.

Blank new device can only be done if the communication port and Bluetooth connection is not active.

8.1.11 KG/KH-RTU Frontend Window Styles

KG/KH-RTU Frontend has the following styles:

- Windows,
- Amethyst kamri,
- Charcoal dark slate.

The selected style will open again after closing. If the last style used does not open after closing the KG/KH-RTU frontend, then right click one the KG/KH-RTU frontend icon and select “**run as Administrator**”.

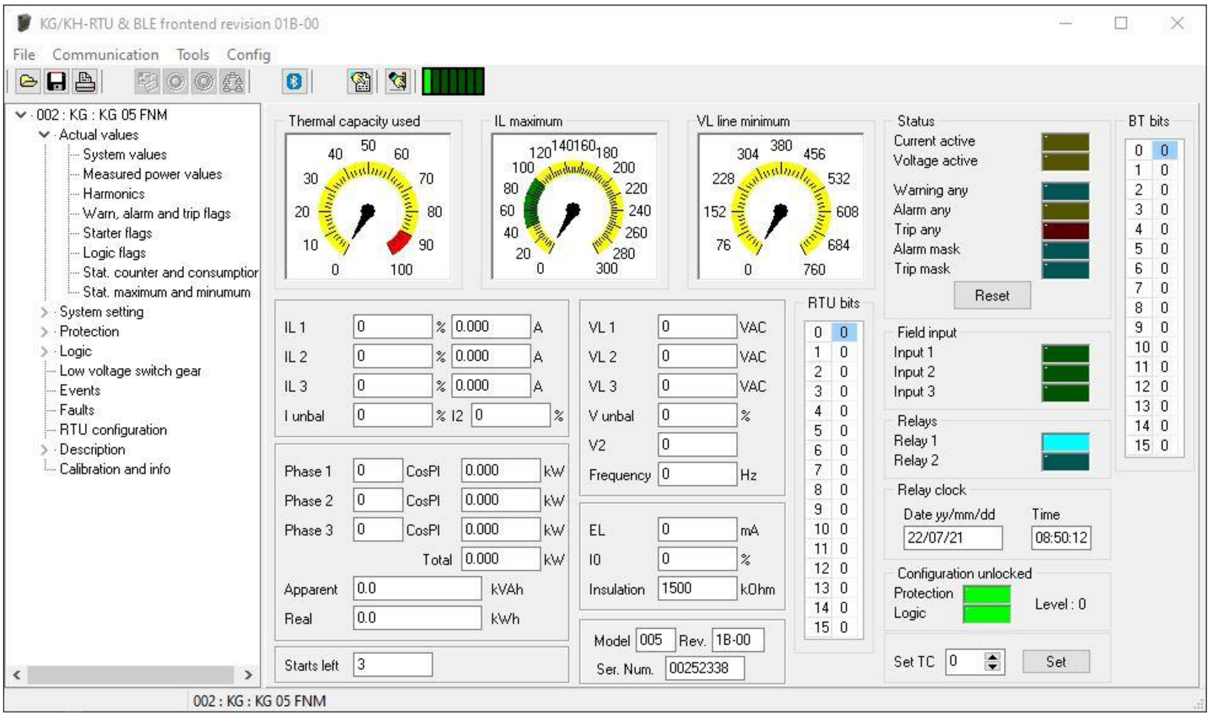


Figure 8.1.11.a: KG/KH-RTU frontend windows style.

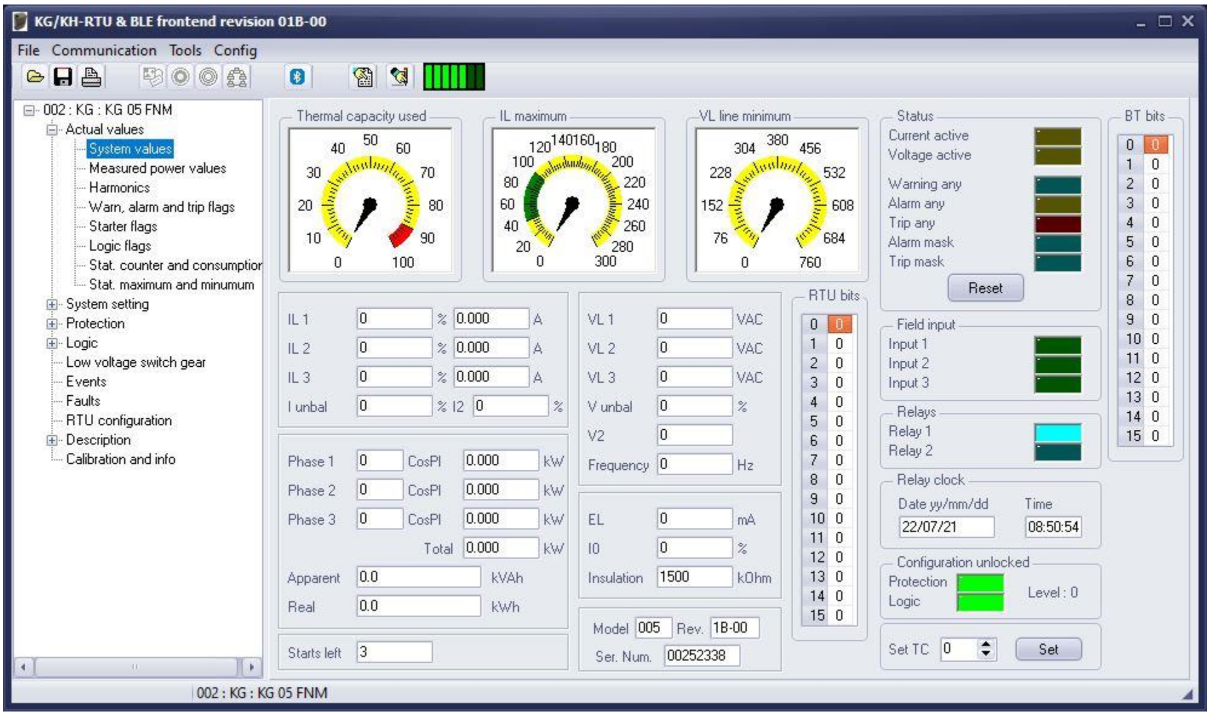


Figure 8.1.11.a: KG/KH-RTU frontend Amethyst kamri style.

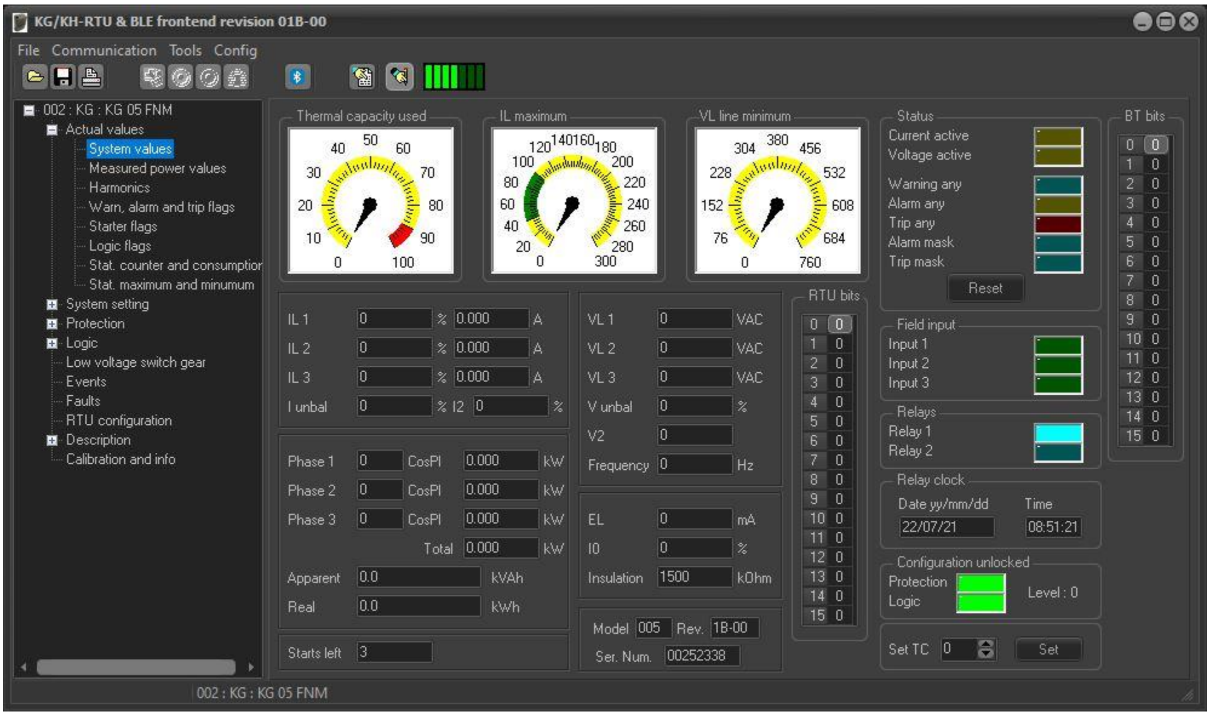


Figure 8.1.11.a: KG/KH-RTU frontend charcoal dark slate style.

8.1.12 Simulator Window KG/KH-RTU Frontend

The build in KG/KH-RTU frontend simulator allows for simulating actual values. The KG/KH-RTU relay will respond to these values as if it was real.

The event and fault record will record if the event or trip condition was real or simulated.

The simulator can be used by SCADA integrators to test the PLC variables if they are getting correctly populated. The values can be simulated via Bluetooth while the PLC is connected to the Modbus-RTU port.

FAT test can be done via the simulator to make sure that the control circuit of the cubical in a MCC system is working according to the acceptance procedure.

The simulator can only simulate actual values for 1 unit.

The simulator window can be accessed via the menu bar Tools -> Simulator.

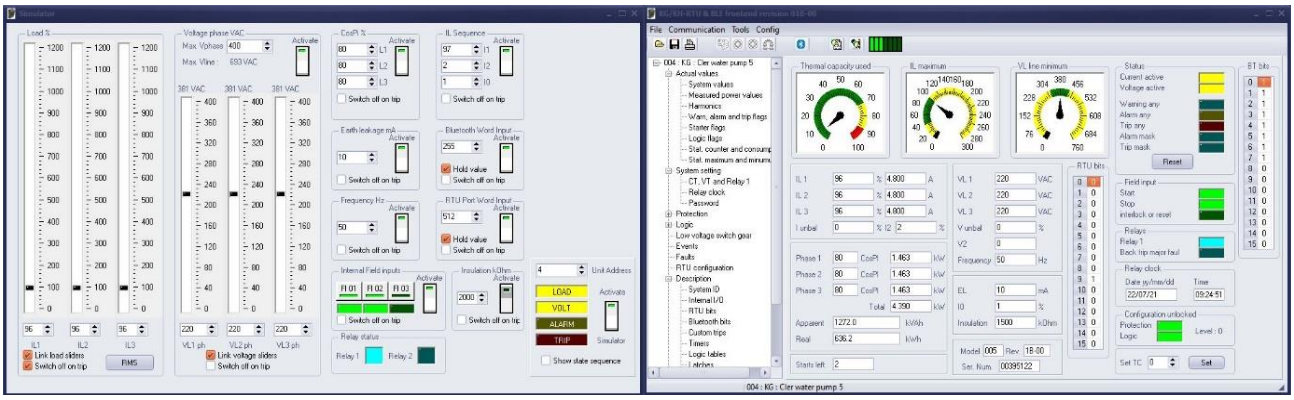


Figure 8.1.12.a: KG/KH-RTU frontend simulator and actual window side by side.

The simulator has 3 modes:

- Static simulation,
- Static rms simulation,
- State sequence simulation.

Before activating any of the modes of the simulator make sure that the unit address is set to the correct KG/KH-RTU relay Modbus-RTU address even if connected via Bluetooth.

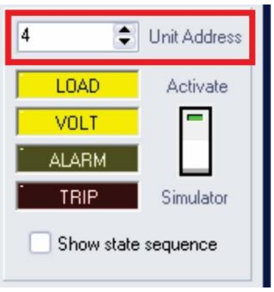


Figure 8.1.12.b: KG/KH-RTU frontend simulator unit address selected.

Static Simulation

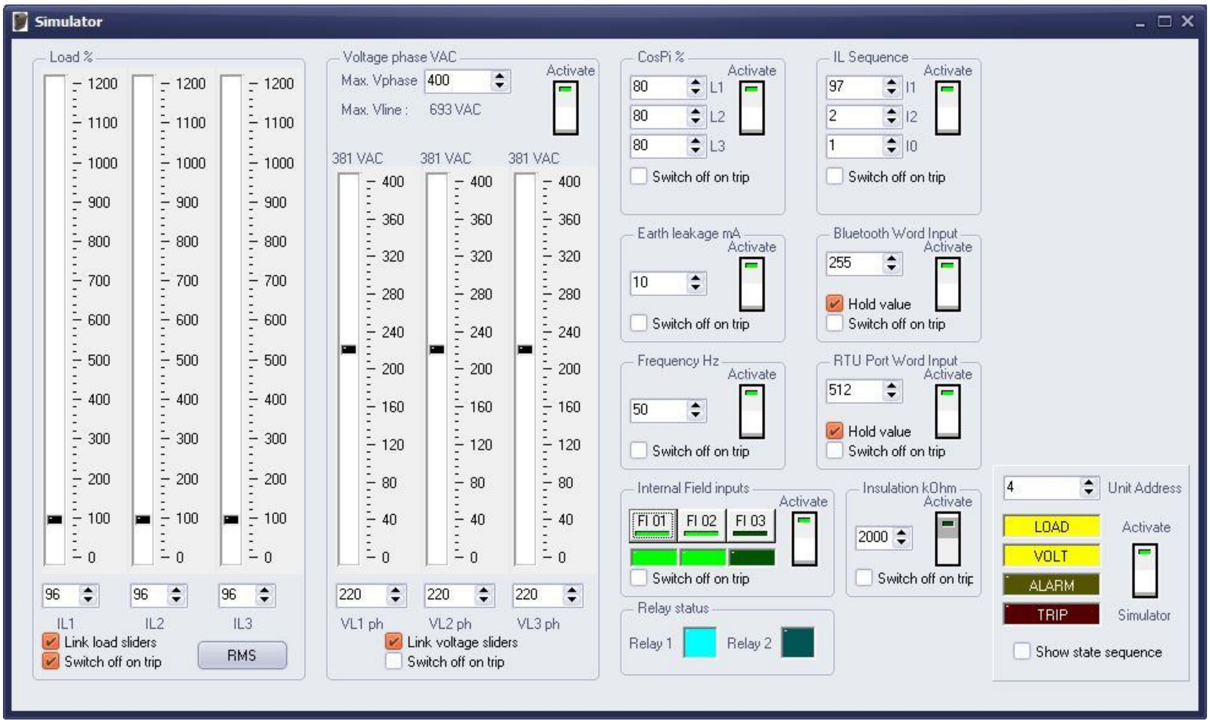


Figure 8.1.12.c: KG/KH-RTU frontend simulator static mode.

Static simulation is just simulating the actual values as is. The simulated actual values can then be adjusted manually as needed to test that the protection, logic and the low voltage switch gear logic of the KG/KH-RTU relay operates as needed by the application.

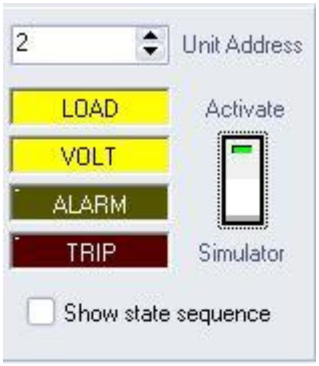


Figure 8.1.12.d: KG/KH-RTU frontend simulator activation panel.

Simulator activation panel (Figure 8.1.12.d) is where the address of the KG/KH-RTU relay must first be selected before activating the simulated actual values. The **Activate Simulator** rocket switch is used to start sending the simulated actual values to the KG/KH-RTU relay.

The following LED are used to indicate the respective status in the KG/KH-RTU relay:

- LOAD = Current level is above the current active threshold.
- VOLT = Voltage level is above the voltage present threshold.
- ALARM = an Alarm flag condition is active.
- TRIP = a Trip flag condition is active.

Show state sequence checkbox is used to activate the state sequence simulation.

Current simulation panel

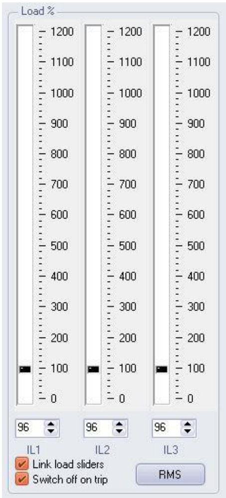


Figure 8.1.12.e: KG/KH-RTU frontend simulator IL panel.

Simulator IL panel allows the simulation of the IL1, IL2 and IL3 actual values. The sliders are marked in percentage. To calculate the simulated ampere that is being simulated use the following example.

KG5 with a 50 % maximum load setting and a CT ratio of 100:5 =
(100 / 5) * 5 Amp * (50 / 100) = 50 Amps.
50 Amps / 100 = 0.5 Amps.

This gives 0.5 Amps per percentage adjusted on the slider bars. 50 % on the slider bar will then be:

50 % * 0.5 Amps = 25 Amps simulated.

IL level can be adjusted by click and drag the slider bars or enter the percentage IL in the IL1, IL2 or IL3 boxes.

Link load sliders checkbox if checked will keep the IL1, IL2 and IL3 levels at the same value. When unchecked then IL1, IL2 and IL3 can be adjusted independently.

Switch off on trip checkbox when checked will set the IL1, IL2 and IL3 levels value to 0 % when a trip condition is detected from the KG/KH-RTU. When unchecked the IL1, IL2 and IL3 levels will remain the same during a trip condition.

Leaving the checkbox unchecked is a good way to test frozen contact.

RMS button will activate the static rms simulation mode.

Voltage simulation panel

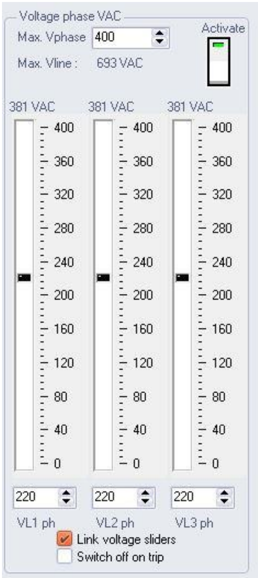


Figure 8.1.12.f: KG/KH-RTU frontend simulator VL panel.

Voltage simulation panel will simulate the phase voltage for VL1, VL2 and VL3 simulation actual values. First the maximum phase voltage must enter to give VL sliders the correct range for the simulation.

Activate rocket switch will activate the VL1, VL2 and VL3 simulated actual levels to be used by the KG/KH-RTU relay. If deactivated, then the KG/KH-RTU relay will use the actual voltage levels.

Simulated voltage levels can be adjusted with aid of the VL1, VL2 and VL3 sliders or edit boxes.

Link load sliders checkbox if checked will keep the VL1, VL2 and VL3 levels at the same value. When unchecked then VL1, VL2 and VL3 can be adjusted independently.

Switch off on trip checkbox when checked will set the VL1, VL2 and VL3 levels value to 0 VAC when a trip condition is detected from the KG/KH-RTU. When unchecked the VL1, VL2 and VL3 levels will remain the same during a trip condition.

Power factor simulation panel

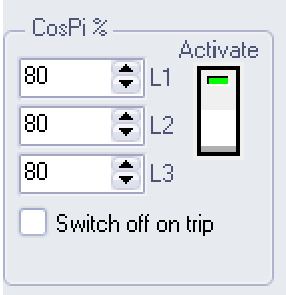


Figure 8.1.12.g: KG/KH-RTU frontend simulator power factor level panel.

Will simulate the power factor actual values.

When the current level and voltage level is below the activation threshold then the power factor level will be read as 0.

Activate rocket switch will activate the L1, L2 and L3 power factor simulated levels values to be used by the KG/KH-RTU relay. If deactivated, then the KG/KH-RTU relay power factor levels will be set to 0.

Switch off on trip checkbox when checked will set the L1, L2 and L3 levels to 0 when a trip condition is detected from the KG/KH-RTU. When unchecked the L1, L2 and L3 levels will remain the same during a trip condition.

Earth leakage simulation panel

Figure 8.1.12.h: KG/KH-RTU frontend simulator earth leakage level panel.

Will simulate the earth leakage actual value.

Activate rocket switch will activate the earth leakage simulated actual level to be used by the KG/KH-RTU relay. If deactivated, then the KG/KH-RTU relay earth leakage level will be a real earth leakage level.

Switch off on trip checkbox when checked will set the earth leakage level to 0 mA when a trip condition is detected from the KG/KH-RTU. When unchecked the earth leakage level will remain the same during a trip condition.

Voltage line frequency simulation panel

Figure 8.1.12.i: KG/KH-RTU frontend simulator voltage line frequency level panel.

Will simulate the line frequency level.

When the voltage level is below the voltage active threshold then the frequency level will be set to 0 Hz.

Activate rocket switch will activate the frequency simulated actual level to be used by the KG/KH-RTU relay. If deactivated, then the KG/KH-RTU relay frequency level will use the actual frequency level if the voltage level simulation is deactivated.

Switch off on trip checkbox when checked will set the frequency level to 0 Hz when a trip condition is detected from the KG/KH-RTU. When unchecked the frequency level will remain the same during a trip condition.

Field inputs simulation panel

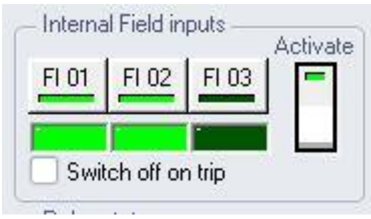


Figure 8.1.12.j: KG/KH-RTU frontend simulator field inputs panel.

Will simulate the field inputs.

FI buttons are latched type buttons that will switch the field inputs on or off. The LED inside of the FI button indicates the field input status that will be send to the KG/KH-RTU relay.

LED's under FI buttons indicated the status of the field inputs of the KG/KH-RTU relay.

Activate rocket switch will activate the field input simulated actual values to be used by the KG/KH-RTU relay. If deactivated, then the KG/KH-RTU relay will use the actual field input status.

Switch off on trip checkbox when checked will set the field input values to off when a trip condition is detected from the KG/KH-RTU. When unchecked the field input values will remain the same during a trip condition.

IL sequence simulation panel

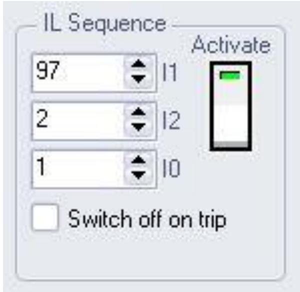


Figure 8.1.12.k: KG/KH-RTU frontend simulator IL sequence panel.

Will simulate the IL I1 positive, I2 negative and I0 zero sequence current.

When the current is below the current activation threshold then all the IL sequence levels will be set to 0.

Activate rocket switch will activate the IL sequence simulated actual levels to be used by the KG/KH-RTU relay. If deactivated, then the KG/KH-RTU relay level will set the IL sequence simulated actual levels to 0.

Switch off on trip checkbox when checked will set the IL sequence levels to 0 when a trip condition is detected from the KG/KH-RTU. When unchecked the IL sequence levels will remain the same during a trip condition.

Bluetooth word input simulation panel

Figure 8.1.12.l: KG/KH-RTU frontend simulator Bluetooth word input panel.

Will simulate the Bluetooth word input that could come from a SCADA system via Bluetooth.

Activate rocket switch will activate the Bluetooth word input simulated actual value to be used by the KG/KH-RTU relay. If deactivated, then the KG/KH-RTU relay value will use the actual Bluetooth word value.

Hold value when checked will send the last Bluetooth word input simulated actual value send last. This is to allow changing the value without sending the change. When unchecked the value that is in the Bluetooth word input simulated actual value will be send constantly.

Switch off on trip checkbox when checked will set the Bluetooth word input value to 0 when a trip condition is detected from the KG/KH-RTU. When unchecked the Bluetooth word input value will remain the same during a trip condition.

Modbus-RTU word input simulation panel

Figure 8.1.12.m: KG/KH-RTU frontend simulator Modbus-RTU word input panel.

Will simulate the Modbus-RTU word input that could come from a SCADA system via Modbus-RTU.

Activate rocket switch will activate the Modbus-RTU word input simulated actual value to be used by the KG/KH-RTU relay. If deactivated, then the KG/KH-RTU relay will use the actual Modbus-RTU word value.

Hold value when checked will send the last Modbus-RTU word input simulated actual value send last. This is to allow changing the value without sending the change. When unchecked the value that is in the Modbus-RTU word input simulated actual value will be send constantly.

Switch off on trip checkbox when checked will set the Modbus-RTU word input value to 0 when a trip condition is detected from the KG/KH-RTU. When unchecked the Modbus-RTU word input value will remain the same during a trip condition.

Insulation simulation panel

Figure 8.1.12.n: KG/KH-RTU frontend simulator insulation panel.

Will simulate the insulation level.

When current active or feedback active signal is active then the insulation level will be ignored by the KG/KH-RTU relay.

Activate rocket switch will activate the insulation simulated actual level to be used by the KG/KH-RTU relay. If deactivated, then the KG/KH-RTU relay level will use the actual insulation level measurement.

Switch off on trip checkbox when checked will set the insulation level to 0 kOhm when a trip condition is detected from the KG/KH-RTU. When unchecked the insulation level will remain the same during a trip condition.

Static RMS simulation

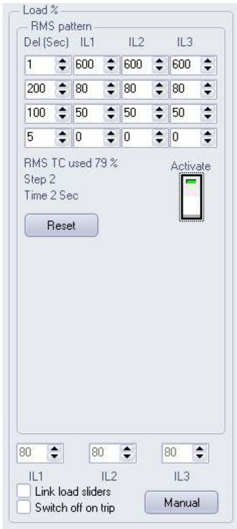


Figure 8.1.12.o: KG/KH-RTU frontend simulator static RMS simulation.

To set the KG/KH-RTU frontend simulator to static RMS simulation mode. Click on the **RMS** button located on the current simulation panel. The current RMS panel will open. The **link load sliders** will be disabled but the **switch off on trip** will remain active.

Current RMS panel is useful to see how much thermal capacity will be used with an expected load pattern of a motor. Also, the current RMS load pattern will show the expected thermal capacity that will be used with the load pattern entered below the last state.

The current RMS simulation panel has a 4 step sequence stage. Each stage has a time delay to stay in seconds before moving to the next stage. When the 4th stage has been completed then stage 1 will be executed again.

To activate the static RMS simulator, the simulator activation rocket switch and the static RMS panel rocket switch must be set to activate. When both are enabled, the RMS will start running through the IL levels set in the RMS load pattern.

Reset button will reset the RMS step back to step 1.

Manual will stop the static RMS simulation and return the simulation back to static simulation mode.

Switch off on trip checkbox when checked will set the IL1, IL2 and IL3 levels value to 0 % when a trip condition is detected from the KG/KH-RTU regardless of the step that is being executed.

State sequencer simulation

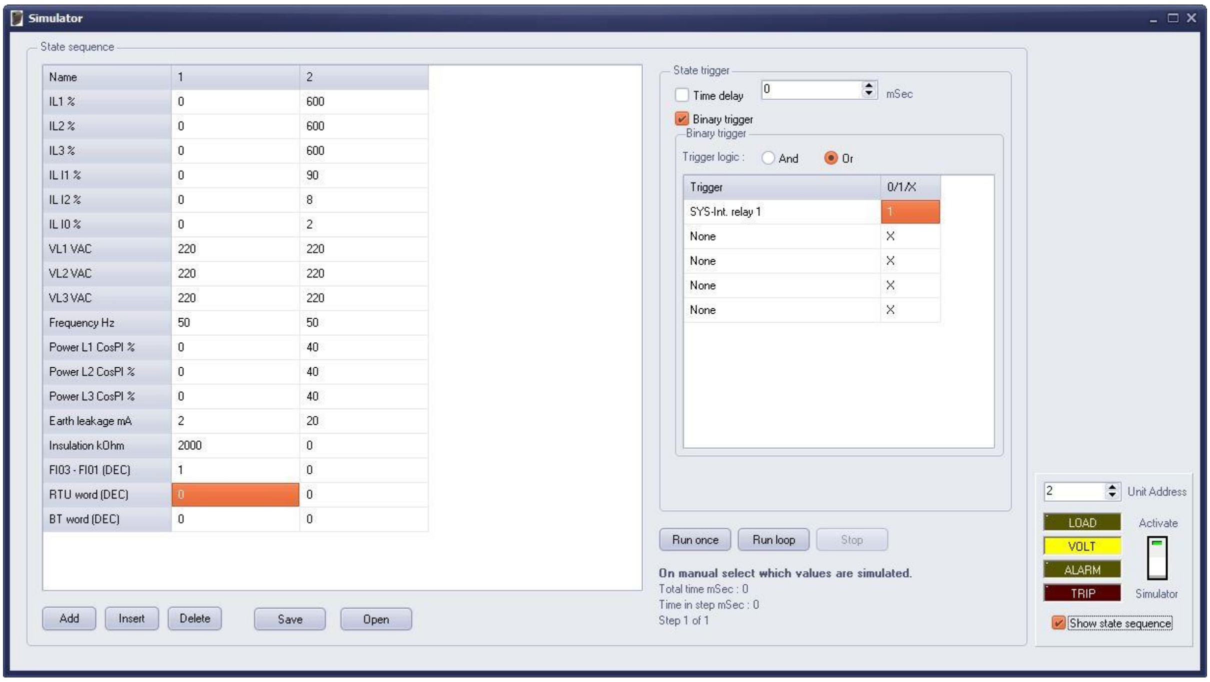


Figure 8.1.12.p: KG/KH-RTU frontend simulator state sequence simulator mode.

The state sequence simulator mode allows for more complex testing or simulation for different KG/KH-RTU relay applications. State sequence panels has a list of KG/KH-RTU relay actual values that can be used at each step of the state sequence. State trigger is conditions that need to be met in order for the state sequence to advance to the next step.

Except for the IL1, IL2 and IL3 all other KG/KH-RTU relay actual values can be enabled or disabled. In order to enable or disable the KG/KH-RTU relay go to the static simulation mode and activate the rocket switches for the selected KG/KH-RTU relay actual values needed.

Add button will add a new state at the end of the steps. In the above image if state 1 is selected and the add button was clicked a state 3 will be added to the end.

Insert button will add a new state to the right of the selected state. In the above image if state 1 is selected and the insert button was clicked then state 2 will become state 3 and a new state will set at state 2 position.

Delete button will delete the current state selected.

Save button will save the state sequence simulation to a file.

Open button will open and load a state sequence simulation from a file.

State sequence simulator trigger panel

Figure 8.1.12.q: KG/KH-RTU frontend simulator state sequence simulator trigger panel.

The trigger panel is the conditions that need to be met to move from 1 state to the next state in the state sequence list.

Click on the state sequence column to view that state triggers.

The triggers can use a **Time delay** or **Binary trigger** or **Time delay** and **Binary trigger** condition need to be met before advancing. In order to select the condition check the checkbox next to the trigger selection.

In the case that the **Time delay** and **Binary trigger** is selected. Then the condition that was met first will allow the state sequence state will move on to the next.

Time delay trigger is a set time that the selected state can be active in milli seconds.

Binary trigger is bit conditions that need to be met to advance to the next step. The 5 bits can be placed with **AND** logic that all bits must match the state to advance to the next state sequence state. **OR** logic will use any of the 5 bits true state to advance to the next state sequence state. Double click on the trigger row and select the bit from the KG/KH-RTU relay that must be monitored for the logic condition. Click on the row in the column **0/1/X** to select between 0 = false, 1 = true or X = do not care about this bit.

Before starting the state sequence, the simulator activation rocket switch must be active.

Run once will run through the state sequence once.

Run loop will run through all the state sequence state. At the end the 1st state sequence state will execute again.

Stop will stop the state sequence from running.

8.1.13 Recorder KG/KH-RTU Frontend

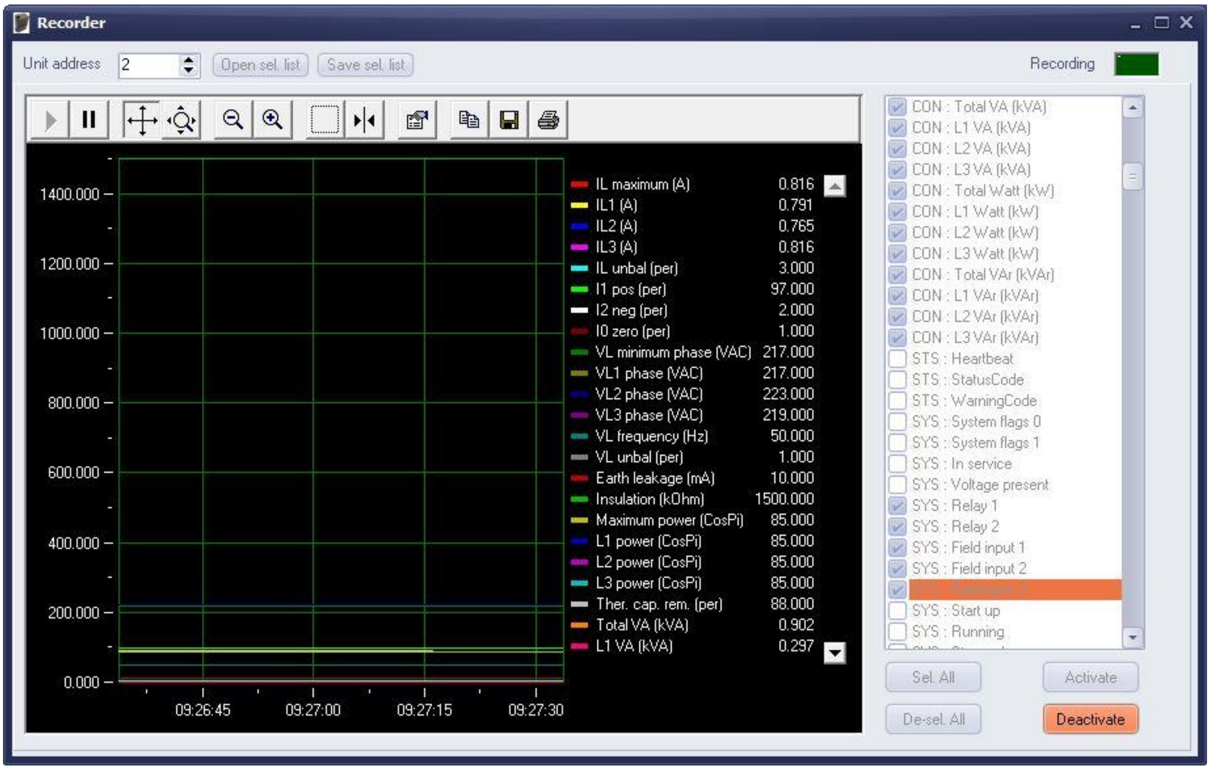


Figure 8.1.13.a: KG/KH-RTU frontend recorder.

KG/KH-RTU frontend recorder allows recording of the KG/KH-RTU relay actual values.

The recording can be done via the Modbus-RTU port or Bluetooth.

Before starting the recording make sure that the correct **Unit address** is selected in the address bar.

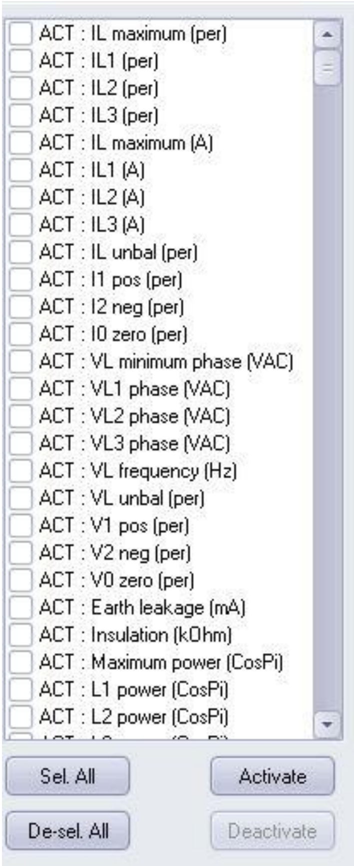


Figure 8.1.13.b: KG/KH-RTU frontend recorder actual value list.

Select the KG/KH-RTU relay actual values that need to be recorded from the actual value list (Figure 8.1.13.b) by checking the check box on the left of the actual value parameter. Only the values selected in the actual value list will be used for the recording. Click the **Activate** button. The actual value list will become greyed out and the selected actual values will be added to the graph (Figure 8.1.13.a).

Saving and opening the selected value list

The list can be saved by clicking on the **Save sel. list** button or a previous saved list can be opened by clicking on the **Open sel. list** button.

The list can only be saved or opened when the graph is deactivated.

Starting the record to file

Click the property button  of the graph. The Plot property window will then pop up (Figure 8.1.13.c).

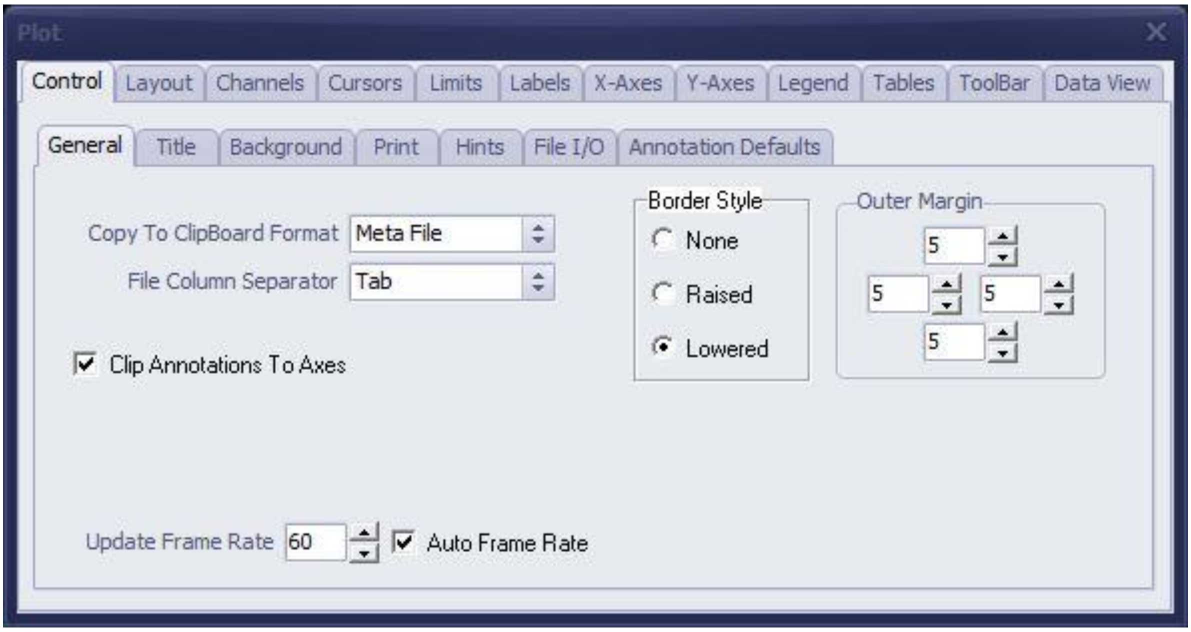


Figure 8.1.13.c: KG/KH-RTU frontend recorder plot property window.

Click on the **File I/O** tab. The record to file reported file will open (Figure 8.1.13.d). Click the file selection **…** button. After selecting the folder and file to record to click the **Activate** button.

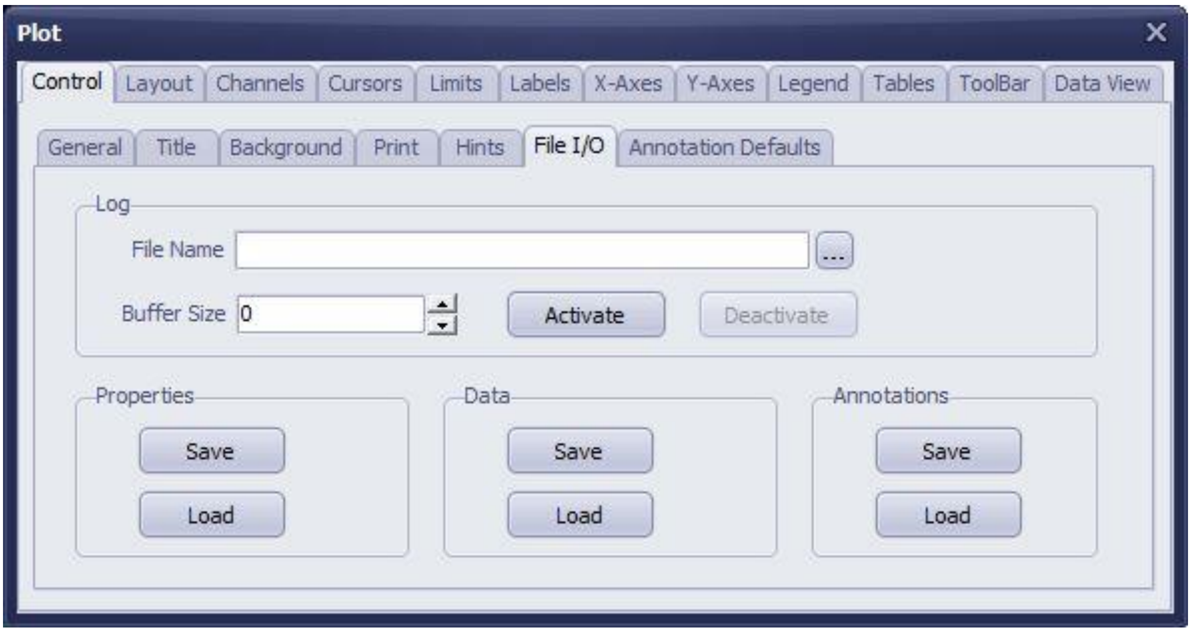


Figure 8.1.13.d: KG/KH-RTU frontend recorder plot recorder deactivated.

After the **Activate** button is clicked the file I/O window will lock (Figure 8.1.13.e). The Plot property window can be placed by pressing the **X** button. If the recording is being written to the file successful, the record LED 

will be active. It is possible to have the KG/KH-RTU frontend and the recorder open on the same time.

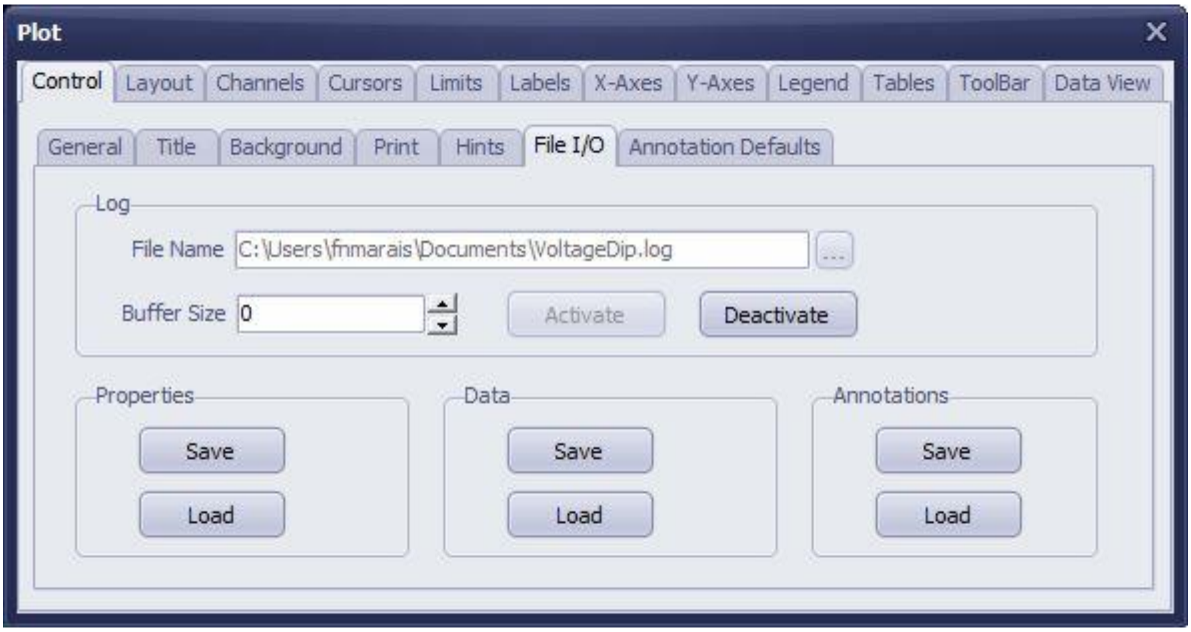
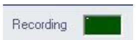


Figure 8.1.13.e: KG/KH-RTU frontend recorder plot recorder activated.

To stop the recording, open the plot property window and under the **File I/O** tab click the **Deactivate** button. The recording LED 

will then be deactivated. After deactivating the recording, the recording file that is a CSV format can then be imported into a spreadsheet application.

Importing the CVS file using spread sheet applications like Microsoft Excel™

The following example uses MS Excel 365™.

Open a new spread sheet.

Select Data -> From Text/CSV (Figure 8.1.13.f).

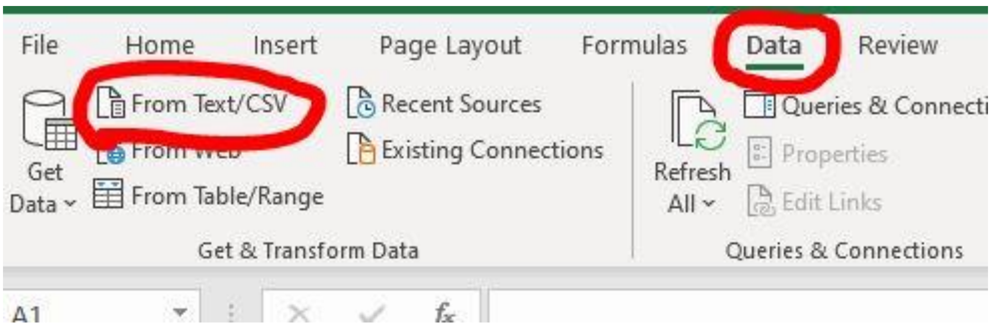


Figure 8.1.13.f: MS Excel select to import the CSV file.

Change the file type to “All Files (*.*)” and select the recorded file.

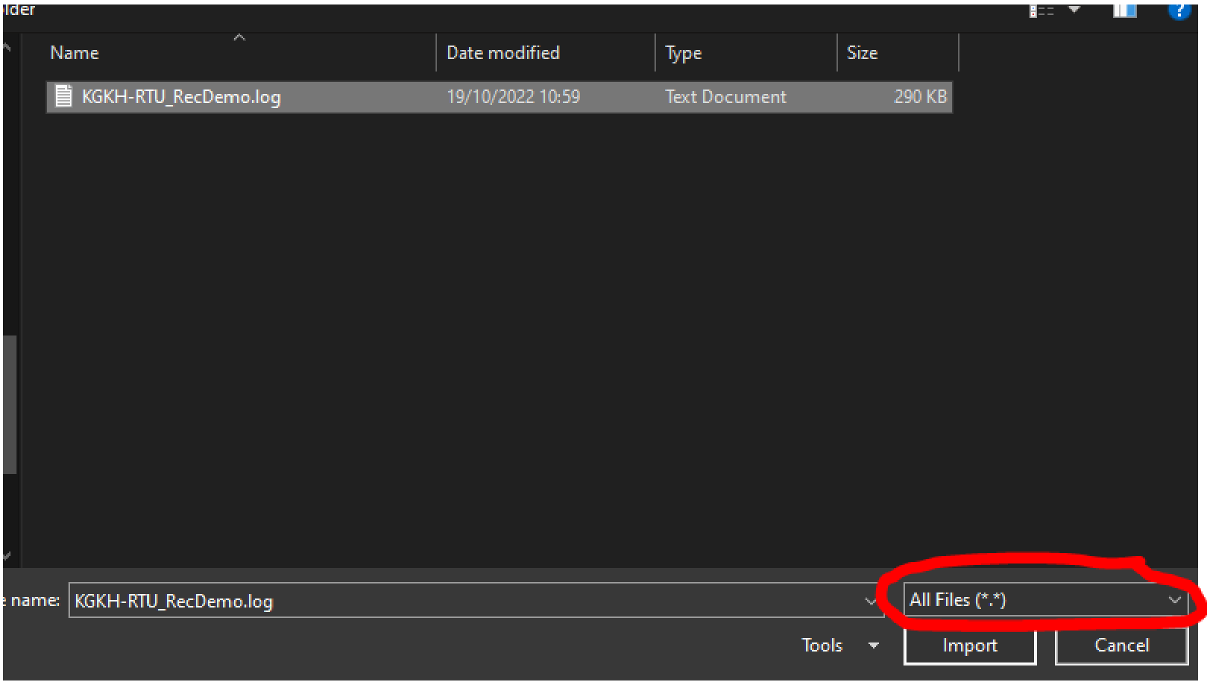


Figure 8.1.13.g: Select the recorded file.

To correct the date and time stamp right click on column A and select *“Format Cell”*. Select *“Custom”* and type the date format *“dd/mm/yyyy hh:mm:ss.000”* and click *“OK”* button.

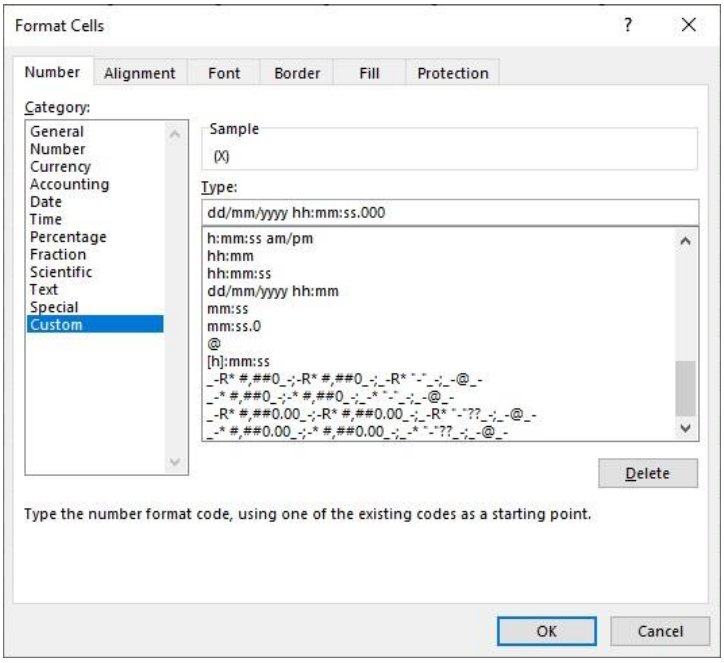


Figure 8.1.13.h: Change recording date and time format.

When correct column A will show as a readable date and time format.

A (X)	IL maxim
19/10/2022 10:51:58.929	
19/10/2022 10:51:59.029	
19/10/2022 10:51:59.138	
19/10/2022 10:51:59.248	
19/10/2022 10:51:59.360	
19/10/2022 10:51:59.470	
19/10/2022 10:51:59.582	
19/10/2022 10:51:59.689	
19/10/2022 10:51:59.797	
19/10/2022 10:51:59.906	
19/10/2022 10:52:00.020	
19/10/2022 10:52:00.123	
19/10/2022 10:52:00.233	
19/10/2022 10:52:00.347	
19/10/2022 10:52:00.457	
19/10/2022 10:52:00.561	
19/10/2022 10:52:00.670	
19/10/2022 10:52:00.783	
19/10/2022 10:52:00.888	
19/10/2022 10:52:01.003	
19/10/2022 10:52:01.109	
19/10/2022 10:52:01.321	
19/10/2022 10:52:01.347	
19/10/2022 10:52:01.436	
19/10/2022 10:52:01.548	
19/10/2022 10:52:01.654	
19/10/2022 10:52:01.764	
19/10/2022 10:52:01.877	
19/10/2022 10:52:01.982	
19/10/2022 10:52:02.094	

Figure 8.1.13.h: Recording column A show correct date and time format.

The area can now be selected, and a chart can be created from the selected data.

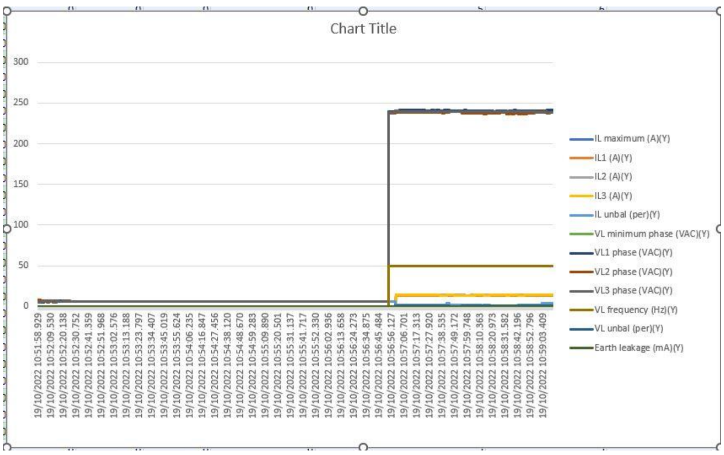


Figure 8.1.13.i: Recorded data converted to chart.

8.2 KG/KH-RTU Android Application Configuration Software

The KG/KH-RTU Android application configuration software (KG/KH-RTU app) will allow the KG/KH-RTU relay to be monitored and configured via a phone, tablet or any other smart device with Android installed and can support Bluetooth low energy.

8.2.1 Installing KG/KH-RTU App

To install the KG KH Relay App, go to the Play store on an Android phone. Type “KG_KH Relay” in the search box (Figure 8.2.1.a).

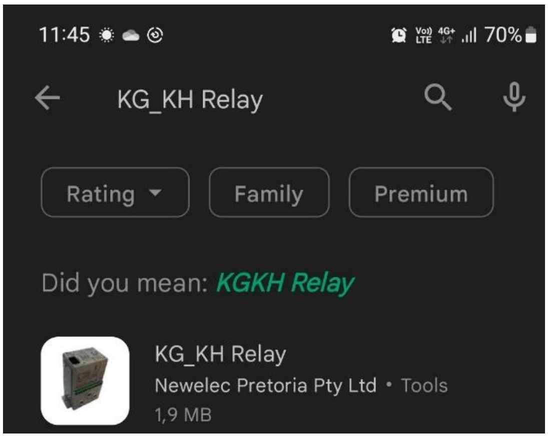


Figure 8.2.1.a: KG/KH-RTU Relay Android application from play store

Click on the KG_KH Relay NewElec Pretoria Pty Ltd application. Click on the install button and wait for the installation to complete.

Enabling device location permission for the KG/KH-RTU application

It is crucial that the location of the KG/KH-RTU app must be given permission to use the location of the device. The KG/KH-RTU app does not share the location of the device. But it is required by the Bluetooth component to locate the KG/KH-RTU relay via Bluetooth LE.

The walkthrough is done using HUAWEI mate 20.

To enable the KG/KH-RTU app permission to use the device location follow the following steps:

1. Open **settings** on the smart device.

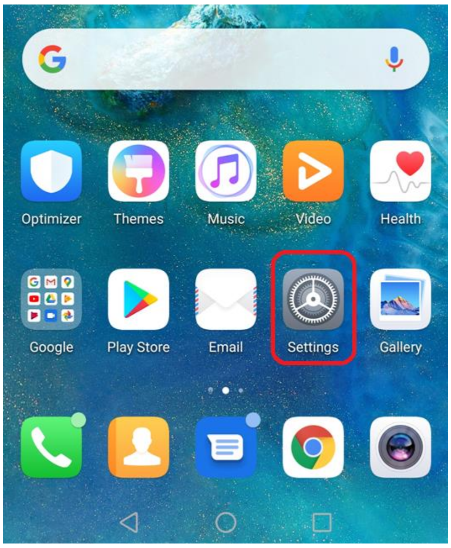


Figure 8.2.1.b: Smart device settings.

2. Select **Apps**

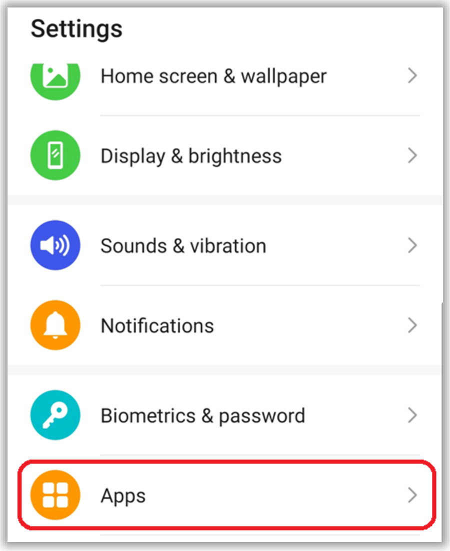


Figure 8.2.1.c: Smart device Apps location.

3. Select **Permission manager**

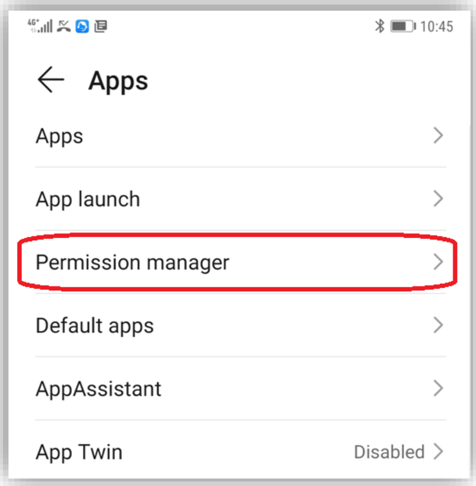


Figure 8.2.1.d: Smart device Permission manager.

4. Select **Location**

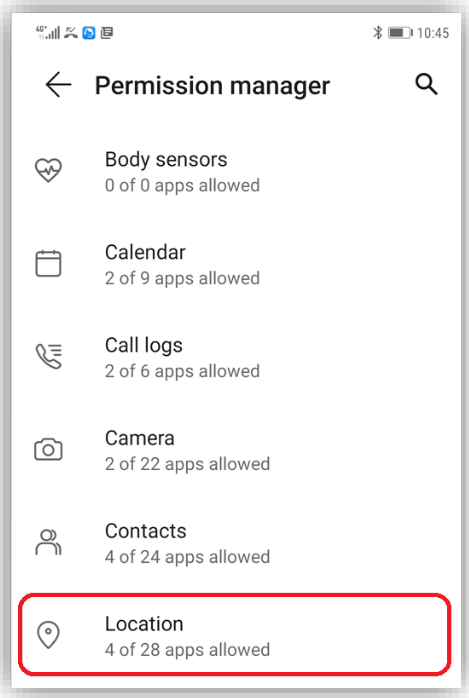


Figure 8.2.1.e: Smart device Location manager.

5. Select the **KG_KH – XXX-XX** App

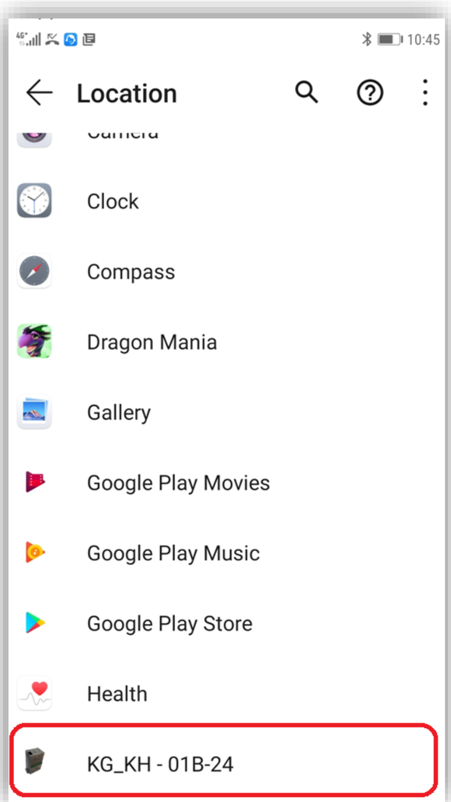


Figure 8.2.1.f: Smart device select the KG/KH-RTU app for location permission.

6. Make sure that the location permission is set to **Allow only while using the app**

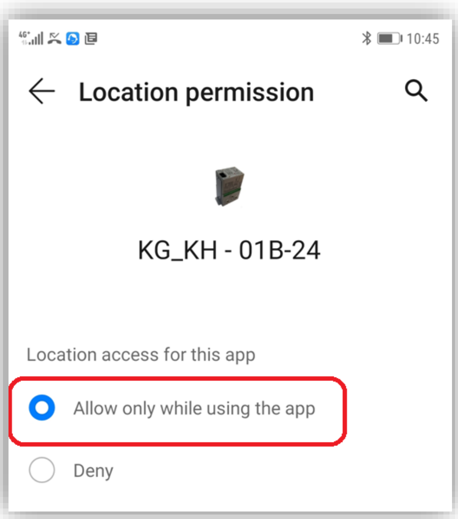


Figure 8.2.1.g: Smart device select the KG/KH-RTU app for location permission activated.

After the location settings has been applied, the KG/KH-RTU app is then ready for use.

8.2.2 Linking Up the KG/KH-RTU App and KG/KH-RTU Relay

Open the KG/KH-RTU app. Click on the Device icon located in the lower right corner.
The scanning for KG/KH-RTU relays will begin.

Figure 8.2.2.a: KG/KH-RTU app select Device to start scanning.

When doing a Bluetooth LE scan, it is possible to find multiple KG/KH-RTU relays. A list of KG/KH-RTU relays will show that has been detected (Figure 8.2.2.a). The Bluetooth LE scan will last for 10 seconds before the device list is populated.

Figure 8.2.2.b: KG/KH-RTU app showing results of KG/KH-RTU relays detected.

To distinguish between KG-RTU and KH-RTU relays, the image icon will be used to indicate KG-RTU or KH-RTU relay.
(Figure 8.2.2.c) shows the device list with one KG-RTU and one KH-RTU relay in the device list.

Next to the image of the KG/KH-RTU relay listed is some useful information about the KG/KH-RTU relay (Figure 8.2.2.c).

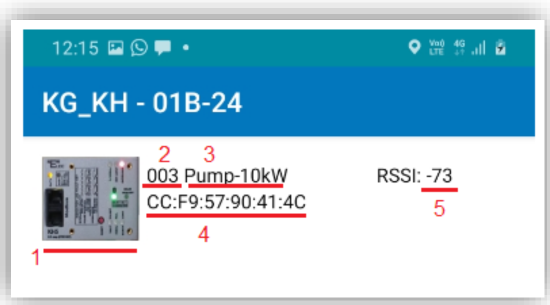


Figure 8.2.2.c: KG/KH-RTU app found unit description.

1. KG-RTU or KH-RTU image.
2. Modbus-RTU Slave Address of the relay.
3. KG/KH-RTU Relay Unit ID.
4. Bluetooth LE MAC address.
5. Signal strength indicator in db. (See 8.3.1)

After the KG/KH-RU has been located that is needed click on KG/KH-RTU device. The KG/KH-RTU device Bluetooth LED will go from green to a flashing blue colour (Figure 8.2.2.d).

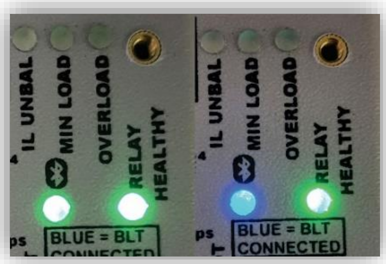


Figure 8.2.2.d: KG/KH-RTU relay Bluetooth status LED from disconnected to connected.

8.2.3 KG/KH-RTU App Home Screen

The KG/KH-RTU app home screen (Figure 8.2.3.a) is the base navigation menu to all the KG/KH-RTU relays parameters.

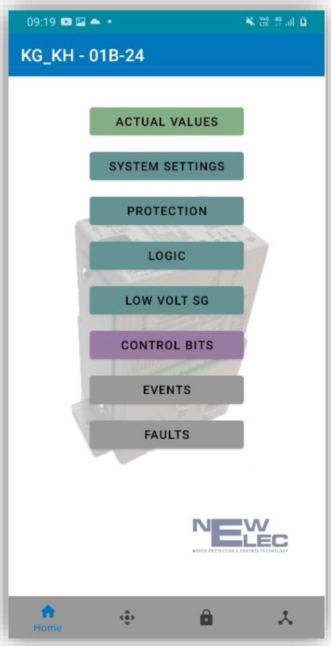


Figure 8.2.3.a: KG/KH-RTU app home screen layout.

KG/KH-RTU app home screen can be selected at any point during all the other screens by pressing the **Home** button  located on the lower left corner.

8.2.4 KG/KH-RTU App Password

Depending on the configuration of the KG/KH-RTU application the KG/KH-RTU may be protected via a password. This requires the KG/KH-RTU app to unlock the KG/KH-RTU relay with a password.

The password key can be inserted by click on the **lock** 

button located on the bottom, second from the right. The KG/KH-RTU app unlock screen (Figure 8.2.4) will then open. Here the password can be entered to unlock the KG/KH-RTU protection or protection and logic configuration depending on the password configuration in the KG/KH-RTU relay.

Figure 8.2.4: KG/KH-RTU app password screen.

8.2.5 Read Settings Using the KG/KH-RTU App

When going into any selected settings screen the settings will be updated on the KG/KH-RTU App automatically.

8.2.6 Write Settings Using the KG/KH-RTU App

Go to the setting page of the setting that needs to be altered as in Figure 8.2.6.a.

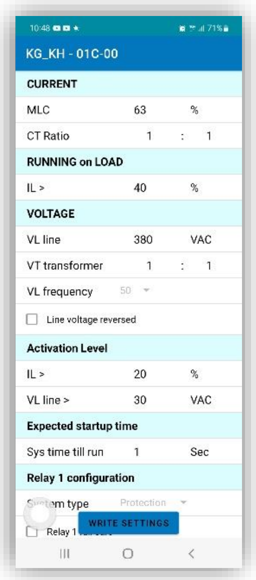


Figure 8.2.6.a: KG/KH-RTU App system setting screen.

Touch the desire setting parameter that needs to change. For example, changing the VL line voltage selection touch the 380 VAC as in Figure 8.2.6.a. A popup window as in Figure 8.2.6.b will open that will allow changing of the parameter field.

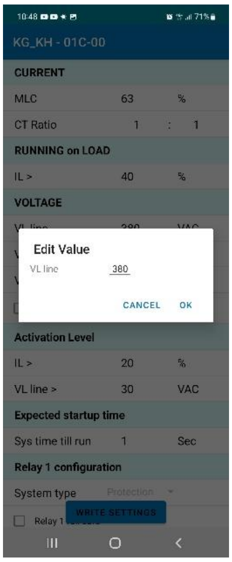


Figure 8.2.6.b: KG/KH-RTU App VL line parameter edit pop up.

Edit the parameter value and touch the "**OK**" button. After the popup window closed touch the 

"**WRITE SETTINGS**" button. All the settings off the setting category will then be updated.

Settings changes that have been changed and has not been written to the KG/KH-RTU Relay, will cleared by the read settings when going back to the home selection screen.

8.2.7 Signal strength

Only a signal strength above -75db will allow the KG or KH relay to be shown in the device list. Relays with a signals strength below -75db will not be shown in the device list.

8.2.8 Device name change

The device name of the relay can **ONLY** be changed from the front end. The Android App will use the same device name given in the front end as the display name for the device.

The device name given by the frontend will also be used by the Android App.

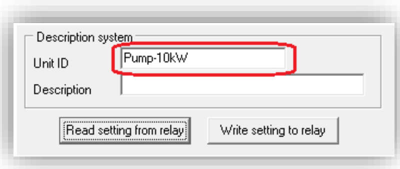


Figure 8.3.2.a: Frontend Device name via Unit ID.

Figure 8.3.2.b: Android App Device name displayed.

9 Actual Values

The actual values are the real time system values like current and voltages. These actual values can be viewed using either the Frontend or the Android App.

This section indicates how to obtain the actual values from the KG/KH-RTU by using either the **Frontend** or the **Android App** used to communicate with the KG/KH-RTU.

9.1 System values

9.1.1 Indicators

Indicators system values screen:

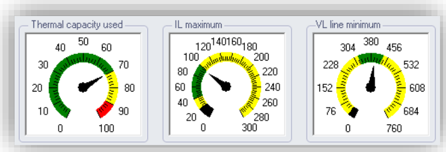
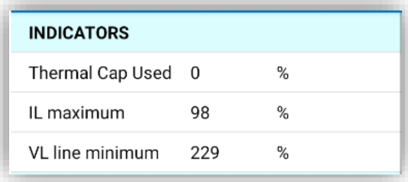
<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Actual values ☞ System values</td><td>☞ Actual values ☞ System values</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><td>Thermal capacity used</td><td colspan="2">When thermal curve selection is IEC60255-8 then the thermal capasity works as is. Any other selection then the thermal capasity used becomes time till trip completer in persentage value.</td></tr>
<tr><td>IL Maximum</td><td colspan="2">Maximum IL between the three phases IL1, IL2 and IL3 in percentage load of the MLC selection.</td></tr>
<tr><td>VL lime minimum</td><td colspan="2">Minimum VL line voltage between the three phase voltage VL1, VL2 and VL 3 in VAC.</td></tr>
</table>

Table 9.1.1: Indicators system values screen.

9.1.2 Current

All current measured and calculated related parameters are displayed on the system values screen.

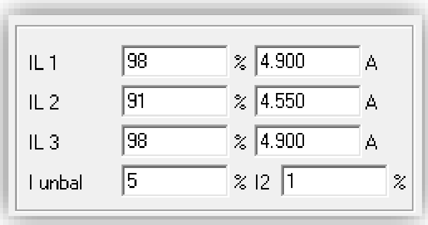
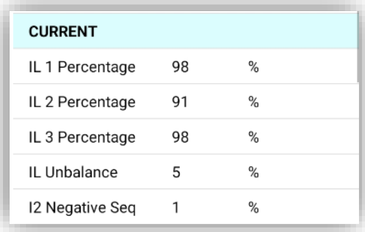
	Frontend	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		
Parameters		
IL1, IL2 and IL3	3 phase current load levels in % of the MLC selection.	
I unbal	IL unbalance level between IL1, IL2 and IL3 in %.	
I2 Negative sequence	I2 negative sequence calculation of IL1, IL2 and IL3 in %.	

Table 9.1.2: Current system values screen.

9.1.3 Voltage

All voltage measured and calculated related parameters are displayed on the system values screen.

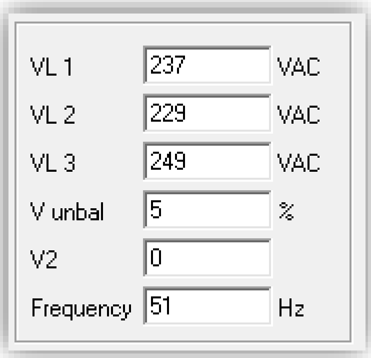
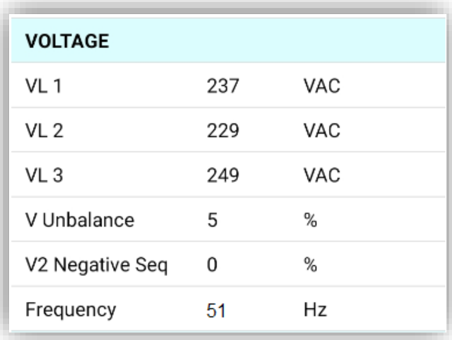
	Frontend	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		
Parameters		
VL1, VL2 and VL3	Voltage line 3 phase VL1, VL2 and VL3 measured as phase voltage in VAC.	
VL unbalance	Voltage unbalance level calculated units in %.	
V2 negative sequence	VL negative sequence calculation across VL1, VL2 and VL3, units in %.	
Frequency	VL maximum frequency measured accorss VL1, VL2 and VL3 in Hertz.	

Table 9.1.3: Voltage system values screen.

9.1.4 Earth Leakage

All earthing measured and calculated parameters are displayed on the system values screen.

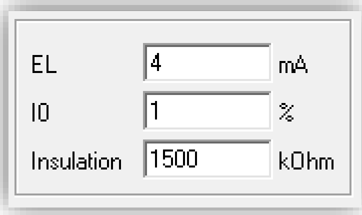
	Frontend	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		
Parameters		
Earth leakage	Earth leakage measurement done via a CBCT in mA.	
I0 zero sequence	I0 sequence calculation from IL1, IL2 and IL3 in %.	
Insulation	Insulation measurement done via the insulation lockout modulre in kOhm.	

Table 9.1.4: Earth leakage system values screen.

9.1.5 Actual Power Levels Summary

Actual power level measured, and calculated parameters displayed on the system values screen.

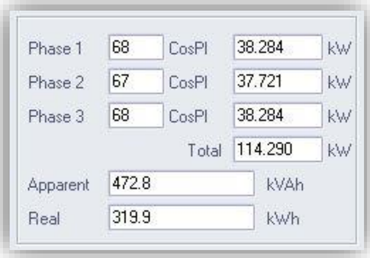
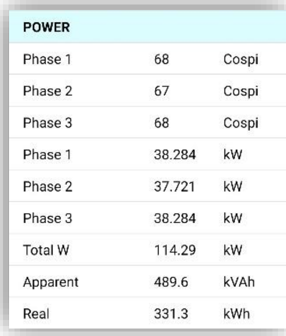
	Frontend	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		
Parameters		
L1, L2 and L3 Cosθ	Angle difference between IL and VL measured and calculated in % of Cosθ.	
L1, L2 and L3 real power	L1, L2 and L3 and total real power measured and calculated in kWatts.	
Total apparent power consumed	Total calculated apparent power being consumed in kVAh.	
Total real power consumed	Total calculated real power being consumed in kWh.	

Table 9.1.5: Actual power levels summary system values screen.

9.1.6 Starts Left

Start left calculated on the system values screen.

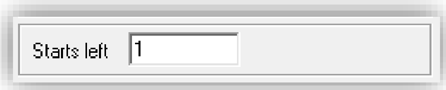
	Front-end	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		See chapter 9.1.5
Parameters		
Starts left	Amount of start left before KG/KH-RTU will prevent another start from starting the application.	

Table 9.1.6: Starts left system values screen.

9.1.7 KG/KH-RTU Information

All KG/KH-RTU information parameters displayed on the system values screen.

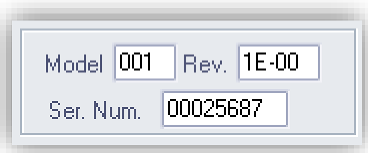
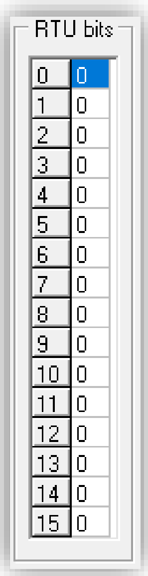
	Frontend	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		Not available
Parameters		
Model	KG/KH-RTU IL rated modal number in Amps.	
Revision	Firmware revision loaded into the KG/KH-RTU FLASH memory.	
Serial number	Serial number allocated to the KG/KH-RTU.	

Table 9.1.7: Actual KG/KH-RTU system values screen.

9.1.8 Control Bits

All KG/KH-RTU control bits parameters are displayed on the system values screen.

<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Actual values ☞ System values</td><td>☞ Actual values ☞ System values</td></tr>
<tr><td>Screens</td><td>

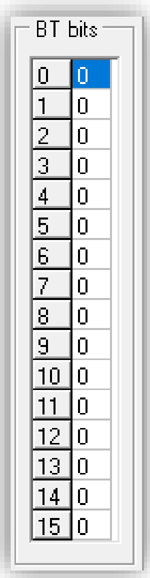

</td><td>Not available</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><td>RTU bits</td><td colspan="2">Control bits that is controlled via the Modbus-RTU communication port.</td></tr>
<tr><td>BT bits</td><td colspan="2">Control bits that is controlled via the Bluetooth communication port.</td></tr>
</table>

Table 9.1.8: KG/KH-RTU control bits system values screen.

9.1.9 Status

All status parameters are displayed on the system values screen.

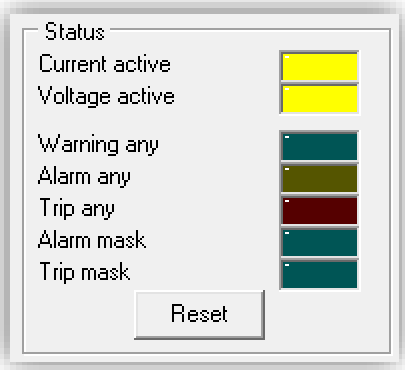
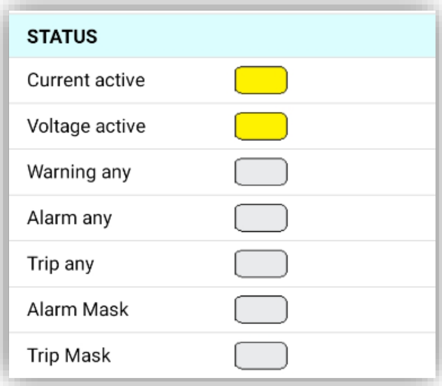
	Frontend	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		
Parameters		
Current active	One of the IL levels is above the IL activation level.	
Voltage active	One of the VL levels is above the VL activation level.	
Warning any	One of the warning flags are active.	
Alarm any	One of the alarm flags are active.	
Alarm mask	One of the alarm flags that is enabled with the alarm flag mask (See chapter 9.7.7) is active.	
Trip mask	One of the trip flag that is enabled with the trip flag mask (See chapter 9.7.7) is active.	

Table 9.1.9:KG/KH-RTU status system values screen.

9.1.10 Field Input and Relay Status

All field inputs and relay's status parameters displayed on the system values screen.

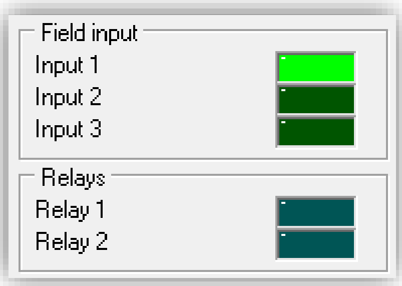
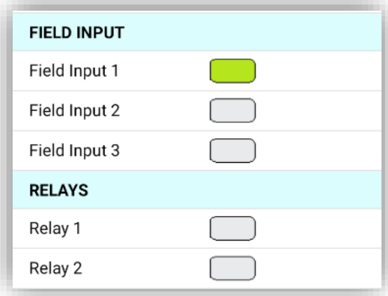
	Frontend	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		
Parameters		
Field input 1, 2 and 3	Field input 1, 2 and 3 status.	
Relay 1 and 2	Relay 1 and 2 energization status.	

Table 9.1.10: Field inputs and relay outputs system values screen.

9.1.11 Relay Clock and Relay Unlock

Relay clock and protection status parameters displayed on the system values screen.

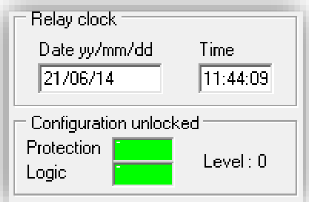
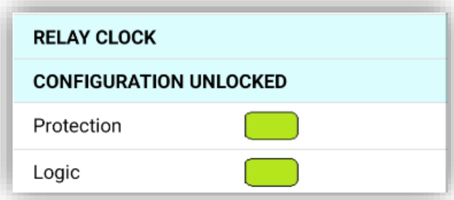
	Frontend	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		
Parameters		
Relay clock	KG/KH-RTU Relay internal clock date and time stamp. This time is used for date and time stamping the event and fault records.	
Password unlock indication	Indicate if the protection and logic configuration is unlocked and can be configured. If deactivated then a password is needed to unlock the protection or logic configuration block.	

Table 9.1.12: KG/KH-RTU clock and protection unlocked system values screen.

9.1.12 Set Thermal Capacity

Reset the thermal capacity to a level between 0 % and 100 %.

Set thermal capacity can be used to clear the thermal capacity memory to start equipment.

It is recommended to use the set thermal capacity feature only when needing to start a motor under emergency condition. Resetting the thermal capacity continuously can cause damage to equipment.

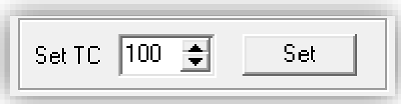
	Frontend	Android Application
Navigation	☞ Actual values ☞ System values	☞ Actual values ☞ System values
Screens		Not available
Parameters		
Set TC	Set the thermal capacity used level to configured level.	

Table 9.1.12: Set thermal capacity used level system values screen.

9.2 Measured Power Values

9.2.1 Current and Voltage Levels

All current and voltage measured and calculated parameters displayed on the measure power values screen.

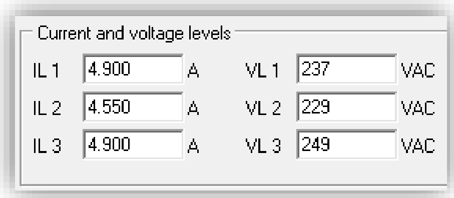
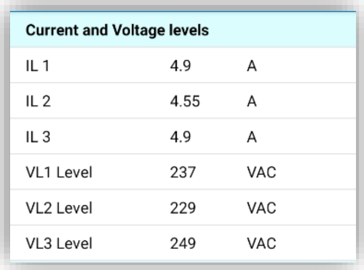
	Frontend	Android Application
Navigation	☞ Actual values ☞ Measured power values	☞ Actual values ☞ Measured power values
Screens		
Parameters		
IL1, IL2 and IL3	Current levels of IL1, IL2 and IL3 dispayed in Amps.	
VL1, VL2 and VL3	Voltage levels of VL1, VL2 and VL3 displayed in VAC phase voltage.	

Table 9.2.1: Current and voltage levels measured power values screen.

9.2.2 Power Levels

All active measured power level parameters displayed in the measured power values screen.

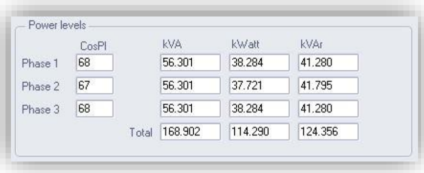
<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Actual values ☞ Measured power values</td><td>☞ Actual values ☞ Measured power values</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><td>L1, L2 and L3 Cosθ</td><td colspan="2">Angle difference between IL and VL measured and calculated in % of Cosθ.</td></tr>
<tr><td>L1, L2, L3 and total apparent power</td><td colspan="2">Apparent power calculated from measured IL and VL in kVA.</td></tr>
<tr><td>L1, L2, L3 and total real power</td><td colspan="2">Real power calculated from measured IL, VL and Cosθ in kWatt.</td></tr>
<tr><td>L1, L2, L3 and total reactive power</td><td colspan="2">Reactive power calculated from measurement IL, VL, kVA and kWatt.</td></tr>
</table>

Table 9.2.2: Power levels measured power values screen.

9.3 Harmonics

9.3.1 Harmonic Levels

Indicate the harmonic parameter levels for current and voltages on all three phases. Harmonic levels f0 to f31 is displays as a bar graph, where each green bar indicates a harmonic level in the harmonics screen.

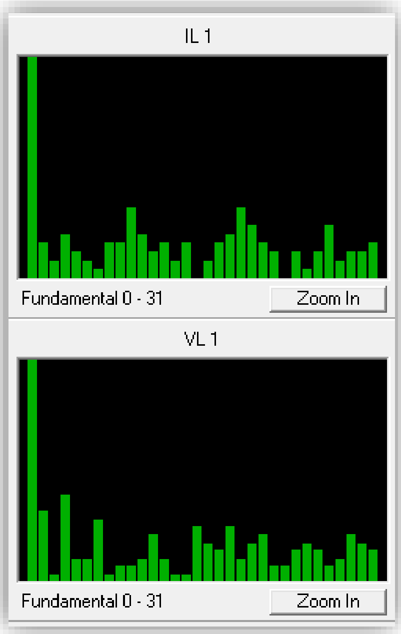
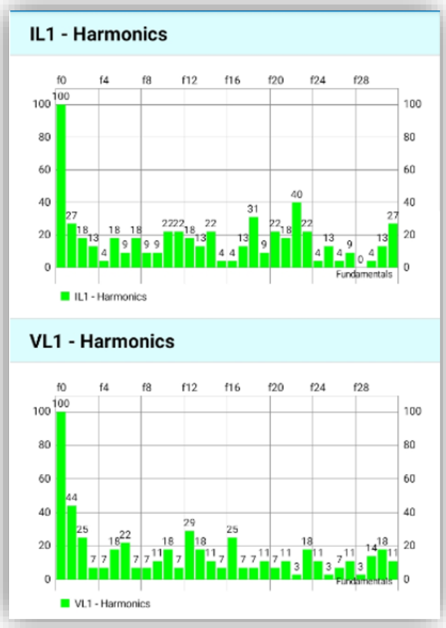
	Frontend	Android Application
Navigation	☞ Actual values ☞ Harmonics	☞ Actual values ☞ Harmonics
Screens		
Parameters		
IL1, IL2, IL3, VL1, VL2 and VL3 fundamental 0 to 31 levels	Fundamental frequency of the selected voltage line frequency selected (See chapter 10.1.4).	

Table 9.3.1: Harmonic fundamental 0 to 31 levels on harmonics screen.

9.3.2 Harmonic Maximums

Harmonics maximum measured and calculated parameters level displayed on the harmonics screen.

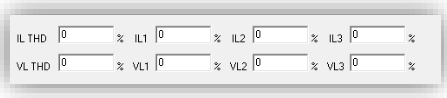
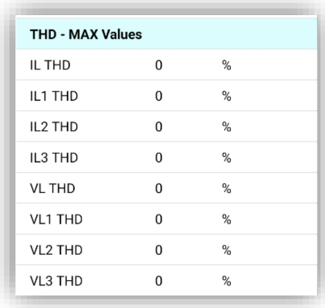
	Frontend	Android Application
Navigation	☞ Actual values ☞ Harmonics	☞ Actual values ☞ Harmonics
Screens		
Parameters		
IL THD	IL maximum total harmonic distortion level between IL1, IL2 and IL3 in %.	
VL THD	VL maximum total harmonic distortion level between VL1, VL2 and VL3 in %.	
IL1, IL2 and IL3 THD	IL1, IL2 and IL3 measured and calculated total harmonic distortion level in %.	
VL1, VL2 and VL3 THD	VL1, VL2 and VL3 measured and calculated total harmonic distortion level in %.	

Table 9.3.2: Harmonic maximums on harmonic screen.

9.4 *Warning, Alarm and Trip Flags*

Across all screens warning, alarm and trip flag will be represented as follow in Table 9.4:

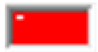
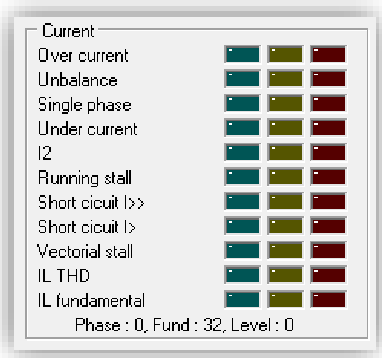
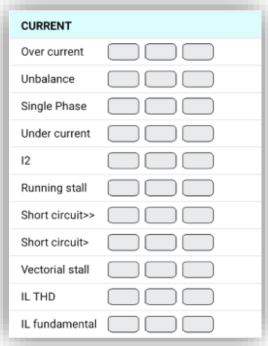
Indications	Frontend		Android Application	
	True	False	True	False
Warning flag				
Alarm flag				
Trip flag				

Table 9.4: Warning, alarm and trip flag indications on the KG/KH-RTU frontend and app.

9.4.1 Current Flags

Indicate the warning, alarm and trip flags for current parameters on warning, alarm and trip screen.

Note that the descriptions are brief and for full description see the protection feature for more information.

	Frontend	Android Application
Navigation	☞ Actual values ☞ Warn, alarm and trip flags	☞ Actual values ☞ Warn, alarm and trip flags
Screens		
Parameters		
Over current warning, alarm and trip flags	IL overcurrent warning and alarm flag will become true once IL1 or IL2 or IL3 goes above 100% IL level. The alarm flag will then activate the time till trip. When the time to trip limit is reached then the trip flag will be set. The warning and alarm flag will become false once IL1, IL2 and IL3 level is below 100% IL. The trip flag can only become false after a reset command is executed via autoreset or manual reset and the time to reset has expired.	
Unbalance warning, alarm and trip flags	IL unbalance warning and alarm flag will become true once the IL unbalance level is above the threshold and will start the time till trip counter. In the event that the IL unbalance falls below the IL unbalance trip level then the time till trip will be reseted. When the time till trip has reached the IL unbalance trip time then the IL unbalance trip flag will be set to true. The IL unbalance trip flag can only be reseted manualy.	

Single phase warning, alarm and trip flags	IL single phase warning and alarm flag will become true once the IL unblance level is above 70%. The time till trip will activate. When the IL unbalance level is below 70% then the IL single phase warning and alarm flag will become falls. In the event that the time till trip is complete then the IL single phase trip flag will be set. The IL single phase trip flag can only be reset manualy.
Under current warning, alarm and trip flags	Under current warning and alarm flag will be set true once the IL level or power level on one of the phases is below the trip threshold the under current warning and alarm flag will be set to true and the time till trip will be activated. When the IL level or power level is above trip threshold the under current warning and alarm flag will be set to false. When the time till trip is over the IL under current trip delay the under current trip flag will be set. The trip flag can be set to false with manual or auto reset.
I2 negative sequence warning, alarm and trip flags	I2 warning and alarm flag will be set to true when the I2 level is above the I2 trip threshold. The time till trip will then be activated. When the I2 level is below the I2 trip threshold then the I2 warning and alarm flag will be set to false. When the time till trip is above the I2 trip delay then the I2 trip flag will be set to true. I2 trip flag can be set to false with a manual reset.
Running stall warning, alarm and trip flags	When the running stall conditions are met the runnning stall warning and alarm flag will be set to true. The time till trip will be activated. When the IL level falls below the running stall trip threshold the running stall warning and alarm flag will be set to false. When the time till trip is above the running stall trip delay then the running stall trip flag will be set to true. The running stall trip flag can be reset to false with a manual reset.
Short circuit I>> warning, alarm and trip flags	Short circuit I>> warning and alarm flag will be set to true when the short circuit conditions are met and start the short circuit I>> time till trip. The warning and alarm flag will be set to false once the short circuit conditions are cleared. When the short circuit I>> time till trip is obve the short circuit I>> trip delay then the trip flag will be set to true. The short circuit I>> trip flag can be set to false with a manual reset.
Short circuit I> warning, alarm and trip flags	Short circuit I> warning and alarm flag will be set to true when the short circuit conditions are met and start the short circuit I> time till trip. The warning and alarm flag will be set to false once the short circuit conditions are cleared. When the short circuit I> time till trip is obve the short circuit I> trip delay then the trip flag will be set to true. The short circuit I> trip flag can be set to false with a manual reset.
Vectorial stall warning, alarm and trip flags	Vectorial stall warning and alarm flag will be set to true once the vectorial stall conditions are met. The vectorial stall time till trip will be activated. When the vectorial stall condition is cleared the the vectorial stall warning and alarm flag will be set to false. Once the time till trip is above the vectorial stall trip delat then the vectorial stall trip flag will be set to true. The vectorial stall trip flag can be set to false with a manual reset.
IL THD warning, alarm and trip flags	IL THD warning and alarm flag will be set to true once the IL THD level is above the IL THD trip level. The IL THD time till trip will then be activated. When the IL THD level is below the IL THD trip level then the IL THD warning and alarm flag will then be set to false. When the IL THD time till trip is above the IL THD trip delay then the IL THD trip flag will then be set to true. The IL THD trip flag can be set to false with a manual reset.
IL fundamental warning, alarm and trip flags	IL fundamental warning and alarm flag will be set to true once one of the IL fundamental levels are above the IL fundamental trip level. The IL fundamental time till trip will then be activated. Once all IL fundamental levels are below the IL fundamental trip level the IL fundamental warning and alarm flag will be set to false. When the IL fundamental time till trip is above the IL fundamental trip delay then

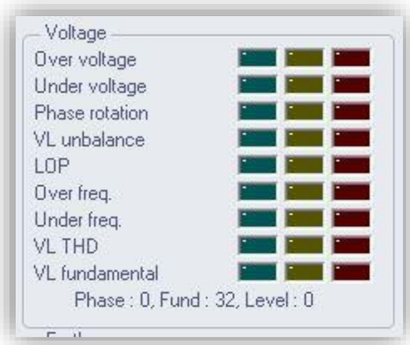
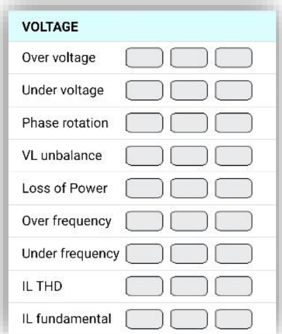
	the IL fundamental trip flag will be set to true. The IL fundamental trip flag can then be reset to false with a manual reset.

Table 9.4.1: Current warning, alarm and trip flags panel.

9.4.2 Voltage Flags

Indicate the warning, alarm and trip flags for voltage parameters on warning, alarm and trip screen.

Note that the descriptions are brief and for full description see the protection feature for more information.

	Frontend	Android Application
Navigation	☞ Actual values ☞ Warn, alarm and trip flags	☞ Actual values ☞ Warn, alarm and trip flags
Screens		
Parameters		
Over voltage warning, alarm and trip flags	Over voltage warning and alarm flags will be set to true once one of voltage phases is above the over voltage trip threshold. The over voltage time till trip will then be activated. When all three phases voltage level is below the over voltage trip threshold then the warning and alarm flag will be set to false. When the over voltage time till trip is over the over voltage trip delay the over voltage trip flag will be set to true. The over voltage trip flag can be set to false with a manual reset.	
Under voltage warning, alarm and trip flags	Under voltage warning and alarm flags will be set to true once one of voltage phases is below the under voltage trip threshold but above VL active level. The under voltage time till trip will be activated. When all three phases is above the under voltage trip threshold then the under voltage warning and alarm flag will be set to false. When the under voltage time till trip is above the under voltage trip delay then the under voltage trip flag will be set. The under voltage trip flag can be set to false with a manual reset.	
Phase rotation warning, alarm and trip flags	Voltage phase rotation warning and alarm flags will be set to true once voltage phase rotation conditions are met. The voltage phase rotation time till trip will then be activated. Once the voltage phase rotation contions are corrected the warning and trip flag will be set to false. When the voltage phase rotation time till trip is above the voltage phase rotation trip delay the voltage phase rotation trip flag will then be set to true. The voltage phase rotation trip flag can be cleared with a manual reset.	

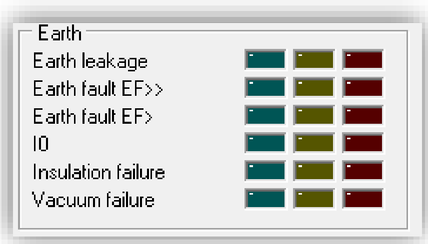
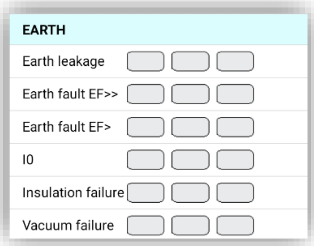
VL unbalance warning, alarm and trip flags	VL unbalance warning and alarm flags will be set to true once the VL unbalance level is above the VL unbalance trip level. The VL unbalance time till trip will then be activated. Once the VL unbalance level is below the VL unbalance trip level then the VL unbalance warning and alarm flags will be set to false. When the VL unbalance time till trip is above the VL unbalance trip delay then the VL unbalance trip flag will then be set to true. The VL unbalance trip flag can be set to false with a manual reset.
Loss of power warning, alarm and trip flags	When all three phase voltage becomes 0 VAC then the LOP warning and alarm flag will be set to true. The LOP time till trip will be activated. When all three voltage phases is above the voltage active level then the LOP warning and alarm flag will be set to false. When the LOP time till trip is above the LOP trip time then the LOP trip flag will be set to true. The LOP trip flag can be set to false with a manual reset.
Over frequency warning, alarm and trip flags	When the voltage line frequency level is over the over frequency trip level the over frequency warning and alarm flag will be set to true. The over frequency time till trip will be activated. When the the voltage line frequency level is below the over frequency trip level the over frequency warning and alarm flag will be set to false. When the over frequency time till trip is above the over frequency trip delay then the over frequency trip flag will be set to true. The over frequency trip flag can be set to false with a manual reset.
Under frequency warning, alarm and trip flags	When the voltage line frequency level is below the under frequency trip level the under frequency warning and alarm flags will be set to true. The under voltage time tilll trip will activate. When the voltage line frequency level is above the under frequency trip level then the under frequency warning and alarm level will be set to false. When the under frequency time till trip goes over the under frequency trip delay then the under frequency trip flag will be set to true. The under frequency trip flag can be set to false with a manual reset.
VL THD warning, alarm and trip flags	When the VL THD level is above the VL THD trip level then the VL THD warning and alarm flag will be set to true. The VL THD time till trip will be activated. When the VL THD level is below the VL THD level is below the VL THD trip level then the VL THD warning and alarm flag will be set to false. When the VL THD time till trip is above the VL THD trip delay then the VL THD trip flag will be set. The VL THD trip flag can be set to false with a manual reset.
VL fundamental warning, alarm and trip flag	When any of the VL fundamental levels is above the VL fundametal trip level the VL fundamental warning and alarm flag will be set to true. The VL fundamental time till trip will be activated. When all VL fundamental levels are below the VL fundamental trip level then the VL fundamental warning and alarm flag will be set to false. When the VL fundamental time till trip is over the VL fundamental trip delay then the VL fundamental trip flag will be set to true. The VL fundamental trip flag can be set to false with a manual reset.

Table 9.4.2: Voltage warning, alarm and trip flags panel.

9.4.3 Earth Leakage Flags

Indicate the warning, alarm and trip flags for earth leakage parameters on warning, alarm and trip screen.

Note that the descriptions are brief and for full description see the protection feature for more information.

	Frontend	Android Application
Navigation	☞ Actual values ☞ Warn, alarm and trip flags	☞ Actual values ☞ Warn, alarm and trip flags
Screens		
Parameters		
Earth leakage warning, alarm and trip flags	When the earth leakage level is above the earth leakage trip level. Then the earth leakage warning and alarm flag will be set to true. The earth leakage time till trip will be activated. When the earth leakage level falls below the earth leakage trip level then the earth leakage warning and alarm flag will be set to false. When the earth leakage time till trip is above the earth leakage trip delay then the eart leakage trip flag will be set to true. The earth leakage trip flag can be set to false with a manual reset.	
EF>> warning, alarm and trip flags	When the earth leakage level is above the EF>> trip level then the earth fault warning and alarm flags will be set to true. The EF>> time till trip will be activated. When the earth leakage level falls below the EF>> trip level then the EF>> warning and alarm flag will be set to false. When the EF>> time till trip is above the EF>> trip delay then the EF>> trip flag will be set to true. The EF>> trip flag can be set to false with a manual reset.	
I0 warning, alarm and trip flags	When the I0 level is above the I0 trip level then the I0 warning and alarm flags will be set to true. The I0 time till trip will be activated. When the I0 level goes below the I0 trip level then the I0 warning and alarm will be set to false. When the I0 time till trip is above the I0 trip delay then the I0 trip flag will be set to true. The I0 trip flag can be set to false with a manual reset.	
Insulation failure warning, alarm and trip flags	When the insulation level is below the insulation trip level then the insulation failure warning and alarm flags will be set to true. The insulation failure time till trip will then be activated. When the insulation level goes above the insulation failure trip level then the insulation failure warning and alarm flags will be set to false. When the the insulation failure time till trip is above the insulation failure trip delay then the insulation failure trip flag will be set to true. The insulation failure trip flag can be set to false with a manual reset.	

Vacuum failure warning, alarm and trip flags	When the vacuum failure conditions are met the vacuum failure warning and alarm flags will be set to true. The vacuum failure time till trip will be activated. When the vacuum failure conditions are not met then the vacuum failure warning and alarm flags will be set to false. When the vacuum failure time till trip is above the vacuum failure trip delay then the vacuum failure trip flag will be set to true. The vacuum failure trip flag can be set to false with a manual reset.

Table 9.4.3: Earth leakage warning, alarm and trip flags panel.

9.4.4 Low Voltage Switch Gear Flags

Indicate the warning, alarm and trip flags for switch gear parameters on warning, alarm and trip screen.

Note that the descriptions are brief and for full description see the protection feature for more information.

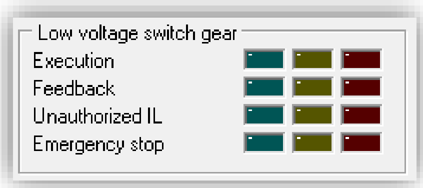
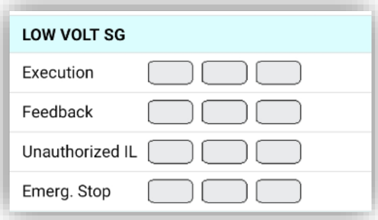
	Frontend	Android Application
Navigation	☞ Actual values ☞ Warn, alarm and trip flags	☞ Actual values ☞ Warn, alarm and trip flags
Screens		
Parameters		
Execution warning, alarm and trip flags	Execution warning and alarm flags will be set to true when a start is executed. Once the switch gear is given a start command then the execution time till trip will be activated. When the switch gear is running the warning and alarm flag will be set to false. If the switch gear did not get up to a running condition then the execution trip flag will be set true. The execution trip can be reset with a manual reset.	
Feedback warning, alarm and trip flags	Feedback warning and alarm flags will become true when the running condition becomes false. The feedback time till trip will be activated. Feedback warning and alarm flag will become false when the running condition becomes true. If the feedback time till trip is over the feedback trip delay then the feedback trip flag will become true. The feedback trip flag can be set to false with a manual reset.	
Unauthorized IL warning, alarm and trip flags	Unauthorized IL warning and alarm flags will be set to true when load or feedback is detected without a start command. The unauthorized IL time till trip will be activated. When the load and feedback signal goes back to false then the unauthorized IL warning and alarm flag will be set to false. When the unauthorized IL time till trip is above the unauthorized IL trip delay then the unauthorized IL trip flag will be set to true. The unauthorized IL trip flag can be set to false with a manual reset.	
Emergency stop warning, alarm and trip flags	Emergency stop warning, alarm and trip flags will be set to true when the emergency stop signal becomes true. When the emergency stop signal becomes false then the emergency stop warning, alarm and trip flags will be set to false.	

Table 9.4.4: Low voltage switch gear warning, alarm an trip flags panel.

9.4.5 System Flags

Indicate the warning, alarm and trip flags for system parameters on warning, alarm and trip screen.

Note that the descriptions are brief and for full description see the protection feature for more information.

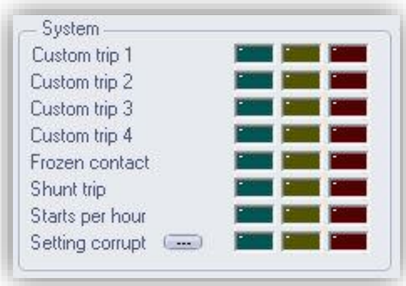
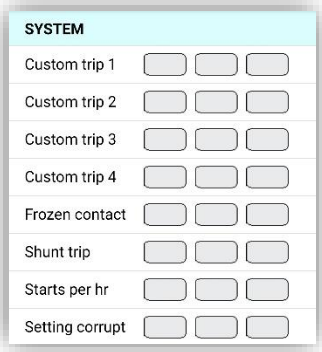
<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Actual values ☞ Warn, alarm and trip flags</td><td>☞ Actual values ☞ Warn, alarm and trip flags</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><td>Custom trip 1 to 4 warning, alarm and trip flags</td><td colspan="2">Custom trip warning and alarm flag will be set to true when the custom trip input is active. The custom trip time till trip timer will be activated. When the custom trip input signal is de-activated then the custom trip warning and alarm flag will be set to false. When the custom trip time till trip is above the custom trip delay then the custom trip, trip flag will be set to true. The custom trip, trip flag can be set to false with a manual reset.</td></tr>
<tr><td>Frozen contact warning, alarm and trip flags</td><td colspan="2">Frozen contact warning and alarm flags will be set to true when current is active during were the main contactor is welded. The frozen contact time till trip will be activated. When the current falls below inservice level the frozen contact warning and alarm flags will be set to false. When the frozen contact time till trip is above the frozen contact trip delay the trip flag will be set to true. The frozen contact trip flag can be set to false with a manual reset.</td></tr>
<tr><td>Shun trip warning, alarm and trip flags</td><td colspan="2">In the even that the shunt needs to be tripped first before the main contact the shunt trip warning and alarm flags will be set to true. The shunt trip time till trip will be activated. There is no condition that cancels the warning and alarm flag as this is a committed trip condition. Once the shunt trip time till trip is above the shunt trip delay the shunt trip, trip flag will be set to true. The shunt trip, trip flag can be set to false with a manual or auto reset.</td></tr>
<tr><td>Stats per hour warning, alarm and trip flags</td><td colspan="2">When one start is left the starts per hour warning and alarm flag will be set to true. If another start is regain then the warning and alarm flag will be set to false. When the last start is used then the start per hour trip flag will be set to true. The starts per hour trip flag will auto reset to false when another start becomes avalliable.</td></tr>
<tr><td>Setting corruption warning, alarm and trip flags</td><td colspan="2">When a critical or non critical setting corruption occures then the warning and alarm flag will be set to true. In the event of a critical setting corruption that requires reconfiguration of the settings due to that the corruption affects the operation of the KG/KH-RTU relay will be set to true. The setting corruption warning, alarm and trip flags can only be set to false by correcting the settings.</td></tr>
</table>

Figure 9.4.5: System warning, alarm and trip flags panel.

9.5 Modbus-RTU and Bluetooth Control bits

Control bits are command instruction from the PLC to the KG/KH-RTU relay via the Modbus-RTU port or the Bluetooth port.

Note that the descriptions are brief and for full description see the RTU configuration for more information.

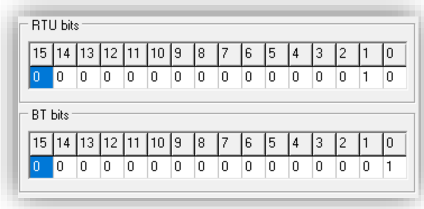
	Frontend	Android Application
Navigation	☞ Actual values ☞ Warn, alarm and trip flags	☞ Actual values ☞ Warn, alarm and trip flags
Screens		Not available
Parameter		
RTU bits	Command word bits status coming from the PLC to the KG/KH-RTU relay via the Modbus-RTU port.	
BT bits	Command word bits status coming from the PLC to the KG/KH-RTU relay via the Bluetooth port.	

Table 9.5: Modbus-RTU and Bluetooth words bits status panel.

9.6 *Starter Flags*

Summary actual window of the low voltage switch gear starter logic being executed.

Note that the descriptions are brief and for full description see the low voltage switch gear for more information.

9.6.1 Start Signals

Indicates the status of the 3 starter signals sources:

- Local
- Remote
- PLC

Note that the descriptions are brief and for full description see the low voltage switch gear for more information.

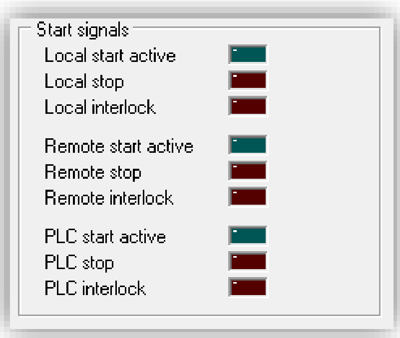
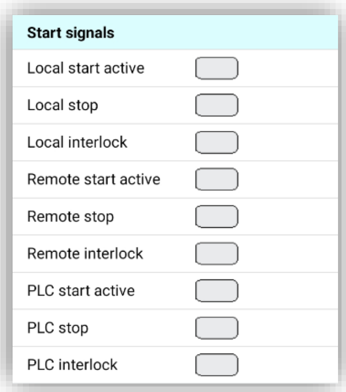
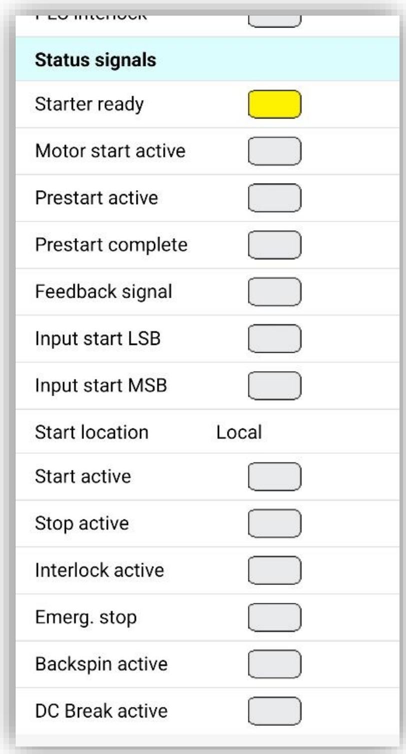
	Frontend	Android Application
Navigation	☞ Actual values ☞ Starter flags	☞ Actual values ☞ Starter flags
Screens		
Parameters		
Local, remote and PLC start active	Indicates the start status from the selected source.	
Local, remote and PLC stop active	Indicates the stop status from the selected source.	
Local, remote and PLC interlock active	Indicated the interlock status from the selected source.	

Table 9.6: Local, remote and PLC starter input signal status panel.

9.6.2 Starter Status Signals

Indicates the status of the low voltage switch gear signal flags.

Note that the descriptions are brief and for full description see the low voltage switch gear for more information.

<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Actual values ☞ Starter flags</td><td>☞ Actual values ☞ Starter flags</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><td>Starter ready status flag</td><td colspan="2">When stater ready flag is set true then the stater logic of the KG/KH-RTU relay is ready to start the application. When the starter ready flag is false then the KG/KH-RTU starter logic will prevent the application from starting.</td></tr>
<tr><td>Motor start active status flag</td><td colspan="2">When the motor start active flag is false then the starter logic has not placed the application in a run state. When the motor start active flag is true then the starter logic has placed the application into a run state.</td></tr>
<tr><td>Prestart active status flag</td><td colspan="2">When prestart active flag is set to true. The starter logic is then warning that the starter logic of the KG/KH-RTU is about to start the appliction. When false the the starter logic has not received start command or the prestart is complete.</td></tr>
<tr><td>Prestart complete status flag</td><td colspan="2">When prestart complete flag is set to true, then the starter logic of the KG/KH-RTU has completed the prestart warning.</td></tr>
</table>

Feedback signal status flag	Indicates the status of the feedback signal input selected.
Input start selection LSB and MSB status flags	Indicated the status of the starter selections LSB and MSB input signals selected.
Start location selected	Indicates if the starter logic will acept the start commond from a local, remote or PLC signal.
Start active status flag	When the start active status flag is true then the local, remote or PLC start input signal is active.
Stop active status flag	When the stop active status flag is true then the local, remote or PLC stop input signal is active.
Interlock active status flag	When the interlock status flag is true then the local, remote or PLC interlock signal is active.
Emergency stop status flag	When the emergency stop status flag is true then the emergency stop input signal is active.
Backspin active status flag	When the backspin active status flag is true then the starter logic is giving time for the application to run dowm the drive.
DC brake active status flag	Used to apply a DC voltage onto a motor type application to brake the motor. When active then the KG/KH-RTU starter logic is attempting to brake the application.

Table 9.6.2: Starter status signals panel.

9.7 Logic Status Flags

KG/KH-RTU internal logics status flags to indicate the output state of the logic module.

Note that the descriptions are brief and for full description see logic functions for more information.

9.7.1 Logic Table

Indicate the status of logic table 1 to 6 output.

Note that the descriptions are brief and for full description see logic functions for more information.

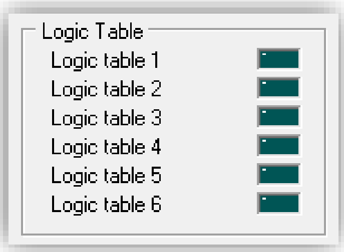
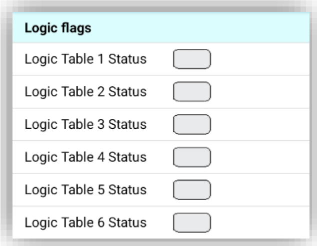
	Frontend	Android Application
Navigation	☞ Actual values ☞ Logic flags	☞ Actual values ☞ Logic flags
Screens		
Parameters		
Logic table 1 to 6 output status flag	Status of the logic table 1 to 6 output status flags.	

Table 9.7.1: Logic table output status flags panel.

9.7.2 TC Comparator

Indicate the status of the thermal capacity comparators output.

Note that the descriptions are brief and for full description see logic functions for more information.

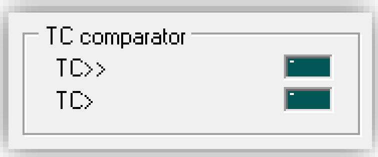
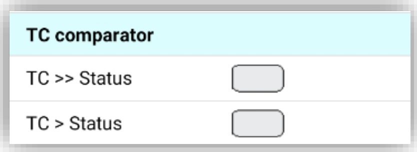
<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Actual values ☞ Logic flags</td><td>☞ Actual values ☞ Logic flags</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><td>TC>> output status flag</td><td colspan="2">Thermal capasity used high, high comparator output status.</td></tr>
<tr><td>TC> output status flag</td><td colspan="2">Thermal capasity used high comparator output status.</td></tr>
</table>

Table 9.7.2: Thermal capacity comparator output status flags panel.

9.7.3 Pulse Generator

Indicate the status of the pulse generator output.

Note that the descriptions are brief and for full description see logic functions for more information.

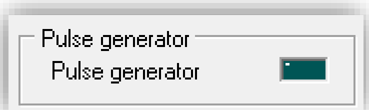
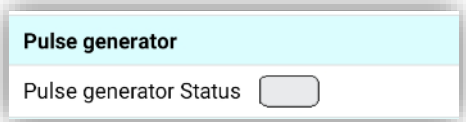
<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Actual values ☞ Logic flags</td><td>☞ Actual values ☞ Logic flags</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><td>Pulse generator output status flag</td><td colspan="2">Status of the pulse generator output status flag.</td></tr>
</table>

Table 9.7.3: Pulse generator output status flag panel.

9.7.4 RTC Start and Stop

Indicates the output status of the RTC start and stop.

Note that the descriptions are brief and for full description see logic functions for more information.

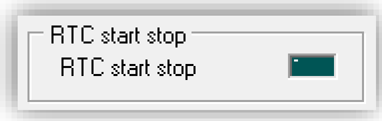
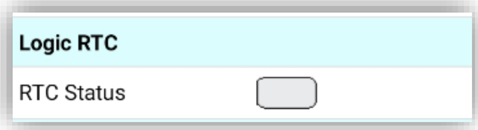
	Frontend	Android Application
Navigation	☞ Actual values ☞ Logic flags	☞ Actual values ☞ Logic flags
Screens		
Parameters		
RTC start stop output status flag	Status of the RTC start and stop output status flag.	

Table 9.7.4: RTC start and stop output status flag panel.

9.7.5 Counter

Indicate the output status of counter 1 to 2.

Note that the descriptions are brief and for full description see logic functions for more information.

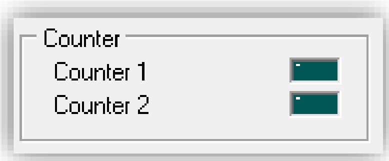
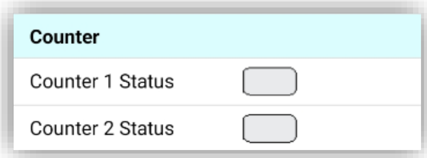
	Frontend	Android Application
Navigation	☞ Actual values ☞ Logic flags	☞ Actual values ☞ Logic flags
Screens		
Parameters		
Counter 1 and 2 output status flag	Status of the counters output status flags.	

Table 9.7.5: Counters output status flags panel.

9.7.6 Latch

Indicate the output status of the latch 1 to 2.

Note that the descriptions are brief and for full description see logic functions for more information.

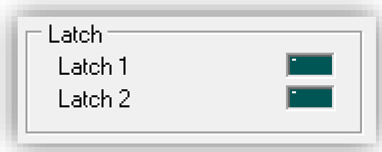
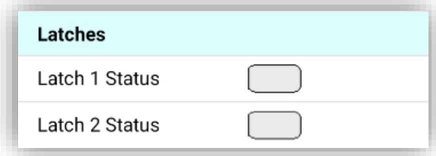
	Frontend	Android Application
Navigation	☞ Actual values ☞ Logic flags	☞ Actual values ☞ Logic flags
Screens		
Parameters		
Latch 1 and 2 output status flags	Status of the latches output flags.	

Table 9.7.6: Latches output status flags panel.

9.7.7 Mask

Indicate the status of the alarm and trip mask output status flag.

Note that the descriptions are brief and for full description see logic functions for more information.

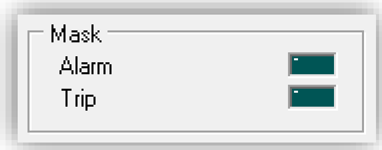
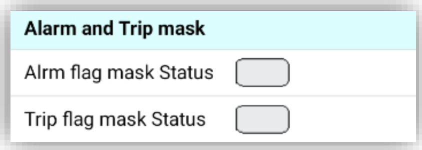
	Frontend	Android Application
Navigation	☞ Actual values ☞ Logic flags	☞ Actual values ☞ Logic flags
Screens		
Parameters		
Alarm flag mask output status flag	Status of the alarm flag mask output status flag.	
Trip flag output status flag	Status of the trip flag mask output status flag.	

Table 9.7.7: Alarm and trip flag mask output status flag panel.

9.7.8 Timer

Indicate the status of Timer 1 to 2 output status flags.

Note that the descriptions are brief and for full description see logic functions for more information.

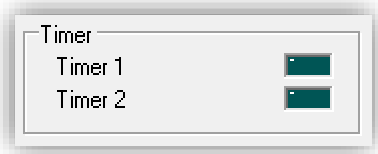
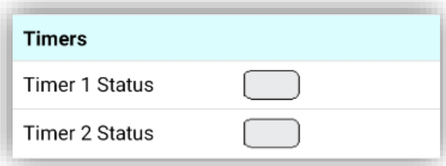
	Frontend	Android Application
Navigation	☞ Actual values ☞ Logic flags	☞ Actual values ☞ Logic flags
Screens		
Parameters		
Timer 1 and 2 output status flags	Status of timers output status flags.	

Table 9.7.8: Timers output status flags panel.

9.7.9 Status Reporter

Indicate the status of the status reporter output status flags.

Note that the descriptions are brief and for full description see logic functions for more information.

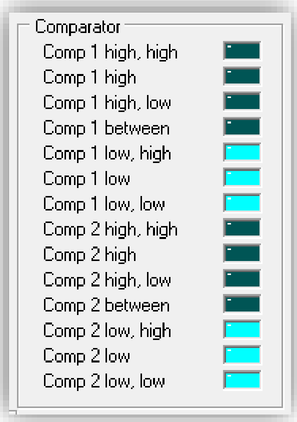
	Frontend	Android Application
Navigation	☞ Actual values ☞ Logic flags	☞ Actual values ☞ Logic flags
Screens		Not available
	Parameters	
Status reporter output status flag	Status of the status reporter output status flag.	

Table 9.7.9: Status reporter output status flags panel.

9.7.10 Comparator

Indicate the status of comparator 1 to 2 output status flags.

Note that the descriptions are brief and for full description see logic functions for more information.

	Frontend	Android Application
Navigation	☞ Actual values ☞ Logic flags	☞ Actual values ☞ Logic flags
Screens		Not available
Parameters		
Comparator 1 and 2 high, high output status flags	Status of comparator high, high output status flag. The comparator high, high output status flag will be set to true when the comparator level is above the comparator high, high set level, and set to false when the comparator level is below the comparator high, high set level.	
Comparator 1 and 2 high output status flags	Status of the comparator high output status flag. The comparator high output status flag will be set to true when the comparator level is above the comparator high, high set level, and set to false when the comparator level is below the comparator high, low set level.	
Comparator 1 and 2 high, low output status flags	Status of the comparator high, low output status flag. The comparator high, low output status flag will be set to true when the comparator level is above the high, low level, and set to false when the comparator level is below the comparator high, low level.	
Comparator 1 and 2 between output status flags	Status of the comparator between output status flag. The comparator between output status flag will be set to true when the comparator signal is between the comparator high, low set level and comparator low, high set level, and set to false when the comparator level is out of the comparator high, low and comparator low, high set levels.	
Comparator 1 and 2 low, high output status flags	Status of the comparator low, high output status flag. The comparator low, high output status flag will be set to true when the comparator level is below the comparator low, high set level, and set to false when the comparator level above the comparator low, high set level.	
Comparator 1 and 2 low output status flags	Status of the comparator low output status flag. The comparator low output status flag will be set to true when the comparator level is below the comparator low, low set level, and set to false when the comparator level is above the comparator low, high set level.	

Comparator 1 and 2 low, low output status flags	Status of the comparator low, low output status flag. The comparator low, low output status flag will be set true when the comparator level is below the comparator low, low set level, and set false when the comparator level is above the comparator low, high set level.

Table 9.7.10: Comparators output status flags panel.

9.8 Statistical Counters and Consumption

Gives a general view of the application performance during operating conditions.

9.8.1 Running Hours

Keeps track of the applications hourly activity in operations.

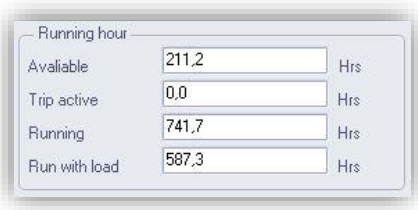
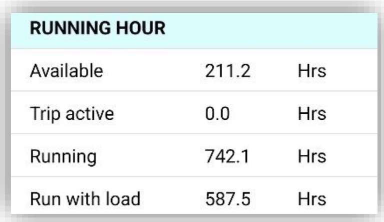
	Frontend	Android Application
Navigation	☞ Actual values ☞ Stat counter and consumption	☞ Actual values ☞ Stat counter and consumption
Screens		
Parameters		
Available	Hours accumalated while the KG/KH-RTU relay is powered on with no load being consumed by the application.	
Trip active	Hours accumalated while the KG/KH-RTU relay has a trip active.	
Running	Hours accumulated by the KG/KH-RTU relay while the application is running lightly loaded. For example a conveyor belt running transporting no product on the belt.	
Running with load	Hours accumulated by the KG/KH-RTU relay while the current is above the running on load set level. For example a conveyor belt running and transporting production on the belt.	

Table 9.8.1: Running hours panel.

9.8.2 Statistical Counters

Counters to give an indication on the application performance.

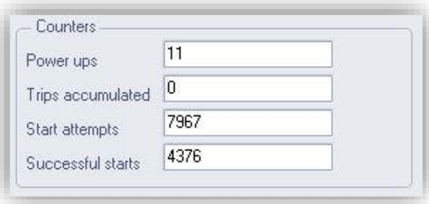
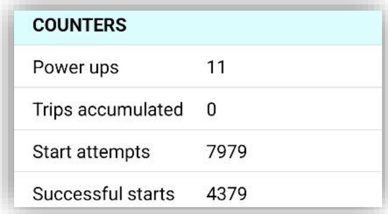
	Frontend	Android Application
Navigation	☞ Actual values ☞ Stat counter and consumption	☞ Actual values ☞ Stat counter and consumption
Screens	 	
	Parameters	
Power ups	Counter accumelating how many times the application was switch on and off.	
Trip accumulated	Indication of how many trip did occure on the application. Can be used as an indication to see if the panel is faulty and needs to be analyzed.	
Start attempts	Amount of start that have been executed.	
Successful starts	Out of the amout of start attempts how many starts did complete successfully.	

Table 9.8.2: Statistical counter panel.

9.8.3 Motor Startup

Indication of levels used during the start up of the application.

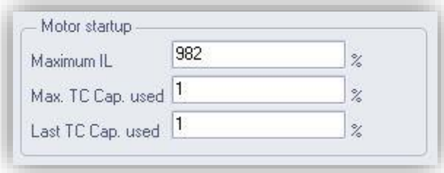
	Frontend	Android Application
Navigation	☞ Actual values ☞ Stat counter and consumption	☞ Actual values ☞ Stat counter and consumption
Screens		
Parameters		
Maximum IL	Maximum current used during the application startups.	
Maximum thermal capacity used	Maximum thermal capacity used during the application startups.	
Last thermal capacity used	The last thermal capacity used during the application startup.	

Table 9.8.3 Statistical of application start up diagnostic panel.

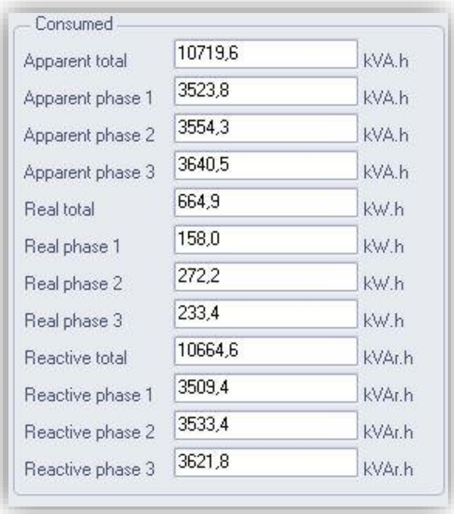
9.8.4 Consumed

Power consumed over time by the application on each phase as well as total.

The values can be reset or changed via the Modbus-RTU port.

	Frontend	Android Application
Navigation	☞ Actual values ☞ Stat counter and consumption	☞ Actual values ☞ Stat counter and consumption

Screens



Parameters	
Apparent total, phase 1, phase 2 and phase 3	Apparent power consumed over time using $S_{apparant} = V*I * \sqrt{3}$
Real total, phase 1, phase 2 and phase 3	Real power consumed over time using $P_{real} = S_{apparent} * \cos\theta$
Reactive total, phase 1, phase 2 and phase 3	Reactive power consumed over time using $Q = P_{real} * \tan\theta$

Table 9.8.4: Apparent, real and reactive power consumed panel.

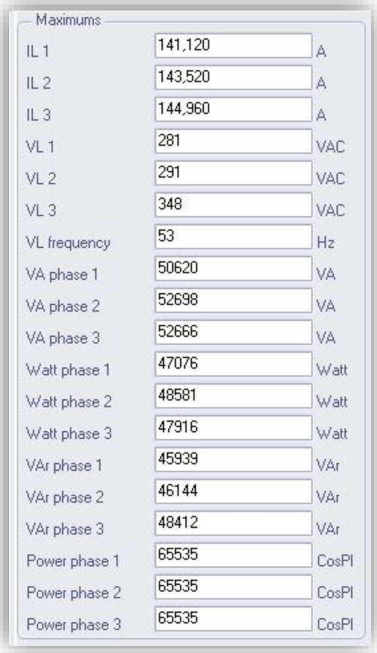
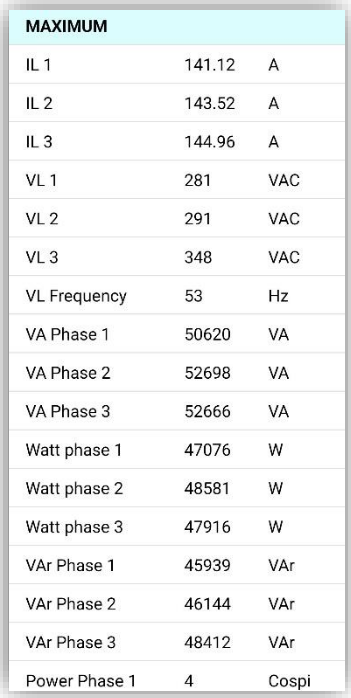
9.9 Statistic Maximums and Minimums

Keeps track of the maximum and minimum levels that was detected during running conditions of the application.

The values can be reset or changed via the Modbus-RTU port.

9.9.1 Maximums

Maximum actual levels detected during running conditions.

	Frontend	Android Application
Navigation	☞ Actual values ☞ Stat maximum and minimum	☞ Actual values ☞ Stat maximum and minimum
Screens		
Parameters		
IL1, IL2 and IL3 levels	Maximum load used in Amps measured during running cycle of the application.	
VL1, VL2 and VL3 levels	Maximum phase voltage used in VAC measured during running cycle of the application.	
VL frequency	Maximum line voltage frequency used in Hz measured during running cycle of the application.	
VA phase 1, phase 2 and phase 3	Maximum apparent power used in VA measured during running cycle of the application.	
Watts phase 1, phase 2 and phase 3	Maximum real power used in Watts measured during the running cycle of the application.	

Reactive power phase 1, phase 2 and phase 3	Maximum reactive power used in VAr measured during the running cycle of the application.
Power phase 1, phase 2 and phase 3	Maximum power factor level used in cosθ measured during the running cycle of the applicataion.

Table 9.9.1: Statistic maximum levels panel.

9.9.2 Minimums

Minimum actual levels detected during running conditions.

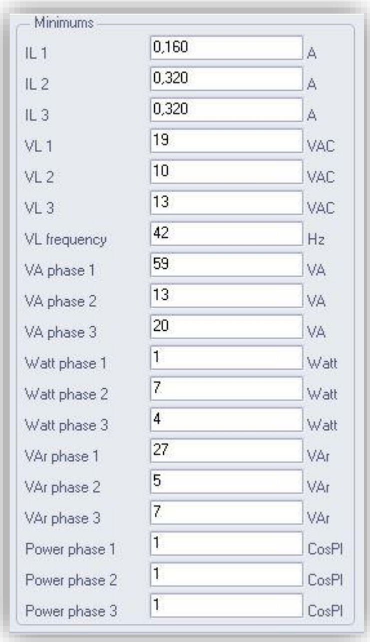
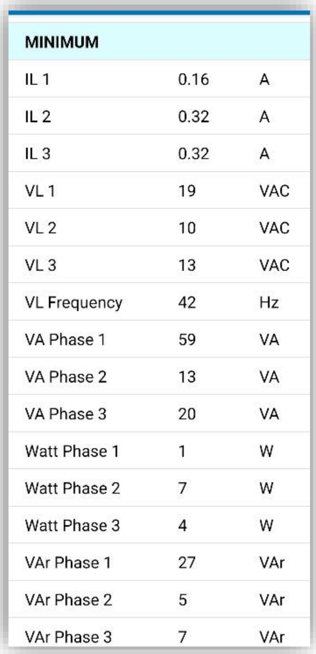
<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Actual values ☞ Stat maximum and minimum</td><td>☞ Actual values ☞ Stat maximum and minimum</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><td>IL1, IL2 and IL3 levels</td><td colspan="2">Minimum load used in Amps measured during running cycle of the application.</td></tr>
<tr><td>VL1, VL2 and VL3 levels</td><td colspan="2">Minimum phase voltage used in VAC measured during running cycle of the application.</td></tr>
<tr><td>VL frequency</td><td colspan="2">Minimum line voltage frequency used in Hz measured during running cycle of the application.</td></tr>
<tr><td>VA phase 1, phase 2 and phase 3</td><td colspan="2">Minimum apparent power used in VA measured during running cycle of the application.</td></tr>
<tr><td>Watts phase 1, phase 2 and phase 3</td><td colspan="2">Minimum real power used in Watts measured during the running cycle of the application.</td></tr>
<tr><td>Reactive power phase 1, phase 2 and phase 3</td><td colspan="2">Minimum reactive power used in VAr measured during the running cycle of the application.</td></tr>
<tr><td>Power phase 1, phase 2 and phase 3</td><td colspan="2">Minimum power factor level used in cosθ measured during the running cycle of the applicataion.</td></tr>
</table>

Table 9.9.2: Statistic minimum levels panel.

10 System Settings

Consist of the base configurations that the KG/KH-RTU relay needs to function. This will include setting the current, voltage, type of application, KG/KH-RTU internal clock as well as the password security level.

10.1 CT, VT and Type of Application

10.1.1 Current

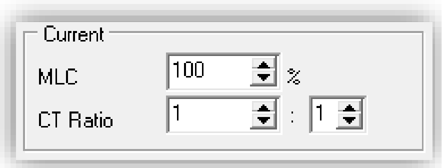
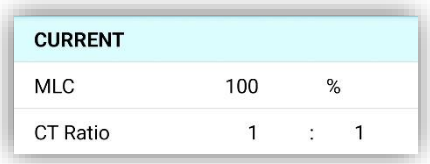
Configuring the maximum load current (MLC) and CT ratio will give the KG/KH-RTU the ability to correctly read the motor load level to provide accurate readings and protection.

The correct configuration of the MLC and CT ratio will provide the In current level.

To calculate In use the following formula:
In = Modal number x (MLC / 100) x (CT Prim / CT Sec)

Working back from the Amp rating to calculate the MLC level formula:
MLC = In / ((CT Prim / CT Sec) x 100 x Modal number)

Example:
KH5 with a 100:5 external CT connected and want to connect to a 63 Amp motor.
MLC = 63 / ((100 / 5) x 100 x 5)
MLC = 63 %

	Frontend	Android Application
Navigation	☞ System setting ☞ CT, VT and Relay 1	☞ System setting ☞ CT, VT and Relay 1
Screens		

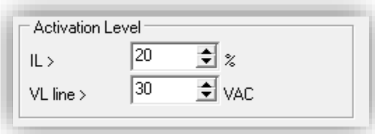
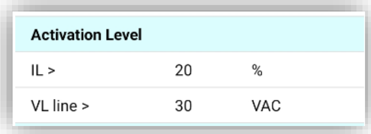
Parameters			
	Range	**Inc**	**Description**
MLC	10 to 100% Default : 10 %	1 %	In multiplying factor of 0.1 to 1.0.
CT primary ratio	1 to 10000 Default : 1	1	Primary ratio of current transformer installed in the application.
CT secondary ratio	1 to 9 Default : 1	1	Secondary ratio of the current transformer installed in the application.

Table 10.1.1: Current configuration panel.

10.1.2 Activation Level

Activation level is the working levels for current and voltage. When the current or the voltage levels are below the activation level then all corresponding protection, logic and monitoring feature will be disabled and ignore the current or voltage level.

When the current or voltage is above the activation level then the protection, logic and monitoring that use current or voltage will be activated.

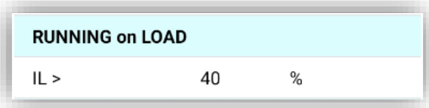
	Frontend	Android Application
Navigation	☞ System setting ☞ CT, VT and Relay 1	☞ System setting ☞ CT, VT and Relay 1
Screens		

Parameters			
	Range	**Inc**	**Description**
IL >	1 to 30 % Default : 10 %	1 %	Load level that one of the three current phases needs to be above to activate all current related protection, logic, and monitoring functions.
VL line >	10 to 30000 VAC Default : 30 VAC	1 VAC	Voltage level that one of the three voltage phases needs to be above to activate all voltage related protection, logic, and monitoring functions.

Table 10.1.2: Current and voltage activation levels on the activation panel.

10.1.3 Running on Load

Running on load is used with the monitoring feature running on load to indicate that the application was running production and not idling. Example is to distinguish between a conveyor belt running with, or without material on the conveyor belt.

	Frontend	Android Application
Navigation	☞ System setting ☞ CT, VT and Relay 1	☞ System setting ☞ CT, VT and Relay 1
Screens		

Parameters			
	Range	**Inc**	**Description**
IL >	1 to 80% Default : 40 %	1 %	Current load level where the application is running production and not idling.

Table 10.1.3: Running on load on the running on load panel.

10.1.4 Voltage

Parameters that are needed by the KG/KH-RTU relay to know the voltage configuration in the application.
The KG/KH-RTU will use these parameters in protection, logic and monitoring features.

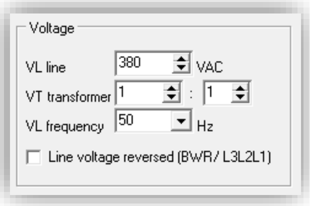
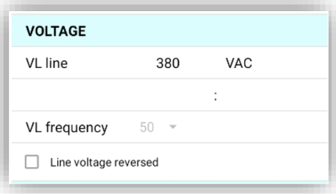
VL line will be incoming supply to the application.

The KG/KH-RTU relay can only handle a line supply voltage up to 550 VAC system directly connected. When the supply line voltage is above 550 VAC then a transformer or voltage converter will be needed.

Example:
System line voltage is 11 kV.
A voltage transformer of 11 kV to 110 VAC is connected between the incoming line voltage and KG/KH-RTU relay.

The VL line must be set to 11000 VAC.

The VT transformer parameter must then be set to 11000 : 110 to allow the line voltage reading to be correctly calculated for voltage protection, logic and monitoring features.

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ System setting ☞ CT, VT and Relay 1</td><td>☞ System setting ☞ CT, VT and Relay 1</td></tr>
<tr><td>Screens</td><td colspan="2"></td><td></td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>VL line</td><td>10 to 33000 VAC

Default : 380 VAC</td><td>1 VAC</td><td>Actual incoming line voltage level.</td></tr>
<tr><td>VT transformer primary</td><td>1 to 33000

Default : 1</td><td>1</td><td>Primary side of the voltage transformer rating.</td></tr>
<tr><td>VT transformer</td><td>1 to 110

Default : 1</td><td>1</td><td>Secondary side of the voltage transformer rating.</td></tr>
<tr><td>VL frequency</td><td>50Hz or 60Hz

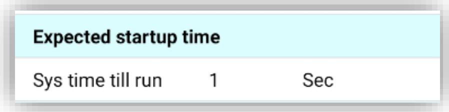
Default : 50 Hz</td><td>50 Hz</td><td>Incoming line voltage frequency.</td></tr>
<tr><td>Line voltage reversed</td><td>Enable or disable

Default : Disable</td><td></td><td>If the incoming supply voltage has been wired in reverse line voltage reverse can then be enabled to indicate that the KG/KH-RTU incoming line voltage is wired in reverse.</td></tr>
</table>

Table 10.1.4: System voltage configuration panel.

10.1.5 Expected Startup Time

Expected startup time is for low load applications were the start-up current of the application does not go above 6 x In. System time till run is used to record the startup events as will as the monitors successful starts.

	Frontend	Android Application
Navigation	☞ System setting ☞ CT, VT and Relay 1	☞ System setting ☞ CT, VT and Relay 1
Screens		

Parameters			
	Range	Inc	Description
Sys time till run	1 to 60 Sec Default : 3 Sec	1 Sec	Longest time for the application to get into a running state.

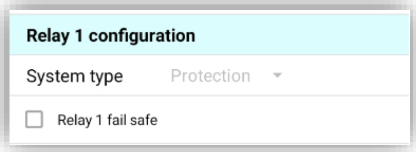
Table 10.1.5: Expected startup time panel.

10.1.6 Relay 1 Configuration

Relay 1 cannot be configured with logic. Limitation configuration of relay is according to the application that the KG/KH-RTU relay is configured in. The three-configuration application selection is:

- Protection,
- Motor DOL and
- Feeder.

Also indicates if relay 1 should be configured fail safe. Allowing for when the KG/KH-RTU relay auxiliary supply is disconnected that the application will stop. When fail safe is enabled relay 1 will energize when in a healthy state.

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ System setting ☞ CT, VT and Relay 1</td><td>☞ System setting ☞ CT, VT and Relay 1</td></tr>
<tr><td>Screens</td><td colspan="2"></td><td></td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>System type</td><td>0 : Protection,
1 : Motor DOL and
2 : Feeder.

Default : 0 Protection</td><td></td><td>Selection for the type of application the KG/KH-RTU relay is configured in.</td></tr>
<tr><td>Relay 1 fail safe</td><td>Enable or disabled

Default : Enabled</td><td></td><td>Will energize relay 1 when in a healthy state.</td></tr>
</table>

Table 10.1.6: Relay 1 configuration panel.

10.2 Relay Internal Clock

Configure the KG/KH-RTU relay internal system clock (Also known as the RTC real time clock).

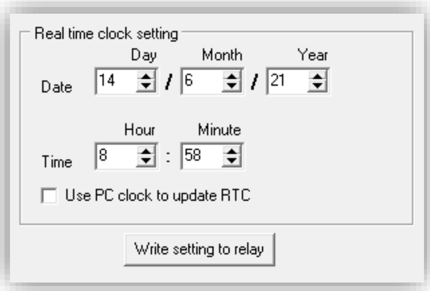
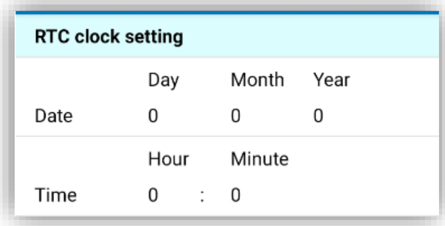
	Frontend	Android Application
Navigation	☞ System setting ☞ CT, VT and Relay 1	☞ System setting ☞ CT, VT and Relay 1
Screens		
Parameters		
Date	Enter the current date (Day/Month/Year)	
Time	Enter the current time (Hour/Minute)	
Use PD to update RTC	Use the configuration tools date and time to configure the KG/KH=RTU relays date and time.	

Table 10.2: KG/KH-RTU relay system clock configuration panel.

10.3 Password

Password protection will allow only selected personal to alter settings to the KG/KH-RTU relay for the application.

KG/KH-RTU relay default factory password is 0000. With the password set to 0000 the KG/KH-RTU relay is not password protected and setting can be altered without entering the password.

The password is stored in the KG/KH-RTU relay. It is crucial that the password must be documented and kept in a secure location for access. As loosing the password can cause down time. If a password cannot be located. Contact NewElec at support@newelec.co.za for assistance to unlock the password.

The KG/KH-RTU relay has 2 password levels:

- Protection : New password given for only the protection part
- Logic : New password given logic as well as protection

A unlock password is located on the KG/KH-RTU frontend and app to unlock the selected settings. On the KG/KH-RTU frontend Figure 10.3 indicates a green status to indicate that the KG/KH-RTU relays protection or logic can be changed.

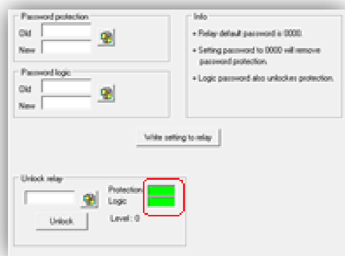
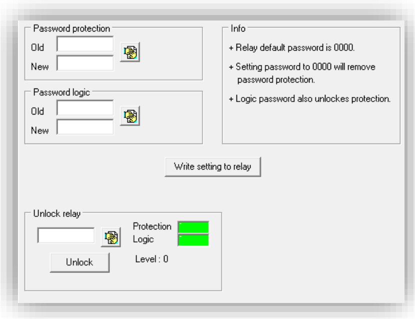


Figure 10.3: KG/KH-RTU frontend indicating that the KG/KH-RTU relay password is unlocked.

	Frontend	Android Application
Navigation	☞ System setting ☞ CT, VT and Relay 1	☞ System setting ☞ CT, VT and Relay 1
Screens		Not available

Parameters			
	Range	**Inc**	**Description**
Password protection	0000 to 9999 Default : 0000	1	Set the KG/KH-RTU relay password to protect the protection feature of the KG/KH-RTU relay only.
Password logic	0000 to 9999	1	Set the KG/KH-RTU relay password to protect the protection and logic features of the KG/KH-RTU relay.
Unlock relay	0000 to 9999	1	Uses the protection or logic password to unlock the protection or logic features of the KG/KH-RTU relay.

Table 10.3: Password configuration panel.

11 Protection Features

11.1 Current Protection Features

11.1.1 ANSI 37 - Phase Undercurrent or Under Power Detection

A relay that functions when the current or power flow decreases below a predetermined value.

When the load current level or power level of an active circuit decreases below the normal operational level a fault condition is registered and either a trip command or corrective action command is initiated. Only one phase needs to be below the trip level, but the current present flag still needs to be active.

Protection feature only gets armed after start-up delay initiation of ANSI 37 feature expires.
If power factor level is used for the ANSI 37 element and the voltage measurement source is removed, rendering Cos Ø measurement impossible the ANSI 37 protection will revert to the use of minimum load current as a backup or alternative setting.

Selectable time delay auto reset flag is available to auto restart the drive if the fault was minimum load only, fault is cleared, and thermal capacity is below reset level. Do note that any other trip will deactivate the auto reset flag.

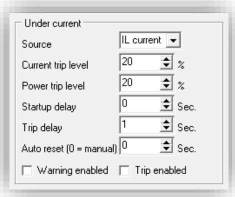
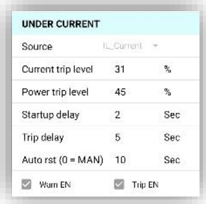
	Frontend		Android Application
Navigation	☞ Protection ☞ Current		☞ Protection ☞ Current
Screens			
Parameters			
	Range	**Inc**	**Description**
Source	0 : IL (Current) 1 : Power factor. Default : 0	1	Select the source for ANSI 37 protection feature.
Current trip level	10 to 99 % Default : 45 %	1 %	Fix trip level that the current level must be below to set the warning or alarm flag to true.
Power trip level	10 to 99 % Default : 45 %	1 %	Fix trip level that the power factor level must be below to set the warning or alarm flag to true.
Start up delay	0 to 200 Sec Default : 2 Sec	1 Sec	ANSI 37 to ignore IL and power factor level. Allowed time to prime the application.
Trip delay	1 to 200 Sec Default : 5 Sec	1 Sec	Time till the trip flag will be set to true from that the alarm flag was set to true and lockout the application.
Auto reset	0 to 65000 Sec Default : 0 Sec	1 Sec	Time till auto reset of ANSI 37 trip flag. 0 : Manual reset. 1 – 65000 : Time till reset.
Warning enabled	True / False Default : True		Enable or disable the warning flag.
Trip enabled	True / False Default : True		Enable or disable the alarm and trip flag.
Reset			
Manual / Auto All alarm flags, current active and feedback must be false before resetting. No other trip flags must be set to true.			
Applications			
• Pumps. • Detect if a pump is running dry. • Section that is not allowed to run a light load.			

Table 11.1.1: ANSI 37 phase undercurrent or under power detection configuration panel.

11.1.2 ANSI 46 – Phase Negative Sequence / Unbalance

A relay that functions when the poly-phase currents are of reverse-phase sequence or when the poly-phase currents are unbalanced or contain negative phase sequence components above a given amount.

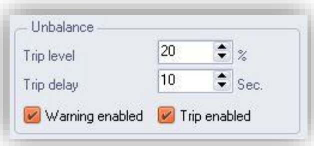
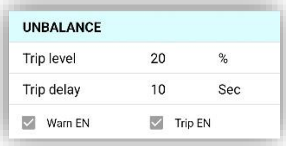
Protect the switch gear from delivering unbalance loads.
This protection can be achieved in three ways:

- Load unbalance.
  - % Difference = ((Max load – Min Load) / Avg Load) x 100.
- Negative phase sequence.
  - Neg. phase seq. = (IL1[0] + IL2[240] + IL3[120]).
- Single phase.
  - Unbalance level above 70%.

Sensitive protection to detect 2-phase faults at the ends of long lines.

Protection of equipment against temperature build-up, caused by an unbalanced power supply, phase inversion or loss of phase, and against phase current unbalance.

Current Unbalance Protection

	Frontend	Android Application
Navigation	☞ Protection ☞ Current	☞ Protection ☞ Current
Screens		

Parameters			
	Range	**Inc**	**Description**
Trip level	5 to 50 % Default : 40 %	1 %	Fix trip level that the current unbalance level must exceed to set the warning or alarm flag to true.
Trip delay	1 to 250 Sec Default : 20 Sec	1 Sec	Time till the trip flag will be set to true from that the alarm flag was set to true to lockout the application.
Warning enabled	True / False Default : True		Enable or disable the warning flag.
Trip enabled	True / False Default : True		Enable or disable the alarm and trip flag.

Reset
Manual

Applications
• Feeder applications. • Motor applications. • Other applications were the device being protected can be over heated by an unbalance load.

Table 11.1.2.a: ANSI 46 phase current unbalance configuration panel.

Single Phase Protection

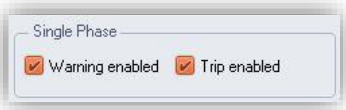
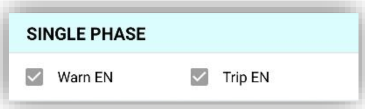
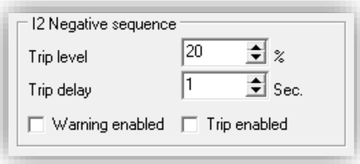
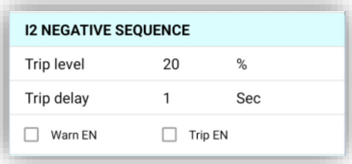
	Frontend		Android Application
Navigation	☞ Protection ☞ Current		☞ Protection ☞ Current
Screens			
Parameters			
	Range	**Inc**	**Description**
Trip level	70 %		Fix trip level that the current unbalance level must exceed to set the warning or alarm flag to true.
Trip delay	1 Sec		Fix time till the trip flag will be set to true from that the alarm flag was set to true to lockout the application.
Warning enabled	True / False Default : True		Enable or disable the warning flag.
Trip enabled	True / False Default : True		Enable or disable the alarm and trip flag.
Reset			
Manual			
Applications			
• Application cannot operate with a phase loss. • Applications were the device being protected can be over heated by an unbalance load.			

Table 11.1.2.b: ANSI 46 single phase configuration panel.

I2 Negative Sequence

	Frontend	Android Application
Navigation	☞ Protection ☞ Current	☞ Protection ☞ Current
Screens		

Parameters			
	Range	**Inc**	**Description**
Trip level	10 to 90 % Default : 40 %	1 %	Trip level that the I2 negative sequence level must exceed to set the warning and alarm flag to true.
Trip delay	1 to 250 Sec Default : 20 Sec	1 Sec	Time till the trip flag will be set to true from that the alarm flag was set to true to lockout the application
Warning enabled	True / False Default : False		Enable or disable the warning flag.
Trip enabled	True / False Default : False		Enable or disable the alarm and trip flag.
Reset			
Manual			
Applications			
Feeder that needs to prevent that source of current is not going upstream.			

Table 11.1.2.c: ANSI 46 I2 negative sequence configuration panel.

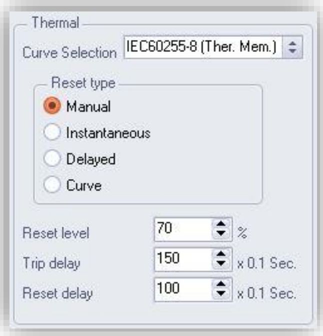
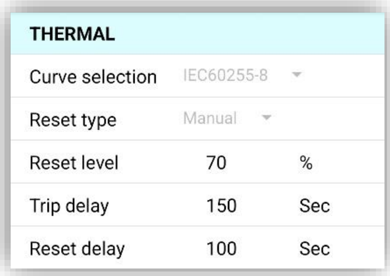
11.1.3 ANSI 49 - Machine or Transformer Thermal (I2T) Detection

A relay that functions when the temperature of a machine armature winding or other load-carrying winding or element of a machine or power transformer exceeds a predetermined value.

Protection against thermal damage caused by overloads on machines (transformers, motors or generators). The thermal capacity used is calculated according to an I2T mathematical model specified in the IEC60255-8 full thermal model which considers also referred to as ANSI 49 RMS.

Do note that that the IEC60255-8 is the only curve selection that has a thermal memory. The thermal capacity level will be reloaded from memory when the auxiliary power of the KG/KH-RTU relay is cycle.

All other curves have not memory.

	Frontend	Android Application
Navigation	☞ Protection ☞ Current	☞ Protection ☞ Current
Screens		

Parameters			
	Range	Inc	Description
Curve selection	0 : IEC60255-8 (Thermal memory) 1 : DEFT 2 : IEC_NINV 3 : IEC_VINV 4 : IEC_LINV 5 : IEC_EINV 6 : ANSI_MINV 7 : ANSI_VINV 8 : ANSI_EINV 9 : Thermal flat 10 : IT 11 : I2T 12 : I4T Default : 0	1	Different thermal or curve modes are available depending on the device being thermally protected.

Reset type	0 : Manual 1 : Instantaneous 2 : Delayed 3 : Curve Default : 0	1	Various resets are available but not available to all the curve selections. Manual is available to all the curves and will cause a thermal trip to latch the trip contact. Instantaneous is available to all the curves except IEC60255-8 ANSI 49 as this curve has a thermal memory. Delayed is available to all the curves except IEC60255-8 ANSI 49 as this curve has a thermal memory. Curve is available to all the curves.
Reset level	1 to 99 % Default : 70 %	1 %	The thermal used reset level. The level must be so that a device can start without using all the capacity.
Trip delay	1 to 30000 x 0.1 Sec Default : 150 x 0.1 Sec	1 x 0.1 Sec	Selected curves time till trip multiplier. This trip time works with MLC setting.
Reset delay	1 to 30000 x 0.1 Sec Default : 100 x 0.1 Sec	1 x 0.1 Sec	Selected curves time till reset multiplier. This trip time works with MLC setting.
Reset			
Manual or auto			
Applications			
• All applications. • Thermal is used to protect the windings of the motor with the I^2T curve.			

Table 11.1.3: ANSI 49 Machine or transformer thermal detection configuration panel.

11.1.4 ANSI 50P - Phase Instantaneous Over Current

Relay that functions instantaneously on an excessive value of phase to phase current or on an excessive rate of current rise, and phase vector shift, thus indicating a fault in the apparatus or circuit being protected.

Three-phase protection against overloads and phase-to-phase short-circuits.

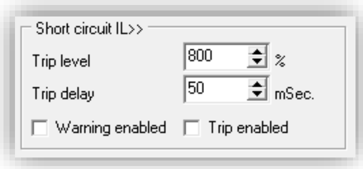
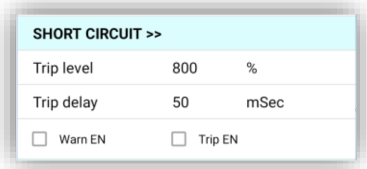
Relay that functions instantaneously on an excessive value of current or on an excessive rate of current rise, thus indicating a fault in the apparatus or circuit being protected.

Two level with independent definite time delays.

Very high amplitude, rate of change, phase angle (vector shift) and I2 negative < 20 % is used to ensure that the fault is a short circuit condition.

This is to eliminate false short circuit trips.

Short Circuit >>

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Protection ☞ Current</td><td>☞ Protection ☞ Current</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>Trip level</td><td>600 to 1000 %

Default : 900 %</td><td>1 %</td><td>Trip level that the current level needs to exceed to set the warning and alarm flag to true.</td></tr>
<tr><td>Trip delay</td><td>30 to 300 mSec

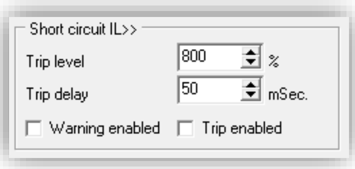
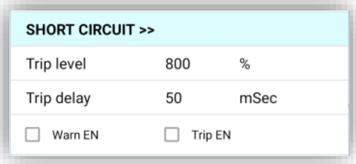
Default : 30 mSec</td><td>10 mSec</td><td>Time till the trip flag will be set to true from that the alarm flag was set to true to lockout the application.</td></tr>
<tr><td>Warning enabled</td><td>True / False

Default : True</td><td></td><td>Enable or disable the warning flag.</td></tr>
<tr><td>Trip enabled</td><td>True / False

Default : True</td><td></td><td>Enable or disable the alarm and trip flag.</td></tr>
<tr><th colspan="4">Reset</th></tr>
<tr><td colspan="4">Manual</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">All applications were the drives cable is exposed to damage.
Feeder panels.
Fitting panels.</td></tr>
</table>

Table 11.1.4.a: ANSI 50P Phase instantaneous over current (Short circuit >>) configuration panel.

Short circuit >

	Frontend	Android Application
Navigation	☞ Protection ☞ Current	☞ Protection ☞ Current
Screens		

Parameters			
	Range	**Inc**	**Description**
Trip level	600 to 1000 % Default : 600 %	1 %	Trip level that the current level needs to exceed to set the warning and alarm flag to true.
Trip delay	100 to 2500 mSec Default : 500 mSec	10 mSec	Time till the trip flag will be set to true from that the alarm flag was set to true to lockout the application.
Warning enabled	True / False Default : True		Enable or disable the warning flag.
Trip enabled	True / False Default : True		Enable or disable the alarm and trip flag.

Reset
Manual

Applications
• All applications were the drives cable is exposed to damage. • Feeder panels. • Fitting panels.

Table 11.1.4.b: ANSI 50P Phase instantaneous over current (Short circuit >) configuration panel.

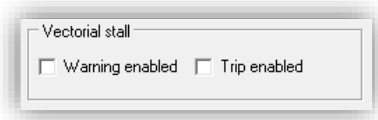
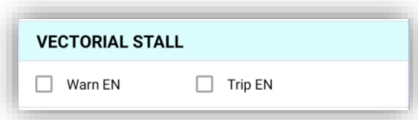
11.1.5 ANSI 51LS – Lock Rotor During Start Up

Protects drives against lock rotors during start up conditions.

Monitors the rate of change of the power factor level requirement is that power factor must improve during acceleration to speed (Cos Ø curve will follow shape of motor speed torque curve) when motor has insufficient torque to continue acceleration to operational sped the Cos Ø value will remain constant a 3sec delay in this condition is sufficient to accelerate through any normal toque fluctuations that can occur with dual cage or deep bar rotor designs.

Also works with the IEC60255-8 curve selection.

Power factor must improve within 40% of the time of the thermal curve time selected.

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Protection ☞ Current</td><td>☞ Protection ☞ Current</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>Warning enabled</td><td>True / False

Default : False</td><td></td><td>Enable or disable the warning flag.</td></tr>
<tr><td>Trip enabled</td><td>True / False

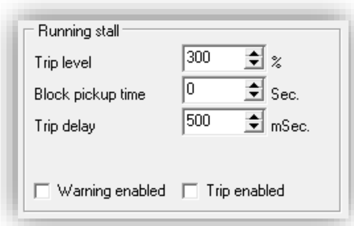
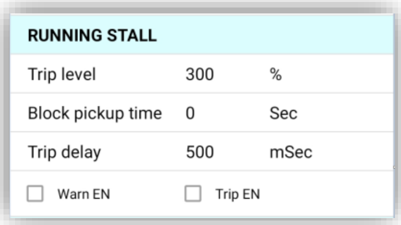
Default : False</td><td></td><td>Enable or disable the alarm and trip flag.</td></tr>
<tr><th colspan="4">Reset</th></tr>
<tr><td colspan="4">Manual</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">• Crusher.
• Conveyer.
• Drum screen.</td></tr>
</table>

Table 11.1.5: ANSI 51LS Lock rotor during start up (Vectorial stall) configuration panel.

11.1.6 ANSI 51LR – Locked Rotor During Running

Protects drives against lock rotors during running conditions.

Once the motor has successfully run up to speed and timed out the startup delay ANSI 51LR element is armed, should an impact causes the load current to exceed the preset running stall trip level and remain above this level for the preset trip will be tripped on ANSI 51LR and latched out requiring a reset signal. delay the motor.

<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Protection ☞ Current</td><td>☞ Protection ☞ Current</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
</table>

Parameters			
	Range	Inc	Description
Trip level	110 to 300 % Default : 300 %	1 %	Trip level that the current must exceed to set the warning or alarm flag to true.
Block pickup time	0 to 200 Sec Default : 0 Sec	1 Sec	Time it takes for the application to stabilize before the running stall protection function will be activated.
Trip delay	100 to 2000 mSec Default : 500 mSec	10 mSec	Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.
Warning enabled	True / False Default : False		Enable or disable the warning flag.
Trip enabled	True / False Default : False		Enable or disable the alarm and trip flag.

Reset
Manual

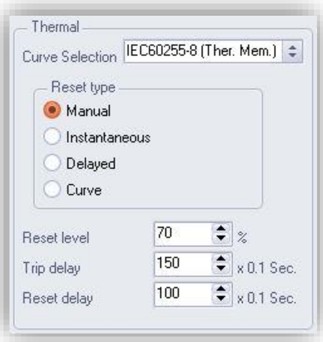
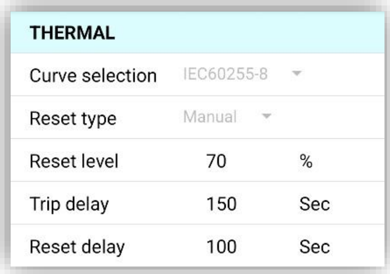
Applications
• Crushers. • Conveyers. • Miller. • Jet or normal fans. • Any drive that must be protected against mechanical jam.

Table 11.1.6: ANSI 51LR – Locked rotor during running (Running stall) configuration panel.

11.1.7 ANSI 51P – Phase Timed Over Current

Protection against thermal damage caused by overloads on machines (transformers, motors or generators). No thermal memory is available for these curves.

ANSI 49 or ANSI 51P will always be enable as overcurrent protection is a must on all devices.

	Frontend		Android Application
Navigation	☞ Protection ☞ Current		☞ Protection ☞ Current
Screens			
	Parameters		
	Range	Inc	Description
Curve selection	0 : IEC60255-8 (Thermal memory) 1 : DEFT 2 : IEC_NINV 3 : IEC_VINV 4 : IEC_LINV 5 : IEC_EINV 6 : ANSI_MINV 7 : ANSI_VINV 8 : ANSI_EINV 9 : Thermal flat 10 : IT 11 : I2T 12 : I4T to 12 Default : 0	1	Different thermal or curve modes are available depending on the device being thermally protected.
Reset type	0 : Manual 1 : Instantaneous 2 : Delayed 3 : Curve Default : 0	1	Various resets are available but not available to all the curve selections. Manual is available to all the curves and will cause a thermal trip to latch the trip contact. Instantaneous is available to all the curves except IEC60255-8 ANSI 49 as this curve has a thermal memory.

			Delayed is available to all the curves except IEC60255-8 ANSI 49 as this curve has a thermal memory. Curve is available to all the curves.
Reset level	1 to 99 % Default : 70 %	1 %	The thermal used reset level. The level must be so that a device can start without using all the capacity.
Trip delay	1 to 30000 x 0.1 Sec Default : 150 x 0.1 Sec	1 x 0.1 Sec	Selected curves time till trip multiplier. This trip time works with MLC setting.
Reset delay	1 to 30000 x 0.1 Sec Default : 100 x 0.1 Sec	1 x 0.1 Sec	Selected curves time till reset multiplier. This trip time works with MLC setting.
Reset			
Manual or auto			
Applications			
• All applications. • Thermal is used to protect the windings of the motor with the I^2T curve.			

Table 11.1.7: ANSI 51P Phase timed over current configuration panel.

11.2 Voltage

11.2.1 ANSI 27 - Under Voltage

A relay that operates on phase-to-phase voltage. When it’s input voltage is less than a predetermined value it will initiate a control or protection trip.

Under voltage protection compares a phase-to-phase voltage with a lower limit value. This function is used for asynchronous motors and generators running at rated load. This function is used to initiate actions to shed load to increase network supply stability. It can be used to prevent the starting placing on load additional equipment that could destabilize the supply network.

The catering for supply voltage drops on the supply cable to the motor is a requirement in certain applications. This requires the voltage level setting of the supply voltage to be elevated.

The under voltage level will then be applied to this elevated voltage to eliminate the supply cable voltage drop and to be lifted to cater for the motor or transformer rated voltage to be on motor or supply terminals of motor or transformer to allow motor or transformer to operate at full rated.

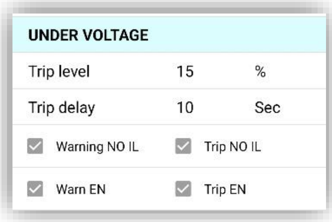
	Frontend		Android Application
Navigation	☞ Protection ☞ Voltage		☞ Protection ☞ Voltage
Screens			
Parameters			
	Range	**Inc**	**Description**
Trip level	1 to 25 % Default : 15 %	1 %	Trip level that one of the voltage phases need to be below to set the warning or alarm flag to true.
Trip delay	1 to 200 Sec Default : 10 Sec	1 Sec	Time till trip to set the trip flag to true from when the alarm flag was set to true to lockout the application.
Warning or trip without IL	True / False Default : True		Enable that the protection feature can execute without load or disable that current active must be true for the protection feature to execute.
Warning enabled	True / False Default : True		Enable or disable the warning flag.
Trip enabled	True / False Default : True		Enable or disable the alarm and trip flag.
Reset			
Manual			
Applications			
Where applications can not start with an incoming under voltage supply.			

Table 11.2.1: ANSI 27 Under voltage configuration panel.

11.2.2 ANSI 47 – Phase-Sequence Voltage or Phase-Balance Overvoltage

A relay that functions when the poly-phase currents are of reverse-phase sequence or when the poly-phase currents are unbalanced or contain negative phase sequence components above a given magnitude.

Protection of the sequence is done in 2 ways:

- Protection for the rotation of the line voltage into the switch gear.
    - Phase rotation will look at the line voltage input and trip in 500 ms. if the rotation is incorrect.
- Voltage unbalance calculates the unbalance level between the voltage phase levels.
    - % Difference = (((Max phase volt – Min phase volt) / Avg phase volt) x 100)

Voltage phase rotation

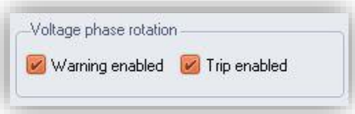
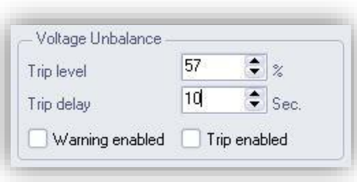
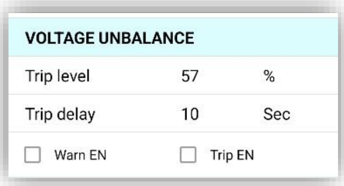
	Frontend		Android Application
Navigation	☞ Protection ☞ Voltage		☞ Protection ☞ Voltage
Screens			
Parameters			
	Range	**Inc**	**Description**
Trip delay	500 mSec fixed		Time till the trip flag is set to true when the alarm flag was set to true to lockout the application.
Warning enabled	True / False Default : True		Enable or disable the warning flag.
Trip enabled	True / False Default : True		Enable or disable the alarm and trip flag.
Reset			
Auto reset once fault is fixed.			
Applications			
• Drives that can only move in one direction and the source supply is pluggable. • Fitting panels. • Feeder panels. • Pumps.			

Table 11.2.2.a: ANSI 77 Phase-sequence voltage or phase-balanced overvoltage (Phase rotation) configuration panel.

Voltage unbalance

<table>
<tr><th></th><th colspan="2">Frontend</th><th colspan="2">Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Protection ☞ Voltage</td><td colspan="2">☞ Protection ☞ Voltage</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><th colspan="5">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th colspan="2">Description</th></tr>
<tr><td>Trip level</td><td>10 to 60 %

Default : 57 %</td><td>1 %</td><td colspan="2">Trip level that the voltage unbalance level must exceed to set the warning and alarm flag to true.</td></tr>
<tr><td>Trip delay</td><td>1 to 200 Sec

Default : 10 Sec</td><td>1 Sec</td><td colspan="2">Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.</td></tr>
<tr><td>Warning enabled</td><td>True / False

Default : False</td><td></td><td colspan="2">Enable or disable the warning flag.</td></tr>
<tr><td>Trip enabled</td><td>True / False

Default : False</td><td></td><td colspan="2">Enable or disable the alarm and trip flag.</td></tr>
<tr><th colspan="5">Reset</th></tr>
<tr><td colspan="5">Manual</td></tr>
<tr><th colspan="5">Applications</th></tr>
<tr><td colspan="5">• Any critical transformers that need to be protected.
• Feeder panels.
• Fitting panels.</td></tr>
</table>

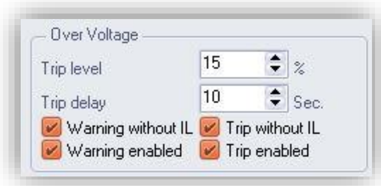
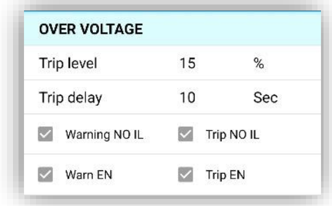
Table 11.2.2.b: ANSI 77 Phase-sequence voltage or phase-balanced overvoltage (Voltage unbalance) configuration panel.

11.2.3 ANSI 59 - Over Voltage

Detection of abnormally high network voltage or checking for sufficient voltage to enable source transfer. Works with phase-to-phase or phase-to-neutral voltage, each voltage being monitored separately.

The maximum phase voltage level out of the three phases is used to determine if a over voltage condition is active.

A selection can be made that current needs to be active or not active in order to activate the over voltage condition.

	Frontend	Android Application
Navigation	☞ Protection ☞ Voltage	☞ Protection ☞ Voltage
Screens		

Parameters			
	Range	**Inc**	**Description**
Trip level	1 to 25 % Default : 15 %	1 %	Trip level that one of the three voltage phases need to exceed to activate the warning or alarm flag.
Trip delay	1 to 200 Sec Default : 10 Sec	1 Sec	Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.
Warning or trip without IL	True / False Default : True		Enable that the protection feature can execute without load or disable that current active must be true for the protection feature to execute.
Warning enabled	True / False Default : True		Enable or disable the warning flag.
Trip enabled	True / False Default : True		Enable or disable the alarm and trip flag.

Reset
Manual

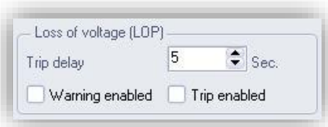
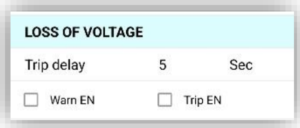
Applications
• Applications where the supply can easily go over to an over voltage condition. • Generators.

Table 11.2.3: ANSI 59 Over voltage configuration panel.

11.2.4 ANSI 78V – Voltage Loss of Power

Monitors the system line voltage. Should any of the phases on the system line voltage drop below the ANSI 27 undervoltage setpoint and not restore before the set trip delay the KG/KH-RTU relay will trip the contactor and latch the fault.

The fault can only be reset once all three phases of the system supply are restored and are above the ANSI 27 undervoltage trip level.

<table>
<tr><th></th><th colspan="3">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="3">☞ Protection ☞ Voltage</td><td>☞ Protection ☞ Voltage</td></tr>
<tr><td>Screens</td><td colspan="3">
</td><td>
</td></tr>
<tr><th colspan="5">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th colspan="2">Description</th></tr>
<tr><td>Trip delay</td><td>1 to 200 Sec</td><td>1 Sec</td><td colspan="2">Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.</td></tr>
<tr><td>Warning enabled</td><td>True / False

Default : False</td><td></td><td colspan="2">Enable or disable the warning flag.</td></tr>
<tr><td>Trip enabled</td><td>True / False

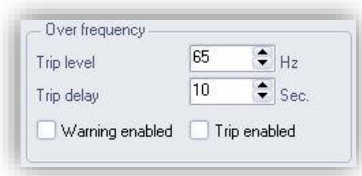
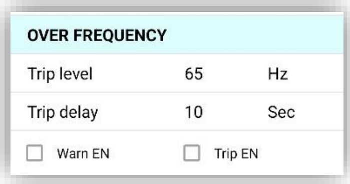
Default : False</td><td></td><td colspan="2">Enable or disable the alarm and trip flag.</td></tr>
<tr><th colspan="5">Reset</th></tr>
<tr><td colspan="5">Manual</td></tr>
<tr><th colspan="5">Applications</th></tr>
<tr><td colspan="5">Application where it is crucial that the incoming voltage must be monitored.</td></tr>
</table>

Table 11.2.4: ANSI 78V Voltage loss of power configuration panel.

11.2.5 ANSI 81O - Over Frequency

A relay that responds to the frequency of an electrical quantity, operating when the frequency exceeds a predetermined value.

Monitoring of the supply frequency allows for pre-emptive control as well as identification of over fluxing and under fluxing of motor and generator windings.

<table>
<tr><th></th><th colspan="2">Frontend</th><th colspan="2">Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Protection ☞ Voltage</td><td colspan="2">☞ Protection ☞ Voltage</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><th colspan="5">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th colspan="2">Description</th></tr>
<tr><td>Trip level</td><td>40 to 80 Hz

Default : 65 Hz</td><td>1 Hz</td><td colspan="2">Trip level that the frequency level must exceed to set the warning or alarm flag to true.</td></tr>
<tr><td>Trip delay</td><td>1 to 200 Sec

Default : 10 Sec</td><td>1 Sec</td><td colspan="2">Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.</td></tr>
<tr><td>Warning enabled</td><td>True / False

Default : False</td><td></td><td colspan="2">Enable or disable the warning flag.</td></tr>
<tr><td>Trip enabled</td><td>True / False

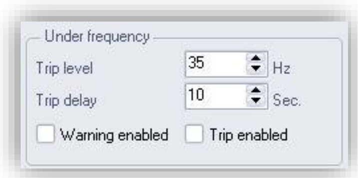
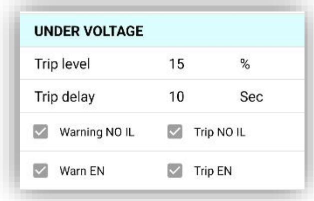
Default : False</td><td></td><td colspan="2">Enable or disable the alarm and trip flag.</td></tr>
<tr><th colspan="5">Reset</th></tr>
<tr><td colspan="5">Manual</td></tr>
<tr><th colspan="5">Applications</th></tr>
<tr><td colspan="5">• Winding application that heats up due to frequency being unstable.
• Generator.</td></tr>
</table>

Table 11.2.5: ANSI 81O Over frequency configuration panel.

11.2.6 ANSI 81U - Under Frequency

A relay that responds to the frequency of an electrical quantity, operating when the frequency is less than the predetermined value.

Indicates increased loading of generator or under speed on prime mover condition can lead to increased current as well as overloading.

	Frontend	Android Application
Navigation	☞ Protection ☞ Voltage	☞ Protection ☞ Voltage
Screens		

Parameters			
	Range	**Inc**	**Description**
Trip level	30 to 60 Hz Default : 35 Hz	1 Hz	Trip level that the frequency level must be below to set the warning or alarm flag to false.
Trip delay	1 to 200 Sec Default : 10 Sec	1 Sec	Time till the trip flag will be set to true from that the alarm flag was set to true to lockout the application.
Warning enabled	True / False Default : False		Enable or disable the warning flag.
Trip enabled	True / False Default : False		Enable or disable the alarm and trip flag.

Reset
Manual
Applications
• Winding application that heats up due to frequency being unstable. • Generator.

Table 11.2.6 ANSI 81U Under frequency configuration panel.

11.3 Earth Leakage

11.3.1 ANSI 50BF – Breaker Failure

KG/KH-RTU relay determines the failure of the main contact in the following 2 methods:

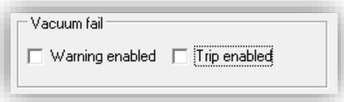
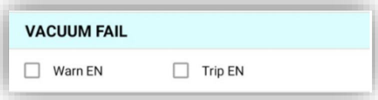
- Frozen contact
  - A trip instruction was given but the load current or feedback signal is still active.
- Vacuum failure
  - A voltage pulse can be seen from the bottom of the main contactor that means that the contactor has a high resistance across one or more of the phases.

Frozen contact

Parameters			
	Range	**Inc**	**Description**
Trip level	Current active fixed		Current or the feedback signal must be active after a trip command has been given. The warning or alarm flag will then be set to true.
Trip delay	1 Second fixed		Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.
Warning enabled	True fixed		Warning flag always enabled.
Trip enabled	True fixed		Alarm and trip flag always enabled.
Reset			
Manual.			
Applications			
Applications using a main contactor to supply drive or other application.			

Table 11.3.3.a: ANSI 50BF Breaker failure (Vacuum fail) configuration panel.

Vacuum failure

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Protection ☞ Earth leakage</td><td>☞ Protection ☞ Earth leakage</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>Trip level</td><td>10 VAC pulse fixed</td><td></td><td>Trip level that the vacuum level must exceed to set the warning or alarm flag to true.</td></tr>
<tr><td>Trip delay</td><td>Fixed on instantaneous trip.</td><td></td><td>Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application</td></tr>
<tr><td>Warning enabled</td><td>True / False

Default : False</td><td></td><td>Enable or disable the warning flag.</td></tr>
<tr><td>Trip enabled</td><td>True / False

Default : False</td><td></td><td>Enable or disable the alarm and trip flag.</td></tr>
<tr><th colspan="4">Reset</th></tr>
<tr><td colspan="4">Manual.</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">Applications using a main contactor to supply drive or other application.</td></tr>
</table>

Table 11.3.3.b: ANSI 50BF Breaker failure (Vacuum fail) configuration panel.

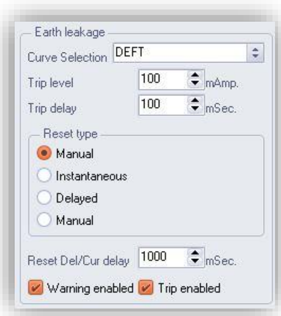
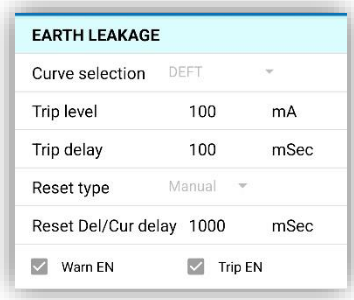
11.3.3 ANSI 50G/51G – Ground Instantaneous Overcurrent / Timed Ground Instantaneous Overcurrent

Relay that functions instantaneously on an excessive value of earth fault current on solidly earthed system, will exhibit an excessive rate of current rise of earth fault or zero sequence current, thus indicating a fault in the apparatus or circuit being protected.

Detection of phase to ground fault. The MEprotect detects this fault via 4 methods:

- Earth leakage via a CBCT core
- Earth fault >> via a CBCT core
- Earth fault > via a CBCT core
- I0 zero sequence component.
    - Zero sequence level % = (IL1[0] + IL2[0] + IL3[0]).

Earth leakage

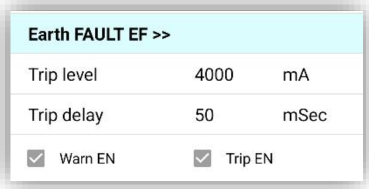
	Frontend	Android Application
Navigation	☞ Protection ☞ Earth leakage	☞ Protection ☞ Earth leakage
Screens		

Parameters			
	Range	**Inc**	**Description**
Curve Selection	0 : DEFT 1 : IDMT 2 : IEC_NINV 3 : IEC_VINV 4 : IEC_LINV 5 : IEC_EINV 6 : ANSI_MINV 7 : ANSI_VINV 8 : ANSI_EINV 9 : Thermal flat 10 : IT 11 : I2T 12 : I4T Default : 0	1	Curve that will be applied with the trip delay and trip level depending on the curve selection. For more detail on the curves see Chapter 20.
Trip level	40 to 28000 mA Default : 100 mA	1 mA	Trip level that the earth leakage level must exceed to set the warning or alarm flag to true.

Trip delay	100 to 2000 mSec Default : 100 mSec	10 mSec	Trip delay works with the curve selection. Trip time that it will take to set the trip flag to true from that the alarm flag was set to true to lockout the application.
Reset type	0 : Manual 1 : Instantaneous 2 : Delayed 3 : Curve Default : 0	1	Type of reset that needs to be executed when the trip flag was set to true.
Reset Del/Cur delay	100 to 2000 mSec Default : 1000 mSec	10 mSec	If reset is not set to manual, then the time till reset will activate if no alarm and no current active. After the time till reset exceeds the reset delay then the trip flag will be set to false.
Warning enabled	True / False Default : True		Enable or disable the warning flag.
Trip enabled	True / False Default : True		Enable or disable the alarm and trip flag.
Reset			
Manual or automatically			
Applications			
• Used were touch potentials can be hazardous to personnel on site. This can result in the loss of life. • Earth leakage 0,03 to 28 amp used as recoverable protection no permanent damage to equipment typical ingress of moisture or lubricant.			

Table 11.3.1.a ANSI 50G/51G Ground instantaneous or delayed overcurrent (Earth leakage) configuration panel.

Earth fault >>

<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Protection ☞ Earth leakage</td><td>☞ Protection ☞ Earth leakage</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
</table>

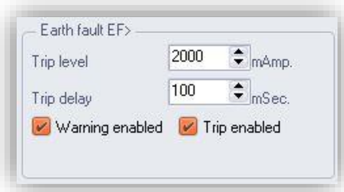
Parameters			
	Range	**Inc**	**Description**
Trip level	2000 to 28000 mA Default : 4000 mA	1 mA	Trip level that the earth leakage level must exceed to set the warning or alarm flag to true.
Trip delay	50 to 1000 mSec Default : 50 mSec	10 mSec	Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.
Warning enabled	True / False Default : True		Enable or disable the warning flag.
Trip enabled	True / False Default : True		Enable or disable the alarm and trip flag.

Reset
Manual

Applications
• Used were touch potentials can be hazardous to personnel on site. This can result in the loss of life. • Earth leakage 0,03 to 28 amp used as recoverable protection no permanent damage to equipment typical ingress of moisture or lubricant.

Table 11.3.1.b: ANSI 50G/51G Ground instantaneous or delayed overcurrent (Earth fault >>) configuration panel.

Earth fault >

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><th>Navigation</th><td colspan="2">☞ Protection ☞ Earth leakage</td><td>☞ Protection ☞ Earth leakage</td></tr>
<tr><th>Screens</th><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><th>Trip level</th><td>2000 to 28000 mA

Default : 4000 mA</td><td>1 mA</td><td>Trip level that the earth leakage level must exceed to set the warning or alarm flag to true.</td></tr>
<tr><th>Trip delay</th><td>100 to 10000 mSec

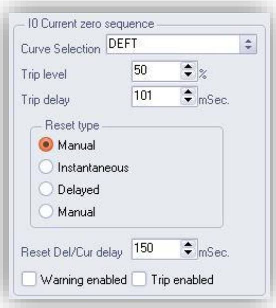
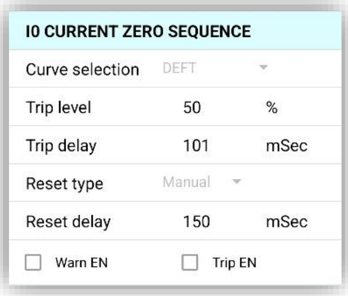
Default : 50 mSec</td><td>10 mSec</td><td>Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.</td></tr>
<tr><th>Warning enabled</th><td>True / False

Default : True</td><td></td><td>Enable or disable the warning flag.</td></tr>
<tr><th>Trip enabled</th><td>True / False

Default : True</td><td></td><td>Enable or disable the alarm and trip flag.</td></tr>
<tr><th colspan="4">Reset</th></tr>
<tr><td colspan="4">Manual</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">Used were touch potentials can be hazardous to personnel on site. This can result in the loss of life.
Earth leakage 0,03 to 28 amp used as recoverable protection no permanent damage to equipment typical ingress of moisture or lubricant.</td></tr>
</table>

Table 11.3.1.c: ANSI 50G/51G Ground instantaneous or delayed overcurrent (Earth fault >) configuration panel.

I0 zero sequence

<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td>☞ Protection ☞ Earth leakage</td><td>☞ Protection ☞ Earth leakage</td></tr>
<tr><td>Screens</td><td>
</td><td>
</td></tr>
</table>

Parameters

	Range	Inc	Description
Curve Selection	0 : DEFT 1 : IDMT 2 : IEC_NINV 3 : IEC_VINV 4 : IEC_LINV 5 : IEC_EINV 6 : ANSI_MINV 7 : ANSI_VINV 8 : ANSI_EINV 9 : Thermal flat 10 : IT 11 : I2T 12 : I4T Default : 0	1	Curve that will be applied with the trip delay and trip level depending on the curve selection. For more detail on the curves see Chapter 20.
Trip level	1 to 100 % Default : 50 %	1 %	Trip level that the I0 zero sequence level must exceed to set the warning or alarm flag to true.
Trip delay	100 to 2000 mSec Default : 101 mSec	10 mSec	Trip delay works with the curve selection. Trip time that it will take to set the trip flag to true from that the alarm flag was set to true to lockout the application.
Reset type	0 : Manual 1 : Instantaneous 2 : Delayed 3 : Curve Default : 0	1	Type of reset that needs to be executed when the trip flag was set to true.
Reset Del/Cur delay	100 to 2000 mSec Default : 1000 mSec	10 mSec	If reset is not set to manual, then the time till reset will activate if no alarm and no current active. After the time till

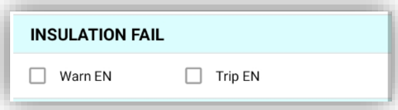
			reset exceeds the reset delay then the trip flag will be set to false.
Warning enabled	True / False Default : False		Enable or disable the warning flag.
Trip enabled	True / False Default : False		Enable or disable the alarm and trip flag.
Reset			
Manual or automatically			
Applications			
• Used were touch potentials can be hazardous to personnel on site. This can result in the loss of life. • Used as recoverable protection no permanent damage to equipment typical ingress of moisture or lubricant.			

Table 11.3.1.d ANSI 50G/51G Ground instantaneous or delayed overcurrent (I0 zero sequence) configuration panel.

11.3.4 ANSI 64 - Insulation Lockout

Detects if the resistance to earth is lower than safe operational value.

Typical application would be a submersible pump, should the waterproof cable entry fail, and water enters the motor winding chamber or fills the motor. Insulation failure measurement < =1 MOhm to earth can be used to prevent starting or connecting supply voltage to windings or space heater.

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Protection ☞ Earth leakage</td><td>☞ Protection ☞ Earth leakage</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>Trip level</td><td>1 MOhm fixed</td><td></td><td>Trip level that the insulation level must fall below to set the warning or alarm flag to true.</td></tr>
<tr><td>Trip delay</td><td>Instantaneous fixed</td><td></td><td>Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.</td></tr>
<tr><td>Warning enabled</td><td>True / False

Default : False</td><td></td><td>Enable or disable the warning flag.</td></tr>
<tr><td>Trip enabled</td><td>True / False

Default : False</td><td></td><td>Enable or disable the alarm and trip flag.</td></tr>
<tr><th colspan="4">Reset</th></tr>
<tr><td colspan="4">Manual</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">• Wet environment like submersible pumps.
• Environment with conductive dust.
• Detect when a cable is damaged.</td></tr>
</table>

Table 11.2.3: ANSI 64 Insulation Lockout configuration panel.

11.4 Shunt reset

11.4.1 ANSI 86RST – Lockout Reset

The shunt trip will activate when current is still active or feedback signal still active. Once the current and feedback signal is not active then the relay mapped to will de-energize. If current of feedback signal becomes active again then the relay mapped to shunt trip will energize again.

On high current related faults, the shunt will trip the MCCB first then after one second the main contactor. With low current faults the shunt will trip the main contactor first then after a second the MCCB.

This feature made the shunt reset redundant and is just kept not to reset the shunt trip flag on power cycle.

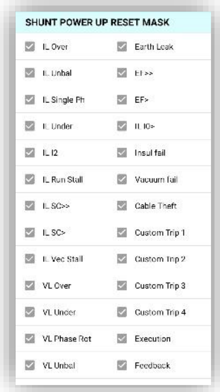
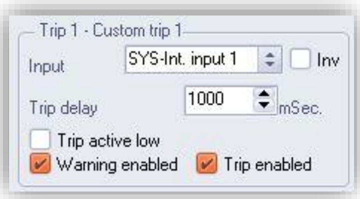
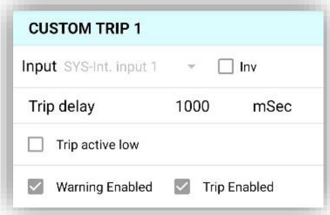
	Frontend		Android Application
Navigation	☞ Protection ☞ Shunt reset		☞ Protection ☞ Shunt reset
Screens			
Parameters			
	Range	**Inc**	**Description**
Enable shut reset for trip	True / False Default : True		Enable to reset the shunt trip flag on power up.
Applications			
Prevent the shunt trip to trip the MCCB on power up with a critical trip.			

Table 11.4.1 ANSI 86RST: Lockout reset configuration panel.

11.5 General
11.5.1 ANSI 86L Lockout Logic (Custom Trip)

Gives the option to create four custom trips that can lockout the KG/KH-RTU relay from operation. Selecting the dropdown menu on Input, a range of KG/KH-RTU relay flags are available to create a custom trip.

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Protection ☞ General</td><td>☞ Protection ☞ General</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>Input</td><td>0 to 32767

Default : 0</td><td>1</td><td>KG/KH-RTU relay flags that can be selected to lockout the KG-KH-RTU from operation. When the signal meets the trip condition the warning or alarm flag will be set to true.</td></tr>
<tr><td>Inv</td><td>Enable / Disable

Default : False</td><td></td><td>Inverts the KG/KH-RTU relay flag selected in the Input parameter.</td></tr>
<tr><td>Trip delay</td><td>100 to 60000 mSec

Default : 1000 mSec</td><td>10 mSec</td><td>Time till the trip flag will be set to true from when the alarm flag was set to true to lockout the application.</td></tr>
<tr><td>Trip active low</td><td>Enable / Disable

Default : False</td><td></td><td>System flag must transition from high to low to set the warning and alarm flag to true instead of low to high.</td></tr>
<tr><td>Warning enabled</td><td>True / False

Default : False</td><td></td><td>Enable or disable the warning flag.</td></tr>
<tr><td>Trip enabled</td><td>True / False

Default : False</td><td></td><td>Enable or disable the alarm and trip flag.</td></tr>
<tr><th colspan="4">Reset</th></tr>
<tr><td colspan="4">Manual</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">Application that require a custom lockout procedure.</td></tr>
</table>

Table 11.5.1: ANSI 86L Lockout logic (Custom Trip) configuration panel.

11.5.2 ANSI 66 - Starts per Hour Control

A device that functions to allow only a specified number of operations of a given device or equipment, or a specified number of successive operations within a given time of each other. It is also a device that functions to energize a circuit periodically or for fractions of specified time intervals, or that is used to permit intermittent acceleration or jogging of a machine at low speeds for mechanical positioning.

Limiting starts to a motor that can take place in an hour.

Consecutive starts will allow an attempt to restart the drive again if the start attempt failed as well as limit the jogging and inching operations to a maximum of 3 attempts.

When one start is left then a 1 start left warning or alarm flag will be activated.

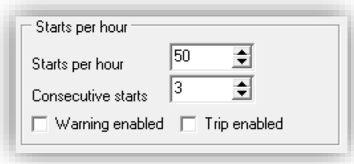
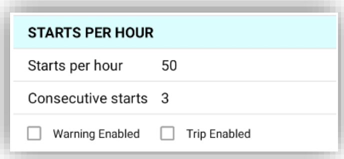
	Frontend		Android Application
Navigation	☞ Protection ☞ General		☞ Protection ☞ General
Screens			
Parameters			
	Range	**Inc**	**Description**
Starts per hour	1 to 60 Default : 6	1	Amount of starts that can be done in an hour time ranging from one in an hour to one per minute. When only there is only one start left the warning or alarm flag will be set to true. With no starts left the warning and alarm flag will be set to false and the trip flag will be set to true.
Consecutive starts	1 to 3 Default : 3	1	With each start an additional start is available if the application did not get it right to start.
Warning enabled	True / False Default : False		Enable or disable the warning flag.
Trip enabled	True / False Default : False		Enable or disable the alarm and trip flag.
Reset			
Automatic.			
Applications			
Applications were the device that function can only operate with certain amount of starts.			

Table 11.5.2: ANSI 66 Starts per hour configuration panel.

11.6 ANSI THD – Harmonics Monitor

Harmonic current and voltage measurements and monitoring from 1st up to 31st harmonic with warning, alarm and trip settings of allowable individual harmonic levels, as well as the calculation of the THD value in the load current and supply voltage makes for a powerful analytical tool.

Protection of windings, as well as prevention of eddy currents in transformer, motor and generator laminated iron cores as well as structural steel on different devices resulting in localised hot spots as well as overheating.

Individual harmonic level warning flags are used on the current and voltage to indicate if a specific harmonic has gone over the fundamental warning level.

THD for percentage current and voltage maximum levels with warning, alarm and trip delay flag activation.

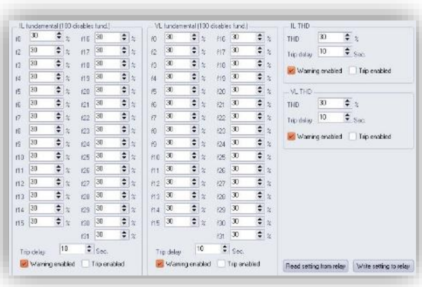
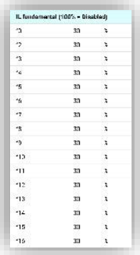
	Frontend			Android Application
Navigation	☞ Protection ☞ Harmonics			☞ Protection ☞ Harmonics
Screens				 
Parameters – IL fundamental & VL fundamental				
	Range	**Inc**	**Description**	
Fundamental f0 – f31	1 to 100 % Default : 30 %	1 %	Trip level that the selected fundamental level must exceed to set the warning or alarm flag to true.	
Trip delay	1 to 60 Sec Default : 10 Sec	1 Sec	Time till trip that will set the trip flag to true from when the alarm flag was set to true to lockout the application.	
Warning enabled	True / False Default : True		Enable or disable the warning flag.	
Trip enabled	True / False Default : False		Enable or disable the alarm and trip flag.	
Parameters – IL THD & VL THD				
	Range	**Inc**	**Description**	
THD	1 to 100 % Default : 30 %	1 %	Trip level that the selected fundamental level must exceed to set the warning or alarm flag to true.	
Trip delay	1 to 60 Sec Default : 10 Sec	1 Sec	Time till trip that will set the trip flag to true from when the alarm flag was set to true to lockout the application.	
Warning enabled	True / False Default : True		Enable or disable the warning flag.	
Trip enabled	True / False Default : False		Enable or disable the alarm and trip flag.	
Reset				
Manual.				
Applications				
Any winding or noise sensitive application that needs protection from any harmonics.				

Table 11.6: ANSI THD Fundamental and THD configuration panel.

11.7 External Reset Mask

Give control over external reset signals from the field inputs, Bluetooth and Modbus-RTU. External reset signal can be blocked on certain protections functions that forces maintenance staff to inspect the application then to press the reset button on the control panel.

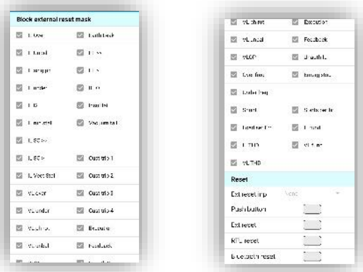
	Frontend		Android Application
Navigation	☞ Protection ☞ External reset mask		☞ Protection ☞ External reset mask
Screens			
Parameters			
	Range	**Inc**	**Description**
Reset masks	Enable / Disable Default : True		Enable to allow the fault to be reset from external source.
Ext reset input (see note*)	Field input 01 to Field input 03 Default : None		Field input selection to act as a reset.
Ext reset input (see note **)	See table F33 Default : False('0')		System flags to select to control the inputs of the external reset.
Inv for Ext reset input (see note **)	Enable / Disable Default : Disable		Inverts the KG/KH-RTU relay flag selected in the Input parameter.
Applications			
Where external resets have been wired and those external resets need to be blocked in order for maintenance staff to inspect the panel before reset.			
Note			
* KG-RTU device revision 01D and lower, KH-RTU device revision 01F and lower, KG/KH RTU frontend revision 02D and lower, KG/KH BLE and RTU frontend revision 01C. ** KG-RTU device revision 01E and lower, KH-RTU device revision 01G and lower, KG/KH RTU frontend revision 02E and lower, KG/KH BLE and RTU frontend revision 01D.			

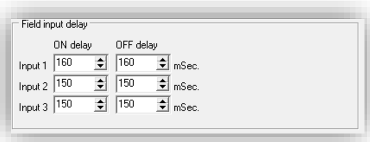
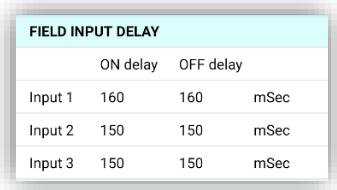
Table 11.7: External reset mask configuration panel.

12 Logic

12.1 Internal I/O

12.1.1 Field Input Delay

Allow a delay on the 24 to 220 VAC/VDC field inputs. The field input will need to stay on the on or off state before the KG/KH-RTU relay will respond to the field input new state.

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Logic ☞ Internal I/O</td><td>☞ Logic ☞ Internal I/O</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>Input 1 to 3 ON delay</td><td>50 to 60000 mSec

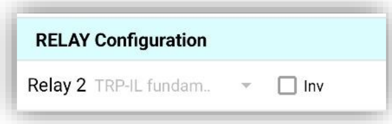
Default : 150 mSec</td><td>10 mSec</td><td>Time it will take before the on, on the field input will be set to true.</td></tr>
<tr><td>Input 1 to 3 OFF delay</td><td>50 to 60000 mSec

Default : 150 mSec</td><td>10 mSec</td><td>Time it will take before the off on the field input will be set to false.</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">Application where the signal will be unstable. Example a water lever switch.</td></tr>
</table>

Table 12.1.1: Field input delay configuration panel.

12.1.2 Relay Configuration

Configure the control signal that will control relay 2.

<table>
<tr><th></th><th colspan="2">Frontend</th><th colspan="2">Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Logic ☞ Internal I/O</td><td colspan="2">☞ Logic ☞ Internal I/O</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><th colspan="5">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th colspan="2">Description</th></tr>
<tr><td>Relay 2</td><td>See table X</td><td></td><td colspan="2">System flags to select to control relay 2 input. See F33.</td></tr>
<tr><td>Inv</td><td>Enable / Disable

Default : Disable</td><td></td><td colspan="2">Inverts the KG/KH-RTU relay flag selected in the Input parameter.</td></tr>
<tr><th colspan="5">Applications</th></tr>
<tr><td colspan="5">Signal needed to make relay 2 operational for the application.</td></tr>
</table>

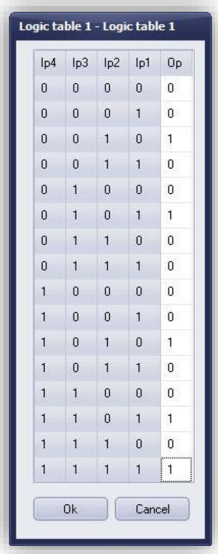
Table 12.1.2: Relay 2 configuration control panel.

12.2 Logic Tables

Logic tables 1 - 6 are used to combine several signal events to create six outputs. Each logic table consists of Input 1 to Input 4. These inputs can be any of the system flags, see F69.

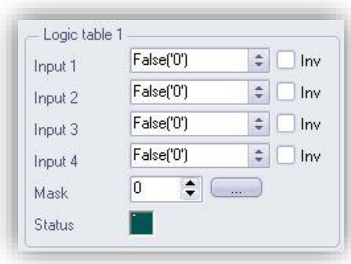
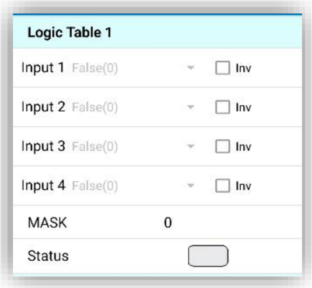
The Mask is used to specify which logic combination of the four inputs will create a logic one output.

Figure 12.2.a is that mask table. When **"Op" == 1,** then this input combination will produce a logic 1 as output for that particular logic combination.



Ip4	Ip3	Ip2	Ip1	Op
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Figure 12.2: Logic table mask.

<table>
<tr><th></th><th>Frontend</th><th colspan="2">Android Application</th></tr>
<tr><th>Navigation</th><td>☞ Logic ☞ Logic tables</td><td colspan="2">☞ Logic ☞ Logic tables</td></tr>
<tr><th>Screens</th><td>
</td><td colspan="2">
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><th>Input 1 to 4 for table 1 to 6</th><td>See table F33

Default : False('0')</td><td></td><td>System flags to select to control the inputs of the logic table.</td></tr>
<tr><th>Inv for input 1 to 4 for table 1 to 6</th><td>Enable / Disable

Default : Disable</td><td></td><td>Inverts the KG/KH-RTU relay flag selected in the Input parameter.</td></tr>
<tr><th>Mask for table 1 to 6</th><td>0 to 65535

Default : 0</td><td>1</td><td>Logical mask that acts as OR and AND logic.</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">Configurable logic needed for specific applications.</td></tr>
</table>

Table 12.2: Logic table configuration panel.

12.3 Comparator

12.3.1 Comparator 1 & 2

Compare input analogue value against high high, high low, low high and low low.

2 comparators are available.

7 flags will be set depending on the value and the limits set.

- LF Comp 1 high high
    - Level must go above the high high level to set the flag.
    - Level must go below the high high level to clear the flag.
- LF Comp 1 high low
    - Level must go above the high low level to set the flag.
    - Level must go below the high low level to clear the flag.
- LF Comp 1 high
    - Level must go above the high high to set the flag.
    - Level must go below the high level to clear the flag.
- LF Comp 1 Between
    - Level must go below the high level and above the low level to set the flag.
    - Level must go below the low level or above the high level to clear the flag.
- LF Comp 1 low
    - Level must go below the low low to set the flag.
    - Level must go above the low level to clear the flag.
- LF Comp 1 low high
    - Level must go below the low high level to set the flag.
    - Level must go above the low high level to clear the flag.
- LF Comp 1 low low
    - Level must go below the low low level to set the flag.
    - Level must go above the low low level to clear the flag.

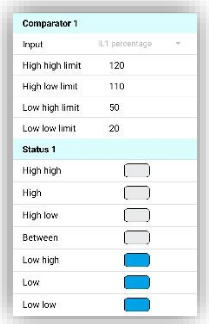
	Frontend		Android Application
Navigation	☞ Logic ☞ Comparator		☞ Logic ☞ Comparator
Screens			
Parameters			
	Range	**Inc**	**Description**
Input for comparator 1 and 2	See table F36 Default : IL1 percentage		System flags to select to control the inputs of the logic table.
High, high limit for comparator 1 and 2	0 to 65535 Default : 120	1	Input value must exceed the high, high to set the high and high, high flag to true. Below the high, high limit will set the high, high flag to false.
High, low limit for comparator 1 and 2	0 to 65535 Default : 110	1	Input value must exceed the high, low limit to set the high, low flag. Below the high, low limit will set the high and high, low flag to false. Between flag must be between high, low and low, high limit to be set to true, else between flag will be set to false.
Low, high limit for comparator 1 and 2	0 to 65535 Default : 50	1	Input value must exceed the low, high limit to set the low, high flag, low flag and low, low flag to false. Below the low, high limit the low, high flag will be set to true. Between flag must be between high, low and low, high limit to be set to true, else between flag will be set to false.
Low, low limit for comparator 1 and 2	0 to 65535 Default : 20	1	Input value must be below the low, low limit to set the low, high, low and low, low flag to true. Exceeding the low, low limit will set to false.
Applications			
Create an alert when a certain value exceeds a critical value			

Table 12.3.1: Comparators configuration panel.

12.3.2 TC Comparator

Logic thermal capacity (TC) warning levels. TC high is the 1st limit the thermal capacity used level or time till trip in percentage time needs to be over to set TC high (TC>) level flag. TC high, high (TC>>) is the 2nd limit the thermal capacity level must be over to set TC high, high flag.

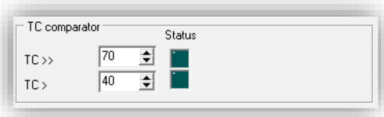
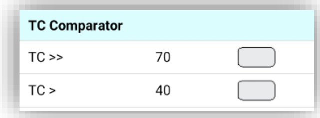
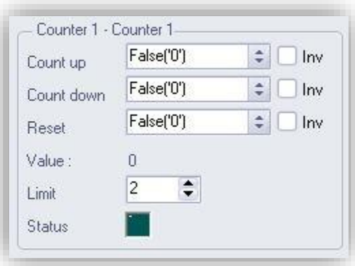
	Frontend		Android Application
Navigation	☞ Logic ☞ Comparator		☞ Logic ☞ Comparator
Screens			
Parameters			
	Range	**Inc**	**Description**
TC >>	1 to 100 % Default : 70 %	1 %	When the thermal capacity used or time till trip exceed limit then the TC>> flag will be set to true. When the thermal capacity used or time till trip is below the limit then the TC>> flag will be set to false.
TC >	1 to 100% Default : 40 %	1%	When the thermal capacity used or time till trip exceed the limit then the TC> flag will be set to true. When the thermal capacity used or time till trip is below the limit then the TC> flag will be set to false.
Applications			
Create an alert when the Thermal capacity exceeds a critical value			

Table 12.3.2: Thermal capacity used comparator configuration panel.

12.4 Counters

Two counters used to count up and down. Each counter has a count limit that can be set. As soon as the count limit is reach the count flag will go high and requires a reset to reset the count. A up and down input is assigned that needs a pulse in order to count up and down.

	Front-end	Android Application
Navigation	☞ Logic ☞ Counters	☞ Logic ☞ Counters
Screens		

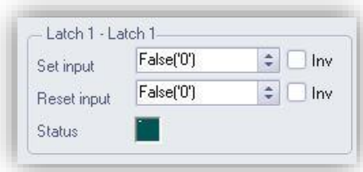
Parameters			
	Range	**Inc**	**Description**
Count up for counter 1 and 2	See table F33 Default : False('0')		System flags to select to control the inputs of the count up input.
Inv count up for counter 1 and 2	Enable / Disable Default : Disable		Inverts the KG/KH-RTU relay flag selected in the Input parameter.
Count down for counter 1 and 2	See table F33 Default : False('0')		System flags to select to control the inputs of the count down input.
Inv count down for counter 1 and 2	Enable / Disable Default : Disable		Inverts the KG/KH-RTU relay flag selected in the Input parameter.
Reset for counter 1 and 2	See table F33 Default : False('0')		System flags to select to control the inputs of the reset input.
Inv reset for counter 1 and 2	Enable / Disable Default : Disable		Inverts the KG/KH-RTU relay flag selected in the Input parameter.
Limit for counter 1 and 2	0 to 65535 Default : 2	1	Counter limit that the count value must be equal or greater to set the counter flag to true. When the counter value is below the counter limit value then the counter flag will be set to false.
Applications			
To monitor the number of events happening.			

Table 12.4: Counters configuration panel.

12.5 Latches

Latch that sets a bit and hold the bits set till a reset is given. Can be used to see if a condition occurred and monitor later as the latch will stay high until a reset is given.

Do note that the latched are non-volatile and will be set to false after a power cycle.

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Logic ☞ Latches</td><td>☞ Logic ☞ Latches</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>Set input for latch 1 and 2</td><td>See table F33

Default : False(‘0’)</td><td></td><td>System flags to select to control the inputs of the latch set input.</td></tr>
<tr><td>Inv set input for latch 1 and 2</td><td>Enable / Disable

Default : Disable</td><td></td><td>Inverts the KG/KH-RTU relay flag selected in the Input parameter.</td></tr>
<tr><td>Reset input for latch 1 and 2</td><td>See table F33

Default : False(‘0’)</td><td></td><td>System flags to select to control the inputs of the latch reset input.</td></tr>
<tr><td>Inv reset input for latch 1 and 2</td><td>Enable / Disable

Default : Disable</td><td></td><td>Inverts the KG/KH-RTU relay flag selected in the Input parameter.</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">Creating a custom latch. To detect when an event has happened.</td></tr>
</table>

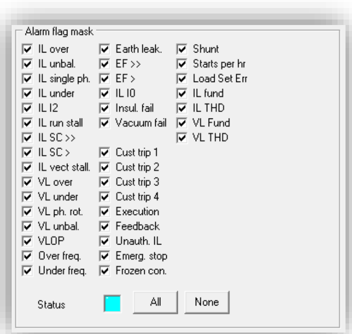
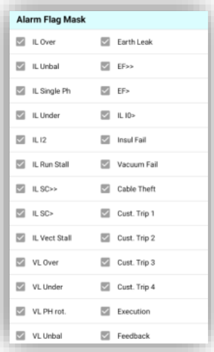
Table 12.5: Latch configuration panel.

12.6 Alarm and Trip Mask

12.6.1 Alarm Flag Mask

Flag used to select certain alarm flags to activate the alarm flag mask.

Do note that the alarm flag mask will not prevent an alarm flag condition to cause a trip condition to lockout the KG/KH-RTU relay.

<table>
<tr><th></th><th colspan="2">Frontend</th><th colspan="2">Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Logic ☞ Alarm and trip mask</td><td colspan="2">☞ Logic ☞ Alarm and trip mask</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><th colspan="5">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th colspan="2">Description</th></tr>
<tr><td>Alarm flag to mask</td><td>Enable / Disable

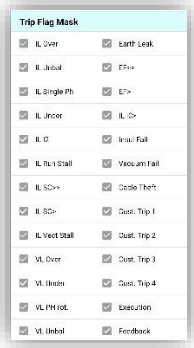
Default : Enabled</td><td></td><td colspan="2">Enable a protection feature alarm flag to be part of the alarm flag mask.</td></tr>
<tr><th colspan="5">Applications</th></tr>
<tr><td colspan="5">Mask out unwanted alarms to be sent to the SCADA or KG/KH-RTU relay logic.</td></tr>
</table>

Table 12.6.1: Alarm flag mask configuration panel.

12.6.2 Trip Flag Mask

Flag used to select certain trip flags to activate the trip flag mask.

Do not that the trip flag mask will not prevent a trip flag condition to lockout the KG/KH-RTU relay.

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><th>Navigation</th><td colspan="2">☞ Logic ☞ Alarm and trip mask</td><td>☞ Logic ☞ Alarm and trip mask</td></tr>
<tr><th>Screens</th><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><th>Trip flag to mask</th><td>Enable / Disable

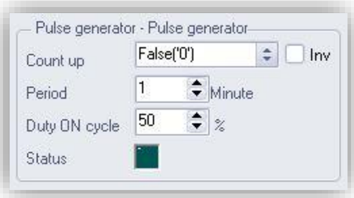
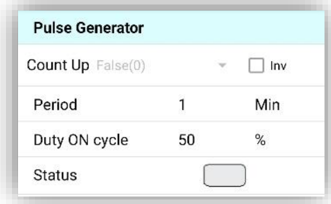
Default : Enabled</td><td></td><td>Enable a protection feature trip flag to be part of the trip flag mask.</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">Mask out unwanted trips to be sent to the SCADA or KG/KH-RTU relay logic.</td></tr>
</table>

Table 12.6.2: Trip flag mask configuration panel.

12.7 Pulse Generator

Generates a pulse accordingly to the pulse with and period set.

This could be useful to generate an extra control signal, for instance where 30 second flash visual light is necessary for a remote pumping station, a safely enclosed transformer container with visual light on the top of container or a remote underground ventilation fan.

<table>
<tr><th></th><th colspan="2">Frontend</th><th>Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Logic ☞ Pulse generator</td><td>☞ Logic ☞ Pulse generator</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td>
</td></tr>
<tr><th colspan="4">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th>Description</th></tr>
<tr><td>Input</td><td>See table F33

Default : False(‘0’)</td><td></td><td>System flags to select to control the inputs of the pulse generator input.</td></tr>
<tr><td>Inv input</td><td>Enable / Disable

Default : Disable</td><td></td><td>Inverts the KG/KH-RTU relay flag selected in the Input parameter.</td></tr>
<tr><td>Period</td><td>1 to 1000 Min

Default : 1 Min</td><td>1 Min</td><td>Length of the pulse total.</td></tr>
<tr><td>Duty ON cycle</td><td>1 to 100 %

Default : 50 %</td><td>1 %</td><td>Percentage of the pulse period that the pulse must be on.</td></tr>
<tr><th colspan="4">Applications</th></tr>
<tr><td colspan="4">Where flashing of a visual light is needed.</td></tr>
</table>

Table 12.7: Pulse generator configuration panel.

12.8 RTC Start and Stop

This is important for application where a protected pump or air conditioning motor needs to run only on certain times.

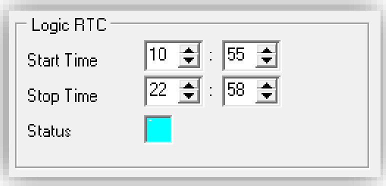
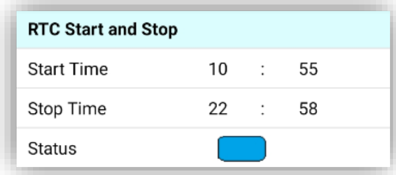
<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><th>Navigation</th><td>☞ Logic ☞ RTC start and stop</td><td>☞ Logic ☞ RTC start and stop</td></tr>
<tr><th>Screens</th><td>
</td><td>
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><th>Start Time</th><td colspan="2">The time the system should start. HH:MM</td></tr>
<tr><th>Stop Time</th><td colspan="2">The time the system should stop. HH:MM</td></tr>
<tr><th colspan="3">Applications</th></tr>
<tr><td colspan="3">Create an auto start stop for a system.
Limit the time frame that a application is allowed to run.</td></tr>
</table>

Table 12.8: RTC start and stop configuration panel.

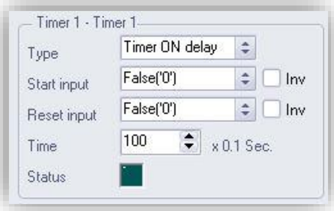
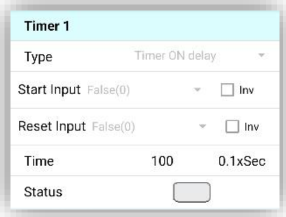
12.9 Timers

There are two Timers (1 & 2) available on each KG/KH-RTU relay. Each timer has a start input that will start the timer count, before enabling the Timer Output. Reset input is used to reset the condition of the timer.

Timeout will be length of the selected timer function.

Each timer has four types and each configuration that can be selected as shown below:

- Timer ON delay
- Timer latch ON delay
- Timer latch OFF delay
- Timer ON pulse

<table>
<tr><th></th><th>Frontend</th><th>Android Application</th></tr>
<tr><th>Navigation</th><td>☞ Logic ☞ Timers</td><td>☞ Logic ☞ Timers</td></tr>
<tr><th>Screens</th><td>
</td><td>
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
</table>

	Range	Inc	Description
Type for timer 1 and 2	Type of timer needed: 0: Timer ON delay 1: Timer latch ON delay 2: Timer OFF delay 3: Timer ON pulse. Default : 0	1	Select how the timer must operate according to input and output signals.
Start input for timer 1 and 2	See table F33 Default : False('0')		System flags to select to control the start input.
Inv start input for timer 1 and 2	Enable / Disable Default : Disable		Inverts the KG/KH-RTU relay flag selected in the Input parameter.
Reset input for timer 1 and 2	See table F33 Default : False('0')		System flags to select to control the reset input.
Inv reset input for timer 1 and 2	Enable / Disable Default : Disable		Inverts the KG/KH-RTU relay flag selected in the Input parameter.
Time	1 to 60000 x 0.1 Sec Default : 100 x 0.1 Sec	0.1 Sec	Delay time for the selected timer type.
Applications			
Create a timer based on system events.			

Table 12.9: Timer configuration panel.

12.10 Status Reporter Flag

Status reporter flag is a single flag that will show different conditions on one bit. This bit can be mapped out to indicate the following states:

- Current active with any trip flag 3 seconds false and 1 second true.
- Current active with no fault always true.
- Emergency stop only 3 seconds true and 3 seconds false.
- Earth leakage or earth fault trip only 1 second true and 1 second false.
- Other trips only 3 second true and 1 second false.
- Healthy with no current always false.

Can be mapped to a light to indicate different states using only one light.

13 Low Voltage Switch Gear Logic

KG/KH-RTU relay has three protection and control methods that can be selected:

- Protection relay that will act as a general protection relay without starter control logic.
- DOL to protect motors with starter control logic.
- Feeder to protect feeder application with starter logic.

Below is the break down of the functionality of the low voltage switch fear logic.

13.1 General Signals

Two important signal inputs are used to determine the state that the application must be at.

- Emergency stop to indicate that the KG/KH-RTU relay must lockout the application.
- Feedback signal to indicate the state of the main control contact in the application.

It is recommended for safety that the emergency stop must lockout the main contactor via the circuit wiring to the main control contact coil, and use the emergency stop signal to the KG/KH-RTU relay as indication or as input to the low voltage switch gear logic.

This will ensure that the main control contact will not operate if the emergency stop is active and the KG/KH-RTU relay is non-operational.

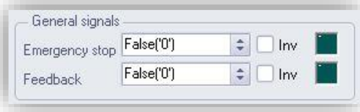
The emergency stop must be an active low signal (normally closed switch) to stop the application in the event of a wire breakage.

The emergency stop trip will automatically reset once the emergency stop signal is true.

Feedback signal is for feeder panels that has low ampere usage or ampere will only be seen when another application is started down the line.

The feedback signal is responsible for three trips:

- Execution fault,
- Feedback fault and
- Unauthorized load.

<table>
<tr><th></th><th colspan="2">Frontend</th><th colspan="2">Android Application</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Protection ☞ Earth leakage</td><td colspan="2">☞ Protection ☞ Earth leakage</td></tr>
<tr><td>Screens</td><td colspan="2">
</td><td colspan="2">
</td></tr>
<tr><th colspan="5">Parameters</th></tr>
<tr><th></th><th>Range</th><th>Inc</th><th colspan="2">Description</th></tr>
<tr><td>Emergency stop input signal</td><td>See table F33

Default : False(‘0’)</td><td></td><td colspan="2">Indicates the status of the emergency stop button. When the input signal is false then the KG/KH-RTU relay will set the warning, alarm and trip flag for the emergency stop.

Once the emergency stop signal is true then the warning, alarm and trip flag will be set to false and the KG/KH-RTU lockout will be automatically reset.

False(‘0’) will disable the emergency stop input signal.

Works with protection, DOL and feeder configuration.</td></tr>
<tr><td>Feedback input signal</td><td>See table F33

Default : False(‘0’)</td><td></td><td colspan="2">Used to execute the following protection:
Feedback,
Execution and
Unauthorized load.
Current active signal is also used as feedback when the feedback signal wire fails to avoid nuisance execution fault.

Works with DOL and feeder configuration.

Protection only works together with unauthorized load and if the emergency stop and stop buttons are configured.</td></tr>
<tr><th colspan="5">Reset</th></tr>
<tr><td colspan="5">Emergency stop will automatically reset.
Feedback, Execution and unauthorized load trips need a manual reset.</td></tr>
<tr><th colspan="5">Applications</th></tr>
<tr><td colspan="5">All application that need a starter configuration.</td></tr>
</table>

Table 13.1: General starter signal configuration panel.

13.1.1 Execution fault

Execution fault is when a start command has been executed but no current or feedback signal was detected in the time frame of the execution fault. The current active signal is OR with the feedback signal for in the event if the feedback signal wire is damaged to get the application started.

13.1.2 Feedback fault

Feedback fault is when the application is running and the feedback signal or current active signal is true, and during the running of the application both the feedback signal and current active signal becomes false, Then the feedback fault will become active.

13.1.3 Unauthorized load

When current active or feedback signal is true then the warning or alarm flag will be set to true. The unauthorized load time till trip timer will become active. When the time till trip timer reached the unauthorized trip delay then the unauthorized load trip flag will be set to true.

Emergency stop auto resets when corrected.

13.2 Control Selection

Low voltage switch gear has three points of control.

- Local,
- Remote and
- PLC.

Depending on the starter location selection is the signal controls that the low voltage switch gear logic will listen to.

Starts and interlocks will only be executed if the control selection is selecting that starter signal controls.

The stop signal across the local, remote and PLC control is a OR control and the low voltage switch gear will always listen to all stop signal disregarding the control selection location.

The location selection works as shown in table 13.2.a.

Location	LSB status	MSB status
Local	0	0
Remote	1	0
PLC	0	1

Table 13.2.a: Starter location selection table.

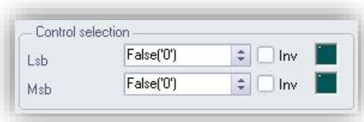
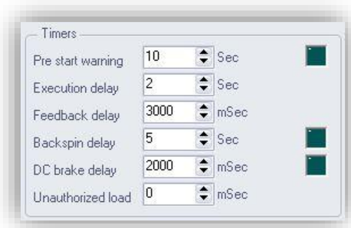
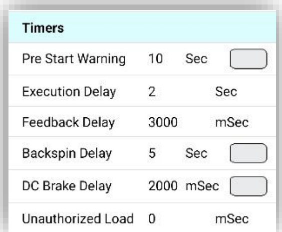
	Frontend	Android Application	
Navigation	☞ Protection ☞ Earth leakage	☞ Protection ☞ Earth leakage	
Screens			
Parameters			
	Range	**Inc**	**Description**
Lsb input signal	See table F33 Default : False('0')		Controls the least significant bit of the starter control selection.
Msb input signal	See table F33 Default : False('0')		Controls the most significant bit of the starter control selection.
Reset			
None			
Applications			
Applications that can send the KG/KH-RTU relay from more than one location. Modbus-RTU control bits, Bluetooth control bits, field inputs or KG/KH-RTU relay internal control logic.			

Table 13.2.b: Control selection configuration panel.

13.3 Timers

Low voltage switch gear timers are used for different functionality of the KG/KH-RTU relay logic.

	Frontend	Android Application	
Navigation	☞ Protection ☞ Earth leakage	☞ Protection ☞ Earth leakage	
Screens			
Parameters			
	Range	**Inc**	**Description**
Pre-start warning timer	0 to 999 Sec Default : 10 Sec	1 Sec	Warning that the application is going to start. Setting the value to 0 Sec will disable the pre-start warning signal.
Execution trip delay	1 to 20 Sec Default : 2 Sec	1 Sec	Time it will take to confirm that the application is running.
Feedback trip delay	10 to 10000 mSec	10 mSec	Dip time allowed when the application is running.

	Default : 3000 mSec		
Backspin time delay	0 to 999 Sec Default : 5 Sec	1 Sec	Allowed time to get the application to come to a stand still before starting again. 0 Sec will disable back spin.
DC brake time delay	0 to 10000 mSec Default : 2000 mSec	10 mSec	Enable the time to apply a DC voltage to the application to brake the motor. 0 mSec will disable DC brake.
Unauthorized load trip delay	0 to 5000 mSec Default : 0 mSec	10 mSec	Prevent the application to start without a start command. 0 mSec will disable unauthorized load.
Reset			
None			
Applications			
Applications that can send the KG/KH-RTU relay from more than one location. Modbus-RTU control bits, Bluetooth control bits, field inputs or KG/KH-RTU relay internal control logic.			

13.3.1 Pre-Start Warning

Allows a time delay from that the start signal was pressed and excepted till the control relay energized. The pre-start warning will give time to sound and alert personnel on site to clear the application before the application is going to start.

When a start command is executed, the pre-start warning flag will be set true for the duration of the pre-start warning delay. After the pre-start warning is completed, the pre-start warning flag will be set to false and the pre-start warning complete flag will be set to true.

When a stop or trip command is executed, the pre-start warning complete flag will be set to false.

Setting the pre-start warning delay to zero seconds will disable the pre-start warning.

Pre-start warning is only available for the DOL and feeder configuration.

13.3.2 Execution Delay

Execution delay gives time for the application to start-up before the low voltage switch gear logic will react to the feedback signal or current active flags.

After the pre-start warning is complete the execution time till trip will be armed, as well as the warning and alarm flag.

If the feedback signal or current active becomes true, then the warning and alarm flag will be set to false and the execution time till trip will be reset.

If the feedback signal and current active does not become true after the execution time till trip expired. Then the execution trip will be set to true and the KG/KH-RTU relay will be locked out.

Execution delay is only available for the DOL and feeder configuration.

13.3.3 Feedback Delay

Feedback fault only becomes active after the application is running.

When the application is running, and the feedback and current active signal becomes false. Then the feedback warning and alarm flag will be set to true. The feedback time till trip will then be armed.

If the feedback signal or current active signal does become true. Then the warning and alarm flag will be set to false. Feedback time till trip timer will also be reset to zero.

If the feedback signal and current active signal does not become true, and the feedback time till trip expired. Then the feedback trip flag will be set to true, and the KG/KH-RTU relay will be locked out.

Feedback delay is only available for the DOL and feeder configuration.

13.3.4 Backspin Delay

Backspin delay is used to give the application time to come to a stand still before starting again. Example a motor that can run forward and reverse in the application. To switch the motor from forward to reverse will damage the application.

When the feedback input signal or current active signal becomes true then the backspin delay will be armed. As soon as no feedback signal and current active is present then the backspin system flag will be set true and the KG/KH-RTU will be locked out to except another start command.

During the true state of the back spin delay the low voltage switch gear will not accept a start command. After the backspin timer is completed the backspin system flag will be set to false and the KG/KH-RTU relay will not be locked out. After the backspin system flag was set to false then another start command can start the application.

Setting the backspin delay time to zero seconds will disable backspin delay.

Backspin delay is available for protection, DOL and feeder configuration.

13.3.5 DC Brake Delay

DC break allows for the implementation of injecting DC voltage to a motor application do bring the motor to a stop quicker. Example would be a motor driving a fly wheel.

When the feedback input signal or current active signal becomes true. The DC brake delay will be activated. After the feedback input signal and current active signal becomes false then the DC brake delay system flag will be set to true, the DC brake timer will be activated and the KG/KH-RTU relay will lockout any other start commands.

During the true state of the DC brake delay the low voltage switch gear will not except a start command. After the DC brake timer is complete the DC brake delay system flag will be set to false and the KG/KH-RTU relay will reset the lockout of the start commands.

Setting the DC brake delay to zero milli seconds will disable the DC brake delay.

DC brake delay is available for protection, DOL and feeder configuration.

13.3.6 Unauthorized Load

Detect when the main control contactor is energized without a start command.

When the feedback signal or current active signal becomes true without a start, or a stop command is active. The unauthorized load warning and alarm flag will be set to true, and the unauthorized time till trip timer will be activated.

When the unauthorized load time till trip exceeds the unauthorized load trip delay then the unauthorized load trip flag will be set to true and the KG/KH-RTU relay will lockout the application.

Setting the unauthorized load trip delay to zero milli seconds will disable the unauthorized load.

Unauthorized load in a DOL or feeder configuration will take the stop, interlock and start input signals into account. In a protection configuration only the stop and interlock input signals will be used.

13.4 Local, Remote and PLC Start Control

The KG/KH-RTU relay low voltage switch gear controller has 3 locations from where the starter logic can be given the command to start, stop or to be locked out with an interlock signal. The three locations can come from:

- Local signals from the panel,
- Remote signals from the field or
- PLC signals from the SCADA.

Only one location can be used to drive a start or interlock signal depending on the control selection (Chapter 13.2).

All the stop signals are in-depended on the control selection and will operate does not matter what the control selection has selected.

The start control has three button configurations to select from:

- Push button,
- Hold till start and
- Latch.

Push Button

Start button is a push button that will send a 1 and will get cleared as soon as the button is released.

When the start button has been pushed the pre-start warning timer will execute followed by the start command.

The stop button must remain normally closed push button. This is to ensure that the wire is not broken to the stop input signal.

Interlock button also needs to be a normally closed circuit to ensure that there is no wire breakage.

Hold till start

The start push button must be pushed in for the duration of the pre-start warning time. If the start push button is released early, then the pre-start warning and start command will be cancelled.

This is a method to make sure that a start is meant to be executed and prevent the application to start by accidental button pushing.

The stop and interlock signal works as per push button selection.

Latch

The start button is a latch type. During any time of the pre-start warning and running of the motor if the start input is false then the application will stop.

Latch type configuration is a fail-safe circuit to make sure that the start signal is active.

The stop and interlock signal works as per push button selection.

14 LED Indications

The KG/KH-RTU relay has 10 indication LED’s to indicate the status of the KG/KH-RTU relay.

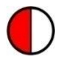
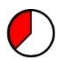
Condition	LED’s used	Indication
ANSI 37 minimum load trip.	Minimum load LED: Solid on.	
ANSI 37 minimum load trip with reset active.	Minimum load LED: One second on and one second off.	
ANSI 46 unbalance trip.	Unbalance LED: Solid on.	
ANSI 46 Single phase trip.	Unbalance LED: 2 seconds on and 1 second off.	
ANSI 46 I2 negative sequence trip.	Unbalance LED: 2 seconds on and 1 second off.	
ANSI 49/51P over current trip.	Over current LED: Solid on.	
ANSI 49 over current trip with auto reset active.	Over current LED: 1 second on and 1 second off.	
ANSI 51LS vectorial stall trip.	Over current LED: Solid on.	
ANSI 50P/51P short circuit trip.	Over current LED: 3 seconds on and 1 second off.	
ANSI 51LR running stall trip.	Over current LED: 2 seconds on an 1 second off.	
ANSI 27 under voltage trip.	Voltage / Phase rotation LED: 2 seconds off and 1 second on.	

Table 14.a: Fault indications.

Condition	LED's used	Indication
ANSI 47 voltage unbalance trip.	Voltage / Phase rotation LED: 1 seconds off and 1 second on.	
ANSI 47 voltage phase rotation trip.	Voltage / Phase rotation LED: Solid on.	
ANSI 59 Over voltage trip.	Voltage/ Phase rotation LED: 2 seconds on and 1 second off.	
ANSI 78V voltage loss of power trip.	Voltage / Phase rotation LED: 1 second on and 1 second off in sync with, Healthy LED: 1 second on and 1 second off.	
ANSI 81O over frequency trip.	Unbalance LED: 1 second on and 1 second off.	
ANSI 81U under frequency trip.	Unbalance LED: 1 second on and 1 second off.	
ANSI 50G/51G earth leakage trip or auto reset.	Earth leakage LED: Solid on.	
ANSI 50G/51G earth fault trip or auto reset.	Earth leakage LED: 1 second on and 1 second off.	
ANSI 50G/51G I0 zero sequence trip or auto reset.	Earth leakage LED: 2 seconds on and 1 second off.	
ANSI 64 insulation lockout trip.	Insulation LED: Solid on.	
ANSI 86L Custom trip.	Insulation lockout LED: 3 seconds on and 1 second off.	

Table 14.b: Fault indications continue.

Condition	LED's used	Indication
ANSI 66 starts per hour trip	Overcurrent LED: 1 second on and 1 second off in sync with, Healthy LED: 1 second on and 1 second off.	
Settings corrupted	All (Red) trip LED's: 1 second on and 1 second off.	
Frozen contact trip	Trip LED of fault with Healthy LED: 1 second on and 1 second off.	
Relay healthy or operational	Healthy LED: Solid on.	
Bluetooth ready	Bluetooth LED: Solid on green.	
Bluetooth paired	Bluetooth LED: Solid blue.	
Bluetooth paired and exchanging data with device.	Bluetooth LED: Flashing.	
Modbus-RTU address	Modbus-RTU address LED: Orange 1 second on and 1 second off is a 100 count. Red 1 second on and 1 second off is a 10 count. Green 1 second on and 1 second off is a count of 1. Example address 123 is 3 green flashes, followed by 2 res flashes and 1 orange flash.	

Table 14.c: Fault indications continue.

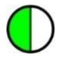
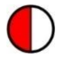
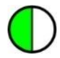
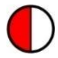
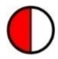
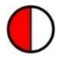
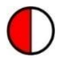
Condition	LED's used	Indication
Emergency stop, stop or interlock.	Healthy LED: 1 second on and 1 second off.	
Unauthorized load	Overcurrent LED: 1 second on and 1 second off in sync with, Healthy LED: 1 second on and 1 second off.	 
Execution fault	Minimum load LED: 1 second on and 1 second off in sync with, Insulation LED: 1 second on and 1 second off.	 
Feedback fault	Minimum load LED: 1 second on and 1 second off in sync with, Insulation LED: 1 second on and 1 second off.	 

Table 14.d: Fault indications continue.

15 Events

KG/KH-RTU relay has 882 events records, that is time and date stamped according to the KG/KH-RTU relay internal clock. Event records will keep record of the following:

- Power up,
- Alarm conditions,
- Trip conditions,
- Setting altered from RTU or BLE port,
- Application going into a start-up, run or stop condition,
- Stop or interlock activated and
- Reset command executed from location,
- Simulator was active during event.

The KG/KH-RTU relay event record can also be saved and imported into a spreadsheet or text editor.

The event record of the KG/KH-RTU relay can only be cleared by the manufacturer.

Each event has the following parameters stored:

	Frontend	Android Application
Navigation	☞ Events	☞ Events
Screens		

Parameters			
	Range	**Inc**	**Description**
Number	1 to 882	1	Sequence number of the event
Date	00/00/00 to 99/12/31		Date format Year/Month/Date
Time	00:00:00.00 to 23:59:59.99		Time format Hour:Minutes:Seconds.mSeconds
Type	Event type (See format F39)		Type of event that occurred.
Alarms	Alarm flags		All alarm flag conditions.
Trips	Trip flags		All trip flag conditions.
Input 1 to 3	0 to 1	1	Boolean status of the field inputs.
Main or rel 2	0 to 1	1	Status of the 2 output contactors. 0 : Energized. 1 : De-energized.
TC remaining	0 to 100 %.	1 %	Thermal capacity remaining or time till trip in percentage.
IL1 to IL3	0 to 1000%	1 %	The current load of L1 to L3 in percentage.
IL unbalance	0 to 100 %	1 %	Current load unbalance level.
I2	0 to 1000 %	1 %	Negative sequence level.

VL1 to VL3	0 to 60000 VAC	1 VAC	The phase voltage level of L1 to L3.
VL unbal	0 to 100 %	1 %	The line voltage unbalance level between phases.
V2	0 to 1000%	1 %	The line voltage negative sequence.
VL Freq	0 to 1000 Hz	1 Hz	The line voltage frequency level detected.
EL	0 to 30000 mA	1 mA	Earth leakage level measured.
I0	0 to 1000 %	1 %	Current zero sequence level.
IL THD	0 to 1000 %	1 %	Highest current load THD detected from IL1, IL2 and IL3.
VL THD	0 to 1000 %	1 %	Highest voltage level THD detected from VL1, VL2 and VL3.
IL fund	0 to 32	1	Current fundamental that trigged a warning or alarm flag. 0 to 31 : Fundamental. 32 : No fundamental went over the warning or alarm flag level.
IL phase	0 to 1000 %	1 %	Current fundamental level.
VL fund	0 to 32	1	Voltage fundamental that trigged a warning or alarm flag. 0 to 31 : Fundamental. 32 : No fundamental went over the warning or alarm flag level.
VL phase	0 to 1000 %	1 %	Voltage fundamental level.
Running hours	0.0 to 429496729.5 Hours	0.1 Hour	Log the running counter at the instance of the event.
Trip clear	0 to 65530 mSec	10 mSec	Time it took for the application to stop the load. Trip clear time is a good indication if the applications contactors are not clearing the faults in time.
Recuring counter	0 to 65535	1	Amount of times this event occurred in sequence.
Applications			
Any application that need to be analysed or diagnosed.			

Table 15: Event parameters.

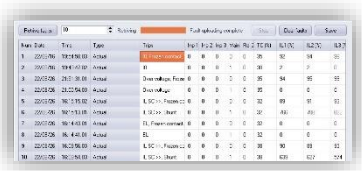
16 Faults

The KG/KH-RTU relay stored up to 208 fault records, each fault is date and time stamped with the KG/KH-RTU relay internal clock. Only trip conditions will be stored.

The KG/KH-RTU relay fault record can also be saved and imported into a spreadsheet or text editor.

The KG/KH-RTU relay fault records can only be cleared via the Modbus-RTU port.

Each fault has the following parameters stored:

	Frontend		Android Application
Navigation	☞ Faults		☞ Faults
Screens			
	Parameters		
	Range	**Inc**	**Description**
Number	1 to 208	1	Sequence number of the event.
Date	00/00/00 to 99/12/31		Date format Year/Month/Date
Time	00:00:00.00 to 23:59:59.99		Time format Hour:Minutes:Seconds.mSeconds
Type	Fault simulated or actual.		Type of fault that occurred.
Trips	Trip flags		Trip flag conditions.
Input 1 to 3	0 to 1	1	Boolean status of the field inputs.
Main or rel 2	0 to 1	1	Status of the 2 output contactors. 0 : Energized. 1 : De-energized.
TC remaining	0 to 100 %.	1 %	Thermal capacity remaining or time till trip in percentage.
IL1 to IL3	0 to 1000%	1 %	The current load of L1 to L3 in percentage.
IL unbalance	0 to 100 %	1 %	Current load unbalance level.
I2	0 to 1000 %	1 %	Negative sequence level.
VL1 to VL3	0 to 60000 VAC	1 VAC	The phase voltage level of L1 to L3.
VL unbal	0 to 100 %	1 %	The line voltage unbalance level between phases.
V2	0 to 1000%	1 %	The line voltage negative sequence.
VL Freq	0 to 1000 Hz	1 Hz	The line voltage frequency level detected.

EL	0 to 30000 mA	1 mA	Earth leakage level measured.
I0	0 to 1000 %	1 %	Current zero sequence level.
IL THD	0 to 1000 %	1 %	Highest current load THD detected from IL1, IL2 and IL3.
VL THD	0 to 1000 %	1 %	Highest voltage level THD detected from VL1, VL2 and VL3.
IL fund	0 to 32	1	Current fundamental that trigged a warning or alarm flag. 0 to 31 : Fundamental. 32 : No fundamental went over the warning or alarm flag level.
IL phase	0 to 1000 %	1 %	Current fundamental level.
VL fund	0 to 32	1	Voltage fundamental that trigged a warning or alarm flag. 0 to 31 : Fundamental. 32 : No fundamental went over the warning or alarm flag level.
VL phase	0 to 1000 %	1 %	Voltage fundamental level.
Running hours	0.0 to 429496729.5 Hours	0.1 Hour	Log the running counter at the instance of the event.
Trip clear	0 to 65530 mSec	10 mSec	Time it took for the application to stop the load. Trip clear time is a good indication if the applications contactors are not clearing the faults in time.
Applications			
Any application that need to be analysed or diagnosed.			

Table 16: Fault parameters.

17 RTU and BLE Configuration

The KG/KH-RTU relay has Modbus-RTU and BLE as a standard way to communicate.

The only 2 parameters that the BLE uses is the address and timeout parameters.

The BLE uses GATT to communicate that runs on a fix baud rate. Also the Bluetooth GATT uses the Modbus-RTU protocol. This is to allow SCADA with Bluetooth capabilities to also communicate with the KG/KH-RTU relay.

The RTU configuration can only be configured via the KG/KH-RTU frontend and not the KG/KH-RTU App.

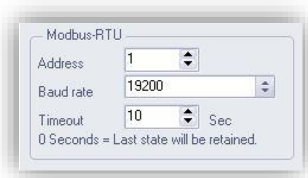
	Frontend		Android Application
Navigation	☞ RTU configuration		Can not be configured via Bluetooth
Screens			
Parameters			
	Range	**Inc**	**Description**
Address	1 to 247 Default : 247	1	Modbus-RTU address assigned to the KG/KH-RTU.
Baud rate	0 : 1200 bps 1 : 2400 bps 2 : 4800 bps 3 : 9600 bps 4 : 19200 bps 5 : 38400 bps 6 : 57600 bps 7 : 115200 bps Default : 4	1	Baud rate that the Modbus-RTU communication port is set at.
Timeout	0 to 60 Sec Default : 0 Sec	1 Sec	When the communication from the SCADA or Bluetooth has stopped communicating. The timeout will then clear the SCADA or Bluetooth control words in. 0 = That KG/KH-RTU relay will retain the last control bits.
Applications			
Application that need to communicate information back to a SCADA system.			

Table 17: RTU communication configuration panel.

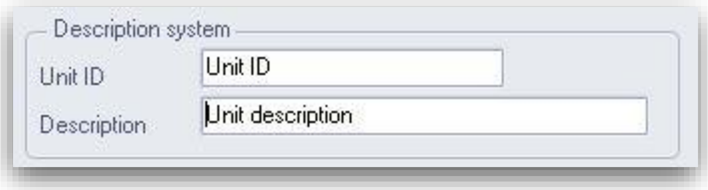
18 Description

Description field is used to provide a short description on the field specific parameter. The KG/KH-RTU relay description fields are stored on the KG/KH-RTU relay to provide a short description of information of the KG/KH-RTU relay parameter.

The KG/KH-RTU relay descriptions can only be edited via the KG/KH-RTU frontend.

18.1 System ID

Unique name or identification that the KG/KH-RTU relay can have assigned to identify the KG/KH-RTU.

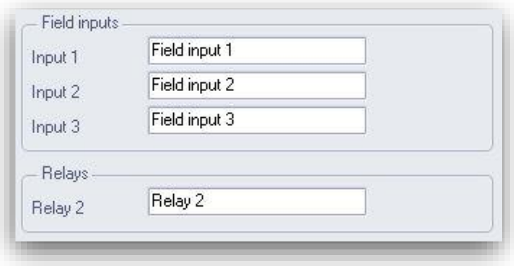
	Frontend
Navigation	☞ Description ☞ System ID
Screens	

Parameters		
	Amount of Char	**Description**
Unit ID	20	Unique name that the KG/KH-RTU relay can have. Unit ID is a short description field that can be used to identify the KG/KH-RTU being configured or monitored. Default : Unit ID.
Description	30	Same as Unit ID but with 30 characters used to describe the KG/KH-RTU relay.

Table 18.1: System ID description configuration panel.

18.2 Internal I/O

Description fields to give a description for the field inputs and relay outputs.

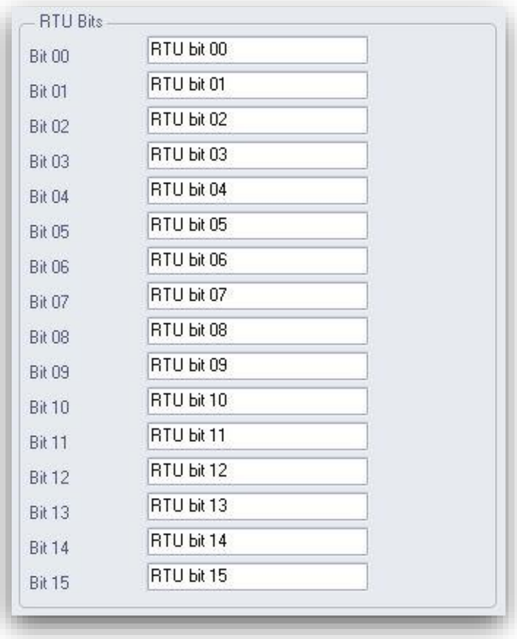
	Frontend
Navigation	☞ Description ☞ Internal I/O
Screens	

Parameters		
	Amount of Char	**Description**
Input 1 to Input 3	20	Give a description to the field inputs. Default : Input 1, Input 2 and Input 3
Relay 2	20	Description for relay 2. Default : Relay 2

Table 18.2: Internal I/O description configuration panel.

18.3 RTU Bits

Description field for the RTU bits coming from the SCADA to the KG/KH-RTU relay via the Modbus-RTU port.

	Frontend
Navigation	☞ Description ☞ RTU bits
Screens	

Parameters		
	Amount of Char	**Description**
Bit 00 to Bit 15	20	Give a description to the RTU bits coming from the SCADA to the KG/KH-RTU relay via Modbus-RTU. Default : RTU bit 00 to RTU bit 15.

Table 18.3: RTU bits description configuration panel.

18.4 BT Bits

Description field for the bits coming from Bluetooth to the KG/KH-RTU relay.

<table>
<tr><th></th><th colspan="2">Frontend</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Description ☞ RTU bits</td></tr>
<tr><td>Screens</td><td colspan="2">
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><th></th><th>Amount of Char</th><th>Description</th></tr>
<tr><td>Bit 00 to Bit 15</td><td>20</td><td>Give a description to the bits coming from Bluetooth to the KG/KH-RTU relay.

Default : BT bit 00 to BT bit 15.</td></tr>
</table>

Table 18.4: Bluetooth bits description configuration panel.

18.5 Custom Trips

Description field to label the custom trip configuration. These labels can aid in what the custom trip was configured for.

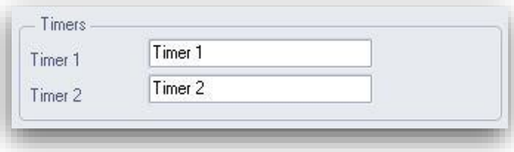
<table>
<tr><th></th><th colspan="2">Frontend</th></tr>
<tr><th>Navigation</th><td colspan="2">☞ Description ☞ Custom trips</td></tr>
<tr><th>Screens</th><td colspan="2">
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><th></th><th>Amount of Char</th><th>Description</th></tr>
<tr><th>Custom trip 1 to custom trip 4</th><td>20</td><td>Give a description label to the 4 custom trip configuration.

Default : Custom trip 1 to 4.</td></tr>
</table>

Table 18.5: Custom trip description configuration panel.

18.6 Timers

Description field to give a short description for what the logic timer is getting used for.

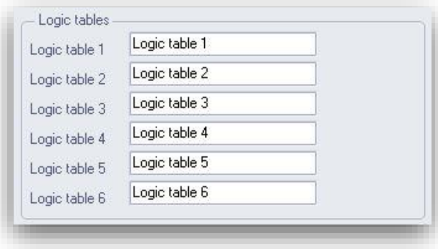
<table>
<tr><th></th><th colspan="2">Frontend</th></tr>
<tr><th>Navigation</th><td colspan="2">☞ Description ☞ Timers</td></tr>
<tr><th>Screens</th><td colspan="2">
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><th></th><th>Amount of Char</th><th>Description</th></tr>
<tr><th>Timer 1 to timer 2</th><td>20</td><td>Give a description label to the timers.

Default : Timer 1 to 2.</td></tr>
</table>

Table 18.6: Timers description configuration panel.

18.7 Logic Tables

Description field to give a short description for what the logic table is getting used for.

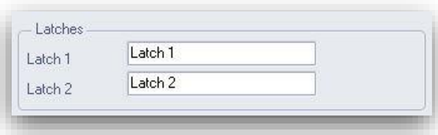
	Frontend
Navigation	☞ Description ☞ Logic tables
Screens	

Parameters		
	Amount of Char	**Description**
Logic table 1 to logic table 6	20	Give a description label to the logic table. Default : Logic table 1 to 6.

Table 18.7: Logic tables description configuration panel.

18.8 Latches

Description field to give a short description for what the latch is used for.

	Frontend
Navigation	☞ Description ☞ Latches
Screens	

Parameters		
	Amount of Char	**Description**
Latch 1 to latch 2	20	Give a description label to the latch. Default : Latch 1 to 2.

18.9 Comparators

Description field to give a short description for what the comparator is used for.

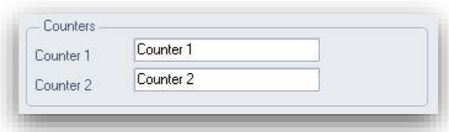
<table>
<tr><th></th><th colspan="2">Frontend</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Description ☞ Comparators</td></tr>
<tr><td>Screens</td><td colspan="2">
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><th></th><th>Amount of Char</th><th>Description</th></tr>
<tr><td>Comparator 1 to comparator 2</td><td>20</td><td>Give a description label to the comparator.

Default : Comparator 1 to 2.</td></tr>
</table>

Table 18.9: Comparator description configuration panel.

18.10 Counters

Description field to give a short description for what the counter is getting used for.

<table>
<tr><th></th><th colspan="2">Frontend</th></tr>
<tr><td>Navigation</td><td colspan="2">☞ Description ☞ Counters</td></tr>
<tr><td>Screens</td><td colspan="2">
</td></tr>
<tr><th colspan="3">Parameters</th></tr>
<tr><th></th><th>Amount of Char</th><th>Description</th></tr>
<tr><td>Counter 1 to counter 2</td><td>20</td><td>Give a description label to the counter.

Default : Counter 1 to 2.</td></tr>
</table>

Table 18.10: Counter description configuration panel.

18.11Pulse Generator

Description field to give a short description for what the pulse generator is getting used for.

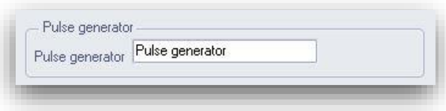
	Frontend	
Navigation	☞ Description ☞ Pulse generator	
Screens		
Parameters		
	Amount of Char	**Description**
Pulse generator	20	Give a description label to the pulse generator. Default : Pulse generator.

Table 18.11: Pulse generator description configuration panel.

18.12RTC Start and Stop

Description field to give a short description for what the logic RTC start and stop is getting used for.

	Frontend	
Navigation	☞ Description ☞ RTC start and stop	
Screens		
Parameters		
	Amount of Char	**Description**
Start and stop	20	Give a description label to the logic RTC start and stop. Default : Logic RTC.

Table 18.12: RTC start and stop description configuration panel.

19 Calibration and Info

Contains manufacturer details and calibrations of the KG/KH-RTU relay. Calibration and info can only be altered by the manufacturer.

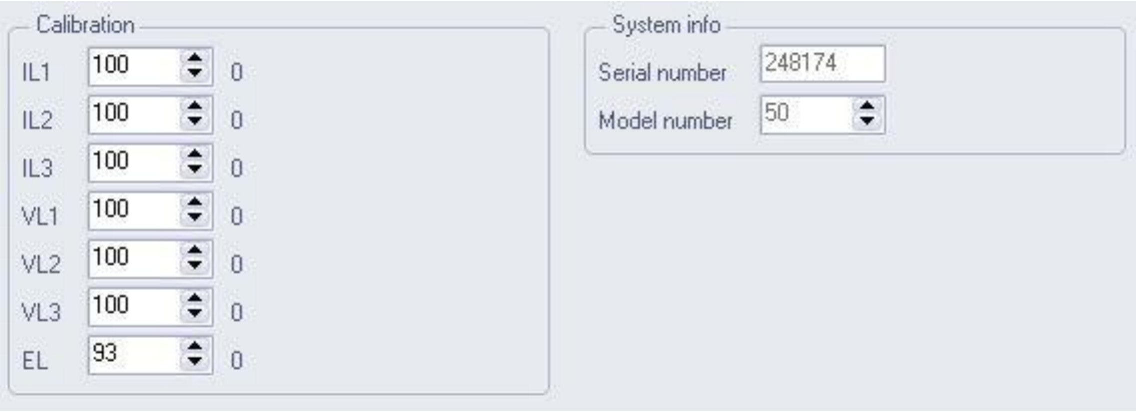


Figure 19: Calibration information panel.

20 KG/KH-RTU Relay Curve Selections

20.1 IEC60255-8 Curve

IEC60255-8 trip curve

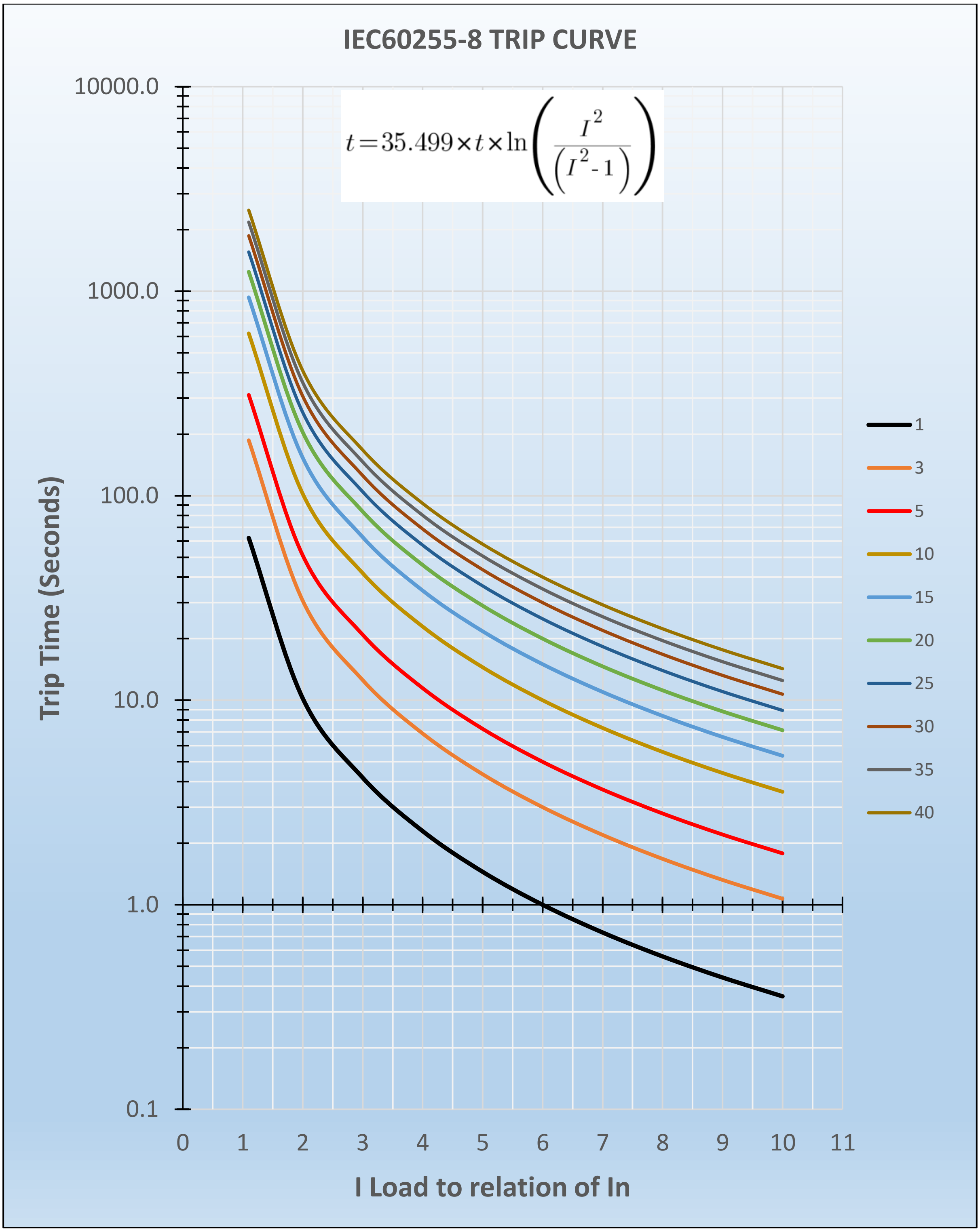


Figure 20.1.a: IEC60255-8 trip curve.

IEC60255-8 reset curve

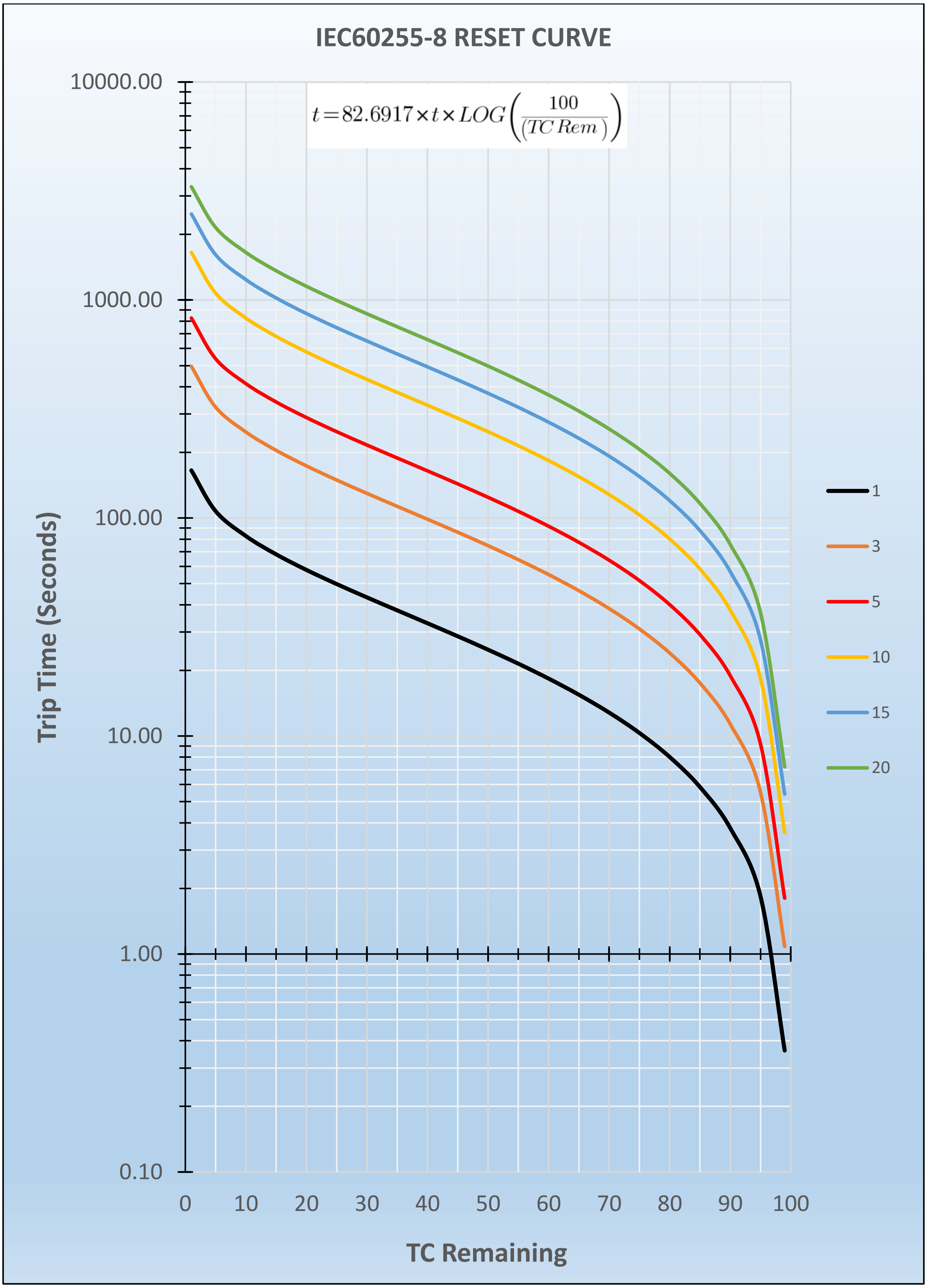


Figure 20.1.b: IEC60255-8 reset curve.

20.2 IEC NINV Curve

IEC NINV trip curve

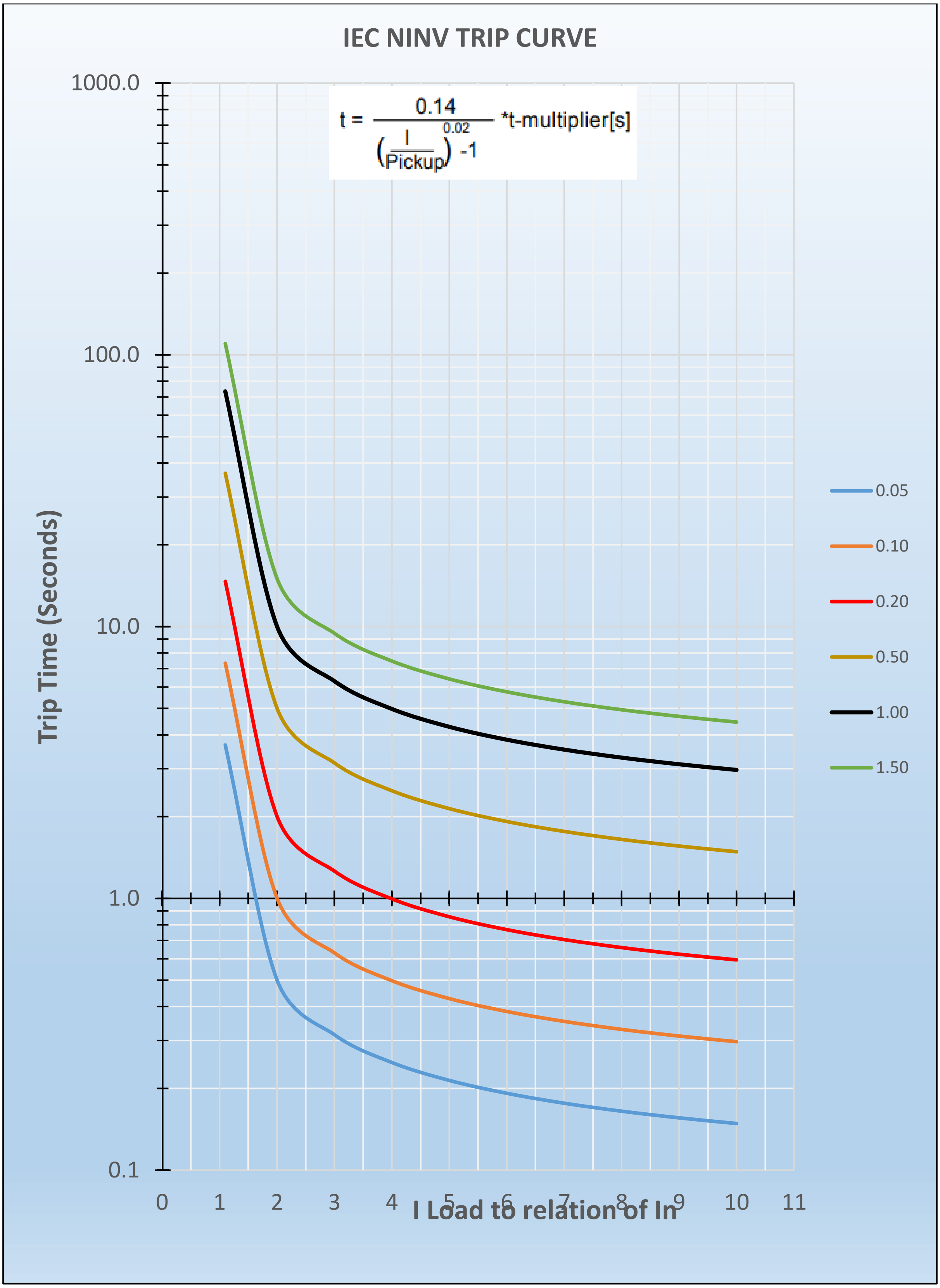


Figure 20.2.a: IEC NINV trip curve.

IEC NINV reset curve

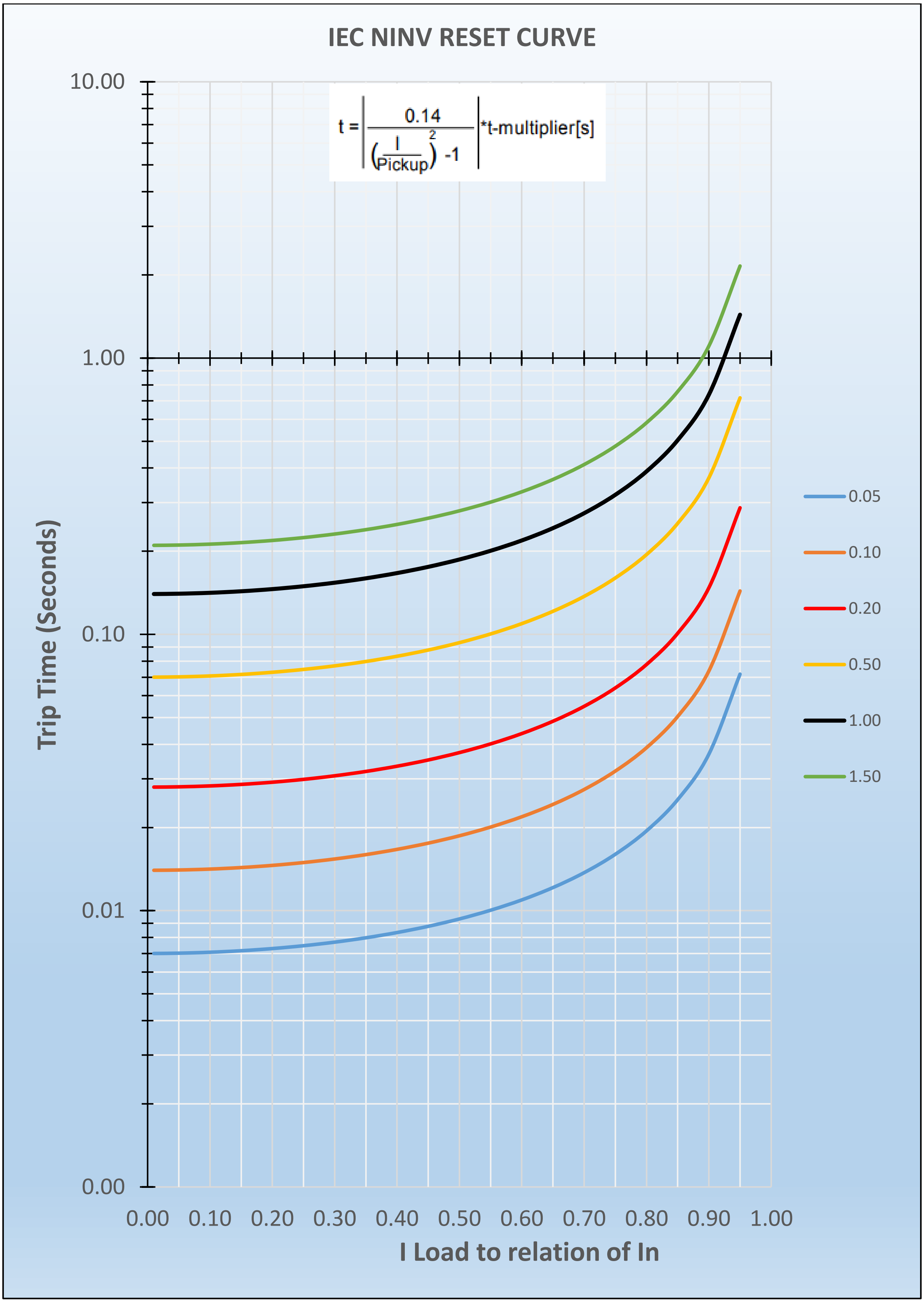


Figure 20.2.b: IEC NINV reset curve.

20.3 IEC VINV Curve

IEC VINV trip curve

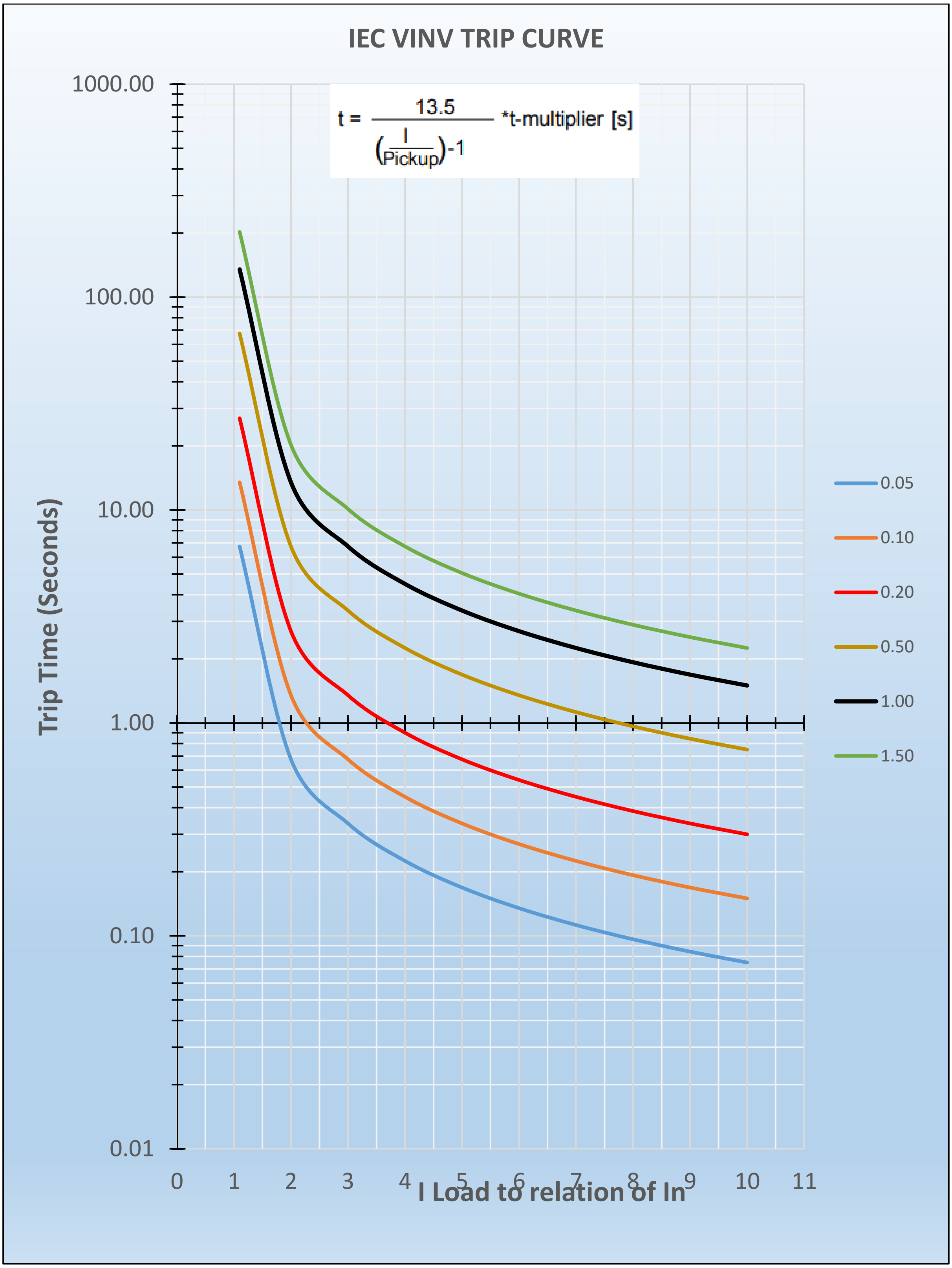


Figure 20.3.a: IEC VINV trip curve.

IEC VINV reset curve

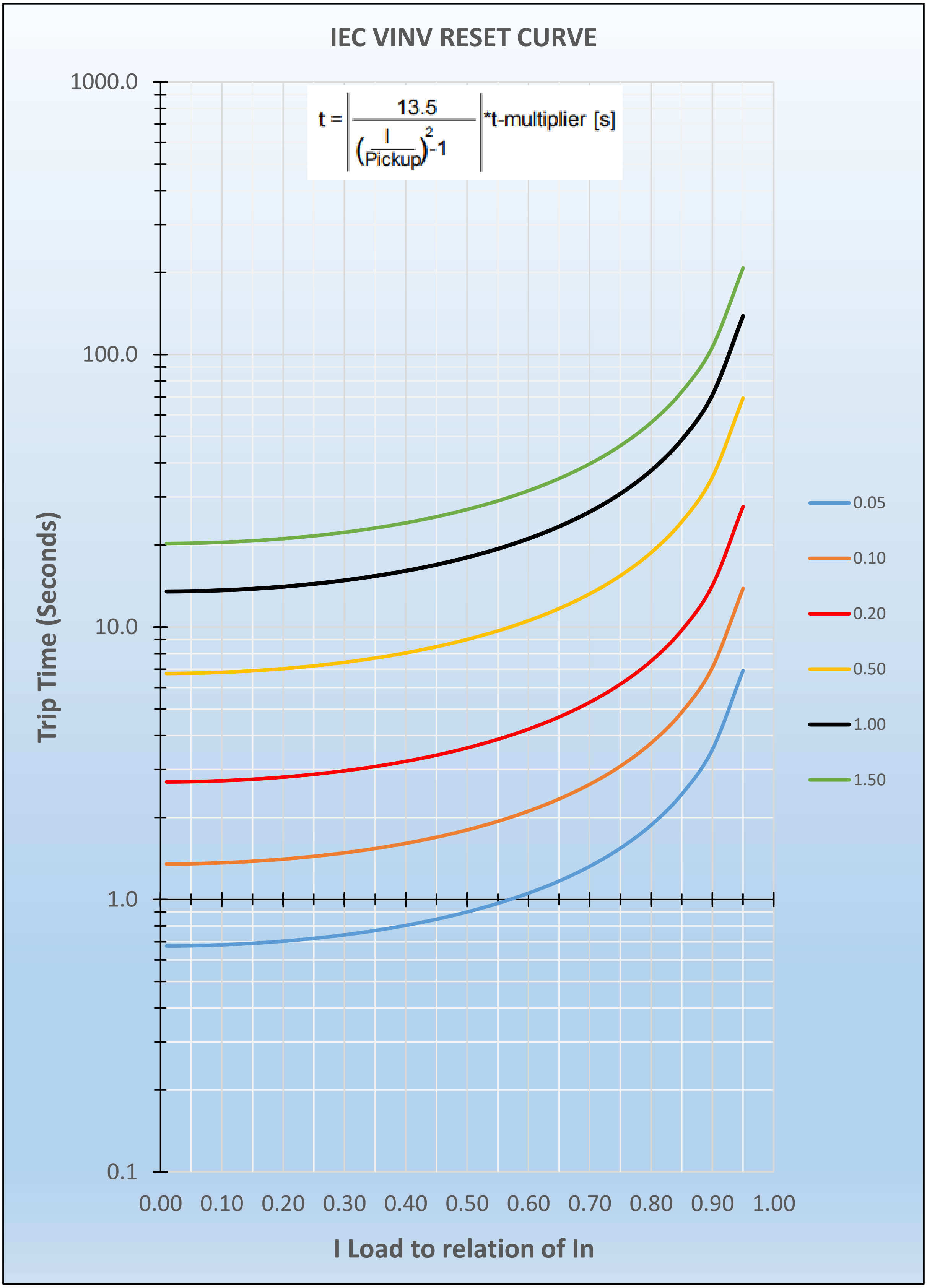


Figure 20.3.b: IEC VINV reset curve.

20.4 IEC LINV Curve

IEC LINV trip curve

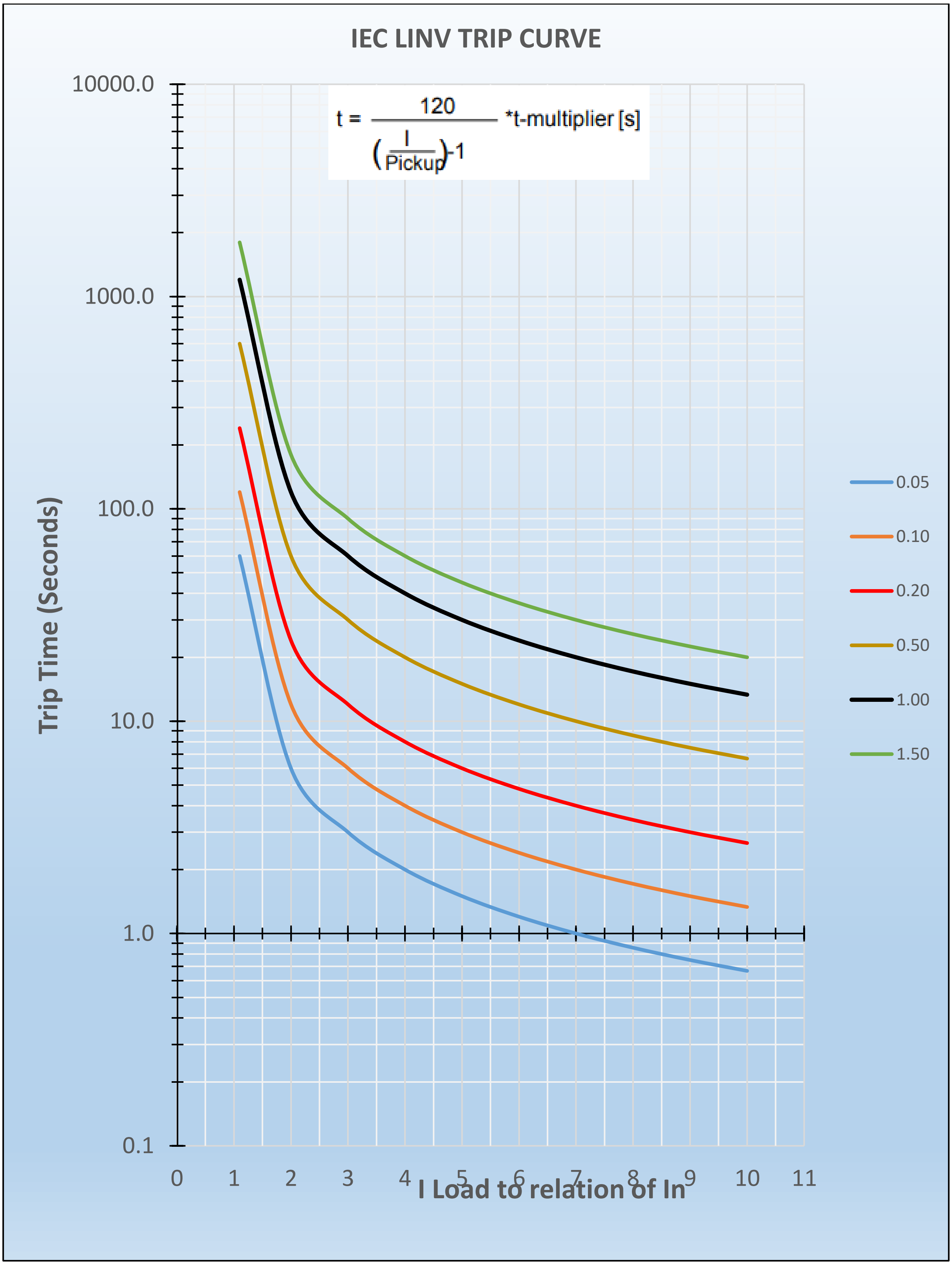


Figure 20.4.a: IEC LINV trip curve.

IEC LINV reset curve

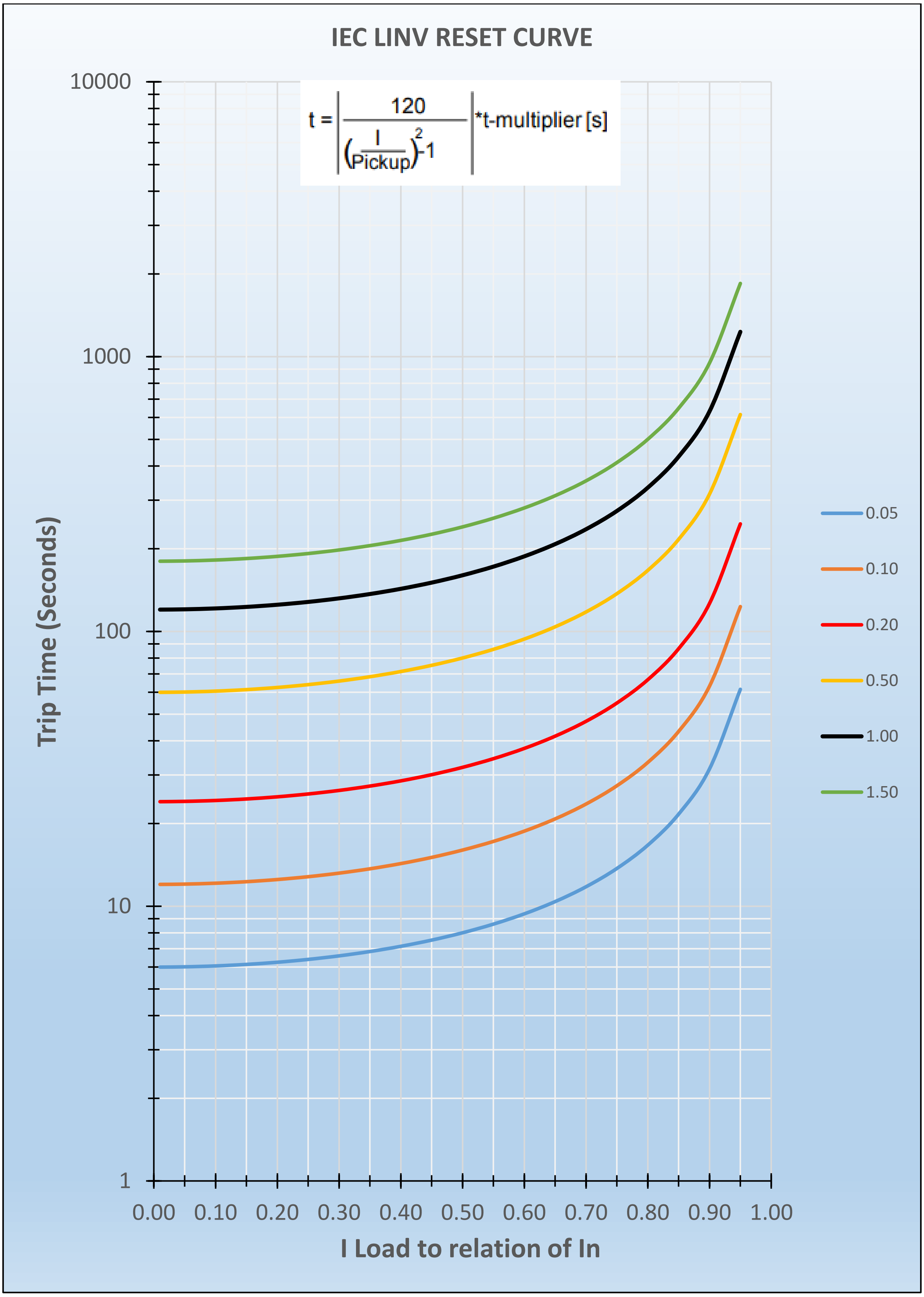


Figure 20.4.b: IEC LINV reset curve.

20.5 IEC EINV Curve

IEC EINV trip curve

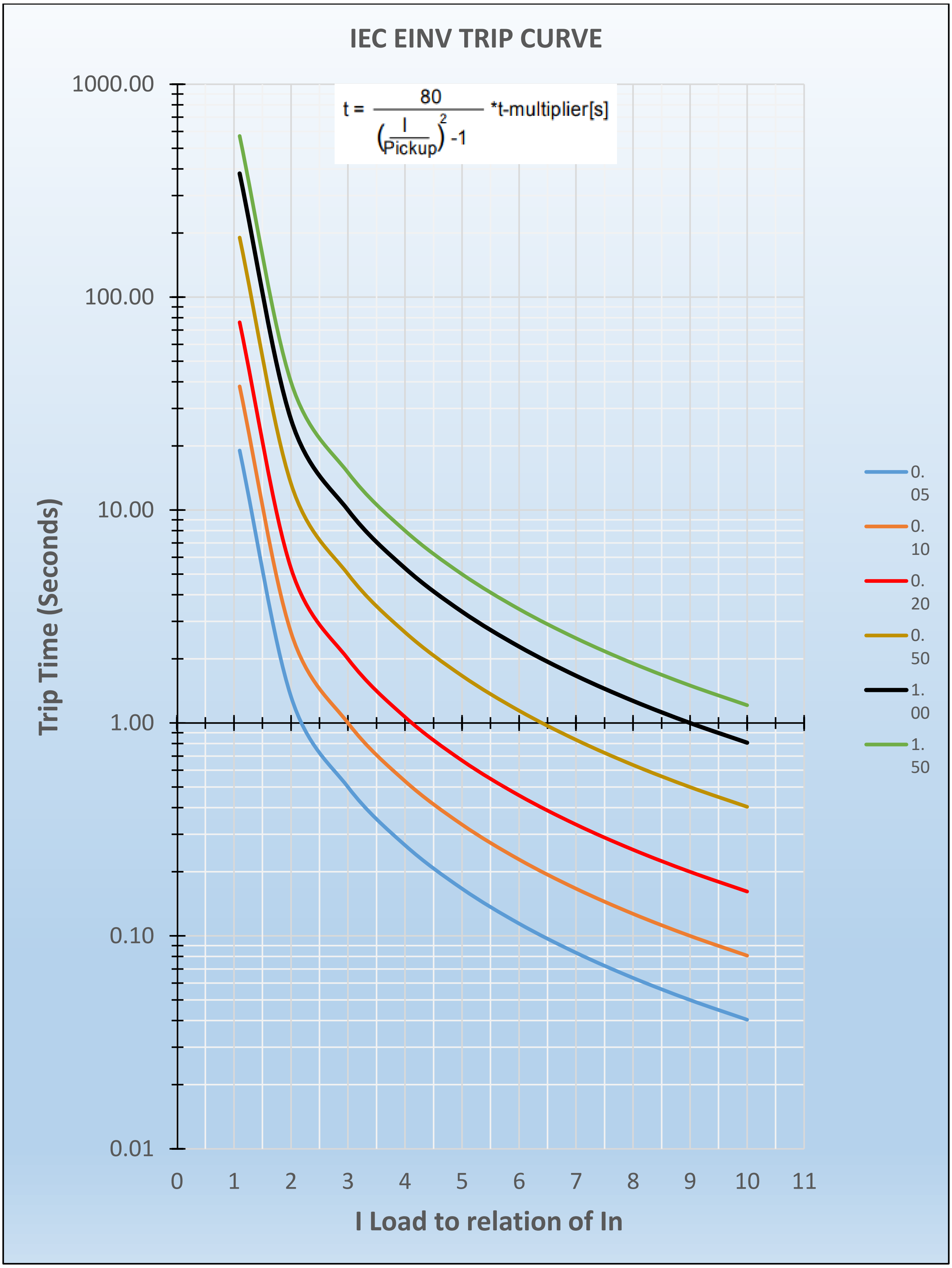


Figure 20.5.a: IEC EINV trip curve.

IEC ENIV reset curve

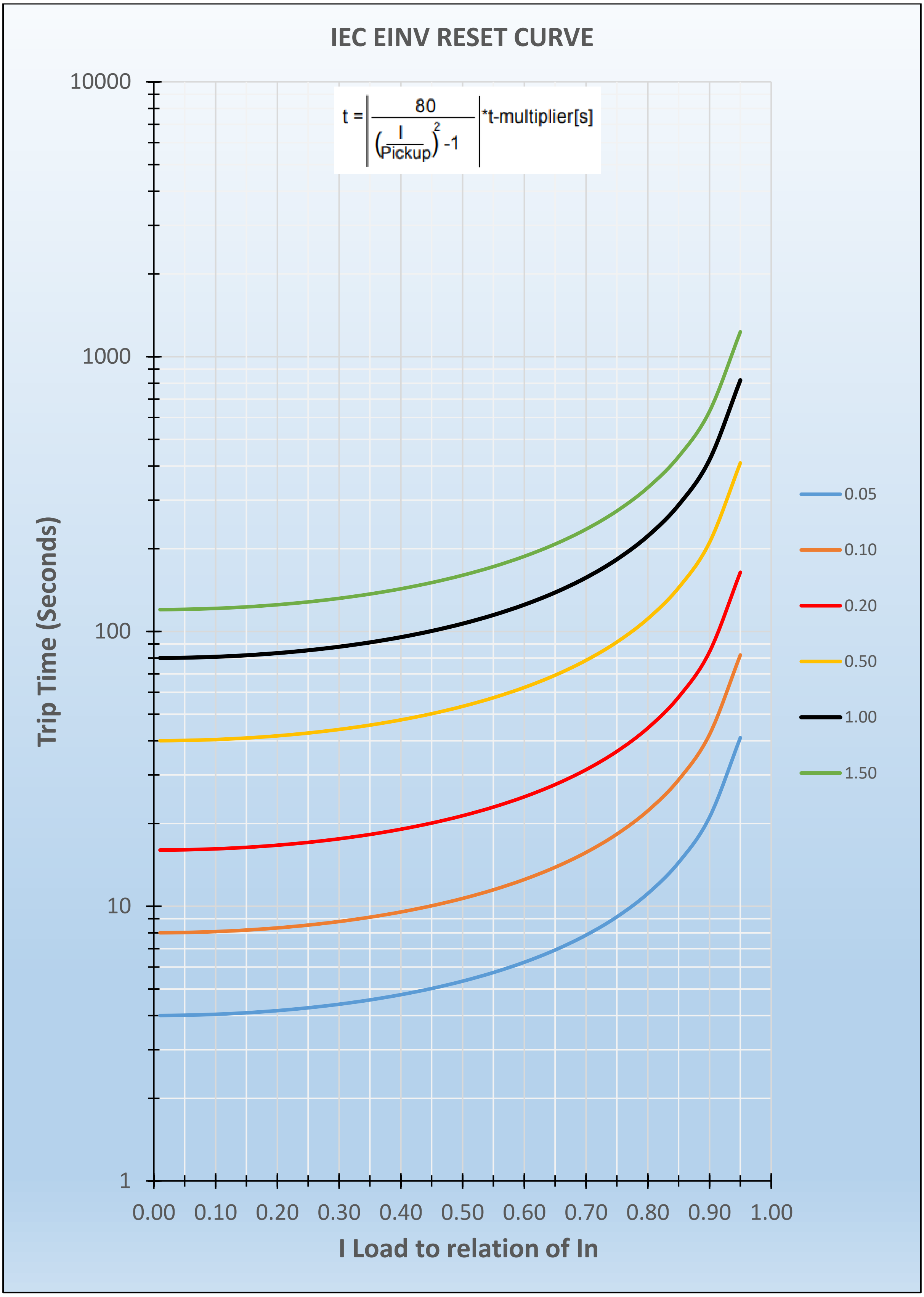


Figure 20.5.b: IEC EINV reset curve.

20.6 ANSI MINV Curve

ANSI MINV trip curve

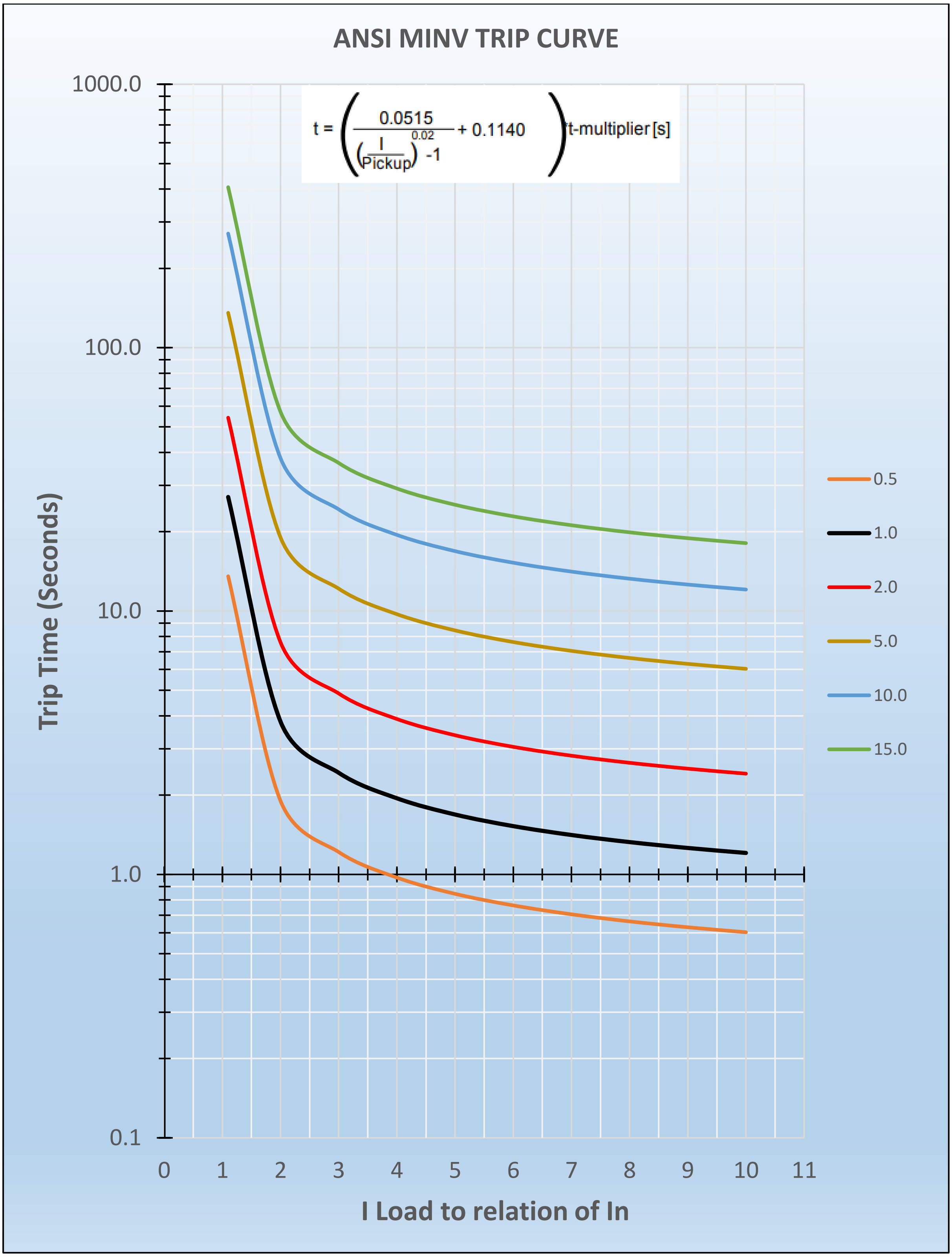


Figure 20.6.a: ANSI MINV trip curve.

ANSI MINV reset curve

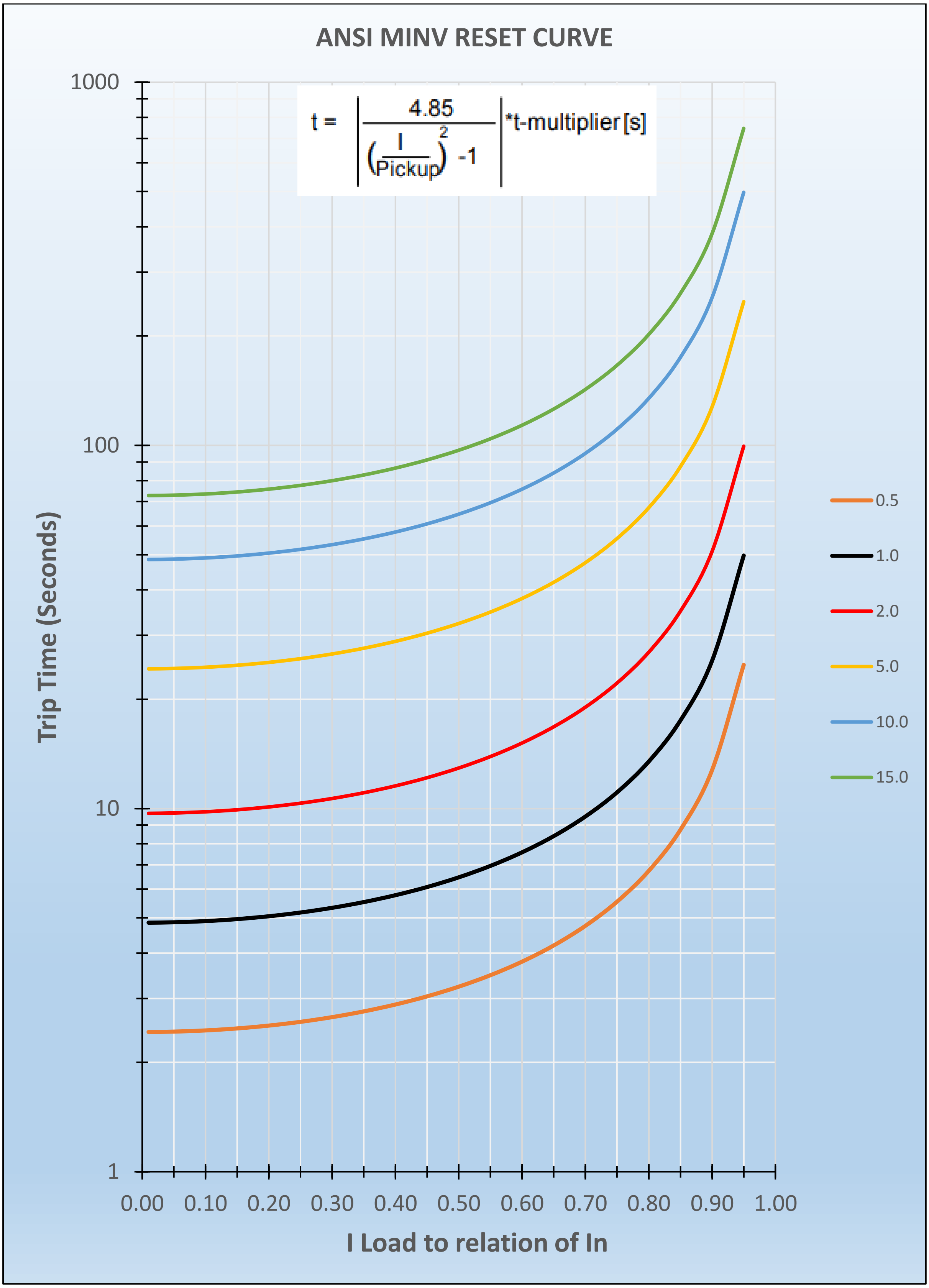


Figure 20.6.b: ANSI MINV reset curve.

20.7 ANSI VINV Curve

ANSI VINV trip curve

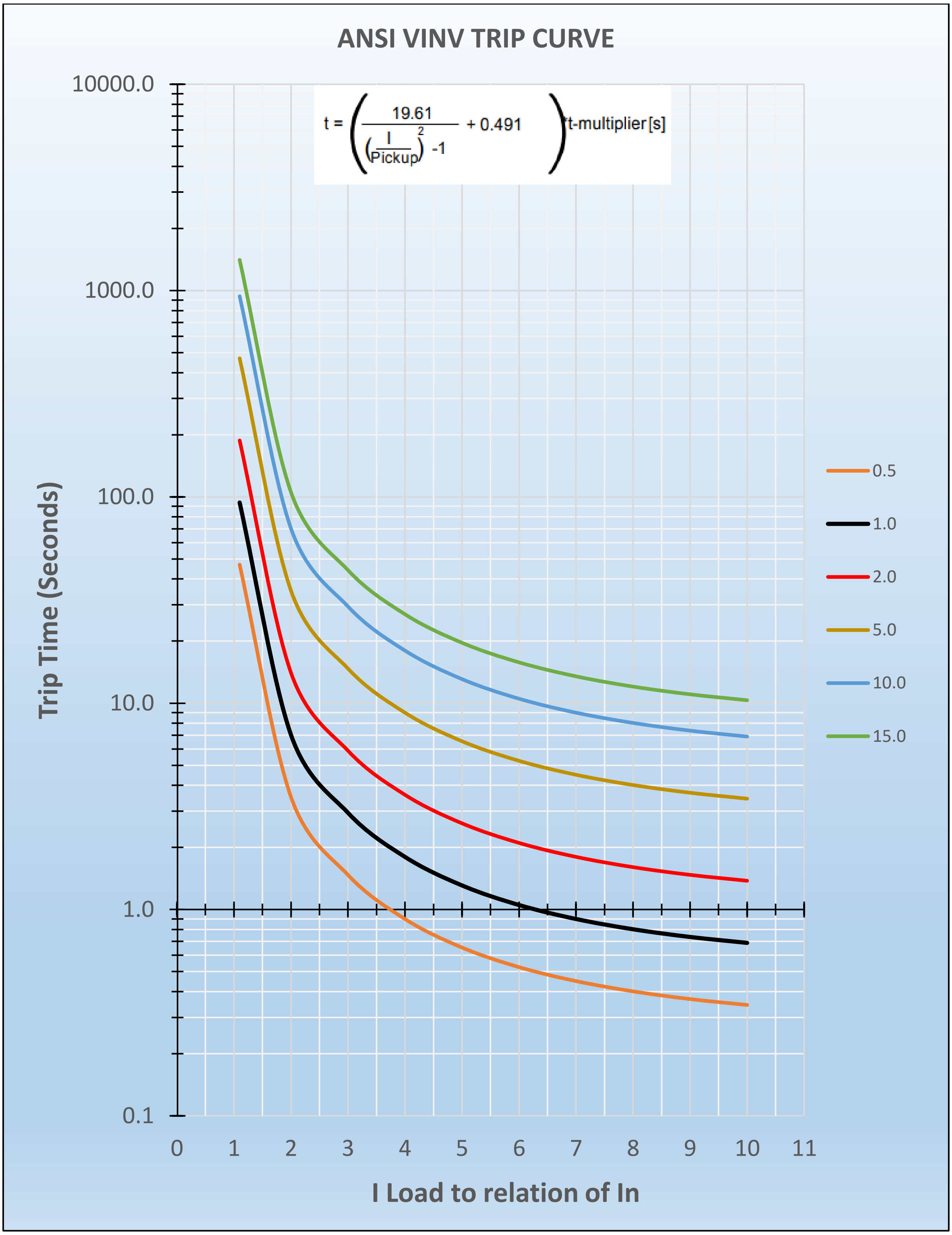


Figure 20.7.a: ANSI VINV trip curve.

ANSI VINV reset curve

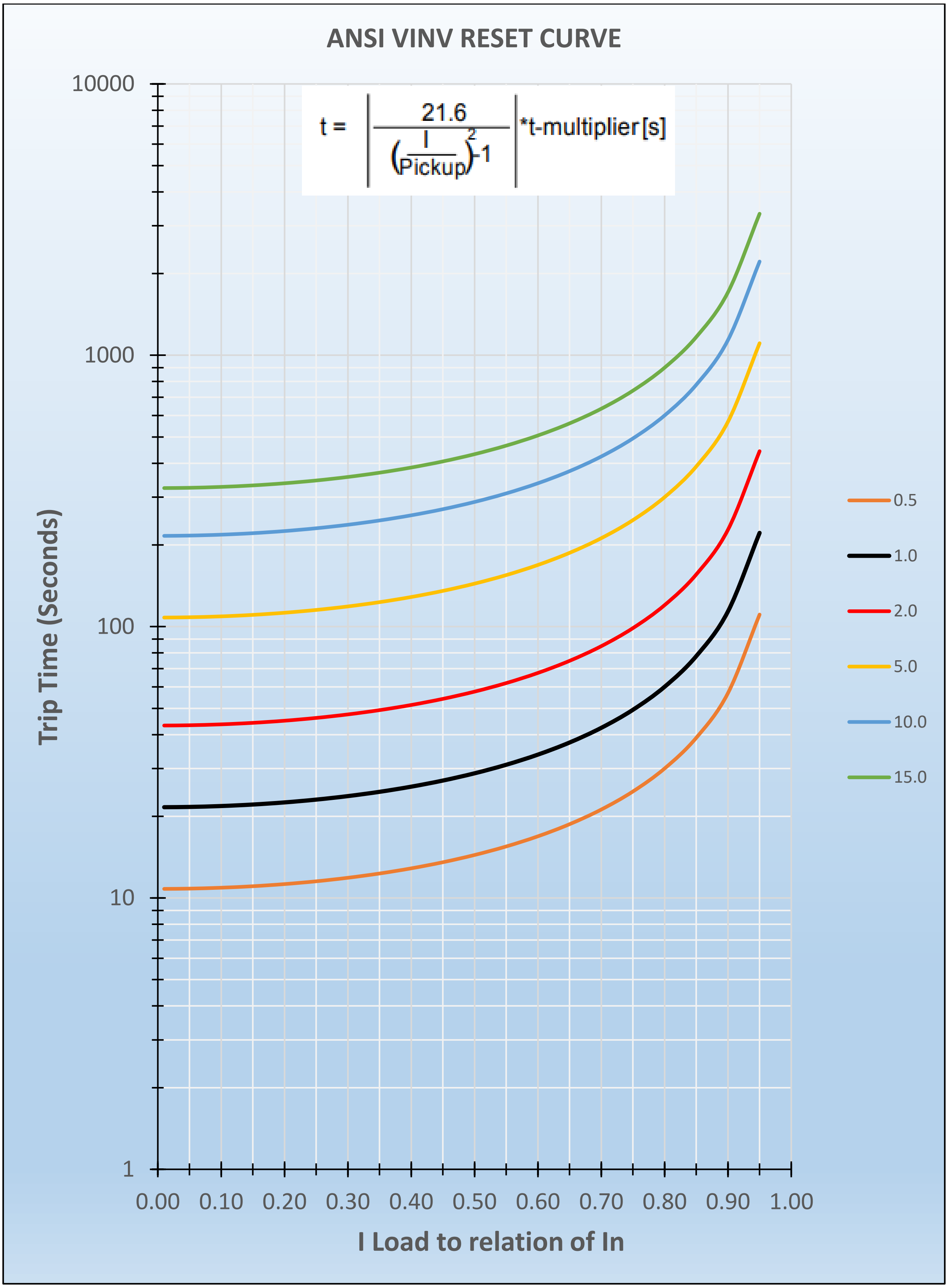


Figure 20.7.b: ANSI VINV reset curve.

20.8 ANSI EINV Curve

ANSI EINV trip curve

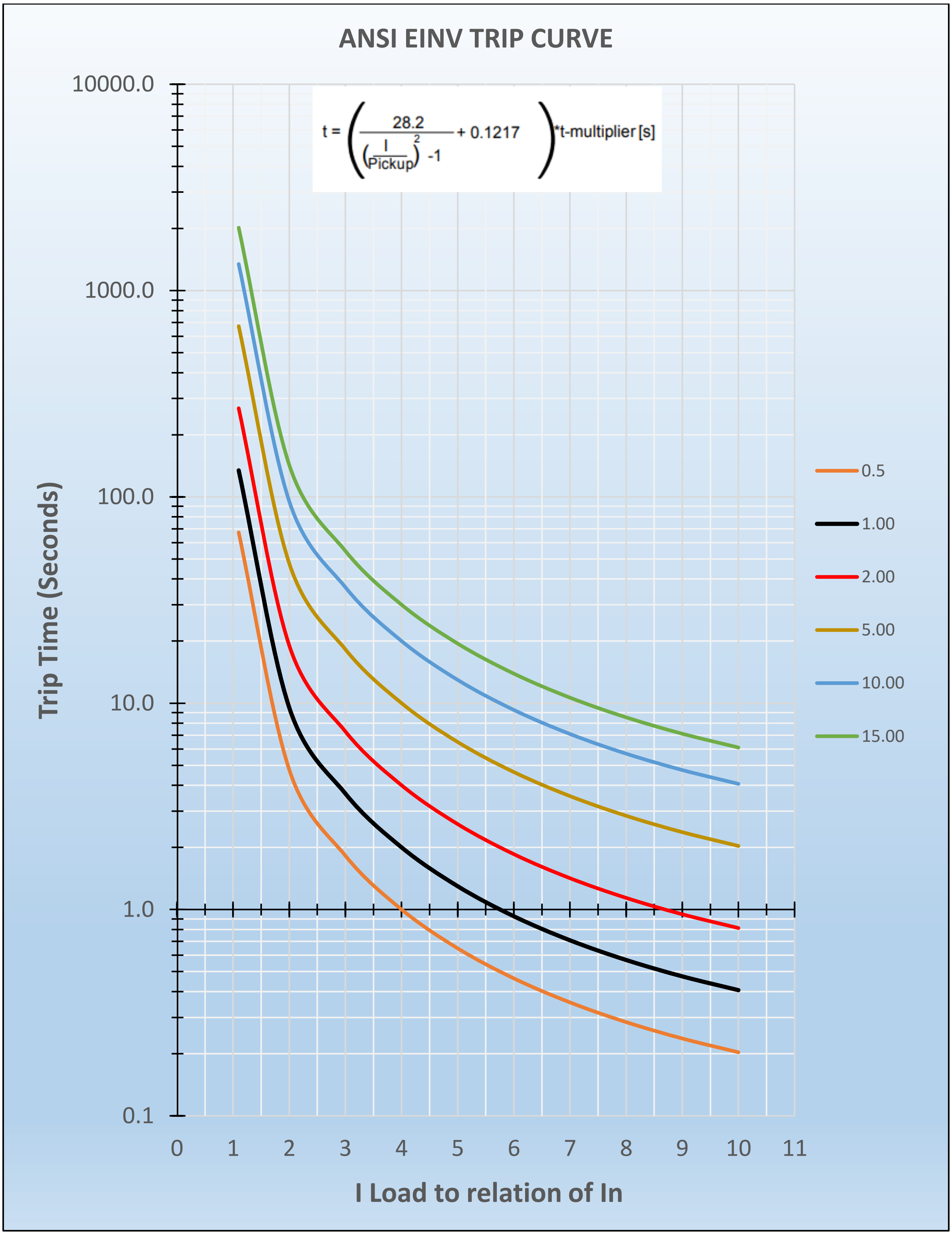


Figure 20.8.a: ANSI EINV trip curve.

ANSI EINV reset curve

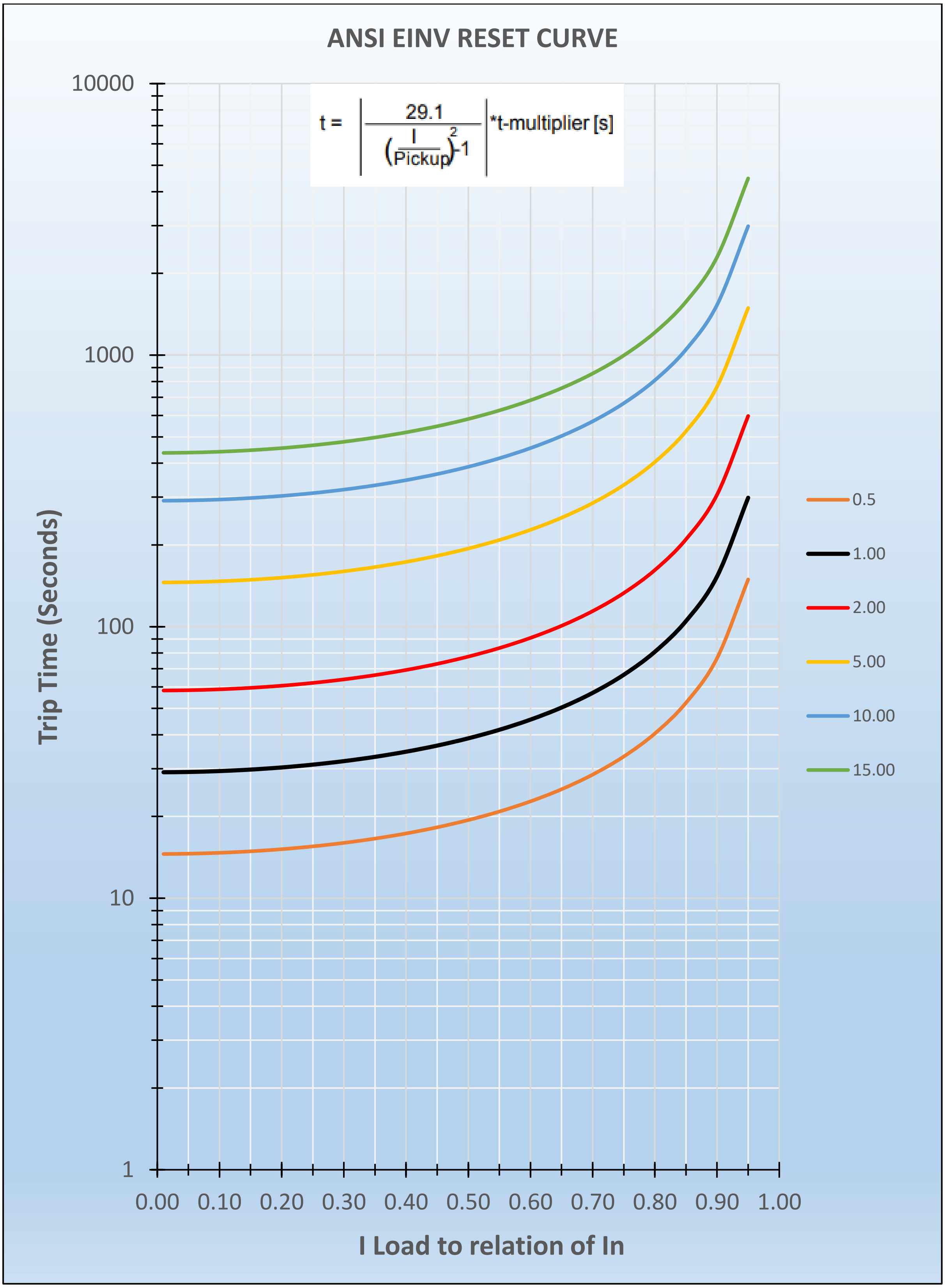


Figure 20.8.b: ANSI EINV reset curve.

20.9 Thermal Flat Curve

Thermal flat trip curve

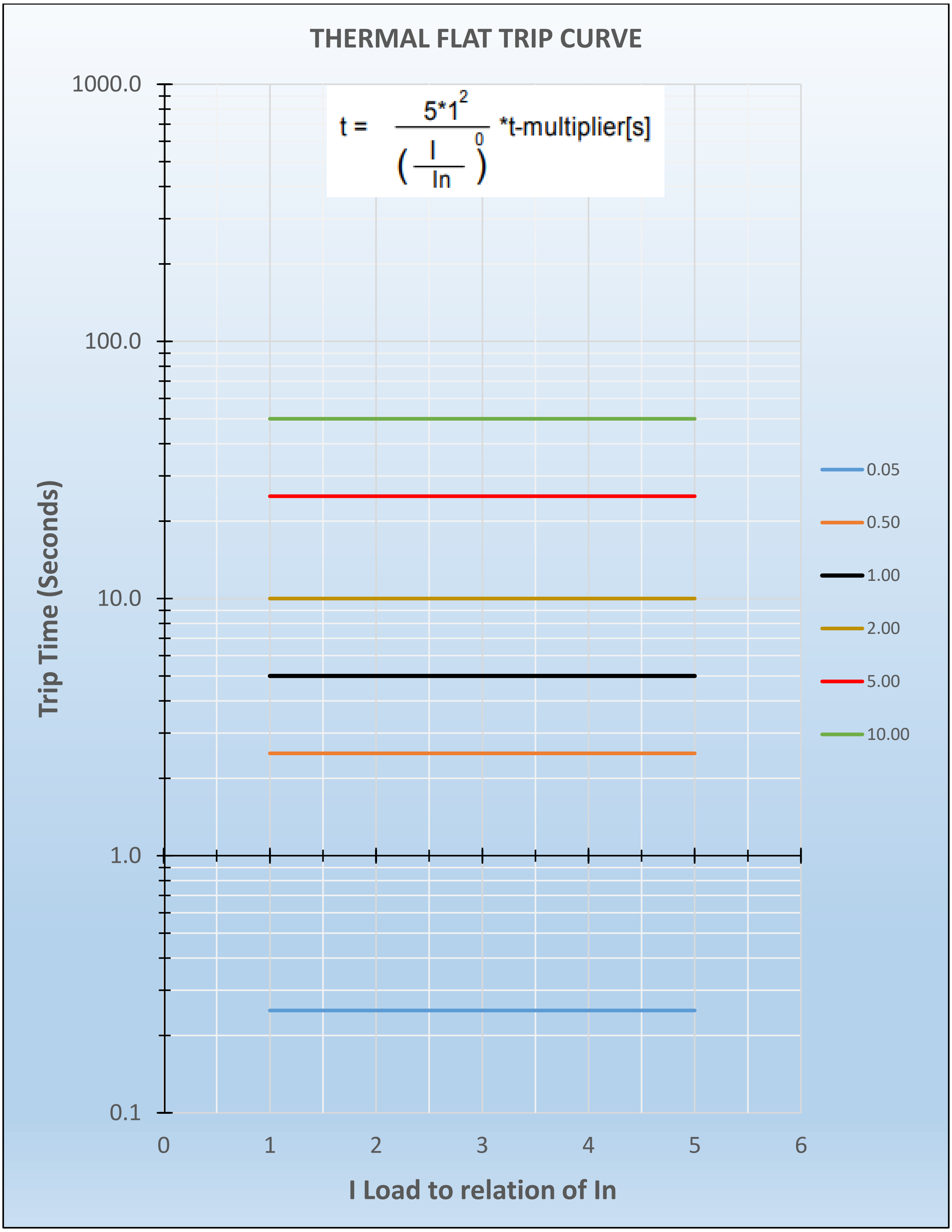


Figure 20.9.a: Thermal flat trip curve.

Thermal flat reset curve

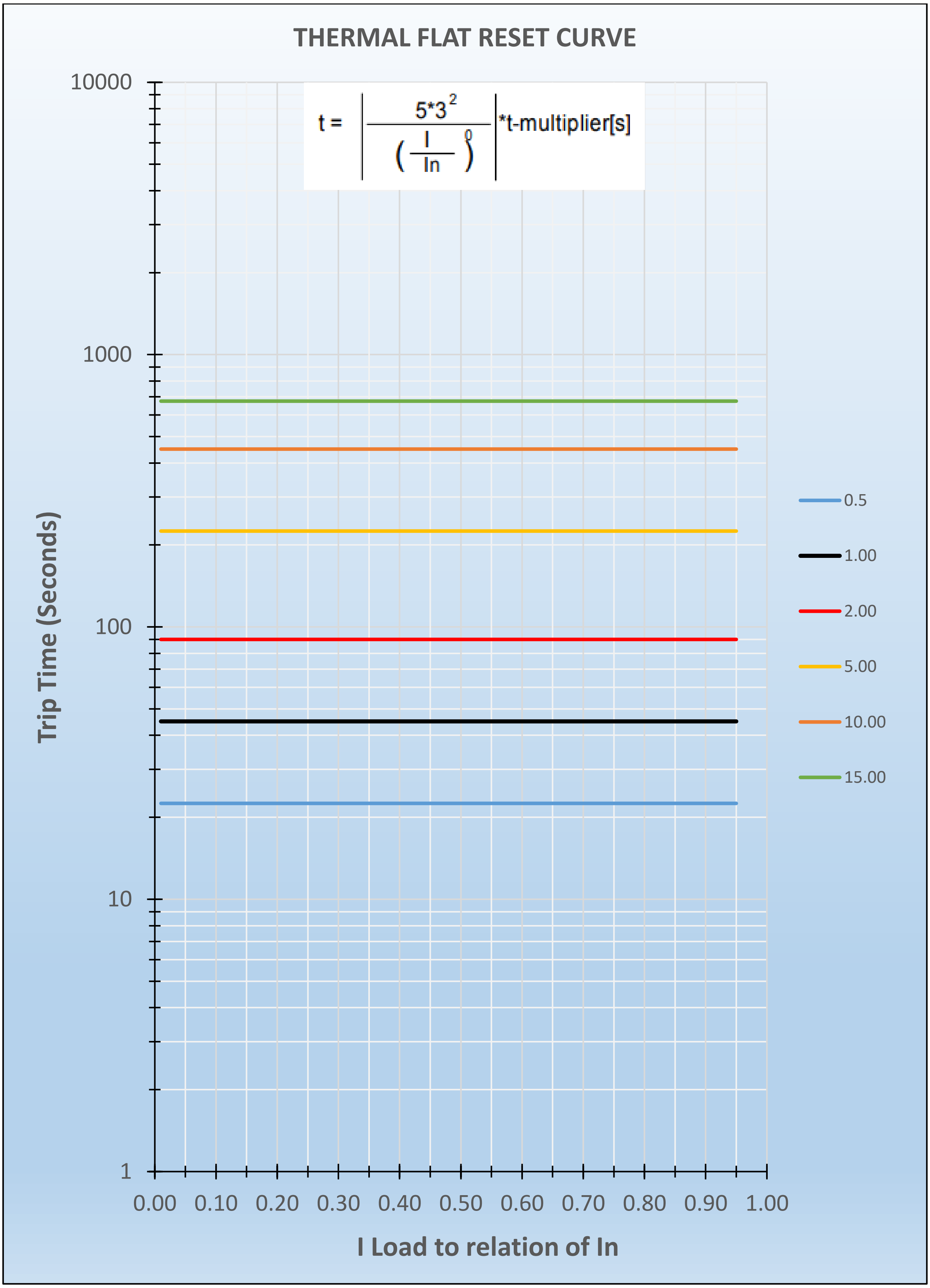


Figure 20.9.b: Thermal flat reset curve.

20.10IT Curve

IT trip curve

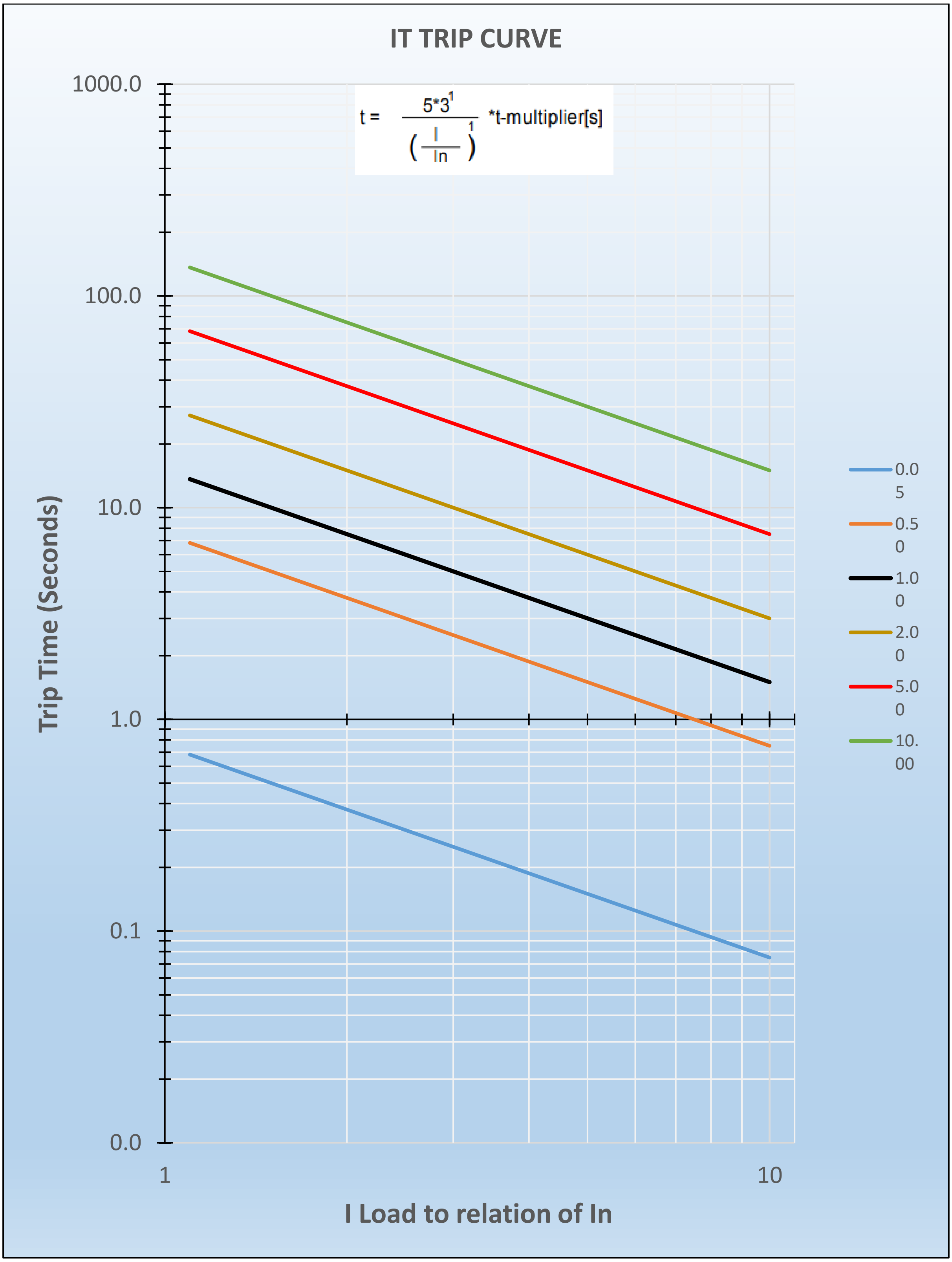


Figure 20.10.a: IT trip curve.

IT reset curve

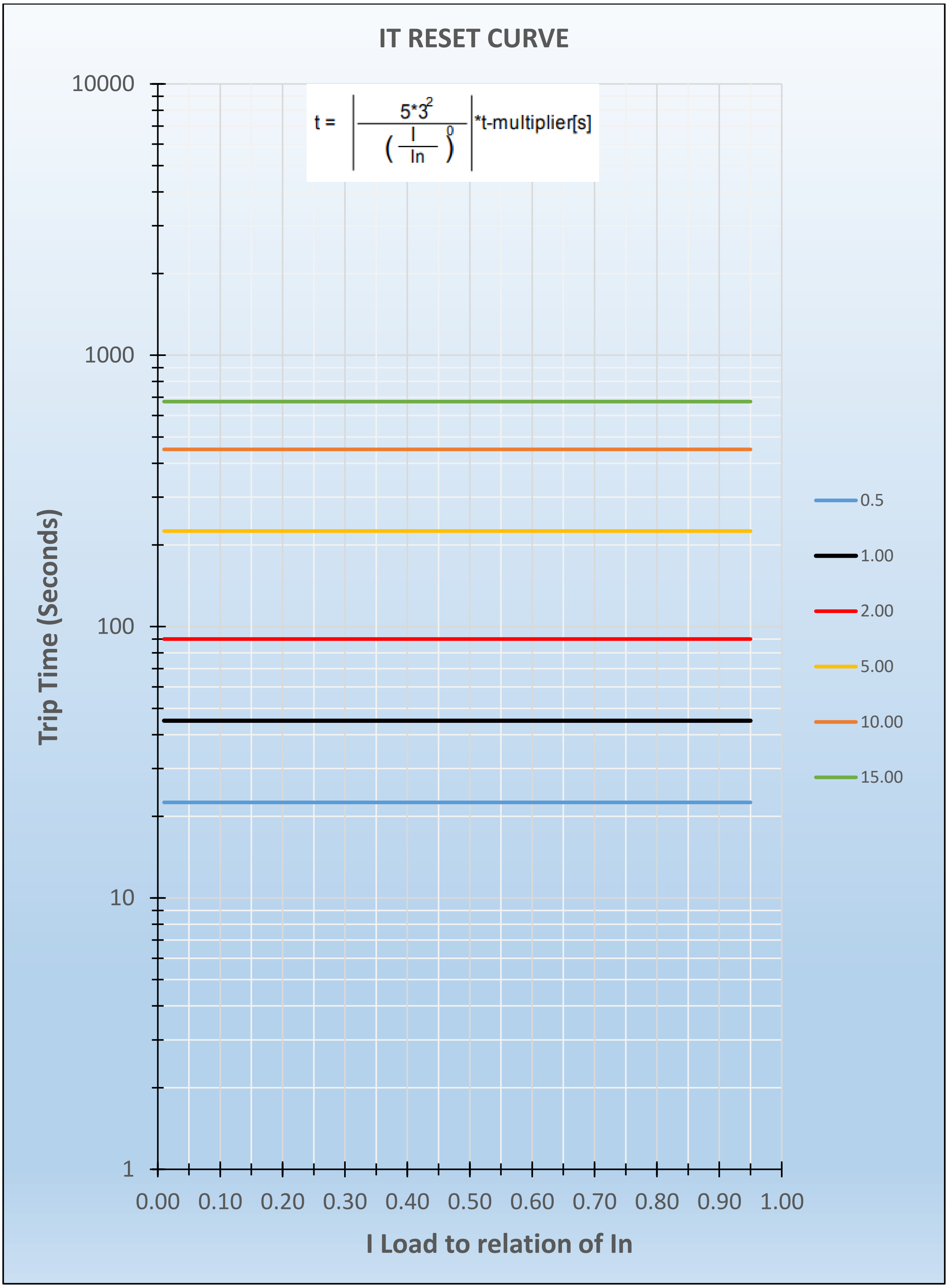


Figure 20.10.b: IT reset curve.

20.11 I^2T Curve

I^2T trip curve

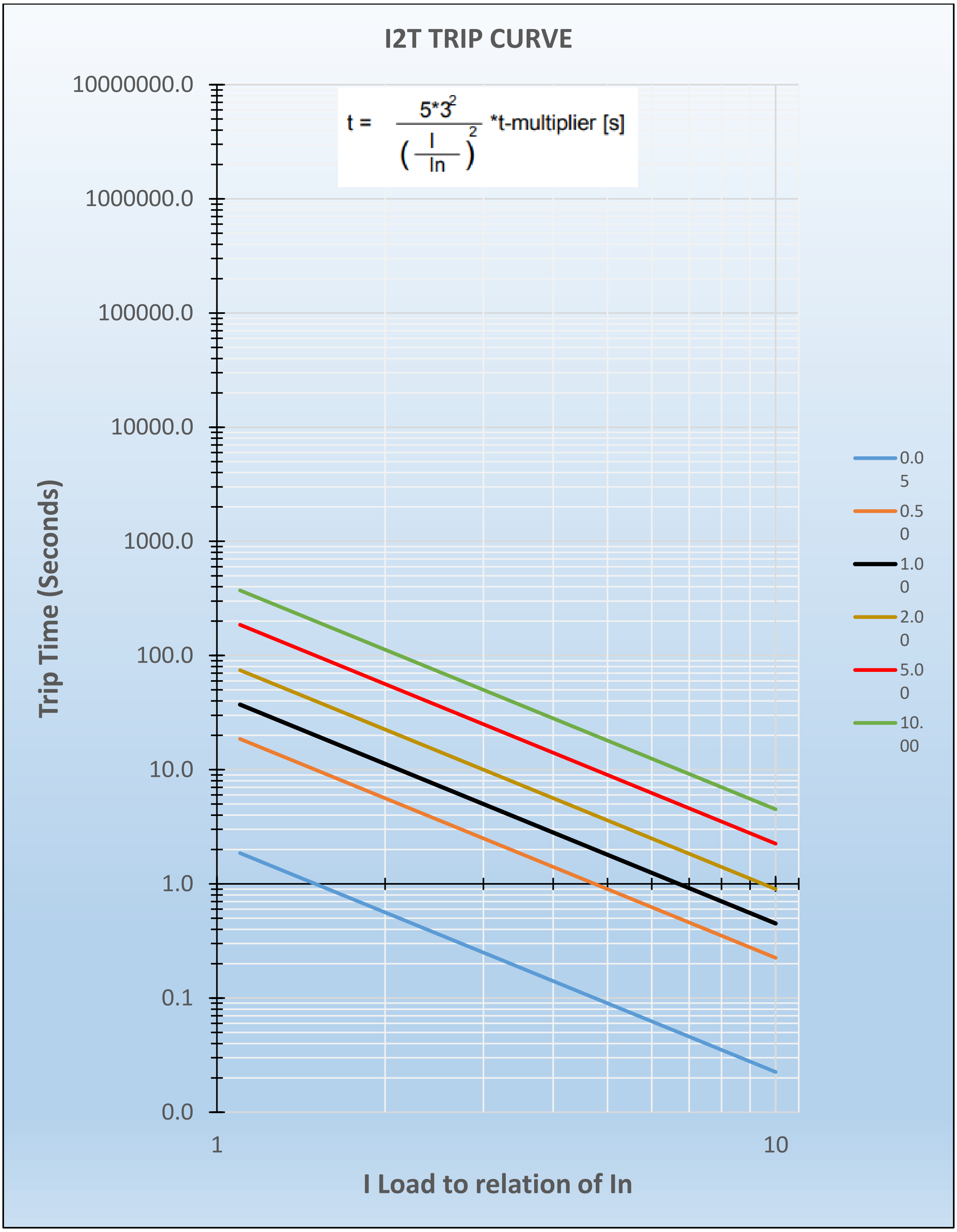


Figure 20.11.a: I^2T trip curve.

I^2T reset curve

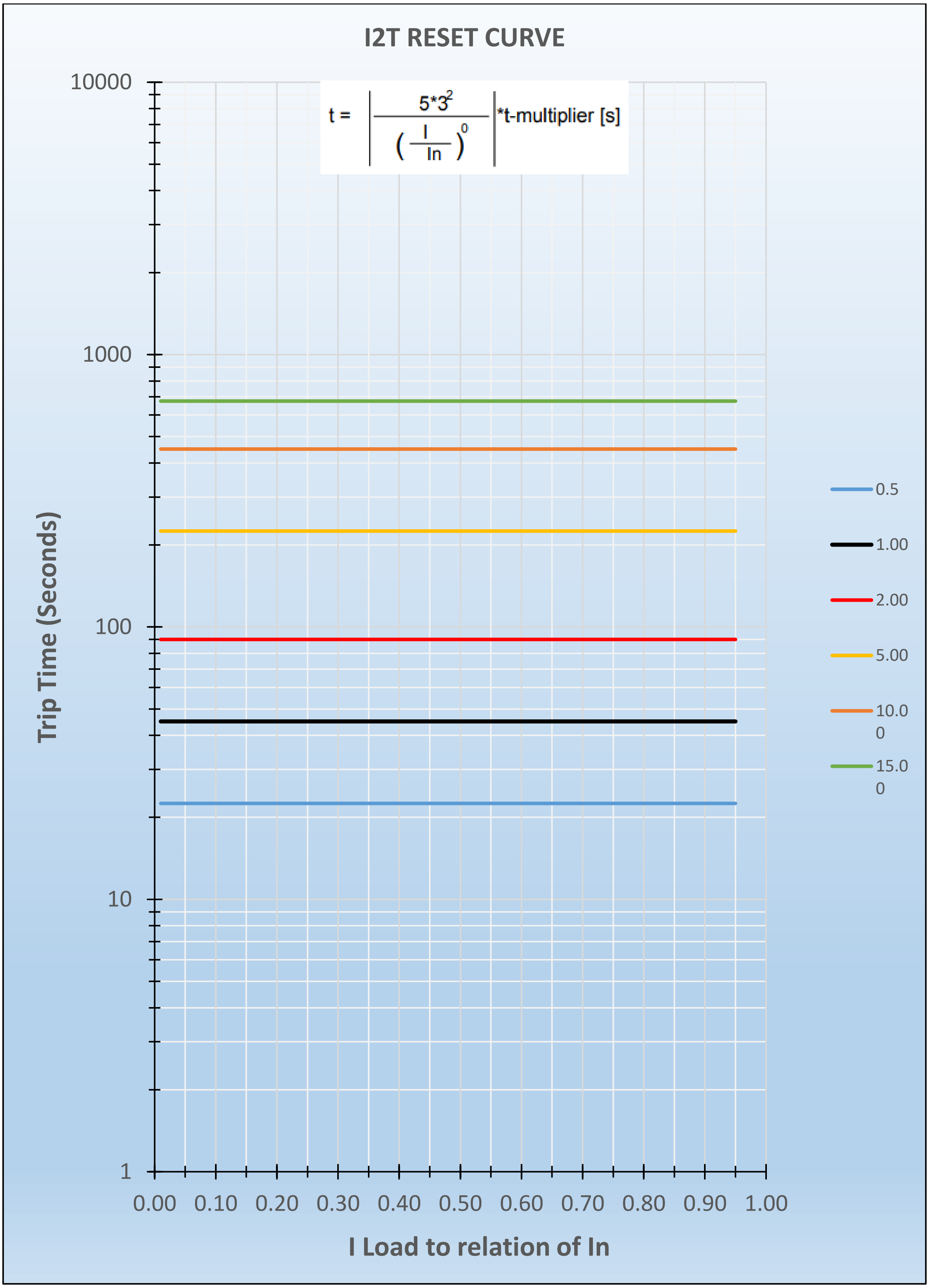


Figure 20.11.b: I^2T reset curve.

20.12 I^4T Curve

I^4T trip curve

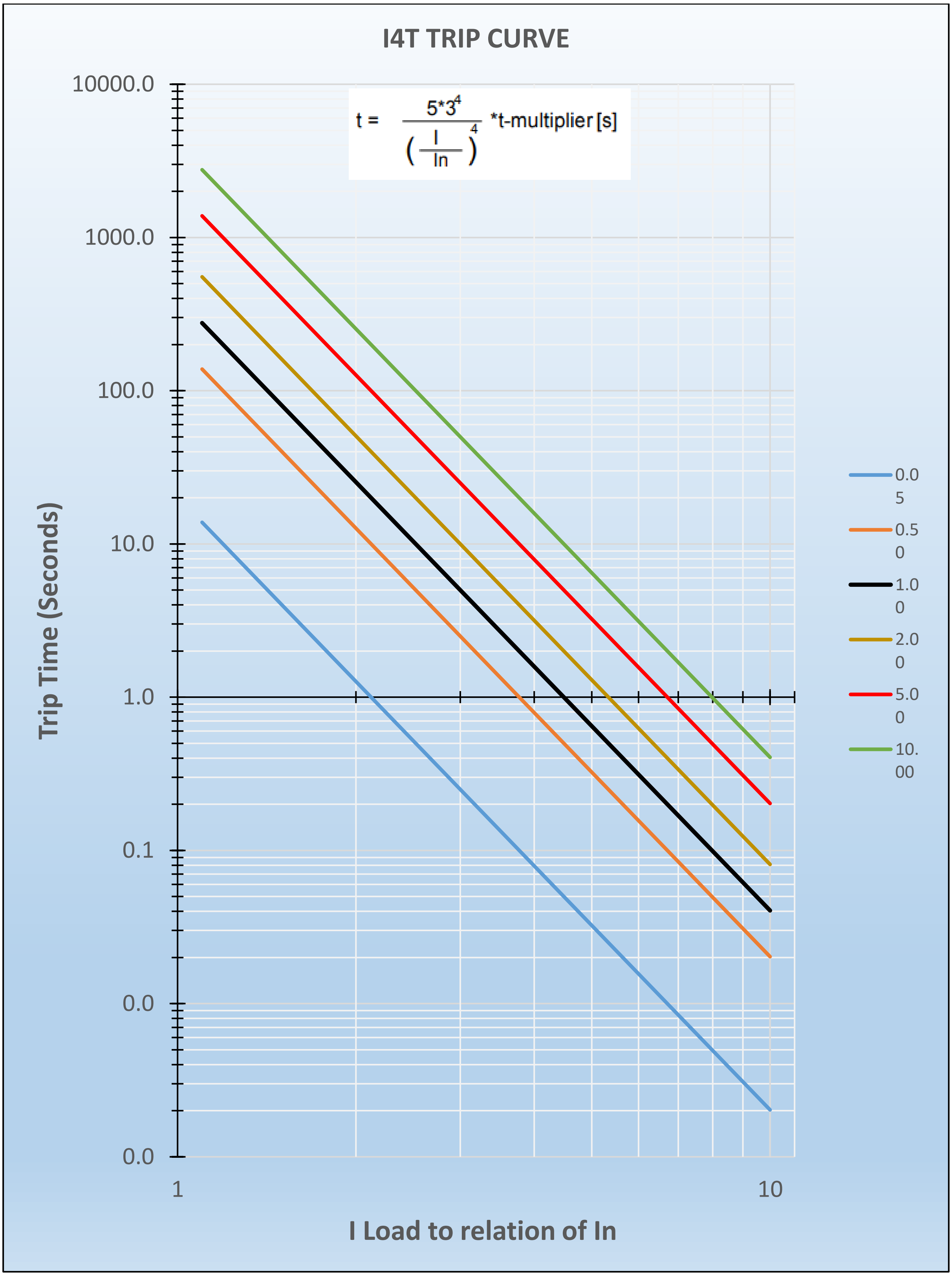


Figure 20.12.a: I^4T trip curve.

I^4T reset curve

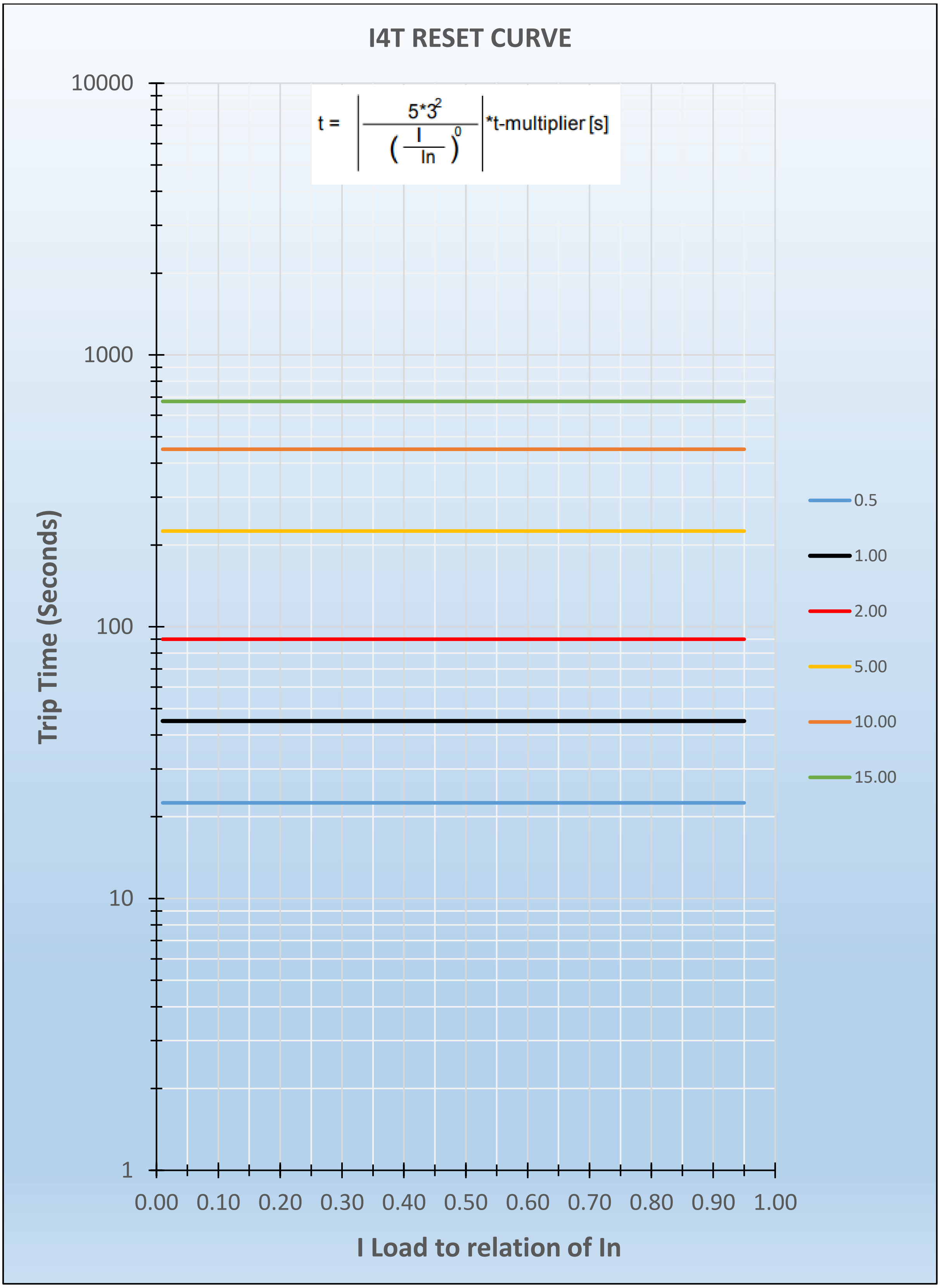
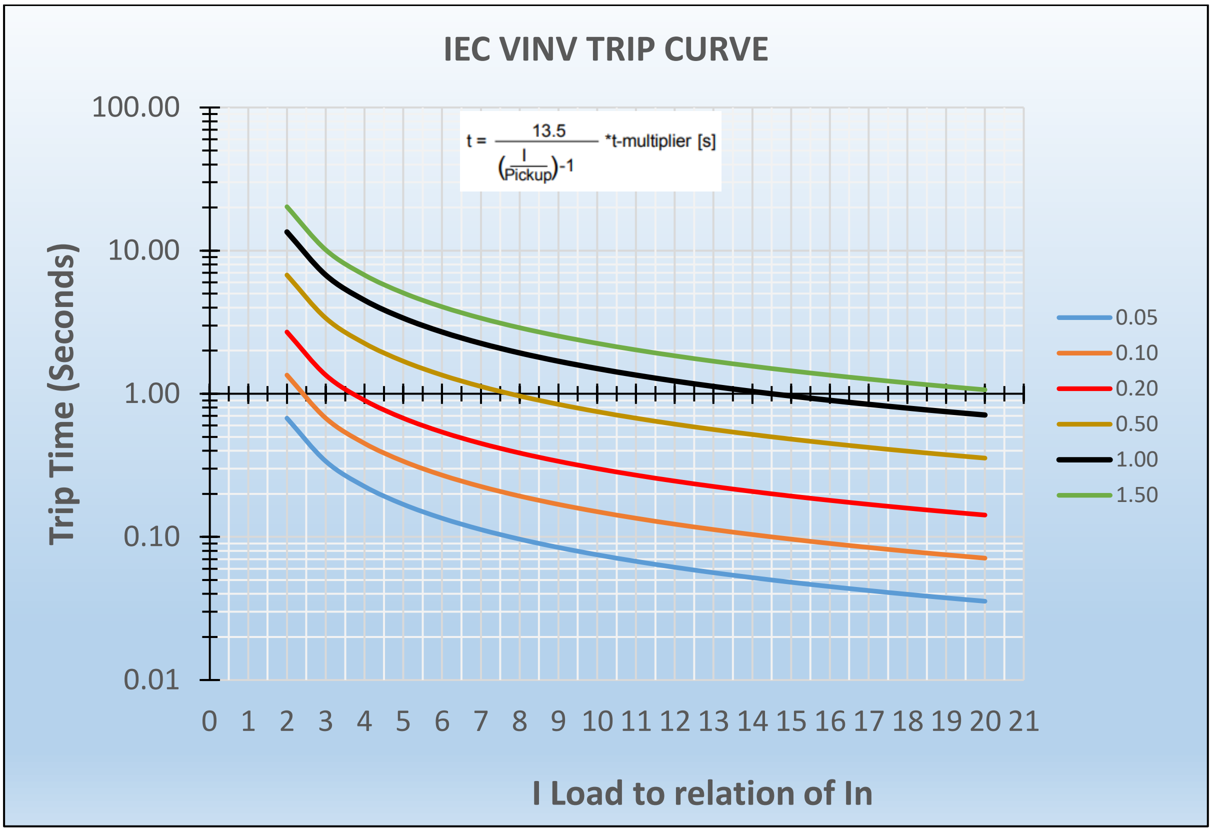


Figure 20.12.b: I^4T reset curve.

Example: Overcurrent ANSI61850 curve


IEC VINV TRIP CURVE
t = 13.5 / ((I/Pickup)-1) *t-multiplier [s]
Trip Time (Seconds)
100.00
10.00
1.00
0.10
0.01
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
I Load to relation of In
0.05
0.10
0.20
0.50
1.00
1.50

21 Modbus-RTU

Modbus-RTU port is a RS485 2 wire solution. The A and B line can be found in Figure 21.

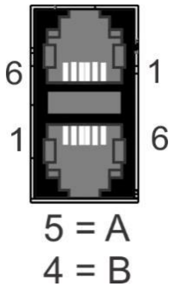


Figure 21: Modbus-RTU connection pins.

Baud rate supported is as follow:

- 1200 bps.
- 2400 bps.
- 4800 bps.
- 9600 bps.
- 19200 bps.
- 38400 bps.
- 57600 bps.
- 115200 bps.

Table 21.a below indicates the state of the LED indication related to the Modbus-RTU indications.

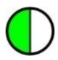
Condition	LED's used	Indication
Modbus-RTU data status	Rx/Tx LED: Will flash green at the rate that valid messages are recieved	
Modbus-RTU address	Modbus-RTU address LED: Orange 1 second on and 1 second off is a 100 count. Red 1 second on and 1 second off is a 10 count. Green 1 second on and 1 second off is a count of 1. Example address 123 is 3 green flashes, followed by 2 res flashes and 1 orange flash.	

Table 21.a: Modbus-RTU indication LED's.

21.1 Modbus Functions Supported

KG/KH-RTU relay support the following Modbus functions:

Function		Function Name
Hex	Dec	
0x03	03	Read Holding Registers. (See Chapter 21.2 for registers) (Address 0x4000)
0x04	04	Read Input Registers. (See Chapter 21.2) (Address 0x3000)
0x06	06	Write Single Register. (See Chapter 21.2) (Address 0x4000)
0x10	16	Write Multiple Registers. (See Chapter 21.2) (Address 0x4000)
0x11	17	Report Slave ID.

Table 21.1: Modbus functions supported.

21.2 Modbus-RTU or BLE Register Map

Modbus-RTU is also send over Bluetooth via Gatt if the application can support communicating BLE.

All register can be accessed using the flowing Modbus functions:

- Read holding 0x03.
- Read input 0x04.
- Write single 0x06.
- Write multiple 0x10.

The Modbus register map is broken up into the following categories show in table 21.2:

Name	Description	Range
Actual values	All actual measured and calculated values.	0 to 112
Harmonic values	Levels of the fundamental and THD of the current and voltage phases.	300 to
Control bits	Control bits from Modbus-RTU port of BLE.	900 to
System settings	KG/KH-RTU relay system configuration.	1000 to
Protection settings	KG/KH-RTU relay protection configuration.	2000 to
Logic settings	KG/KH-RTU relay logic configuration.	3000 to
Low voltage starter settings	KG/KH-RTU low voltage switch gear configuration.	4000 to
Statistic	Statistical data.	5000 to
Modbus-RTU settings	Modbus-RTU configuration.	6000 to
RTC	Real time clock of the KG/KH-RTU relay.	8500 to
Fault record	KG/KH-RTU fault records.	10000 to
Event record	KG/KH-RTU event records.	10100 to
Description	KG/KH-RTU description fields.	11000 to

Table 21.2: Modbus-RTU register summary.

21.2.1 Actual Values

Addr	Name	Type / Format	Unit	R/W	Range
0	Reserved.	Word / F2		R	0 – 65535
1	Password unlocked and heartbeat.	Word / F2		R	0 – 65535
2	Status code.	Word / F6		R	0 – 65535
3	Warning flag code.	Word / F7		R	0 – 65535
4	**Status word.** Bit 00 : In service or feedback active. Bit 01 : Voltage present. Bit 02 : A warning flag is active. Bit 03 : A alarm flag is active. Bit 04 : A trip flag is active. Bit 08 : Relay 1 status. Bit 09 : Relay 2 status. Bit 10 : Field input 1 status. Bit 11 : Field input 2 status. Bit 12 : Field input 3 status. Bit 13 : Protection setting unlocked. Bit 14 : Logic setting unlocked. Bit 15 : Simulator active.	Word / F8		R	0 – 65535
5	IL maximum level.	Word / F2	%	R	0 – 1000
6	IL1 level.	Word / F2	%	R	0 – 1000
7	IL2 level.	Word / F2	%	R	0 – 1000
8	IL3 level.	Word / F2	%	R	0 – 1000
9	IL unbalance level.	Word / F2	%	R	0 – 100
10	I1 positive sequence level.	Word / F2	%	R	0 – 100
11	I2 negative sequence level.	Word / F2	%	R	0 – 100
12	I0 zero sequence level.	Word / F2	%	R	0 – 65535
13	VL minimum phase level.	Word / F2	VAC	R	0 – 65535
14	VL1 phase level.	Word / F2	VAC	R	0 – 65535
15	VL2 phase level.	Word / F2	VAC	R	0 – 65535
16	VL3 phase level.	Word / F2	VAC	R	0 – 65535
17	Voltage frequency level.	Word / F2	Hz	R	0 – 1000
18	Voltage unbalance level.	Word / F2	%	R	0 – 100
19	V1 positive sequence level.	Word / F2	%	R	0 – 100
20	V2 negative sequence level.	Word / F2	%	R	0 – 100
21	V0 zero sequence level.	Word / F2	%	R	0 – 100
22	Earth leakage level.	Word / F2	mA	R	0 – 30000
23	Insulation level.	Word / F2	kOhm	R	0 – 2000
24	Maximum power factor level.	Word / F2	cosΘ	R	0 – 100
25	L1 power factor level.	Word / F2	cosΘ	R	0 – 100
26	L2 power factor level.	Word / F2	cosΘ	R	0 – 100

Table 21.2.1.a: Modbus actual values register address 0 to 26.

Addr	Name	Type / Format	Unit	R/W	Range
27	L3 power factor level.	Word / F2	%	R	0 – 100
28	Thermal capacity or time till trip remaining.	Word / F2	%	R	0 – 100
29	**System flags 0.**	Word / F9		R	0 – 65535
	Bit 00 : In service flag.				
	Bit 01 : Voltage present flag.				
	Bit 02 : Relay 1 energized.				
	Bit 03 : Relay 2 energized.				
	Bit 04 : Field input 1 status.				
	Bit 05 : Field input 2 status.				
	Bit 06 : Field input 3 status.				
	Bit 07 : Application starting up.				
	Bit 08 : Application running.				
	Bit 09 : Application stopped.				
	Bit 10 : Protection password unlocked.				
	Bit 11 : Logic password unlocked.				
30	System flags 1 – reserved.	Word / F2		R	0 – 65535
31	**Warning flags 0.**	Word / F10		R	0 – 65535
	Bit 00 : Over current.				
	Bit 01 : Current unbalance.				
	Bit 02 : Current single phase.				
	Bit 03 : Minimum load.				
	Bit 04 : I2 negative sequence.				
	Bit 05 : Run stall.				
	Bit 06 : Short circuit high, high.				
	Bit 07 : Short circuit high.				
	Bit 08 : Vector stall.				
	Bit 09 : Over voltage.				
	Bit 10 : Under voltage.				
	Bit 11 : Voltage phase rotation.				
	Bit 12 : Voltage unbalance.				
	Bit 13 : Voltage loss of power.				
	Bit 14 : Voltage over frequency.				
	Bit 15 : Voltage under frequency.				

Table 21.2.1.b: Modbus actual values register address 27 to 31.

Addr	Name	Type / Format	Unit	R/W	Range
32	**Warning flags 1.** Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R	0 – 65535
33	**Warning flags 2.** Bit 00 : Shunt trip. Bit 01 : Starts per hour 1 start left. Bit 02 : Error loading KG/KH-RTU relay settings. Bit 03 : Current fundamental. Bit 04 : Current THD. Bit 05 : Voltage fundamental. Bit 06 : Voltage THD.	Word / F12		R	0 – 65535
34	Warning flags 3 – reserved.	Word / F2		R	0 – 65535
35	**Alarm flags 0.** Bit 00 : Over current. Bit 01 : Current unbalance. Bit 02 : Current single phase. Bit 03 : Minimum load. Bit 04 : I2 negative sequence. Bit 05 : Run stall. Bit 06 : Short circuit high, high. Bit 07 : Short circuit high. Bit 08 : Vector stall. Bit 09 : Over voltage. Bit 10 : Under voltage. Bit 11 : Voltage phase rotation. Bit 12 : Voltage unbalance. Bit 13 : Voltage loss of power. Bit 14 : Voltage over frequency. Bit 15 : Voltage under frequency.	Word / F10		R	0 – 65535

Table 21.2.1.c: Modbus actual values register address 32 to 35.

Addr	Name	Type / Format	Unit	R/W	Range
36	**Alarm flags 1.** Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R	0 – 65535
37	**Alarm flags 2.** Bit 00 : Shunt trip. Bit 01 : Starts per hour 1 start left. Bit 02 : Error loading KG/KH-RTU relay settings. Bit 03 : Current fundamental. Bit 04 : Current THD. Bit 05 : Voltage fundamental. Bit 06 : Voltage THD.	Word / F12		R	0 – 65535
38	Alarm flags 3 - reserved.	Word / F2		R	0 – 65535
39	**Trip flags 0.** Bit 00 : Over current. Bit 01 : Current unbalance. Bit 02 : Current single phase. Bit 03 : Minimum load. Bit 04 : I2 negative sequence. Bit 05 : Run stall. Bit 06 : Short circuit high, high. Bit 07 : Short circuit high. Bit 08 : Vector stall. Bit 09 : Over voltage. Bit 10 : Under voltage. Bit 11 : Voltage phase rotation. Bit 12 : Voltage unbalance. Bit 13 : Voltage loss of power. Bit 14 : Voltage over frequency. Bit 15 : Voltage under frequency.	Word / F10		R	0 – 65535

Table 21.2.1.d: Modbus actual values register address 36 to 39.

Addr	Name	Type / Format	Unit	R/W	Range
40	**Trip flags 1.** Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R	0 – 65535
41	**Trip flags 2.** Bit 00 : Shunt trip. Bit 01 : No starts left (Starts per hour). Bit 02 : Error loading KG/KH-RTU relay settings. Bit 03 : Current fundamental. Bit 04 : Current THD. Bit 05 : Voltage fundamental. Bit 06 : Voltage THD.	Word / F12		R	0 – 65535
42	Trip flags 3 – Reserved.	Word / F2		R	0 – 65535
43	**Logic flags 0.** Bit 00 : Logic function table 1 output. Bit 01 : Logic function table 2 output. Bit 02 : Logic function table 3 output. Bit 03 : Logic function table 4 output. Bit 04 : Logic function table 5 output. Bit 05 : Logic function table 6 output. Bit 06 : Thermal capacity high, high output. Bit 07 : Thermal capacity high output. Bit 08 : Comparator 1 high, high output. Bit 09 : Comparator 1 high output. Bit 10 : Comparator 1 high, low output. Bit 11 : Comparator 1 between output. Bit 12 : Comparator 1 low, high output. Bit 13 : Comparator 1 low output. Bit 14 : Comparator 1 low, low output. Bit 15 : Pulse generator output.	Word / F13		R	0 – 65535

Table 21.2.1.e: Modbus actual values register address 40 to 43.

Addr	Name	Type / Format	Unit	R/W	Range
44	**Logic flags 1.** Bit 00 : Comparator 2 high, high output. Bit 01 : Comparator 2 high output. Bit 02 : Comparator 2 high, low output. Bit 03 : Comparator 2 between output. Bit 04 : Comparator 2 low, high output. Bit 05 : Comparator 2 low output. Bit 06 : Comparator 2 low, low output. Bit 07 : Counter 1 output. Bit 08 : Counter 2 output. Bit 09 : Latch 1 output. Bit 10 : Latch 2 output. Bit 11 : Alarm flag mask output. Bit 12 : Trip flag mask output. Bit 13 : Logic RTC start stop output. Bit 14 : Timer 1 output. Bit 15 : Timer 2 output.	Word / F14		R	0 – 65535
45	**Logic flags 2.** Bit 00 : Reset push button active. Bit 01 : External reset active. Bit 02 : Modbus-RTU reset active. Bit 03 : BT reset active. Bit 04 : Thermal capacity auto reset active. Bit 05 : Minimum load auto reset active. Bit 06 : Reserved Bit 07 : Reserved Bit 08 : Status reporter output.	Word / F15		R	0 – 65535
46	Logic flags 3 – reserved.	Word / F2		R	0 – 65535
47	Counter 1 count value.	Word / F2		R	0 – 65535
48	Counter 2 count value.	Word / F2		R	0 – 65535
49	**Starter flags 0.** Bit 00 : Starter ready. Bit 01 : Input selected LSB status. Bit 02 : Input selected MSB status. Bit 03 : Feedback signal output. Bit 04 : Pre start warning active. Bit 05 : Pre start warning complete. Bit 06 : Start command active. Bit 07 : Stop command active. Bit 08 : Interlock command active. Bit 09 : Back spin active. Bit 10 : DC brake active. Bit 11 : Emergency stop status. Bit 12 : Starter logic main contact control status.	Word / F16		R	0 – 65535

Table 21.2.1.f: Modbus actual values register address 44 to 49.

Addr	Name	Type / Format	Unit	R/W	Range
50	**Starter flags 1.**	Word / F17		R	0 – 65535
	Bit 00 : Local start active.				
	Bit 01 : Local interlock active.				
	Bit 02 : Local stop active.				
	Bit 03 : Remote start active.				
	Bit 04 : Remote interlock active.				
	Bit 05 : Remote stop active.				
	Bit 06 : PLC start active.				
	Bit 07 : PLC interlock active.				
	Bit 08 : PLC stop active.				
51	Starter flags 2- reserved.	Word / F2		R	0 – 65535
52	Starts per hour left.	Word / F2		R	0 – 65535
53	RTC year.	Byte Hi / F1	year	R	1 – 99
	RTC month.	Byte Lo / F1	month		1 – 12
54	RTC day.	Word / F2	day	R	1 – 31
55	RTC hour.	Byte Hi / F1	hour	R	0 – 23
	RTC minutes.	Byte Lo / F1	min		0 – 59
56	RTC seconds.	Word / F2	Sec	R	0 – 59
57	Maximum load current selected.	Word / F2	%	R	10 – 100
58	Current transformer primary ratio.	Word / F2		R	1 – 10000
59	Current transformer secondary ratio.	Word / F2		R	1 – 9
60	KG/KH-RTU relay model number.	Word / F2		R	0 – 65535
61	IL1 to IL2 phase angle.	Word / F2	deg	R	0 – 90
62	IL2 to IL3 phase angle.	Word / F2	deg	R	0 – 90
63	IL3 to IL1 phase angle.	Word / F2	deg	R	0 – 90
64	VL1 to VL2 phase angle.	Word / F2	deg	R	0 – 90
65	VL2 to VL3 phase angle.	Word / F2	deg	R	0 – 90
66	VL3 to VL1 phase angle.	Word / F2	deg	R	0 – 90
67	VL1 to IL1 phase angle.	Word / F2	deg	R	0 – 90
68	VL2 to IL2 phase angle.	Word / F2	deg	R	0 – 90
69	VL3 to VL3 phase angle.	Word / F2	deg	R	0 – 90
70	IL fundamental, fundamental generating warning or alarm.	Word / F2		R	0 – 65535
71	IL fundamental phase generating warning or alarm.	Word / F2		R	0 – 65535
72	IL fundamental level warning or alarm.	Word / F2		R	0 – 65535
73	VL fundamental, fundamental generating warning or alarm.	Word / F2		R	0 – 65535
74	VL fundamental phase generating warning or alarm.	Word / F2		R	0 – 65535
75	VL fundamental level warning or alarm.	Word / F2		R	0 – 65535
76 – 77	IL maximum level.	Float / F4	A	R	See F4
78 – 79	IL1 level.	Float / F4	A	R	See F4
80 – 81	IL2 level.	Float / F4	A	R	See F4
82 - 83	IL3 level.	Float / F4	A	R	See F4

Table 21.2.1.g: Modbus actual values register address 50 to 83.

Addr	Name	Type / Format	Unit	R/W	Range
84 – 85	Total VA.	Float / F4	VAC	R	See F4.
86 – 87	L1 VA.	Float / F4	VAC	R	See F4.
88 – 89	L2 VA.	Float / F4	VAC	R	See F4.
90 – 91	L3 VA.	Float / F4	VAC	R	See F4.
92 – 93	Total Watt.	Float / F4	kW	R	See F4.
94 – 95	L1 Watt.	Float / F4	kW	R	See F4.
96 – 97	L2 Watt.	Float / F4	kW	R	See F4.
98 – 99	L3 Watt.	Float / F4	kW	R	See F4.
100 – 101	Total VAr.	Float / F4	kW	R	See F4.
102 – 103	L1 VAr.	Float / F4	kVAr	R	See F4.
104 – 105	L2 VAr.	Float / F4	kVAr	R	See F4.
106 – 107	L3 VAr.	Float / F4	kVAr	R	See F4.
108	Setting corrupted flags 0.	Word / F2		R	0 - 65535
109	Setting corrupted flags 1.	Word / F2		R	0 - 65535
110	Product identification number.	Word / F2		R	42 - KG 43 - KH
111	Softear revision.	Word / F2		R	0 - 65535
112	Reserved	Word / F2		R	0 - 65535

Table 21.2.1.h: Modbus actual values register address 84 to 112.

21.2.2 Harmonic Values

Addr	Name	Type / Format	Unit	R/W	Range
300	IL1 fundamental 0 level.	Word / F2	%	R	0 – 100
301	IL1 fundamental 1 level.	Word / F2	%	R	0 – 100
302	IL1 fundamental 2 level.	Word / F2	%	R	0 – 100
303	IL1 fundamental 3 level.	Word / F2	%	R	0 – 100
304	IL1 fundamental 4 level.	Word / F2	%	R	0 – 100
305	IL1 fundamental 5 level.	Word / F2	%	R	0 – 100
306	IL1 fundamental 6 level.	Word / F2	%	R	0 – 100
307	IL1 fundamental 7 level.	Word / F2	%	R	0 – 100
308	IL1 fundamental 8 level.	Word / F2	%	R	0 – 100
309	IL1 fundamental 9 level.	Word / F2	%	R	0 – 100
310	IL1 fundamental 10 level.	Word / F2	%	R	0 – 100
311	IL1 fundamental 11 level.	Word / F2	%	R	0 – 100
312	IL1 fundamental 12 level.	Word / F2	%	R	0 – 100
313	IL1 fundamental 13 level.	Word / F2	%	R	0 – 100
314	IL1 fundamental 14 level.	Word / F2	%	R	0 – 100
315	IL1 fundamental 15 level.	Word / F2	%	R	0 – 100
316	IL1 fundamental 16 level.	Word / F2	%	R	0 – 100
317	IL1 fundamental 17 level.	Word / F2	%	R	0 – 100
318	IL1 fundamental 18 level.	Word / F2	%	R	0 – 100
319	IL1 fundamental 19 level.	Word / F2	%	R	0 – 100
320	IL1 fundamental 20 level.	Word / F2	%	R	0 – 100
321	IL1 fundamental 21 level.	Word / F2	%	R	0 – 100
322	IL1 fundamental 22 level.	Word / F2	%	R	0 – 100
323	IL1 fundamental 23 level.	Word / F2	%	R	0 – 100
324	IL1 fundamental 24 level.	Word / F2	%	R	0 – 100
325	IL1 fundamental 25 level.	Word / F2	%	R	0 – 100
326	IL1 fundamental 26 level.	Word / F2	%	R	0 – 100
327	IL1 fundamental 27 level.	Word / F2	%	R	0 – 100
328	IL1 fundamental 28 level.	Word / F2	%	R	0 – 100
329	IL1 fundamental 29 level.	Word / F2	%	R	0 – 100
330	IL1 fundamental 30 level.	Word / F2	%	R	0 – 100
331	IL1 fundamental 31 level.	Word / F2	%	R	0 – 100

Table 21.2.2.a: Modbus harmonic values register address 300 to 331.

Addr	Name	Type / Format	Unit	R/W	Range
332	IL2 fundamental 0 level.	Word / F2	%	R	0 – 100
333	IL2 fundamental 1 level.	Word / F2	%	R	0 – 100
334	IL2 fundamental 2 level.	Word / F2	%	R	0 – 100
335	IL2 fundamental 3 level.	Word / F2	%	R	0 – 100
336	IL2 fundamental 4 level.	Word / F2	%	R	0 – 100
337	IL2 fundamental 5 level.	Word / F2	%	R	0 – 100
338	IL2 fundamental 6 level.	Word / F2	%	R	0 – 100
339	IL2 fundamental 7 level.	Word / F2	%	R	0 – 100
340	IL2 fundamental 8 level.	Word / F2	%	R	0 – 100
341	IL2 fundamental 9 level.	Word / F2	%	R	0 – 100
342	IL2 fundamental 10 level.	Word / F2	%	R	0 – 100
343	IL2 fundamental 11 level.	Word / F2	%	R	0 – 100
344	IL2 fundamental 12 level.	Word / F2	%	R	0 – 100
345	IL2 fundamental 13 level.	Word / F2	%	R	0 – 100
346	IL2 fundamental 14 level.	Word / F2	%	R	0 – 100
347	IL2 fundamental 15 level.	Word / F2	%	R	0 – 100
348	IL2 fundamental 16 level.	Word / F2	%	R	0 – 100
349	IL2 fundamental 17 level.	Word / F2	%	R	0 – 100
350	IL2 fundamental 18 level.	Word / F2	%	R	0 – 100
351	IL2 fundamental 19 level.	Word / F2	%	R	0 – 100
352	IL2 fundamental 20 level.	Word / F2	%	R	0 – 100
353	IL2 fundamental 21 level.	Word / F2	%	R	0 – 100
354	IL2 fundamental 22 level.	Word / F2	%	R	0 – 100
355	IL2 fundamental 23 level.	Word / F2	%	R	0 – 100
356	IL2 fundamental 24 level.	Word / F2	%	R	0 – 100
357	IL2 fundamental 25 level.	Word / F2	%	R	0 – 100
358	IL2 fundamental 26 level.	Word / F2	%	R	0 – 100
359	IL2 fundamental 27 level.	Word / F2	%	R	0 – 100
360	IL2 fundamental 28 level.	Word / F2	%	R	0 – 100
361	IL2 fundamental 29 level.	Word / F2	%	R	0 – 100
362	IL2 fundamental 30 level.	Word / F2	%	R	0 – 100
363	IL2 fundamental 31 level.	Word / F2	%	R	0 – 100

Table 21.2.2.b: Modbus harmonic values register address 332 to 363.

Addr	Name	Type / Format	Unit	R/W	Range
364	IL3 fundamental 0 level.	Word / F2	%	R	0 – 100
365	IL3 fundamental 1 level.	Word / F2	%	R	0 – 100
366	IL3 fundamental 2 level.	Word / F2	%	R	0 – 100
367	IL3 fundamental 3 level.	Word / F2	%	R	0 – 100
368	IL3 fundamental 4 level.	Word / F2	%	R	0 – 100
369	IL3 fundamental 5 level.	Word / F2	%	R	0 – 100
370	IL3 fundamental 6 level.	Word / F2	%	R	0 – 100
371	IL3 fundamental 7 level.	Word / F2	%	R	0 – 100
372	IL3 fundamental 8 level.	Word / F2	%	R	0 – 100
373	IL3 fundamental 9 level.	Word / F2	%	R	0 – 100
374	IL3 fundamental 10 level.	Word / F2	%	R	0 – 100
375	IL3 fundamental 11 level.	Word / F2	%	R	0 – 100
376	IL3 fundamental 12 level.	Word / F2	%	R	0 – 100
377	IL3 fundamental 13 level.	Word / F2	%	R	0 – 100
378	IL3 fundamental 14 level.	Word / F2	%	R	0 – 100
379	IL3 fundamental 15 level.	Word / F2	%	R	0 – 100
380	IL3 fundamental 16 level.	Word / F2	%	R	0 – 100
381	IL3 fundamental 17 level.	Word / F2	%	R	0 – 100
382	IL3 fundamental 18 level.	Word / F2	%	R	0 – 100
383	IL3 fundamental 19 level.	Word / F2	%	R	0 – 100
384	IL3 fundamental 20 level.	Word / F2	%	R	0 – 100
385	IL3 fundamental 21 level.	Word / F2	%	R	0 – 100
386	IL3 fundamental 22 level.	Word / F2	%	R	0 – 100
387	IL3 fundamental 23 level.	Word / F2	%	R	0 – 100
388	IL3 fundamental 24 level.	Word / F2	%	R	0 – 100
389	IL3 fundamental 25 level.	Word / F2	%	R	0 – 100
390	IL3 fundamental 26 level.	Word / F2	%	R	0 – 100
391	IL3 fundamental 27 level.	Word / F2	%	R	0 – 100
392	IL3 fundamental 28 level.	Word / F2	%	R	0 – 100
393	IL3 fundamental 29 level.	Word / F2	%	R	0 – 100
394	IL3 fundamental 30 level.	Word / F2	%	R	0 – 100
395	IL3 fundamental 31 level.	Word / F2	%	R	0 – 100

Table 21.2.2.c: Modbus harmonic values register address 364 to 395.

Addr	Name	Type / Format	Unit	R/W	Range
396	VL1 fundamental 0 level.	Word / F2	%	R	0 – 100
397	VL1 fundamental 1 level.	Word / F2	%	R	0 – 100
398	VL1 fundamental 2 level.	Word / F2	%	R	0 – 100
399	VL1 fundamental 3 level.	Word / F2	%	R	0 – 100
400	VL1 fundamental 4 level.	Word / F2	%	R	0 – 100
401	VL1 fundamental 5 level.	Word / F2	%	R	0 – 100
402	VL1 fundamental 6 level.	Word / F2	%	R	0 – 100
403	VL1 fundamental 7 level.	Word / F2	%	R	0 – 100
404	VL1 fundamental 8 level.	Word / F2	%	R	0 – 100
405	VL1 fundamental 9 level.	Word / F2	%	R	0 – 100
406	VL1 fundamental 10 level.	Word / F2	%	R	0 – 100
407	VL1 fundamental 11 level.	Word / F2	%	R	0 – 100
408	VL1 fundamental 12 level.	Word / F2	%	R	0 – 100
409	VL1 fundamental 13 level.	Word / F2	%	R	0 – 100
410	VL1 fundamental 14 level.	Word / F2	%	R	0 – 100
411	VL1 fundamental 15 level.	Word / F2	%	R	0 – 100
412	VL1 fundamental 16 level.	Word / F2	%	R	0 – 100
413	VL1 fundamental 17 level.	Word / F2	%	R	0 – 100
414	VL1 fundamental 18 level.	Word / F2	%	R	0 – 100
415	VL1 fundamental 19 level.	Word / F2	%	R	0 – 100
416	VL1 fundamental 20 level.	Word / F2	%	R	0 – 100
417	VL1 fundamental 21 level.	Word / F2	%	R	0 – 100
418	VL1 fundamental 22 level.	Word / F2	%	R	0 – 100
419	VL1 fundamental 23 level.	Word / F2	%	R	0 – 100
420	VL1 fundamental 24 level.	Word / F2	%	R	0 – 100
421	VL1 fundamental 25 level.	Word / F2	%	R	0 – 100
422	VL1 fundamental 26 level.	Word / F2	%	R	0 – 100
423	VL1 fundamental 27 level.	Word / F2	%	R	0 – 100
424	VL1 fundamental 28 level.	Word / F2	%	R	0 – 100
425	VL1 fundamental 29 level.	Word / F2	%	R	0 – 100
426	VL1 fundamental 30 level.	Word / F2	%	R	0 – 100
427	VL1 fundamental 31 level.	Word / F2	%	R	0 – 100

Table 21.2.2.d: Modbus harmonic values register address 396 to 427.

Addr	Name	Type / Format	Unit	R/W	Range
428	VL2 fundamental 0 level.	Word / F2	%	R	0 – 100
429	VL2 fundamental 1 level.	Word / F2	%	R	0 – 100
430	VL2 fundamental 2 level.	Word / F2	%	R	0 – 100
431	VL2 fundamental 3 level.	Word / F2	%	R	0 – 100
432	VL2 fundamental 4 level.	Word / F2	%	R	0 – 100
433	VL2 fundamental 5 level.	Word / F2	%	R	0 – 100
434	VL2 fundamental 6 level.	Word / F2	%	R	0 – 100
435	VL2 fundamental 7 level.	Word / F2	%	R	0 – 100
436	VL2 fundamental 8 level.	Word / F2	%	R	0 – 100
437	VL2 fundamental 9 level.	Word / F2	%	R	0 – 100
438	VL2 fundamental 10 level.	Word / F2	%	R	0 – 100
439	VL2 fundamental 11 level.	Word / F2	%	R	0 – 100
440	VL2 fundamental 12 level.	Word / F2	%	R	0 – 100
441	VL2 fundamental 13 level.	Word / F2	%	R	0 – 100
442	VL2 fundamental 14 level.	Word / F2	%	R	0 – 100
443	VL2 fundamental 15 level.	Word / F2	%	R	0 – 100
444	VL2 fundamental 16 level.	Word / F2	%	R	0 – 100
445	VL2 fundamental 17 level.	Word / F2	%	R	0 – 100
446	VL2 fundamental 18 level.	Word / F2	%	R	0 – 100
447	VL2 fundamental 19 level.	Word / F2	%	R	0 – 100
448	VL2 fundamental 20 level.	Word / F2	%	R	0 – 100
449	VL2 fundamental 21 level.	Word / F2	%	R	0 – 100
450	VL2 fundamental 22 level.	Word / F2	%	R	0 – 100
451	VL2 fundamental 23 level.	Word / F2	%	R	0 – 100
452	VL2 fundamental 24 level.	Word / F2	%	R	0 – 100
453	VL2 fundamental 25 level.	Word / F2	%	R	0 – 100
454	VL2 fundamental 26 level.	Word / F2	%	R	0 – 100
455	VL2 fundamental 27 level.	Word / F2	%	R	0 – 100
456	VL2 fundamental 28 level.	Word / F2	%	R	0 – 100
457	VL2 fundamental 29 level.	Word / F2	%	R	0 – 100
458	VL2 fundamental 30 level.	Word / F2	%	R	0 – 100
459	VL2 fundamental 31 level.	Word / F2	%	R	0 – 100

Table 21.2.2.e: Modbus harmonic values register address 428 to 459.

Addr	Name	Type / Format	Unit	R/W	Range
460	VL3 fundamental 0 level.	Word / F2	%	R	0 – 100
461	VL3 fundamental 1 level.	Word / F2	%	R	0 – 100
462	VL3 fundamental 2 level.	Word / F2	%	R	0 – 100
463	VL3 fundamental 3 level.	Word / F2	%	R	0 – 100
464	VL3 fundamental 4 level.	Word / F2	%	R	0 – 100
465	VL3 fundamental 5 level.	Word / F2	%	R	0 – 100
466	VL3 fundamental 6 level.	Word / F2	%	R	0 – 100
467	VL3 fundamental 7 level.	Word / F2	%	R	0 – 100
468	VL3 fundamental 8 level.	Word / F2	%	R	0 – 100
469	VL3 fundamental 9 level.	Word / F2	%	R	0 – 100
470	VL3 fundamental 10 level.	Word / F2	%	R	0 – 100
471	VL3 fundamental 11 level.	Word / F2	%	R	0 – 100
472	VL3 fundamental 12 level.	Word / F2	%	R	0 – 100
473	VL3 fundamental 13 level.	Word / F2	%	R	0 – 100
474	VL3 fundamental 14 level.	Word / F2	%	R	0 – 100
475	VL3 fundamental 15 level.	Word / F2	%	R	0 – 100
476	VL3 fundamental 16 level.	Word / F2	%	R	0 – 100
477	VL3 fundamental 17 level.	Word / F2	%	R	0 – 100
478	VL3 fundamental 18 level.	Word / F2	%	R	0 – 100
479	VL3 fundamental 19 level.	Word / F2	%	R	0 – 100
480	VL3 fundamental 20 level.	Word / F2	%	R	0 – 100
481	VL3 fundamental 21 level.	Word / F2	%	R	0 – 100
482	VL3 fundamental 22 level.	Word / F2	%	R	0 – 100
483	VL3 fundamental 23 level.	Word / F2	%	R	0 – 100
484	VL3 fundamental 24 level.	Word / F2	%	R	0 – 100
485	VL3 fundamental 25 level.	Word / F2	%	R	0 – 100
486	VL3 fundamental 26 level.	Word / F2	%	R	0 – 100
487	VL3 fundamental 27 level.	Word / F2	%	R	0 – 100
488	VL3 fundamental 28 level.	Word / F2	%	R	0 – 100
489	VL3 fundamental 29 level.	Word / F2	%	R	0 – 100
490	VL3 fundamental 30 level.	Word / F2	%	R	0 – 100
491	VL3 fundamental 31 level.	Word / F2	%	R	0 – 100
492	IL1 THD level.	Word / F2	%	R	0 – 100
493	IL2 THD level.	Word / F2	%	R	0 – 100
494	IL3 THD level.	Word / F2	%	R	0 – 100
495	IL THD level.	Word / F2	%	R	0 – 100
496	VL1 THD level.	Word / F2	%	R	0 – 100
497	VL2 THD level.	Word / F2	%	R	0 – 100
498	VL3 THD level.	Word / F2	%	R	0 – 100
499	VL THD level.	Word / F2	%	R	0 – 100
500	Reserved	Word / F2		R	0 – 65535

Table 21.2.2.f: Modbus harmonic values register address 460 to 500.

21.2.3 Control Bits

Addr	Name	Type / Format	Unit	R/W	Range
900	Password unlock pin.	Word / F2		R/W	0 – 65535
901	Control word from Modbus-RTU.	Word / F18		R/W	0 – 65535
902	Reset control from Modbus-RTU.	Word / F19		R/W	0 – 65535
	Bit 00 : Reset bit.				
	Bit 01 to bit 15 : Reserved.				
903	Control word from Bluetooth.	Word / F18		R/W	0 – 65535
904	Reset control from Bluetooth.	Word / F19		R/W	0 – 65535
	Bit 00 : Reset bit.				
	Bit 01 to bit 15 : Reserved.				
905 - 999	Reserved.	Word / F2		R/W	0 – 65535

Table 21.2.3: Modbus control bits values register address 900 to 908.

21.2.4 System Settings

Addr	Name	Type / Format	Unit	R/W	Range
1000	Reserved.	Word / F2		R/W	0 - 65535
1001	Maximum load current setting.	Word / F2	%	R/W*	10 - 100
1002	CT primary ratio.	Word / F2		R/W*	1 - 10000
1003	CT secondary ratio.	Word / F2		R/W*	1 - 9
1004	Voltage line input.	Word / F2	VAC	R/W*	10 - 33000
1005	VT primary ratio.	Word / F2		R/W*	1 - 33000
1006	VT secondary ratio.	Word / F2		R/W*	1 - 110
1007	Voltage line frequency. 0 : 50 Hz. 1 : 60 Hz.	Word / F20	Hz	R/W*	0 – 1
1008	Current active level.	Word / F2	%	R/W*	1 - 30
1009	Voltage active level.	Word / F2	VAC	R/W*	1 – 30000
1010	Relay protection type selection. 0 : Protection Relay. 1 : Motor DOL. 2 : Feeder.	Word / F21		R/W*	0 - 2
1011	System configuration control register. Bit 00 : Relay 1 non-fail safe enabled. Bit 01 : Voltage phase rotation reversed. Bit 02 to bit 15 : Reserved.	Word / F22		R/W*	0 - 65535
1012	Load running level.	Word / F2	%	R/W*	1 - 80
1013	Time till application is in running state.	Word / F2	Sec	R/W*	1 - 60
1014 - 1999	Reserved.	Word / F2		R/W	1 - 60

Table 21.2.4: Modbus system settings register address 1000 to 1014.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

21.2.5 Protection Settings

Addr	Name	Type / Format	Unit	R/W	Range
2000	Reserved	Word / F2		R/W	0 – 65535
2001	**Current protection control register.** Bit 00 : Under current source: 0 : Load. 1 : Power factor. Bit 01 to 15 : Reserved.	Word / F23		R/W*	0 – 65535
2002	**IL protection warnings enabled.** Bit 00 : IL unbalance. Bit 01 : IL single phase. Bit 02 : IL under current. Bit 03 : IL I2 negative sequence. Bit 04 : IL Running stall. Bit 05 : IL Short circuit high, high. Bit 06 : IL Short circuit high. Bit 07 : IL Vectorial stall. Bit 08 to 15 : Reserved.	Word / F24		R/W*	0 – 65535
2003	**IL protection trips enabled.** Bit 00 : IL unbalance. Bit 01 : IL single phase. Bit 02 : IL under current. Bit 03 : IL I2 negative sequence. Bit 04 : IL Running stall. Bit 05 : IL Short circuit high, high. Bit 06 : IL Short circuit high. Bit 07 : IL Vectorial stall. Bit 08 to 15 : Reserved.	Word / F24		R/W*	0 – 65535
2004	**Current protection curve.** 0 : IEC 60255-08 Machine I2T. 1 : DEFT. 2 : IEC NINV. 3 : IEC VINV. 4 : IEC LINV. 5 : IEC EINV. 6 : ANSI MINV. 7 : ANSI VINV. 8 : ANSI EINV. 9 : Thermal flat. 10 : IT. 11 : I^2T. 12 : I^4T.	Word / F25		R/W*	0 – 12

Table 21.2.5.a: Modbus protection settings register address 2000 to 2004.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2005	Curve reset type. 0 : Manual. 1 : Instantaneous. 2 : Delayed. 3 : Curve	Word / F26		R/W*	0 – 3
2006	Curve trip time.	Word / F2	Sec x 0.1	R/W*	1 – 30000
2007	Curve reset delay.	Word / F2	Sec x 0.1	R/W*	1 – 30000
2008	Thermal reset level.	Word / F2	%	R/W*	1 – 100
2009	Current unbalance trip level.	Word / F2	%	R/W*	5 – 50
2010	Current unbalance trip delay.	Word / F2	Sec	R/W*	1 – 250
2011	Under current trip level.	Word / F2	%	R/W*	10 – 99
2012	Under power trip level.	Word / F2	%	R/W*	10 – 99
2013	Under current start-up delay.	Word / F2	Sec	R/W*	0 – 200
2014	Under current trip delay.	Word / F2	Sec	R/W*	1 – 200
2015	Under current reset delay.	Word / F2	Sec	R/W*	0 – 65000
2016	I2 negative sequence trip level.	Word / F2	%	R/W*	10 – 90
2017	I2 negative sequence trip delay.	Word / F2	Sec	R/W*	1 – 250
2018	Running stall trip level.	Word / F2	%	R/W*	110 – 300
2019	Running stall blocked delay.	Word / F2	Sec	R/W*	0 – 200
2020	Running stall trip delay.	Word / F2	mSec	R/W*	100 - 2000
2021	Short circuit high, high trip level.	Word / F2	%	R/W*	600 - 1000
2022	Short circuit high, high trip delay.	Word / F2	mSec	R/W*	30 – 300
2023	Short circuit high trip level.	Word / F2	%	R/W*	600 - 1000
2024	Short circuit high trip delay.	Word / F2	mSec	R/W*	100 - 2500
2025 - 2039	Reserved.	Word / F2		R/W	0 – 65535

Table 21.2.5.b: Modbus protection settings register address 2005 to 2039.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2040	VL protection control register. Bit 00 : Over voltage warning without load enabled. Bit 01 : Over voltage trip without load enabled. Bit 02 : Under voltage warning without load enabled. Bit 03 : Under voltage trip without load enabled. Bit 04 to bit 15 : Reserved.	Word / F27		R/W*	0 – 65535
2041	VL protection warnings enabled. Bit 00 : Over voltage. Bit 01 : Under voltage. Bit 02 : Phase rotation. Bit 03 : Voltage symmetry. Bit 04 : Voltage loss of power. Bit 05 : Over frequency. Bit 06 : Under frequency. Bit 07 to bit 15 : Reserved.	Word / F28		R/W*	0 – 65535
2042	Voltage protection trips enabled. Bit 00 : Over voltage. Bit 01 : Under voltage. Bit 02 : Phase rotation. Bit 03 : Voltage symmetry. Bit 04 : Voltage loss of power. Bit 05 : Over frequency. Bit 06 : Under frequency. Bit 07 to bit 15 : Reserved.	Word / F28		R/W*	0 – 65535
2043	Over voltage trip level.	Word / F2	%	R/W*	1 – 25
2044	Over voltage trip delay.	Word / F2	Sec	R/W*	1 – 200
2045	Under voltage trip level.	Word / F2	%	R/W*	1 – 25
2046	Under voltage trip delay.	Word / F2	Sec	R/W*	1 – 200
2047	Voltage unbalance trip level.	Word / F2	%	R/W*	10 – 60
2048	Voltage unbalance trip delay.	Word / F2	Sec	R/W*	1 – 200
2049	Voltage loss of power trip delay.	Word / F2	Sec	R/W*	1 – 200
2050	Voltage over frequency trip level.	Word / F2	Hz	R/W*	40 – 80
2051	Voltage over frequency trip delay.	Word / F2	Sec	R/W*	1 – 200
2052	Voltage under frequency trip level.	Word / F2	Hz	R/W*	30 – 60
2053	Voltage under frequency trip delay.	Word / F2	Sec	R/W*	1 – 200
2054 - 2070	Reserved	Word / F2		R/W*	0 – 65535

Table 21.2.5.c: Modbus protection settings register address 2040 to 2057.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2071	Earth leakage protection warnings enabled. Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 to bit 15 : Reserved.	Word / F29		R/W*	0 – 65535
2072	Earth leakage protection trips enabled. Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure.	Word / F29		R/W*	0 – 65535
2073	Earth leakage trip type. 0 : DEFT. 1 : IDMT. 2 : IEC NINV. 3 : IEC VINV. 4 : IEC LINV. 5 : IEC EINV. 6 : ANSI MINV. 7 : ANSI VINV. 8 : ANSI EINV. 9: Thermal flat. 10 : IT. 11 : I^2T. 12 : I^4T.	Word / F30		R/W*	0 – 12
2074	Earth leakage reset type: 0 : Manual. 1 : Instantaneous. 2 : Delayed. 4 : Curve.	Word / F26		R/W*	0 – 4
2075	Earth leakage trip level.	Word / F2	mA	R/W*	30 – 28000

Table 21.2.5.d: Modbus protection settings register address 2058 to 2073.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2076	Earth leakage trip delay.	Word / F2	mSec	R/W*	100 – 2000
2077	Earth leakage reset delay.	Word / F2	mSec	R/W*	100 – 2000
2078	Earth fault high, high trip level.	Word / F2	mA	R/W*	2000 – 28000
2079	Earth fault high, high trip delay.	Word / F2	mSec	R/W*	50 – 1000
2080	Earth fault high trip level.	Word / F2	mA	R/W*	2000 – 28000
2081	Earth fault high trip delay.	Word / F2	mSec	R/W*	100 – 10000
2082	I0 sequence trip type: 0 : DEFT. 1 : IDMT. 2 : IEC NINV. 3 : IEC VINV. 4 : IEC LINV. 5 : IEC EINV. 6 : ANSI MINV. 7 : ANSI VINV. 8 : ANSI EINV. 9 : Thermal flat. 10 : IT. 11 : I^2T. 12 : I^4T.	Word / F30		R/W*	0 – 65535
2083	I0 sequence reset type: 0 : Manual. 1 : Instantaneous. 2 : Delayed. 3 : Curve.	Word / F26		R/W*	0 – 3
2084	I0 sequence trip level.	Word / F2	%	R/W*	1 – 100
2085	I0 sequence trip delay.	Word / F2	mSec	R/W*	100 – 2000
2086	I0 sequence reset delay.	Word / F2	mSec	R/W*	100 – 2000
2087 – 2095	Reserved	Word / F2		R/W*	0 – 65535

Table 21.2.5.e: Modbus protection settings register address 2076 to 2095.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2096	Shunt reset mask trip flags enabled 0. Bit 00 : Over current. Bit 01 : Current unbalance. Bit 02 : Current single phase. Bit 03 : Minimum load. Bit 04 : I2 negative sequence. Bit 05 : Run stall. Bit 06 : Short circuit high, high. Bit 07 : Short circuit high. Bit 08 : Vector stall. Bit 09 : Over voltage. Bit 10 : Under voltage. Bit 11 : Voltage phase rotation. Bit 12 : Voltage unbalance. Bit 13 : Voltage loss of power. Bit 14 : Voltage over frequency. Bit 15 : Voltage under frequency.	Word / F10		R/W*	0 – 65535
2097	Shunt reset mask trip flags enabled 1. Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R/W*	0 – 65535

Table 21.2.5.f: Modbus protection settings register address 2096 to 2097.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2098	Shunt reset mask trip flags enabled 2. Bit 00 : Shunt trip. Bit 01 : Starts per hour 1 start left. Bit 02 : Error loading KG/KH-RTU relay settings. Bit 03 : Current fundamental. Bit 04 : Current THD. Bit 05 : Voltage fundamental. Bit 06 : Voltage THD. Bit 07 to bit 15 : Reserved.	Word / F12		R/W*	0 – 65535
2099	Shunt reset mask trip flags enabled 2 reserved.	Word / F2		R/W*	0 – 65535
2100	System protection control Bit 00 : Custom trip 1 active low enabled. Bit 01 : Custom trip 2 active low enabled. Bit 02 : Custom trip 3 active low enabled. Bit 03 : Custom trip 4 active low enabled. Bit 04 to bit 15 : Reserved.	Word / F31		R/W*	0 – 65535
2101	System warnings enabled. Bit 00 : Reserved. Bit 01 : Custom trip 1 warning enabled. Bit 02 : Custom trip 2 warning enabled. Bit 03 : Custom trip 3 warning enabled. Bit 04 : Custom trip 4 warning enabled. Bit 05 : One start left warning enabled. Bit 06 to bit 15 : Reserved.	Word / F32		R/W*	0 – 65535
2102	System trip enabled Bit 00 : Reserved. Bit 01 : User custom trip 1 trip enabled. Bit 02 : User custom trip 2 trip enabled. Bit 03 : User custom trip 3 trip enabled. Bit 04 : User custom trip 4 trip enabled. Bit 05 : Starts per hour trip enabled. Bit 06 to bit 15 : Reserved.	Word / F32		R/W*	0 – 65535
2103	Custom trip 1 input signal.	Word / F33		R/W*	0 – 65535
2104	Custom trip 1 trip delay.	Word / F2	mSec	R/W*	100 – 60000
2105	Custom trip 2 input signal.	Word / F33		R/W*	0 – 65535
2106	Custom trip 2 trip delay.	Word / F2	mSec	R/W*	100 – 60000
2107	Custom trip 3 input signal.	Word / F33		R/W*	0 – 65535
2108	Custom trip 3 trip delay.	Word / F2	mSec	R/W*	100 – 60000

Table 21.2.5.g: Modbus protection settings register address 2098 to 2108.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2109	Custom trip 4 input signal.	Word / F33		R/W*	0 – 65535
2110	Custom trip 4 trip delay.	Word / F2	mSec	R/W*	100 – 60000
2111	Starts per hour limit.	Word / F2		R/W*	1 – 60
2112	Consecutive starts allowed.	Word / F2		R/W*	1 – 3
2113	External reset input signal.	Word / F34		R/W*	1 – 2048
2114	**External reset allowed mask 0.** Bit 00 : Over current. Bit 01 : Current unbalance. Bit 02 : Current single phase. Bit 03 : Minimum load. Bit 04 : I2 negative sequence. Bit 05 : Run stall. Bit 06 : Short circuit high, high. Bit 07 : Short circuit high. Bit 08 : Vector stall. Bit 09 : Over voltage. Bit 10 : Under voltage. Bit 11 : Voltage phase rotation. Bit 12 : Voltage unbalance. Bit 13 : Voltage loss of power. Bit 14 : Voltage over frequency. Bit 15 : Voltage under frequency.	Word / F10		R/W*	0 – 65535
2115	**External reset allowed mask 1.** Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R/W*	0 – 65535

Table 21.2.5.h: Modbus protection settings register address 2109 to 2115.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2116	External reset allowed mask 2. Bit 00 : Shunt trip. Bit 01 : Starts per hour 1 start left. Bit 02 : Error loading KG/KH-RTU relay settings. Bit 03 : Current fundamental. Bit 04 : Current THD. Bit 05 : Voltage fundamental. Bit 06 : Voltage THD. Bit 07 to bit 15 : Reserved.	Word / F12		R/W*	0 – 65535
2117	External reset allowed mask 3 – Reserved.	Word / F2		R/W*	0 – 65535
2118 - 2119	Reserved	Word / F2		R/W*	0 – 65535
2120	Harmonic warnings enabled. Bit 00 : IL Fundamental. Bit 01 : VL Fundamental. Bit 02 : IL THD. Bit 03 : VL THD. Bit 04 to bit 15 : Reserved.	Word / F35		R/W*	0 – 65535
2121	Harmonic trips enabled. Bit 00 : IL Fundamental. Bit 01 : VL Fundamental. Bit 02 : IL THD. Bit 03 : VL THD. Bit 04 to bit 15 : Reserved.	Word / F35		R/W*	0 – 65535
2122	IL fundamental 0 warning and trip level.	Word / F2	%	R/W*	1 – 100
2123	IL fundamental 2 warning and trip level.	Word / F2	%	R/W*	1 – 100
2124	IL fundamental 3 warning and trip level.	Word / F2	%	R/W*	1 – 100
2125	IL fundamental 4 warning and trip level.	Word / F2	%	R/W*	1 – 100
2126	IL fundamental 5 warning and trip level.	Word / F2	%	R/W*	1 – 100
2127	IL fundamental 6 warning and trip level.	Word / F2	%	R/W*	1 – 100
2128	IL fundamental 7 warning and trip level.	Word / F2	%	R/W*	1 – 100
2129	IL fundamental 8 warning and trip level.	Word / F2	%	R/W*	1 – 100
2130	IL fundamental 9 warning and trip level.	Word / F2	%	R/W*	1 – 100
2131	IL fundamental 10 warning and trip level.	Word / F2	%	R/W*	1 – 100
2132	IL fundamental 11 warning and trip level.	Word / F2	%	R/W*	1 – 100
2133	IL fundamental 12 warning and trip level.	Word / F2	%	R/W*	1 – 100
2134	IL fundamental 13 warning and trip level.	Word / F2	%	R/W*	1 – 100
2135	IL fundamental 14 warning and trip level.	Word / F2	%	R/W*	1 – 100
2136	IL fundamental 15 warning and trip level.	Word / F2	%	R/W*	1 – 100
2137	IL fundamental 16 warning and trip level.	Word / F2	%	R/W*	1 – 100

Table 21.2.5.i: Modbus protection settings register address 2116 to 2137.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2138	IL fundamental 17 warning and trip level.	Word / F2	%	R/W*	1 – 100
2139	IL fundamental 18 warning and trip level.	Word / F2	%	R/W*	1 – 100
2140	IL fundamental 19 warning and trip level.	Word / F2	%	R/W*	1 – 100
2141	IL fundamental 20 warning and trip level.	Word / F2	%	R/W*	1 – 100
2142	IL fundamental 21 warning and trip level.	Word / F2	%	R/W*	1 – 100
2143	IL fundamental 22 warning and trip level.	Word / F2	%	R/W*	1 – 100
2144	IL fundamental 23 warning and trip level.	Word / F2	%	R/W*	1 – 100
2145	IL fundamental 24 warning and trip level.	Word / F2	%	R/W*	1 – 100
2146	IL fundamental 25 warning and trip level.	Word / F2	%	R/W*	1 – 100
2147	IL fundamental 26 warning and trip level.	Word / F2	%	R/W*	1 – 100
2148	IL fundamental 27 warning and trip level.	Word / F2	%	R/W*	1 – 100
2149	IL fundamental 28 warning and trip level.	Word / F2	%	R/W*	1 – 100
2150	IL fundamental 29 warning and trip level.	Word / F2	%	R/W*	1 – 100
2151	IL fundamental 30 warning and trip level.	Word / F2	%	R/W*	1 – 100
2152	IL fundamental 31 warning and trip level.	Word / F2	%	R/W*	1 – 100
2153	IL fundamental trip delay.	Word / F2	Sec	R/W*	1 – 60
2154	IL THD warning and trip level.	Word / F2	%	R/W*	1 – 100
2155	IL THD trip delay.	Word / F2	Sec	R/W*	1 – 60
2156	VL fundamental 00 warning and trip level.	Word / F2	%	R/W*	1 – 100
2157	VL fundamental 02 warning and trip level.	Word / F2	%	R/W*	1 – 100
2158	VL fundamental 03 warning and trip level.	Word / F2	%	R/W*	1 – 100
2159	VL fundamental 04 warning and trip level.	Word / F2	%	R/W*	1 – 100
2160	VL fundamental 05 warning and trip level.	Word / F2	%	R/W*	1 – 100
2161	VL fundamental 06 warning and trip level.	Word / F2	%	R/W*	1 – 100
2162	VL fundamental 07 warning and trip level.	Word / F2	%	R/W*	1 – 100
2163	VL fundamental 08 warning and trip level.	Word / F2	%	R/W*	1 – 100
2164	VL fundamental 09 warning and trip level.	Word / F2	%	R/W*	1 – 100
2165	VL fundamental 10 warning and trip level.	Word / F2	%	R/W*	1 – 100
2166	VL fundamental 11 warning and trip level.	Word / F2	%	R/W*	1 – 100
2167	VL fundamental 12 warning and trip level.	Word / F2	%	R/W*	1 – 100
2168	VL fundamental 13 warning and trip level.	Word / F2	%	R/W*	1 – 100
2169	VL fundamental 14 warning and trip level.	Word / F2	%	R/W*	1 – 100
2170	VL fundamental 15 warning and trip level.	Word / F2	%	R/W*	1 – 100
2171	VL fundamental 16 warning and trip level.	Word / F2	%	R/W*	1 – 100
2172	VL fundamental 17 warning and trip level.	Word / F2	%	R/W*	1 – 100
2173	VL fundamental 18 warning and trip level.	Word / F2	%	R/W*	1 – 100
2174	VL fundamental 19 warning and trip level.	Word / F2	%	R/W*	1 – 100
2175	VL fundamental 20 warning and trip level.	Word / F2	%	R/W*	1 – 100
2176	VL fundamental 21 warning and trip level.	Word / F2	%	R/W*	1 – 100
2177	VL fundamental 22 warning and trip level.	Word / F2	%	R/W*	1 – 100
2178	VL fundamental 23 warning and trip level.	Word / F2	%	R/W*	1 – 100

Table 21.2.5.j: Modbus protection settings register address 2138 to 2178.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

Addr	Name	Type / Format	Unit	R/W	Range
2179	VL fundamental 24 warning and trip level.	Word / F2	%	R/W*	1 – 100
2180	VL fundamental 25 warning and trip level.	Word / F2	%	R/W*	1 – 100
2181	VL fundamental 26 warning and trip level.	Word / F2	%	R/W*	1 – 100
2182	VL fundamental 27 warning and trip level.	Word / F2	%	R/W*	1 – 100
2183	VL fundamental 28 warning and trip level.	Word / F2	%	R/W*	1 – 100
2184	VL fundamental 29 warning and trip level.	Word / F2	%	R/W*	1 – 100
2185	VL fundamental 30 warning and trip level.	Word / F2	%	R/W*	1 – 100
2186	VL fundamental 31 warning and trip level.	Word / F2	%	R/W*	1 – 100
2187	VL fundamental trip delay.	Word / F2	Sec	R/W*	1 – 60
2188	VL THD warning and trip level.	Word / F2	%	R/W*	1 – 100
2189	VL THD trip delay.	Word / F2	Sec	R/W*	1 – 60
2190 - 2999	Reserved.	Word / F2		R/W*	0 – 65535

Table 21.2.5.k: Modbus protection settings register address 2178 to 2190.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock protection.

21.2.6 Logic Settings

Addr	Name	Type / Format	Unit	R/W	Range
3000	Reserved.	Word / F2		R/W*	0 – 65535
3001	Logic control register 0 – Reserved.	Word / F2		R/W*	0 – 65535
3002	Logic control register 1 – Reserved.	Word / F2		R/W*	0 – 65535
3003	Relay 2 input.	Word / F33		R/W*	0 – 65535
3004	Field input 1 on delay.	Word / F2	mSec	R/W*	50 – 60000
3005	Field input 1 off delay.	Word / F2	mSec	R/W*	50 – 60000
3006	Field input 2 on delay.	Word / F2	mSec	R/W*	50 – 60000
3007	Field input 2 off delay.	Word / F2	mSec	R/W*	50 – 60000
3008	Field input 3 on delay.	Word / F2	mSec	R/W*	50 – 60000
3009	Field input 3 off delay.	Word / F2	mSec	R/W*	50 – 60000
3010 - 3019	Reserved	Word / F2		R/W*	0 – 65535
3020	Logic function 1 input 1, input.	Word / F33		R/W*	0 – 65535
3021	Logic function 1 input 2, input.	Word / F33		R/W*	0 – 65535
3022	Logic function 1 input 3, input.	Word / F33		R/W*	0 – 65535
3023	Logic function 1 input 4, input.	Word / F33		R/W*	0 – 65535
3024	Logic function 1 mask.	Word / F2		R/W*	0 – 65535
3025	Logic function 2 input 1, input.	Word / F33		R/W*	0 – 65535
3026	Logic function 2 input 2, input.	Word / F33		R/W*	0 – 65535
3027	Logic function 2 input 3, input.	Word / F33		R/W*	0 – 65535
3028	Logic function 2 input 4, input.	Word / F33		R/W*	0 – 65535
3029	Logic function 2 mask.	Word / F2		R/W*	0 – 65535

Table 21.2.6.a: Modbus logic settings register address 3000 to 3029.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
3030	Logic function 3 input 1, input.	Word / F33		R/W*	0 – 65535
3031	Logic function 3 input 2, input.	Word / F33		R/W*	0 – 65535
3032	Logic function 3 input 3, input.	Word / F33		R/W*	0 – 65535
3033	Logic function 3 input 4, input.	Word / F33		R/W*	0 – 65535
3034	Logic function 3 mask.	Word / F2		R/W*	0 – 65535
3035	Logic function 4 input 1, input.	Word / F33		R/W*	0 – 65535
3036	Logic function 4 input 2, input.	Word / F33		R/W*	0 – 65535
3037	Logic function 4 input 3, input.	Word / F33		R/W*	0 – 65535
3038	Logic function 4 input 4, input.	Word / F33		R/W*	0 – 65535
3039	Logic function 4 mask.	Word / F2		R/W*	0 – 65535
3040	Logic function 5 input 1, input.	Word / F33		R/W*	0 – 65535
3041	Logic function 5 input 2, input.	Word / F33		R/W*	0 – 65535
3042	Logic function 5 input 3, input.	Word / F33		R/W*	0 – 65535
3043	Logic function 5 input 4, input.	Word / F33		R/W*	0 – 65535
3044	Logic function 5 mask.	Word / F2		R/W*	0 – 65535
3045	Logic function 6 input 1, input.	Word / F33		R/W*	0 – 65535
3046	Logic function 6 input 2, input.	Word / F33		R/W*	0 – 65535
3047	Logic function 6 input 3, input.	Word / F33		R/W*	0 – 65535
3048	Logic function 6 input 4, input.	Word / F33		R/W*	0 – 65535
3049	Logic function 6 mask.	Word / F2		R/W*	0 – 65535
3050	Comparator 1 input.	Word / F36		R/W*	0 – 65535
3051	Comparator 1 high, high limit.	Word / F2		R/W*	0 – 65535
3052	Comparator 1 high, low limit.	Word / F2		R/W*	0 – 65535
3053	Comparator 1 low, high limit.	Word / F2		R/W*	0 – 65535
3054	Comparator 1 low, low limit.	Word / F2		R/W*	0 – 65535
3055	Comparator 2 input.	Word / F36		R/W*	0 – 65535
3056	Comparator 2 high, high limit.	Word / F2		R/W*	0 – 65535
3057	Comparator 2 high, low limit.	Word / F2		R/W*	0 – 65535
3058	Comparator 2 low, high limit.	Word / F2		R/W*	0 – 65535
3059	Comparator 2 low, low limit.	Word / F2		R/W*	0 – 65535
3060	Thermal capacity comparator high, high limit.	Word / F2		R/W*	1 – 100
3061	Thermal capacity comparator high limit.	Word / F2		R/W*	1 – 100
3062 - 3069	Reserved.	Word / F2		R/W*	0 – 65535

Table 21.2.6.b: Modbus logic settings register address 3030 to 3069.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
3070	Counter 1 limit.	Word / F2		R/W*	0 – 65535
3071	Counter 1 count up input.	Word / F33		R/W*	0 – 65535
3072	Counter 1 count down input.	Word / F33		R/W*	0 – 65535
3073	Counter 1 reset input.	Word / F33		R/W*	0 – 65535
3074	Counter 2 limit.	Word / F2		R/W*	0 – 65535
3075	Counter 2 count up input.	Word / F33		R/W*	0 – 65535
3076	Counter 2 count down input.	Word / F33		R/W*	0 – 65535
3077	Counter 2 reset input.	Word / F33		R/W*	0 – 65535
3078	Latch 1 set input.	Word / F33		R/W*	0 – 65535
3079	Latch 1 reset input.	Word / F33		R/W*	0 – 65535
3080	Latch 2 set input.	Word / F33		R/W*	0 – 65535
3081	Latch 2 reset input.	Word / F33		R/W*	0 – 65535
3082	Logic alarm flag mask 0. Bit 00 : Over current. Bit 01 : Current unbalance. Bit 02 : Current single phase. Bit 03 : Minimum load. Bit 04 : I2 negative sequence. Bit 05 : Run stall. Bit 06 : Short circuit high, high. Bit 07 : Short circuit high. Bit 08 : Vector stall. Bit 09 : Over voltage. Bit 10 : Under voltage. Bit 11 : Voltage phase rotation. Bit 12 : Voltage unbalance. Bit 13 : Voltage loss of power. Bit 14 : Voltage over frequency. Bit 15 : Voltage under frequency.	Word / F10		R/W*	0 – 65535

Table 21.2.6.c: Modbus logic settings register address 3070 to 3082.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
3083	Logic alarm flag mask 1. Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R/W*	0 – 65535
3084	Logic alarm flag mask 2. Bit 00 : Shunt trip. Bit 01 : Starts per hour 1 start left. Bit 02 : Error loading KG/KH-RTU relay settings. Bit 03 : Current fundamental. Bit 04 : Current THD. Bit 05 : Voltage fundamental. Bit 06 : Voltage THD. Bit 07 – 15 : Reserved.	Word / F12		R/W*	0 – 65535
3085	Logic alarm flag mask 3 – Reserved.	Word / F2		R/W*	0 – 65535

Table 21.2.6.d: Modbus logic settings register address 3083 to 3085.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
3086	Logic trip flag mask 0. Bit 00 : Over current. Bit 01 : Current unbalance. Bit 02 : Current single phase. Bit 03 : Minimum load. Bit 04 : I2 negative sequence. Bit 05 : Run stall. Bit 06 : Short circuit high, high. Bit 07 : Short circuit high. Bit 08 : Vector stall. Bit 09 : Over voltage. Bit 10 : Under voltage. Bit 11 : Voltage phase rotation. Bit 12 : Voltage unbalance. Bit 13 : Voltage loss of power. Bit 14 : Voltage over frequency. Bit 15 : Voltage under frequency.	Word / F10		R/W*	0 – 65535
3087	Logic trip flag mask 1. Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R/W*	0 – 65535

Table 21.2.6.e: Modbus logic settings register address 3086 to 3087.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
3088	Logic trip flag mask 2. Bit 00 : Shunt trip. Bit 01 : Starts per hour 1 start left. Bit 02 : Error loading KG/KH-RTU relay settings. Bit 03 : Current fundamental. Bit 04 : Current THD. Bit 05 : Voltage fundamental. Bit 06 : Voltage THD. Bit 07 to bit 15 : Reserved.	Word / F12		R/W*	0 – 65535
3089	Logic trip flag mask 3 – Reserved.	Word / F2		R/W*	0 – 65535
3090	Pulse generator input.	Word / F33		R/W*	0 – 65535
3091	Pulse generator period.	Word / F2	Min	R/W*	1 – 1000
3092	Pulse generator duty cycle.	Word / F2	%	R/W*	1 – 100
3093	Logic RTC start time.	Byte high / F1	Hour	R/W*	0 – 23
		Byte low / F1	Min	R/W*	0 – 59
3094	Logic RTC stop time.	Byte high / F1	Hour	R/W*	0 – 23
		Byte low / F1	Min	R/W*	0 – 59
3095	Timer 1 type. 0 : ON delay. 1 : Latch ON delay. 2 : OFF delay 3 : ON pulse.	Word / F37		R/W*	0 – 3
3096	Timer 1 start input.	Word / F33		R/W*	0 – 65535
3097	Timer 1 reset input.	Word / F33		R/W*	0 – 65535
3098	Timer 1 time out.	Word / F2	x 0.1 Sec	R/W*	1 – 60000
3099	Timer 2 type. 0 : ON delay. 1 : Latch ON delay. 2 : OFF delay 3 : ON pulse.	Word / F37		R/W*	0 – 3
3100	Timer 2 start input.	Word / F33		R/W*	0 – 65535
3101	Timer 2 reset input.	Word / F33		R/W*	0 – 65535
3102	Timer 2 time out.	Word / F2	x 0.1 Sec	R/W*	1 – 60000
3103 - 3999	Reserved.	Word / F2		R/W*	0 - 65535

Table 21.2.6.f: Modbus logic settings register address 3088 to 3999.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

21.2.7 Low Voltage Switch Gear Settings

Addr	Name	Type / Format	Unit	R/W	Range
4000	Reserved	Word / F2		R/W*	0 – 65535
4001	Starter control.	Word / F2		R/W*	0 – 65535
4002	Starter input type selection. 0 : Push button. 1 : Hold till start. 2 : Latch button. Bit 00 to bit 03 : Local start. Bit 04 to bit 07 : Remote start. Bit 08 to bit 11 : PLC start.	Word / F36		R/W*	0 – 65535
4003	Start source selection LSB input.	Word / F33		R/W*	0 – 65535
4004	Start source selection MSB input.	Word / F33		R/W*	0 – 65535
4005	Emergency stop input.	Word / F33		R/W*	0 – 65535
4006	Feedback signal input.	Word / F33		R/W*	0 – 65535
4007	Pre-start warning time.	Word / F2	Sec	R/W*	0 – 999
4008	Execution trip delay.	Word / F2	Sec	R/W*	1 – 20
4009	Feedback trip delay.	Word / F2	mSec	R/W*	10 – 10000
4010	Back spin timer.	Word / F2	Sec	R/W*	0 – 999
4011	DC brake timer.	Word / F2	mSec	R/W*	0 – 10000
4012	Unauthorized current trip delay.	Word / F2	mSec	R/W*	0 – 5000
4013	Local start input.	Word / F33		R/W*	0 – 65535
4014	Local interlock input.	Word / F33		R/W*	0 – 65535
4015	Local stop input.	Word / F33		R/W*	0 – 65535
4016	Remote start input.	Word / F33		R/W*	0 – 65535
4017	Remote interlock input.	Word / F33		R/W*	0 – 65535
4018	Remote stop input.	Word / F33		R/W*	0 – 65535
4019	PLC start input.	Word / F33		R/W*	0 – 65535
4020	PLC interlock input.	Word / F33		R/W*	0 – 65535
4021	PLC stop input.	Word / F33		R/W*	0 – 65535
4022 - 4999	Reserved	Word / F2		R/W*	0 – 65535

Table 21.2.7: Modbus starter settings register address 4000 to 4999.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

21.2.8 Statistic Data

Addr	Name	Type / Format	Unit	R/W	Range
5000 - 5001	Reserved.	Word / F2		R/W*	0 - 65535
5002 - 5003	Motor total running hour counter.	Double word / F3	0.1 x Hrs	R/W*	0 - 10000000
5004 - 5005	Motor running on load hour counter.	Double word / F3	0.1 x Hrs	R/W*	0 - 10000000
5006 - 5007	Motor available hour counter.	Double word / F3	0.1 x Hrs	R/W*	0 - 10000000
5008 - 5009	Motor on trip hour counter.	Double word / F3	0.1 x Hrs	R/W*	0 - 10000000
5010	Number of starts executed.	Word / F2		R/W*	0 - 65535
5011	Number of successful starts.	Word / F2		R/W*	0 - 65535
5012	Power up counter.	Word / F2		R/W*	0 - 65535
5013	Trips accumulated counter.	Word / F2		R/W*	0 - 65535
5014	Thermal capacity last used.	Word / F2	%	R/W*	0 - 65535
5015	Maximum thermal capacity used during a start.	Word / F2	%	R/W*	0 - 65535
5016	Maximum load during a start.	Word / F2	A	R/W*	0 - 65535
5017	Reserved.	Word / F2		R/W*	0 - 65535
5018 - 5019	Total kVAh.	Double word / F3	kVAh	R/W*	0 - 10000000
5020 - 5021	Phase 1 kVAh.	Double word / F3	kVAh	R/W*	0 - 10000000
5022 - 5023	Phase 2 kVAh.	Double word / F3	kVAh	R/W*	0 - 10000000
5024 - 5025	Phase 3 kVAh.	Double word / F3	kVAh	R/W*	0 - 10000000

Table 21.2.8.a: Modbus statistic register address 5000 to 5025.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
5026 - 5027	Total kWh.	Double word / F3	kWh	R/W*	0 - 10000000
5028 - 5029	Phase 1 kWh.	Double word / F3	kWh	R/W*	0 - 10000000
5030 - 5031	Phase 2 kWh.	Double word / F3	kWh	R/W*	0 - 10000000
5032 - 5033	Phase 3 kWh.	Double word / F3	kWh	R/W*	0 - 10000000
5034 - 5035	Total kVArh.	Double word / F3	kVArh	R/W*	0 - 10000000
5036 - 5037	Phase 1 kVArh.	Double word / F3	kVArh	R/W*	0 - 10000000
5038 - 5039	Phase 2 kVArh.	Double word / F3	kVArh	R/W*	0 - 10000000
5040 - 5041	Phase 3 kVArh.	Double word / F3	kVArh	R/W*	0 - 10000000
5042 - 5043	IL1 maximum amps during run.	Float / F4	A	R/W*	See F4.
5044 - 5045	IL1 minimum amps during run.	Float / F4	A	R/W*	See F4.
5046 - 5047	IL2 maximum amps during run.	Float / F4	A	R/W*	See F4.
5048 - 5049	IL2 minimum amps during run.	Float / F4	A	R/W*	See F4.
5050 - 5051	IL3 maximum amps during run.	Float / F4	A	R/W*	See F4.
5052 - 5053	IL3 minimum amps during run.	Float / F4	A	R/W*	See F4.

Table 21.2.8.b: Modbus statistic register address 5026 to 5053.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
5054	VL1 maximum phase voltage during running.	Word / F2	VAC	R/W*	0 - 65535
5055	VL1 minimum phase voltage during running.	Word / F2	VAC	R/W*	0 - 65535
5056	VL2 maximum phase voltage during running.	Word / F2	VAC	R/W*	0 - 65535
5057	VL2 minimum phase voltage during running.	Word / F2	VAC	R/W*	0 - 65535
5058	VL3 maximum phase voltage during running.	Word / F2	VAC	R/W*	0 - 65535
5059	VL3 minimum phase voltage during running.	Word / F2	VAX	R/W*	0 - 65535
5060	VL maximum frequency level.	Word / F2	Hz	R/W*	0 - 65535
5061	VL minimum frequency level.	Word / F2	Hz	R/W*	0 - 65535
5062 - 5063	Phase 1 VA maximum.	Double word / F3	VA	R/W*	0 - 10000000
5064 - 5065	Phase 1 VA minimum.	Double word / F3	VA	R/W*	0 - 10000000
5066 - 5067	Phase 2 VA maximum.	Double word / F3	VA	R/W*	0 - 10000000
5068 - 5069	Phase 2 VA minimum.	Double word / F3	VA	R/W*	0 - 10000000
5070 - 5071	Phase 3 VA maximum.	Double word / F3	VA	R/W*	0 - 10000000
5072 - 5073	Phase 3 VA minimum.	Double word / F3	VA	R/W*	0 - 10000000
5074 - 5075	Phase 1 W maximum.	Double word / F3	W	R/W*	0 - 10000000
5076 - 5077	Phase 1 W minimum.	Double word / F3	W	R/W*	0 - 10000000
5078 - 5079	Phase 2 W maximum.	Double word / F3	W	R/W*	0 - 10000000
5080 - 5081	Phase 2 W minimum.	Double word / F3	W	R/W*	0 - 10000000

Table 21.2.8.c: Modbus statistic register address 5054 to 5081.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
5082 - 5083	Phase 3 maximum.	Double word / F3	W	R/W*	0 - 10000000
5084 - 5085	Phase 3 minimum.	Double word / F3	W	R/W*	0 - 10000000
5086 - 5087	Phase 1 VAr maximum.	Double word / F3	VAr	R/W*	0 - 10000000
5088 - 5089	Phase 1 VAr minimum.	Double word / F3	VAr	R/W*	0 - 10000000
5090 - 5091	Phase 2 VAr maximum.	Double word / F3	VAr	R/W*	0 - 10000000
5092 - 5093	Phase 2 VAr minimum.	Double word / F3	VAr	R/W*	0 - 10000000
5094 - 5095	Phase 3 VAr maximum.	Double word / F3	VAr	R/W*	0 - 10000000
5096 - 5097	Phase 3 VAr minimum.	Double word / F3	VAr	R/W*	0 - 10000000
5098	Phase 1 maximum power factor level.	Word / F2	CosPI	R/W*	0 – 100
5099	Phase 1 minimum power factor level.	Word / F2	CosPI	R/W*	0 – 100
5100	Phase 2 maximum power factor level.	Word / F2	CosPI	R/W*	0 – 100
5101	Phase 2 minimum power factor level.	Word / F2	CosPI	R/W*	0 – 100
5102	Phase 3 maximum power factor level.	Word / F2	CosPI	R/W*	0 – 100
5103	Phase 3 minimum power factor level.	Word / F2	CosPI	R/W*	0 – 100
5104 - 5999	Reserved	Word / F2		R/W*	0 - 65535

Table 21.2.8.d: Modbus statistic register address 5082 to 5999.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

21.2.9 Modbus-RTU Settings

Addr	Name	Type / Format	Unit	R/W	Range
6000	Reserved.	Word / F2		R/W*	0 - 65535
6001	Modbus-RTU address.	Word / F2		R/W*	1 - 255
6002	Modbus-RTU baud rate. 0 : 1200 bps. 1 : 2400 bps. 2 : 4800 bps. 3 : 9600 bps. 4 : 19200 bps. 5 : 38400 bps. 6 : 57600 bps. 7 : 115200 bps.	Word /		R/W*	0 – 7
6003	Modbus-RTU timeout.	Word / F2	Sec	R/W*	0 - 60
6004 - 8499	Reserved.	Word / F2		R/W*	0 - 65535

Table 21.2.9: Modbus-RTU configuration register address 6000 to 8499.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

21.2.10 KG/KH-RTU System Clock Settings

Addr	Name	Type / Format	Unit	R/W	Range
8500	Year.	Byte high / F1		R/W*	0 – 99
	Month.	Byte low / F1			1 – 12
8501	Day.	Word / F2		R/W*	1 – 31
8502	Hour.	Byte high / F1	Hour	R/W*	0 – 23
	Minute.	Byte low / F1	Min		0 – 59
8503	Second.	Word / F2	Sec	R/W*	0 – 59
8504	Update RTC.	Word / F2		R/W*	0 – 65535

Table 21.2.10: Modbus RTC configuration register address 8500 to 8499.

*Write a value of 1 (0x0001) to register 8504 to update the clock of the KG/KH-RTU relay.

21.2.11 Fault Records

<table>
<tr><th>Addr</th><th>Name</th><th>Type / Format</th><th>Unit</th><th>R/W</th><th>Range</th></tr>
<tr><td>10000</td><td>Reserved.</td><td>Word / F2</td><td></td><td>R/W</td><td>0 – 65535</td></tr>
<tr><td>10001</td><td>Reset faults.</td><td>Word / F2</td><td></td><td>R/W*</td><td>0 – 65535</td></tr>
<tr><td>10002</td><td>Fault record number requested.</td><td>Word / F2</td><td></td><td>R/W**</td><td>0 – 208</td></tr>
<tr><td>10003</td><td>Fault record number send.</td><td>Word / F2</td><td></td><td>R</td><td>0 – 208</td></tr>
<tr><td rowspan="2">10004</td><td>Fault month.</td><td>Byte high / F1</td><td></td><td rowspan="2">R</td><td>1 – 12</td></tr>
<tr><td>Fault day.</td><td>Byte low / F1</td><td></td><td>1 – 31</td></tr>
<tr><td rowspan="2">10005</td><td>Reserved.</td><td>Byte high / F1</td><td></td><td rowspan="2">R</td><td>0 – 255</td></tr>
<tr><td>Fault year.</td><td>Byte low / F1</td><td></td><td>0 – 99</td></tr>
<tr><td rowspan="2">10006</td><td>Fault seconds.</td><td>Byte high / F1</td><td>Sec</td><td rowspan="2">R</td><td>0 – 59</td></tr>
<tr><td>Fault 10th of a mSec.</td><td>Byte low / F1</td><td>mSec</td><td>0 – 99</td></tr>
<tr><td rowspan="2">10007</td><td>Fault hour.</td><td>Byte high / F1</td><td>Hour</td><td rowspan="2">R</td><td>0 – 23</td></tr>
<tr><td>Fault minute.</td><td>Byte low / F1</td><td>Min</td><td>0 – 59</td></tr>
<tr><td rowspan="17">10008</td><td>Fault trip flags 0.</td><td rowspan="17">Word / F10</td><td rowspan="17"></td><td rowspan="17">R</td><td rowspan="17">0 – 65535</td></tr>
<tr><td>Bit 00 : Over current.</td></tr>
<tr><td>Bit 01 : Current unbalance.</td></tr>
<tr><td>Bit 02 : Current single phase.</td></tr>
<tr><td>Bit 03 : Minimum load.</td></tr>
<tr><td>Bit 04 : I2 negative sequence.</td></tr>
<tr><td>Bit 05 : Run stall.</td></tr>
<tr><td>Bit 06 : Short circuit high, high.</td></tr>
<tr><td>Bit 07 : Short circuit high.</td></tr>
<tr><td>Bit 08 : Vector stall.</td></tr>
<tr><td>Bit 09 : Over voltage.</td></tr>
<tr><td>Bit 10 : Under voltage.</td></tr>
<tr><td>Bit 11 : Voltage phase rotation.</td></tr>
<tr><td>Bit 12 : Voltage unbalance.</td></tr>
<tr><td>Bit 13 : Voltage loss of power.</td></tr>
<tr><td>Bit 14 : Voltage over frequency.</td></tr>
<tr><td>Bit 15 : Voltage under frequency.</td></tr>
</table>

Table 21.2.11.a: Modbus KG/KH-RTU fault records register address 10000 to 10008.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic. 0x005A must be written to register 10001.

**Request a fault from 0 to 208 were 0 is the latest fault.

Addr	Name	Type / Format	Unit	R/W	Range
10009	Fault trip flags 1. Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R	0 – 65535
10010	Fault trip flags 2. Bit 00 : Shunt trip. Bit 01 : Starts per hour 1 start left. Bit 02 : Error loading KG/KH-RTU relay settings. Bit 03 : Current fundamental. Bit 04 : Current THD. Bit 05 : Voltage fundamental. Bit 06 : Voltage THD. Bit 07 to bit 15 : Reserved.	Word / F12		R	0 – 65535
10011	Fault trip flags 3 - Reserved.	Word / F2		R	0 – 65535
10012	Status word. Bit 00 : In service or feedback active. Bit 01 : Voltage present. Bit 02 : A warning flag is active. Bit 03 : A alarm flag is active. Bit 04 : A trip flag is active. Bit 08 : Relay 1 status. Bit 09 : Relay 2 status. Bit 10 : Field input 1 status. Bit 11 : Field input 2 status. Bit 12 : Field input 3 status. Bit 13 : Protection setting unlocked. Bit 14 : Logic setting unlocked. Bit 15 : Simulator active.	Word / F8		R	0 - 65535

Table 21.2.11.b: Modbus KG/KH-RTU fault records register address 10009 to 10012.

Addr	Name	Type / Format	Unit	R/W	Range
10013	Thermal capacity remaining.	Word / F2	%	R	0 – 100
10014	IL1 level.	Word / F2	%	R	0 – 1000
10015	IL2 level.	Word / F2	%	R	0 – 1000
10016	IL3 level.	Word / F2	%	R	0 – 1000
10017	IL unbalance level.	Word / F2	%	R	0 – 100
10018	I2 negative sequence level.	Word / F2	%	R	0 – 1000
10019	VL1 phase level.	Word / F2	VAC	R	0 – 65535
10020	VL2 phase level.	Word / F2	VAC	R	0 – 65535
10021	VL3 phase level.	Word / F2	VAC	R	0 – 65535
10022	VL unbalance.	Word / F2	%	R	0 – 100
10023	V2 negative sequence.	Word / F2	%	R	0 – 65535
10024	Voltage line frequency.	Word / F2	Hz	R	0 – 1000
10025	Earth leakage level.	Word / F2	mA	R	0 – 30000
10026	I0 zero sequence.	Word / F2	%	R	0 – 1000
10027	Breaker clear time.	Word / F2	mSec	R	0 – 65000
10028 - 10029	Running hours.	Double word / F3	0.1 x Hour	R	0 - 10000000
10030	IL THD level.	Word / F2	%	R	0 – 1000
10031	VL THD level.	Word / F2	%	R	0 – 1000
10032	IL fundamental level.	Byte high / F1	%	R	0 – 1000
	IL fundamental phase.	Byte low / F1		R*	0 – 32
10033	VL fundamental level.	Byte high / F1	%	R	0 – 1000
	VL fundamental phase.	Byte low / F1		R*	0 – 32

Table 21.2.11.c: Modbus KG/KH-RTU fault records register address 10013 to 10033.

21.2.12 Event Records

Addr	Name	Type / Format	Unit	R/W	Range
10100	Reserved.	Word / F2		R/W	0 – 65535
10101	Event record number requested.	Word / F2		R/W*	0 – 882
10102	Event record number send.	Word / F2		R	0 – 882
10103	Event month.	Byte high / F1		R	1 – 12
	Event day.	Byte low / F1			1 – 31
10104	Reserved.	Byte high / F1		R	0 – 255
	Event year.	Byte low / F1			0 – 99
10105	Event seconds.	Byte high / F1	Sec	R	0 – 59
	Event 10^{th} of a mSec.	Byte low / F1	mSec		0 – 99
10106	Event hour.	Byte high / F1	Hour	R	0 – 23
	Event minute.	Byte low / F1	Min		0 – 59
10107	**Event alarm flags 0.**	Word / F10		R	0 – 65535
	Bit 00 : Over current.				
	Bit 01 : Current unbalance.				
	Bit 02 : Current single phase.				
	Bit 03 : Minimum load.				
	Bit 04 : I2 negative sequence.				
	Bit 05 : Run stall.				
	Bit 06 : Short circuit high, high.				
	Bit 07 : Short circuit high.				
	Bit 08 : Vector stall.				
	Bit 09 : Over voltage.				
	Bit 10 : Under voltage.				
	Bit 11 : Voltage phase rotation.				
	Bit 12 : Voltage unbalance.				
	Bit 13 : Voltage loss of power.				
	Bit 14 : Voltage over frequency.				
	Bit 15 : Voltage under frequency.				

Table 21.2.12.a: Modbus KG/KH-RTU event records register address 10100 to 10107.

*Request event from 0 to 882. Event 0 being the newest event.

Addr	Name	Type / Format	Unit	R/W	Range
10108	Event alarm flags 1. Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R	0 - 65535
10109	Event alarm flags 2. Bit 00 : Shunt trip. Bit 01 : Starts per hour 1 start left. Bit 02 : Error loading KG/KH-RTU relay settings. Bit 03 : Current fundamental. Bit 04 : Current THD. Bit 05 : Voltage fundamental. Bit 06 : Voltage THD. Bit 07 to bit 15 : Reserved.	Word / F12		R	0 – 65535
10110	Event alarm flags 3 – Reserved.	Word / F2		R	0 – 65535

Table 21.2.12.b: Modbus KG/KH-RTU event records register address 10108 to 10110.

Addr	Name	Type / Format	Unit	R/W	Range
10111	Event trip flags 0. Bit 00 : Over current. Bit 01 : Current unbalance. Bit 02 : Current single phase. Bit 03 : Minimum load. Bit 04 : I2 negative sequence. Bit 05 : Run stall. Bit 06 : Short circuit high, high. Bit 07 : Short circuit high. Bit 08 : Vector stall. Bit 09 : Over voltage. Bit 10 : Under voltage. Bit 11 : Voltage phase rotation. Bit 12 : Voltage unbalance. Bit 13 : Voltage loss of power. Bit 14 : Voltage over frequency. Bit 15 : Voltage under frequency.	Word / F10		R	0 – 65535
10112	Event trip flags 1. Bit 00 : Earth leakage. Bit 01 : Earth fault high, high. Bit 02 : Earth fault high. Bit 03 : I0 zero sequence. Bit 04 : Insulation failure. Bit 05 : Vacuum failure. Bit 06 : Reserved. Bit 07 : Custom trip 1. Bit 08 : Custom trip 2. Bit 09 : Custom trip 3. Bit 10 : Custom trip 4. Bit 11 : Execution. Bit 12 : Feedback. Bit 13 : Unauthorized current. Bit 14 : Emergency stop. Bit 15 : Frozen contact.	Word / F11		R	0 – 65535

Table 21.2.12.c: Modbus KG/KH-RTU event records register address 10111 to 10112.

Addr	Name	Type / Format	Unit	R/W	Range
10113	**Fault trip flags 2.**	Word / F12		R	0 – 65535
	Bit 00 : Shunt trip.				
	Bit 01 : Starts per hour 1 start left.				
	Bit 02 : Error loading KG/KH-RTU relay settings.				
	Bit 03 : Current fundamental.				
	Bit 04 : Current THD.				
	Bit 05 : Voltage fundamental.				
	Bit 06 : Voltage THD.				
	Bit 07 to bit 15 : Reserved.				
10114	Fault trip flags 3 - Reserved.	Word / F2		R	0 – 65535
10115	Status word.	Word / F8		R	0 - 65535
	Bit 00 : In service or feedback active.				
	Bit 01 : Voltage present.				
	Bit 02 : A warning flag is active.				
	Bit 03 : A alarm flag is active.				
	Bit 04 : A trip flag is active.				
	Bit 08 : Relay 1 status.				
	Bit 09 : Relay 2 status.				
	Bit 10 : Field input 1 status.				
	Bit 11 : Field input 2 status.				
	Bit 12 : Field input 3 status.				
	Bit 13 : Protection setting unlocked.				
	Bit 14 : Logic setting unlocked.				
	Bit 15 : Simulator active.				
10116	Reserved.	Word / F2		R	0 – 65535
10117	Thermal capacity remaining.	Word / F2	%	R	0 – 100
10118	IL1 level.	Word / F2	%	R	0 – 1000
10119	IL2 level.	Word / F2	%	R	0 – 1000
10120	IL3 level.	Word / F2	%	R	0 – 1000
10121	IL unbalance level.	Word / F2	%	R	0 – 100
10122	I2 negative sequence.	Word / F2	%	R	0 – 1000
10123	VL1 phase level.	Word / F2	VAC	R	0 – 65535
10124	VL2 phase level.	Word / F2	VAC	R	0 – 65535
10125	VL3 phase level.	Word / F2	VAC	R	0 – 65535
10126	VL unbalance level.	Word / F2	%	R	0 – 100
10127	V2 negative sequence.	Word / F2	%	R	0 – 65535
10128	VL frequency level.	Word / F2	%	R	0 – 1000
10129	Earth leakage level.	Word / F2	mA	R	0 - 30000
10130	I0 negative sequence.	Word / F2	%	R	0 – 1000
10131	Time to clear.	Word / F2	mSec	R	0 – 65530

Table 21.2.12.d: Modbus KG/KH-RTU event records register address 10113 to 10131.

Addr	Name	Type / Format	Unit	R/W	Range
10132 - 10133	Running hours.	Double word / F3	0.1 x Hour	R	0 – 10000000
10134	Recuring counter.	Word / F2		R	0 – 65535
10135	Event type.	Word / F4		R	0 – 65535
10136	IL THD level.	Word / F2	%	R	0 – 1000
10137	VL THD level.	Word / F2	%	R	0 – 1000
10138	IL fundamental level.	Byte high / F1	%	R	0 – 1000
	IL fundamental phase.	Byte low / F1		R*	0 – 32
10139	VL fundamental level.	Byte high / F1	%	R	0 – 1000
	VL fundamental phase.	Byte low / F1		R*	0 – 32

Table 21.2.12.e: Modbus KG/KH-RTU event records register address 10132 to 10139.

21.2.13 Description Settings

Addr	Name	Type / Format	Unit	R/W	Range
11000	Reserved.	Word / F2		R/W*	0 – 65535
11001 - 11010	Unit ID [10].	Word array / F5		R/W*	Char
11011 - 11025	Unit description [15].	Word array / F5		R/W*	Char
11026 - 11035	Field input 1 description [10].	Word array / F5		R/W*	Char
11036 - 11045	Field input 2 description [10].	Word array / F5		R/W*	Char
11046 - 11055	Field input 3 description [10].	Word array / F5		R/W*	Char
11056 - 11065	Relay 2 description [10].	Word array / F5		R/W*	Char
11066 - 11075	RTU bit 00 description [10].	Word array / F5		R/W*	Char
11076 - 11085	RTU bit 01 description [10].	Word array / F5		R/W*	Char
11086 - 11095	RTU bit 02 description [10].	Word array / F5		R/W*	Char
11096 - 11105	RTU bit 03 description [10].	Word array / F5		R/W*	Char
11106 - 11115	RTU bit 04 description [10].	Word array / F5		R/W*	Char
11116 - 11125	RTU bit 05 description [10].	Word array / F5		R/W*	Char
11126 - 11135	RTU bit 06 description [10].	Word array / F5		R/W*	Char

Table 21.2.13.a: Modbus description setting register address 11000 to 11135.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
11136 - 11145	RTU bit 07 description [10].	Word array / F5		R/W*	Char
11146 - 11155	RTU bit 08 description [10].	Word array / F5		R/W*	Char
11156 - 11165	RTU bit 09 description [10].	Word array / F5		R/W*	Char
11166 - 11175	RTU bit 10 description [10].	Word array / F5		R/W*	Char
11176 - 11185	RTU bit 11 description [10].	Word array / F5		R/W*	Char
11186 - 11195	RTU bit 12 description [10].	Word array / F5		R/W*	Char
11196 - 11205	RTU bit 13 description [10].	Word array / F5		R/W*	Char
11206 - 11215	RTU bit 14 description [10].	Word array / F5		R/W*	Char
11216 - 11225	RTU bit 15 description [10].	Word array / F5		R/W*	Char
11226 - 11235	Bluetooth bit 00 description [10].	Word array / F5		R/W*	Char
11236 - 11245	Bluetooth bit 01 description [10].	Word array / F5		R/W*	Char
11246 - 11255	Bluetooth bit 02 description [10].	Word array / F5		R/W*	Char
11256 - 11265	Bluetooth bit 03 description [10].	Word array / F5		R/W*	Char
11266 - 11275	Bluetooth bit 04 description [10].	Word array / F5		R/W*	Char

Table 21.2.13.b: Modbus description setting register address 11136 to 11275.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
11276 - 11285	Bluetooth bit 05 description [10].	Word array / F5		R/W*	Char
11286 - 11295	Bluetooth bit 06 description [10].	Word array / F5		R/W*	Char
11296 - 11305	Bluetooth bit 07 description [10].	Word array / F5		R/W*	Char
11306 - 11315	Bluetooth bit 08 description [10].	Word array / F5		R/W*	Char
11316 - 11325	Bluetooth bit 09 description [10].	Word array / F5		R/W*	Char
11326 - 11335	Bluetooth bit 10 description [10].	Word array / F5		R/W*	Char
11336 - 11345	Bluetooth bit 11 description [10].	Word array / F5		R/W*	Char
11346 - 11355	Bluetooth bit 12 description [10].	Word array / F5		R/W*	Char
11356 - 11465	Bluetooth bit 13 description [10].	Word array / F5		R/W*	Char
11466 - 11475	Bluetooth bit 14 description [10].	Word array / F5		R/W*	Char
11476 - 11485	Bluetooth bit 15 description [10].	Word array / F5		R/W*	Char
11486 - 11495	User trip 1 description [10].	Word array / F5		R/W*	Char
11496 - 11505	User trip 2 description [10].	Word array / F5		R/W*	Char
11506 - 11515	User trip 3 description [10].	Word array / F5		R/W*	Char

Table 21.2.13.c: Modbus description setting register address 11276 to 11515.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
11416 - 11425	User trip 4 description [10].	Word array / F5		R/W*	Char
11426 - 11435	Timer 1 description [10].	Word array / F5		R/W*	Char
11436 - 11445	Timer 2 description [10].	Word array / F5		R/W*	Char
11446 - 11455	Logic table 1 description [10].	Word array / F5		R/W*	Char
11456 - 11465	Logic table 2 description [10].	Word array / F5		R/W*	Char
11466 - 11475	Logic table 3 description [10].	Word array / F5		R/W*	Char
11476 - 11485	Logic table 4 description [10].	Word array / F5		R/W*	Char
11486 - 11495	Logic table 5 description [10].	Word array / F5		R/W*	Char
11496 - 11505	Logic table 6 description [10].	Word array / F5		R/W*	Char
11506 - 11515	Latch 1 description [10].	Word array / F5		R/W*	Char
11516 - 11525	Latch 2 description [10].	Word array / F5		R/W*	Char
11526 - 11535	Comparator 1 description [10].	Word array / F5		R/W*	Char
11536 - 11545	Comparator 2 description [10].	Word array / F5		R/W*	Char
11546 - 11555	Counter 1 description [10].	Word array / F5		R/W*	Char

Table 21.2.13.d: Modbus description setting register address 11416 to 11555.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

Addr	Name	Type / Format	Unit	R/W	Range
11556 - 11565	Counter 2 description [10].	Word array / F5		R/W*	Char
11566 - 11575	Pulse generator description [10].	Word array / F5		R/W*	Char
11576 - 11585	Logic RTC start and stop description [10].	Word array / F5		R/W*	Char

Table 21.2.13.e: Modbus description setting register address 11556 to 11585.

* With password protection enabled, control bits register 900 needs to be set to the correct password to unlock logic.

22 Format Tables

22.1 Format Tables

<table>
<tr><th>Code</th><th colspan="2">Description</th></tr>
<tr><td>F1</td><td colspan="2">Byte, 8 bit value that can range from 0 to 255.</td></tr>
<tr><td>F2</td><td colspan="2">Word, 16 bit value that can range from 0 to 65535.</td></tr>
<tr><td>F3</td><td colspan="2">Double word, 32 bit value that can range from 0 to 4294967295.</td></tr>
<tr><td>F4</td><td colspan="2">Float, 32 bit single precision value 1.175494351 x 10^{-38} to 3.402823466 x 10^{38}.</td></tr>
<tr><td>F5</td><td colspan="2">Word array specified with the amount of words between ‘[]’ in the description field.</td></tr>
<tr><td rowspan="32">F6</td><td colspan="2">Status code (Word Value)</td></tr>
<tr><td>Value</td><td>Description</td></tr>
<tr><td>1</td><td>Unauthorized current alarm flag.</td></tr>
<tr><td>2</td><td>Fronzen contact alarm flag.</td></tr>
<tr><td>3</td><td>Reserved.</td></tr>
<tr><td>4</td><td>Short circuit high, high alarm flag.</td></tr>
<tr><td>5</td><td>I0 zero sequence alarm flag.</td></tr>
<tr><td>6</td><td>Reserved.</td></tr>
<tr><td>7</td><td>Earth fault high, high alarm flag.</td></tr>
<tr><td>8</td><td>Earth fault high alarm flag.</td></tr>
<tr><td>9</td><td>Earth leakage alarm flag.</td></tr>
<tr><td>10</td><td>Running stall alarm flag.</td></tr>
<tr><td>11</td><td>Vectorial stall alarm flag.</td></tr>
<tr><td>12</td><td>Reserved.</td></tr>
<tr><td>13</td><td>IL single phase alarm flag.</td></tr>
<tr><td>14</td><td>Reserved.</td></tr>
<tr><td>15</td><td>IL unbalance alarm flag.</td></tr>
<tr><td>16</td><td>Reserved.</td></tr>
<tr><td>17</td><td>IL negative sequence alarm flag.</td></tr>
<tr><td>18 – 20</td><td>Reserved.</td></tr>
<tr><td>21</td><td>Over current alarm flag.</td></tr>
<tr><td>22 – 24</td><td>Reserved.</td></tr>
<tr><td>25</td><td>IL minimum load alarm flag.</td></tr>
<tr><td>26 – 28</td><td>Reserved.</td></tr>
<tr><td>29</td><td>Insulation lockout alarm flag.</td></tr>
<tr><td>30</td><td>Reserved.</td></tr>
<tr><td>31</td><td>VL over frequency alarm flag.</td></tr>
<tr><td>32</td><td>VL under frequency alarm flag.</td></tr>
<tr><td>33 – 41</td><td>Reserved.</td></tr>
<tr><td>42</td><td>Over voltage alarm flag.</td></tr>
<tr><td>43</td><td>Under voltage alarm flag.</td></tr>
</table>

Table 22.1.a: Modbus format table.

Code	Description

	Status code (Word Value) continue.	
	Value	Description
F6	44 – 45	Reserved.
	46	VL unbalance alarm flag.
	47 – 89	Reserved.
	90	Custom trip 1 alarm flag.
	91	Custom trip 2 alarm flag.
	92	Custom trip 3 alarm flag.
	93	Custom trip 4 alarm flag.
	94 – 95	Reserved.
	96	IL fundamental alarm flag.
	97	IL THD alarm flag.
	98	VL fundamental alarm flag.
	99	VL THD alarm flag.
	100 – 103	Reserved.
	104	Execution alarm flag.
	105	Feedback alarm flag.
	106 – 503	Reserved.
	504	IL current active.
	505	Reserved.
	506	Feedback signal active.
	507 – 514	Reserved.
	515	Pre-start warning active.
	516	Application starting.
	517 – 999	Reserved.
	1000	Unathorized current trip flag.
	1001	Reserved.
	1002	Short circuit high, high trip flag.
	1003	I0 sequence current trip flag.
	1004	Reserved.
	1005	Earth fault high, high trip flag.
	1006	Earth fault high trip flag.
	1007	Earth leakage trip flag.
	1008	Running stall trip flag.
	1009	Vectorial stall trip flag.
	1010	Reserved.
	1011	IL single phase trip flag.
	1012	Reserved.
	1013	IL unbalance trip flag.
	1014	Reserved.
	1015	I2 negative sequence trip flag.
	1016 – 1018	Reserved.

Table 22.1.b: Modbus format table continue.

Code	Description

	Status code (Word Value) continue.	
	Value	**Description**
F6	1019	Overcurrent trip flag.
	1020 – 1022	Reserved.
	1023	IL minimum load trip flag.
	1024 – 1026	Reserved.
	1027	Insulation lockout trip flag.
	1028	Reserved.
	1029	VL over frequency trip flag.
	1030	VL under frequency trip flag.
	1031 – 1039	Reserved.
	1040	Over voltage trip flag.
	1041	Under voltage trip flag.
	1042	VL unbalance trip flag.
	1043 – 1047	Reserved.
	1048	Voltage phase rotation trip flag.
	1049 – 1089	Reserved.
	1090	Cutom trip 1 trip flag.
	1091	Custom trip 2 trip flag.
	1092	Custom trip 3 trip flag.
	1093	Custom trip 4 trip flag.
	1094 – 1095	Reserved.
	1096	IL fundamental trip flag.
	1097	IL THD trip flag.
	1098	VL fundamental trip flag.
	1099	VL THD trip flag.
	1100	Execution trip flag.
	1101	Feedback trip flag.
	1102 – 1104	Reserved.
	1105	Shunt trip, trip flag.
	1106	Frozen contact trip flag.
	1107 – 1116	Reserved.
	1117	Starts per hour trip flag.
	1118	Any interlock active.
	1119	Emergency stop trip flag.
	1120	Load settings trip flag.
	1121	Reserved.
	1122	VL LOP trip flag.
	1123 – 65527	Reserved.
	65528	Backspin active.
	65529	Any stop active.
	65530	Any interlock active.

Table 22.1.c: Modbus format table continue.

Code	Description

Code	Value	Description
F6	**Status code (Word Value) continue.**	
	Value	**Description**
	65531	One more start left.
	65533	Reserved.
	65534	Starter ready.
	65535	Unknown condition.
F7	**Warning flag code (Word value).**	
	Value	**Description**
	0	Reserved.
	1	Unauthorized current.
	2	Frozen contact.
	3	Reserved.
	4	Short circuit high, high.
	5	I0 zero sequence.
	6	Reserved.
	7	Earth fault high, high.
	8	Earth fault high.
	9	Earth leakage.
	10	Running stall.
	11	Vectorial stall.
	12	Reserved.
	13	IL single phase.
	14	Reserved.
	15	IL unbalance.
	16	Reserved.
	17	I2 negative sequence.
	18 – 20	Reserved.
	21	Over current.
	22 – 24	Reserved.
	25	IL minimum load.
	26 – 28	Reserved.
	29	Insulation lockout.
	30	Reserved.
	31	VL over frequency.
	32	VL under frequency.
	33 – 41	Reserved.
	42	Over voltage.
	43	Under voltage.
	44 – 45	Reserved.
	46	VL unbalance.
	47 – 89	Reserved.
	90	Custom trip 1.

Table 22.1.d: Modbus format table continue.

Code	Description

F7	**Warning flag code (Word value).**	
	Value	**Description**
	91	Custom trip 2.
	92	Custom trip 3.
	93	Custom trip 4.
	94 – 95	Reserved.
	96	IL fundamental.
	97	IL THD.
	98	VL fundamental.
	99	VL THD.
	100 – 65535	Reserved.
F8	**Status word (Word value).**	
	Bit	**Description**
	00	In service or feedback active.
	01	Voltage present.
	02	A warning flag is active.
	03	A alarm flag is active.
	04	A trip flag is active.
	05 – 07	Reserved.
	08	Relay 1 status.
	09	Relay 2 status.
	10	Field input 1 status.
	11	Field input 2 status.
	12	Field input 3 status.
	13	Bit Protection setting unlocked.
	14	Logic setting unlocked.
	15	Simulator active.
F9	**System flags 0 (Word value).**	
	Bit	**Description**
	00	In service flag.
	01	Voltage present flag.
	02	Relay 1 energized.
	03	Relay 2 energized.
	04	Field input 1 status.
	05	Field input 2 status.
	06	Field input 3 status.
	07	Application starting up.
	08	Application running.
	09	Application stopped.
	10	Protection password unlocked.
	11	Logic password unlocked.
	12 – 15	Reserved.

Table 22.1.e: Modbus format table continue.

Code	Description	
F10	**Flags 0 (Word value).**	
	Bit	**Description**
	00	Over current.
	01	Current unbalance.
	02	Current single phase.
	03	Minimum load.
	04	I2 negative sequence.
	05	Run stall.
	06	Short circuit high, high.
	07	Short circuit high.
	08	Vector stall.
	09	Over voltage.
	10	Under voltage.
	11	Voltage phase rotation.
	12	Voltage unbalance.
	13	Voltage loss of power.
	14	Voltage over frequency.
	15	Voltage under frequency.
F11	**Flags 1 (Word value).**	
	Bit	**Description**
	00	Earth leakage.
	01	Earth fault high, high.
	02	Earth fault high.
	03	I0 zero sequence.
	04	Insulation failure.
	05	Vacuum failure.
	06	Reserved.
	07	Custom trip 1.
	08	Custom trip 2.
	09	Custom trip 3.
	10	Custom trip 4.
	11	Execution.
	12	Feedback.
	13	Unauthorized current.
	14	Emergency stop.
	15	Frozen contact.

Table 22.1.f: Modbus format table continue.

Code	Description	
F12	**Flags 2 (Word value).**	
	Bit	**Description**
	00	Shunt trip.
	01	Starts per hour 1 start left. (No starts left for trip flags)
	02	Error loading KG/KH-RTU relay settings.
	03	Current fundamental.
	04	Current THD.
	05	Voltage fundamental.
	06	Voltage THD.
	07 – 15	Reserved.
F13	**Logic flags 0 (Word value).**	
	Bit	**Description**
	00	Logic function table 1 output.
	01	Logic function table 2 output.
	02	Logic function table 3 output.
	03	Logic function table 4 output.
	04	Logic function table 5 output.
	05	Logic function table 6 output.
	06	Thermal capacity high, high output.
	07	Thermal capacity high output.
	08	Comparator 1 high, high output.
	09	Comparator 1 high output.
	10	Comparator 1 high, low output.
	11	Comparator 1 between output.
	12	Comparator 1 low, high output.
	13	Comparator 1 low output.
	14	Comparator 1 low, low output.
	15	Pulse generator output.

Table 22.1.g: Modbus format table continue.

Code	Description	
F14	**Logic flags 1 (Word value).**	
	Bit	**Description**
	00	Comparator 2 high, high output.
	01	Comparator 2 high output.
	02	Comparator 2 high, low output.
	03	Comparator 2 between output.
	04	Comparator 2 low, high output.
	05	Comparator 2 low output.
	06	Comparator 2 low, low output.
	07	Counter 1 output.
	08	Counter 2 output.
	09	Latch 1 output.
	10	Latch 2 output.
	11	Alarm flag mask output.
	12	Trip flag mask output.
	13	Logic RTC start stop output.
	14	Timer 1 output.
	15	Timer 2 output.
F15	**Logic flags 2 (Word value).**	
	Bit	**Description**
	00	Reset push button active.
	01	External reset active.
	02	Modbus-RTU reset active.
	03	BT reset active.
	04	Thermal capacity auto reset active.
	05	Minimum load auto reset active.
	06 – 07	Reserved.
	08	Status reporter output.
	09 - 15	Reserved.

Table 22.1.h: Modbus format table continue.

Code	Description	
F16	**Starter flags 0 (Word value).**	
	Bit	**Description**
	00	Starter ready.
	01	Input selected LSB status.
	02	Input selected MSB status.
	03	Feedback signal output.
	04	Pre-start warning active.
	05	Pre-start warning complete.
	06	Start command active.
	07	Stop command active.
	08	Interlock command active.
	09	Back spin active.
	10	DC brake active.
	11	Emergency stop status.
	12	Starter logic main contact control status.
	13 – 15	Reserved.
F17	**Starter flags 1 (Word value).**	
	Bit	**Description**
	00	Local start active.
	01	Local interlock active.
	02	Local stop active.
	03	Remote start active.
	04	Remote interlock active.
	05	Remote stop active.
	06	PLC start active.
	07	PLC interlock active.
	08	PLC stop active.
	09 – 15	Reserved.

Table 22.1.i: Modbus format table continue.

Code	Description	
F18	**Control word from Modbus-RTU PLC / Bluetooth(Word value).**	
	Bit	**Description**
	00	Control bit 00.
	01	Control bit 01.
	02	Control bit 02.
	03	Control bit 03.
	04	Control bit 04.
	05	Control bit 05.
	06	Control bit 06.
	07	Control bit 07.
	08	Control bit 08.
	09	Control bit 09.
	10	Control bit 10.
	11	Control bit 11.
	12	Control bit 12.
	13	Control bit 13.
	14	Control bit 14.
	15	Control bit 15.
F19	**Reset command Modbus-RTU PLC / Bluetooth (Word value).**	
	Bit	**Description**
	00	Reset KG/KH-RTU.
	01 – 15	Reserved.
F20	**Voltage line frequency selection (Word value).**	
	Value	**Description**
	0	50 Hz.
	1	60 Hz.
F21	**Relay protection type selection (Word value).**	
	Value	**Description**
	0	Protection relay.
	1	Motor DOL.
	2	Feeder.
F22	**System configuration control register (Word value).**	
	Bit	**Description**
	00	Relay 1 non-fail safe enabled.
	01	Voltage phase rotation reversed.
	02 – 15	Reserved.
F23	**Current protection control register (Word value).**	
	Bit	**Description**
	00	Under current source: 0 : Load. 1 : Power factor.
	01 – 15	Reserved.

Table 22.1.j: Modbus format table continue.

Code	Description	
F24	**IL protection warnings or trips enabled (Word value).**	
	Bit	**Description**
	00	IL unbalance.
	01	IL single phase.
	02	IL under current.
	03	IL I2 negative sequence.
	04	IL Running stall.
	05	IL Short circuit high, high.
	06	IL Short circuit high.
	07	IL Vectorial stall.
	08 – 15	Reserved.
F25	**Protection curve selection (Word value).**	
	Value	**Description**
	0	IEC 60255-08 machine I2T.
	1	DEFT.
	2	IEC NINV.
	3	IEC VINV.
	4	IEC LINV.
	5	IEC EINV.
	6	ANSI MINV.
	7	ANSI VINV.
	8	ANSI EINV.
	9	Thermal flat.
	10	IT.
	11	I^2T.
	12	I^4T.
F26	**Protection reset type (Word value).**	
	Value	**Description**
	0	Manual.
	1	Instantaneous.
	2	Delayed.
	3	Curve.
F27	**Voltage protection control register (Word value).**	
	Bit	**Description**
	00	Over voltage warning without load enabled.
	01	Over voltage trip without load enabled.
	02	Under voltage warning without load enabled.
	03	Under voltage trip without load enabled.
	04 – 15	Reserved.

Table 22.1.k: Modbus format table continue.

Code	Description	
F28	**VL protection warnings or trips enabled (Word value).**	
	Bit	**Description**
	00	Over voltage.
	01	Under voltage.
	02	Phase rotation.
	03	Voltage symmetry.
	04	Voltage loss of power.
	05	Over frequency.
	06	Under frequency.
	07 – 15	Reserved.
F29	**Earth warning or trip enabled (Word value).**	
	Bit	**Description**
	00	Earth leakage.
	01	Earth fault high, high.
	02	Earth fault high.
	03	I0 zero sequence.
	04	Insulation failure.
	05	Vacuum failure.
	06 - 15	Reserved.
F30	**Protection curve selection 1 (Word value)**	
	Value	**Description**
	0	DEFT.
	1	IDMT.
	2	IEC NINV.
	3	IEC VINV.
	4	IEC LINV.
	5	IEC EINV.
	6	ANSI MINV.
	7	ANSI VINV.
	8	ANSI EINV.
	9	Thermal flat.
	10	IT
	11	I^2T
	12	I^4T

Table 22.1.l: Modbus format table continue.

Code	Description	
F31	**System protection control (Word value).**	
	Bit	**Description**
	00	Custom trip 1 active low enabled.
	01	Custom trip 2 active low enabled.
	02	Custom trip 3 active low enabled.
	03	Custom trip 4 active low enabled.
	04 – 15	Reserved.
F32	**System warning or trip enabled (Word value).**	
	Bit	**Description**
	00	Reserved.
	01	Custom trip 1 warning enabled.
	02	Custom trip 2 warning enabled.
	03	Custom trip 3 warning enabled.
	04	Custom trip 4 warning enabled.
	05	One start left warning enabled.
	06 - 15	Reserved.
F33	**Lookup table 1 (Word value).**	
	Value	**Description**
	0	False.
	1	True.
	2	Current active.
	3	Voltage active.
	4	Relay 1 status.
	5	Relay 2 status.
	6	Field input 1 status.
	7	Field input 2 status.
	8	Field input 3 status.
	9	System starting up.
	10	System running.
	11	System stop.
	12	Protection unlocked.
	13	Logic unlocked.
	14	Over current warning flag.
	15	Current unbalance warning flag.
	16	Current single phase warning flag.
	17	Minimum load warning flag.
	18	I2 negative sequency warning flag.
	19	Running stall warning flag.
	20	Short circuit high, high warning flag.
	21	Short circuit high warning flag.
	22	Vectorial stall warning flag.
	23	Over voltage warning flag.
	24	Under voltage warning flag.

Table 22.1.m: Modbus format table continue.

Code	Description	
	Lookup table 1 continue (Word value).	
	Value	**Description**
	25	Voltage phase rotation warning flag.
	26	Voltage unbalance warning flag.
	27	Voltage loss of potential warning flag.
	28	Voltage over frequency warning flag.
	29	Voltage under frequency warning flag.
	30	Earth leakage warning flag.
	31	Earth fault high, high warning flag.
	32	Earth fault high warning flag.
	33	I0 zero sequency warning flag.
	34	Insulation warning flag.
	35	Vacuum failure warning flag.
	37	Custom trip 1 warning flag.
	38	Custom trip 2 warning flag.
	39	Custom trip 3 warning flag.
	40	Custom trip 4 warning flag.
	41	Execution warning flag.
	42	Feedback warning flag.
	43	Unauthorized current warning flag.
F33	44	Emergency stop warning flag.
	45	Frozen contact warning flag.
	46	Shunt trip warning flag.
	47	One start left warning flag.
	48	Load settings error warning flag.
	49	IL fundamental warning flag.
	50	IL THD warning flag.
	51	VL fundamental warning flag.
	52	VL THD warning flag.
	53	Over current alarm flag.
	54	IL unbalance alarm flag.
	55	IL single phase alarm flag.
	56	Minimum load alarm flag.
	57	I2 negative sequence alarm flag.
	58	Running stall alarm flag.
	59	Short circuit high, high alarm flag.
	60	Short circuit high alarm flag.
	61	Vectorial stall alarm flag.
	62	Over voltage alarm flag.
	63	Under voltage alarm flag.
	64	Voltage phase rotation alarm flag.
	65	Voltage unbalance alarm flag.

Table 22.1.n: Modbus format table continue.

Code	Description	
	Lookup table 1 continue (Word value).	
	Value	**Description**
F33	66	Voltage loss of potential alarm flag.
	67	Voltage over frequency alarm flag.
	68	Voltage under frequency alarm flag.
	69	Earth leakage alarm flag.
	70	Earth fault high, high alarm flag.
	71	Earth fault high alarm flag.
	72	I0 zero sequence alarm flag.
	73	Insulation alarm flag.
	74	Vacuum alarm flag.
	76	Custom trip 1 alarm flag.
	77	Custom trip 2 alarm flag.
	78	Custom trip 3 alarm flag.
	79	Custom trip 4 alarm flag.
	80	Execution alarm flag.
	81	Feedback alarm flag.
	82	Unauthorized current alarm flag.
	83	Emergency stop alarm flag.
	84	Frozen contact alarm flag.
	85	Shunt trip, alarm flag.
	86	One more start left alarm flag.
	87	Load settings error alarm flag.
	88	IL fundamental alarm flag.
	89	IL THD alarm flag.
	90	VL fundamental alarm flag.
	91	VL THD alarm flag.
	92	Over current trip flag.
	93	IL unbalance trip flag.
	94	IL single phase trip flag.
	95	Minimum load trip flag.
	96	I2 negative sequence trip flag.
	97	Running stall trip flag.
	98	Short circuit high, high trip flag.
	99	Short circuit high trip flag.
	100	Vectorial stall trip flag.
	101	Over voltage trip flag.
	102	Under voltage trip flag.
	103	Voltage phase rotation trip flag.
	104	VL unbalance trip flag.
	105	Voltage loss of potential trip flag.
	106	Voltage over frequency.

Table 22.1.o: Modbus format table continue.

Code	Description	
	Lookup table 1 continue (Word value).	
	Value	Description
	107	Voltage under frequency trip flag.
	108	Earth leakage trip flag.
	109	Earth fault high, high trip flag.
	110	Earth fault high trip flag.
	111	I0 zero sequency trip flag.
	112	Insulation trip flag.
	113	Vacuum trip flag.
	115	Custom trip 1 trip flag.
	116	Custom trip 2 trip flag.
	117	Custom trip 3 trip flag.
	118	Custom trip 4 trip flag.
	119	Execution trip flag.
	120	Feedback trip flag.
	121	Unauthorized current trip flag.
	122	Emergency stop trip flag.
	123	Frozen contact trip flag.
	124	Shunt trip, trip flag.
	125	No more starts left trip flag.
F33	126	Load settings error trip flag.
	127	IL fundamental trip flag.
	128	IL THD trip flag.
	129	VL fundamental trip flag.
	130	VL THD trip flag.
	131	Logic table 1 output status.
	132	Logic table 2 output status.
	133	Logic table 3 output status.
	134	Logic table 4 output status.
	135	Logic table 5 output status.
	136	Logic table 6 output status.
	137	Thermal capacity compare high, high output status.
	138	Thermal capacity compare high output status.
	139	Comparator 1 high, high output status.
	140	Comparator 1 high output status.
	141	Comparator 1 high low output status.
	142	Comparator 1 between output status.
	143	Comparator 1 low high output status.
	144	Comparator 1 low output status.
	145	Comparator 1 low, low output status.
	146	Pulse generator output status.
	147	Comparator 2 high, high output status.

Table 22.1.p: Modbus format table continue.

Code	Description	
	Lookup table 1 continue (Word value).	
	Value	Description
	148	Comparator 2 high output status.
	149	Comparator 2 high low output status.
	150	Comparator 2 between output status.
	151	Comparator 2 low high output status.
	152	Comparator 2 low output status.
	153	Comparator 2 low, low output status.
	154	Counter 1 output status.
	155	Counter 2 output status.
	156	Latch 1 output status.
	157	Latch 2 output status.
	158	Logic alarm mask output status.
	159	Logic trip mask output status.
	160	RTC output status.
	161	Timer 1 output status.
	162	Timer 2 output status.
	163	Control panel reset button status.
	164	Field input reset status.
	165	Modbus-RTU reset status.
F33	166	Bluetooth reset status.
	167	Thermal auto reset status.
	168	Minimum load restart flag.
	169	Status reporter flag.
	170	Protection ready or healthy.
	171	Starter selection LSB output status.
	172	Starter selection MSB output status.
	173	Feedback signal status.
	174	Pre-start warning active.
	175	Pre-start warning completed.
	176	Any start active.
	177	Any stop active.
	178	Any interlock active.
	179	Back spin active.
	180	DC brake active.
	181	Emergency stop active.
	182	Starter logic relay output status.
	183	Local start active.
	184	Local interlock active.
	185	Local stop active.
	186	Remote start active.
	187	Remote interlock active.

Table 22.1.q: Modbus format table continue.

Code	Description	
	Lookup table 1 continue (Word value).	
	Value	Description
	188	Remote stop active.
	189	PLC start active.
	190	PLC interlock active.
	191	PLC stop active.
	192	Modbus-RTU control word bit 00 status.
	193	Modbus-RTU control word bit 01 status.
	194	Modbus-RTU control word bit 02 status.
	195	Modbus-RTU control word bit 03 status.
	196	Modbus-RTU control word bit 04 status.
	197	Modbus-RTU control word bit 05 status.
	198	Modbus-RTU control word bit 06 status.
	199	Modbus-RTU control word bit 07 status.
	200	Modbus-RTU control word bit 08 status.
	201	Modbus-RTU control word bit 09 status.
	202	Modbus-RTU control word bit 10 status.
	203	Modbus-RTU control word bit 11 status.
	204	Modbus-RTU control word bit 12 status.
F33	205	Modbus-RTU control word bit 13 status.
	206	Modbus-RTU control word bit 14 status.
	207	Modbus-RTU control word bit 15 status.
	208	Bluetooth control word bit 00 status.
	209	Bluetooth control word bit 01 status.
	210	Bluetooth control word bit 02 status.
	211	Bluetooth control word bit 03 status.
	212	Bluetooth control word bit 04 status.
	213	Bluetooth control word bit 05 status.
	214	Bluetooth control word bit 06 status.
	215	Bluetooth control word bit 07 status.
	216	Bluetooth control word bit 08 status.
	217	Bluetooth control word bit 09 status.
	218	Bluetooth control word bit 10 status.
	219	Bluetooth control word bit 11 status.
	220	Bluetooth control word bit 12 status.
	221	Bluetooth control word bit 13 status.
	222	Bluetooth control word bit 14 status.
	223	Bluetooth control word bit 15 status.
	+32768	Add to the numbers above for F33 to invert the bit.

Table 22.1.r: Modbus format table continue.

Code	Description	
F34	**Lookup table 2 (Word value).**	
	Value	**Description**
	1	Field input 1 status.
	2	Field input 2 status.
	3	Field input 3 status.
F35	**Harmonic warning and trip enabled (Word value).**	
	Bit	**Description**
	00	IL fundamental.
	01	VL fundamental.
	02	IL THD.
	03	VL THD.
	04 – 15	Reserved.
F36	**Lookup table 3 (Word value).**	
	Value	**Description**
	0	Current level maximum percentage.
	1	IL1 level percentage.
	2	IL2 level percentage.
	3	IL3 level percentage.
	4	Current unbalance level percentage.
	5	I1 positive sequence level percentage.
	6	I2 negative sequence level percentage.
	7	I0 zero sequence level percentage.
	8	VL minimum phase voltage level VAC.
	9	VL1 phase voltage level VAC.
	10	VL2 phase voltage level VAC.
	11	VL3 phase voltage level VAC.
	12	VL line frequency maximum Hz.
	13	Voltage unbalance level percentage.
	14	V1 positive sequence level percentage.
	15	V2 negative sequence level percentage.
	16	V0 zero sequence level percentage.
	17	Earth leakage level mA.
	18	Insulation level kOhms.
	19	Maximum power factor level cosθ.
	20	L1 power factor level cosθ.
	21	L2 power factor level cosθ.
	22	L3 power factor level cosθ.
	23	Thermal capacity level/ time till trip remaining percentage.
	24	Counter 1 value.
	25	Counter 2 value.
	26	Starts left.
	27	IL1 to IL2 phase angle degrees.

Table 22.1.s: Modbus format table continue.

Code	Description	
	Lookup table 3 continue (Word value).	
	Value	Description
	28	IL2 to IL3 phase angle degrees.
	29	IL3 to IL1 phase angle degrees.
	30	VL1 to VL2 phase angle degrees.
	31	VL2 to VL3 phase angle degrees.
	32	VL3 to VL1 phase angle degrees.
	33	VL1 to IL1 phase angle degrees.
	34	VL2 to IL2 phase angle degrees.
	35	VL3 to IL3 phase angle degrees.
	36	IL1 fundamental 0 level percentage.
	37	IL1 fundamental 1 level percentage.
	38	IL1 fundamental 2 level percentage.
	39	IL1 fundamental 3 level percentage.
	40	IL1 fundamental 4 level percentage.
	41	IL1 fundamental 5 level percentage.
	42	IL1 fundamental 6 level percentage.
	43	IL1 fundamental 7 level percentage.
	44	IL1 fundamental 8 level percentage.
	45	IL1 fundamental 9 level percentage.
F36	46	IL1 fundamental 10 level percentage.
	47	IL1 fundamental 11 level percentage.
	48	IL1 fundamental 12 level percentage.
	49	IL1 fundamental 13 level percentage.
	50	IL1 fundamental 14 level percentage.
	51	IL1 fundamental 15 level percentage.
	52	IL1 fundamental 16 level percentage.
	53	IL1 fundamental 17 level percentage.
	54	IL1 fundamental 18 level percentage.
	55	IL1 fundamental 19 level percentage.
	56	IL1 fundamental 20 level percentage.
	57	IL1 fundamental 21 level percentage.
	58	IL1 fundamental 22 level percentage.
	59	IL1 fundamental 23 level percentage.
	60	IL1 fundamental 24 level percentage.
	61	IL1 fundamental 25 level percentage.
	62	IL1 fundamental 26 level percentage.
	63	IL1 fundamental 27 level percentage.
	64	IL1 fundamental 28 level percentage.
	65	IL1 fundamental 29 level percentage.
	66	IL1 fundamental 30 level percentage.
	67	IL1 fundamental 31 level percentage.

Table 22.1.t: Modbus format table continue.

Code	Description	
F36	**Lookup table 3 continue (Word value).**	
	Value	**Description**
	68	IL2 fundamental 0 level percentage.
	69	IL2 fundamental 1 level percentage.
	70	IL2 fundamental 2 level percentage.
	71	IL2 fundamental 3 level percentage.
	72	IL2 fundamental 4 level percentage.
	73	IL2 fundamental 5 level percentage.
	74	IL2 fundamental 6 level percentage.
	75	IL2 fundamental 7 level percentage.
	76	IL2 fundamental 8 level percentage.
	77	IL2 fundamental 9 level percentage.
	78	IL2 fundamental 10 level percentage.
	79	IL2 fundamental 11 level percentage.
	80	IL2 fundamental 12 level percentage.
	81	IL2 fundamental 13 level percentage.
	82	IL2 fundamental 14 level percentage.
	83	IL2 fundamental 15 level percentage.
	84	IL2 fundamental 16 level percentage.
	85	IL2 fundamental 17 level percentage.
	86	IL2 fundamental 18 level percentage.
	87	IL2 fundamental 19 level percentage.
	88	IL2 fundamental 20 level percentage.
	89	IL2 fundamental 21 level percentage.
	90	IL2 fundamental 22 level percentage.
	91	IL2 fundamental 23 level percentage.
	92	IL2 fundamental 24 level percentage.
	93	IL2 fundamental 25 level percentage.
	94	IL2 fundamental 26 level percentage.
	95	IL2 fundamental 27 level percentage.
	96	IL2 fundamental 28 level percentage.
	97	IL2 fundamental 29 level percentage.
	98	IL2 fundamental 30 level percentage.
	99	IL2 fundamental 31 level percentage.
	100	IL3 fundamental 0 level percentage.
	101	IL3 fundamental 1 level percentage.
	102	IL3 fundamental 2 level percentage.
	103	IL3 fundamental 3 level percentage.
	104	IL3 fundamental 4 level percentage.
	105	IL3 fundamental 5 level percentage.
	106	IL3 fundamental 6 level percentage.
	107	IL3 fundamental 7 level percentage.

Table 22.1.u: Modbus format table continue.

Code	Description	
	Lookup table 3 continue (Word value).	
	Value	**Description**
	108	IL3 fundamental 8 level percentage.
	109	IL3 fundamental 9 level percentage.
	110	IL3 fundamental 10 level percentage.
	111	IL3 fundamental 11 level percentage.
	112	IL3 fundamental 12 level percentage.
	113	IL3 fundamental 13 level percentage.
	114	IL3 fundamental 14 level percentage.
	115	IL3 fundamental 15 level percentage.
	116	IL3 fundamental 16 level percentage.
	117	IL3 fundamental 17 level percentage.
	118	IL3 fundamental 18 level percentage.
	119	IL3 fundamental 19 level percentage.
	120	IL3 fundamental 20 level percentage.
	121	IL3 fundamental 21 level percentage.
	122	IL3 fundamental 22 level percentage.
	123	IL3 fundamental 23 level percentage.
	124	IL3 fundamental 24 level percentage.
	125	IL3 fundamental 25 level percentage.
F36	126	IL3 fundamental 26 level percentage.
	127	IL3 fundamental 27 level percentage.
	128	IL3 fundamental 28 level percentage.
	129	IL3 fundamental 29 level percentage.
	130	IL3 fundamental 30 level percentage.
	131	IL3 fundamental 31 level percentage.
	132	VL1 fundamental 0 level percentage.
	133	VL1 fundamental 1 level percentage.
	134	VL1 fundamental 2 level percentage.
	135	VL1 fundamental 3 level percentage.
	136	VL1 fundamental 4 level percentage.
	137	VL1 fundamental 5 level percentage.
	138	VL1 fundamental 6 level percentage.
	139	VL1 fundamental 7 level percentage.
	140	VL1 fundamental 8 level percentage.
	141	VL1 fundamental 9 level percentage.
	142	VL1 fundamental 10 level percentage.
	143	VL1 fundamental 11 level percentage.
	144	VL1 fundamental 12 level percentage.
	145	VL1 fundamental 13 level percentage.
	146	VL1 fundamental 14 level percentage.
	147	VL1 fundamental 15 level percentage.

Table 22.1.v: Modbus format table continue.

Code	Description	
	Lookup table 3 continue (Word value).	
	Value	**Description**
F36	148	VL1 fundamental 16 level percentage.
	149	VL1 fundamental 17 level percentage.
	150	VL1 fundamental 18 level percentage.
	151	VL1 fundamental 19 level percentage.
	152	VL1 fundamental 20 level percentage.
	153	VL1 fundamental 21 level percentage.
	154	VL1 fundamental 22 level percentage.
	155	VL1 fundamental 23 level percentage.
	156	VL1 fundamental 24 level percentage.
	157	VL1 fundamental 25 level percentage.
	158	VL1 fundamental 26 level percentage.
	159	VL1 fundamental 27 level percentage.
	160	VL1 fundamental 28 level percentage.
	161	VL1 fundamental 29 level percentage.
	162	VL1 fundamental 30 level percentage.
	163	VL1 fundamental 31 level percentage.
	164	VL2 fundamental 0 level percentage.
	165	VL2 fundamental 1 level percentage.
	166	VL2 fundamental 2 level percentage.
	167	VL2 fundamental 3 level percentage.
	168	VL2 fundamental 4 level percentage.
	169	VL2 fundamental 5 level percentage.
	170	VL2 fundamental 6 level percentage.
	171	VL2 fundamental 7 level percentage.
	172	VL2 fundamental 8 level percentage.
	173	VL2 fundamental 9 level percentage.
	174	VL2 fundamental 10 level percentage.
	175	VL2 fundamental 11 level percentage.
	176	VL2 fundamental 12 level percentage.
	177	VL2 fundamental 13 level percentage.
	178	VL2 fundamental 14 level percentage.
	179	VL2 fundamental 15 level percentage.
	180	VL2 fundamental 16 level percentage.
	181	VL2 fundamental 17 level percentage.
	182	VL2 fundamental 18 level percentage.
	183	VL2 fundamental 19 level percentage.
	184	VL2 fundamental 20 level percentage.
	185	VL2 fundamental 21 level percentage.
	186	VL2 fundamental 22 level percentage.
	187	VL2 fundamental 23 level percentage.

Table 22.1.w: Modbus format table continue.

Code	Description	
	Lookup table 3 continue (Word value).	
	Value	**Description**
F36	188	VL2 fundamental 24 level percentage.
	189	VL2 fundamental 25 level percentage.
	190	VL2 fundamental 26 level percentage.
	191	VL2 fundamental 27 level percentage.
	192	VL2 fundamental 28 level percentage.
	193	VL2 fundamental 29 level percentage.
	194	VL2 fundamental 30 level percentage.
	195	VL2 fundamental 31 level percentage.
	196	VL3 fundamental 0 level percentage.
	197	VL3 fundamental 1 level percentage.
	198	VL3 fundamental 2 level percentage.
	199	VL3 fundamental 3 level percentage.
	200	VL3 fundamental 4 level percentage.
	201	VL3 fundamental 5 level percentage.
	202	VL3 fundamental 6 level percentage.
	203	VL3 fundamental 7 level percentage.
	204	VL3 fundamental 8 level percentage.
	205	VL3 fundamental 9 level percentage.
	206	VL3 fundamental 10 level percentage.
	207	VL3 fundamental 11 level percentage.
	208	VL3 fundamental 12 level percentage.
	209	VL3 fundamental 13 level percentage.
	210	VL3 fundamental 14 level percentage.
	211	VL3 fundamental 15 level percentage.
	212	VL3 fundamental 16 level percentage.
	213	VL3 fundamental 17 level percentage.
	214	VL3 fundamental 18 level percentage.
	215	VL3 fundamental 19 level percentage.
	216	VL3 fundamental 20 level percentage.
	217	VL3 fundamental 21 level percentage.
	218	VL3 fundamental 22 level percentage.
	219	VL3 fundamental 23 level percentage.
	220	VL3 fundamental 24 level percentage.
	221	VL3 fundamental 25 level percentage.
	222	VL3 fundamental 26 level percentage.
	223	VL3 fundamental 27 level percentage.
	224	VL3 fundamental 28 level percentage.
	225	VL3 fundamental 29 level percentage.
	226	VL3 fundamental 30 level percentage.
	227	VL3 fundamental 31 level percentage.

Table 22.1.x: Modbus format table continue.

Code	Description	
F36	**Lookup table 3 continue (Word value).**	
	Value	**Description**
	228	IL1 THD level percentage.
	229	IL2 THD level percentage.
	230	IL3 THD level percentage.
	231	IL THD maximum level percentage.
	232	VL1 THD level percentage.
	233	VL2 THD level percentage.
	234	VL3 THD level percentage.
	235	VL THD maximum level percentage.
	236	Modbus-RTU control word value.
	237	Bluetooth control word value.
F37	**Timer type selection (Word value).**	
	Value	**Description**
	0	ON delay.
	1	Latch ON delay.
	2	OFF delay.
	3	ON pulse.
F38	**Starter input type selection (Word value).**	
	Value	**Description**
	0	Push button.
	1	Hold till start.
	2	Latch button.
	Bit	**Description**
	00 – 03	Local start. See values above.
	04 – 07	Remote start. See values above.
	08 – 11	PLC start. See values above.
	12 – 15	Reserved.
F39	**Event type**	
	Value	**Description**
	0	None.
	1	Power up.
	2	Start attempt.
	3	Running.
	4	Stopped.
	5	Alarm condition.
	6	Trip condition.
	8	Emergency stop.
	9	Settings loading error.
	10	Modbus-RTU changed settings.
	11	Modbus-RTU changed statistic data.
	12	Modbus-RTU erased faults.

Table 22.1.y: Modbus format table continue.

Code	Description	
F39	Event type	
	Value	Description
	13	Modbus-RTU erased events.
	14	Modbus-RTU changed thermal capacity level.
	15	Modbus-RTU changed calibration.
	16	Modbus-RTU changed password.
	17	Modbus-RTU reset passwords with master key.
	18	Modbus-RTU reset command.
	19	Modbus-RTU changed RTC.
	30	Bluetooth changed settings.
	31	Bluetooth changed statistics.
	32	Bluetooth changed password.
	33	Bluetooth reset command.
	34	Bluetooth changed RTC.
	40	Reset push button command.
	41	External reset command.
	90	Pre-start warning start.
	91	Pre-star warning complete.
	92	Feedback detected.
	93	Local start command.
	94	Local stop command.
	95	Local interlock command.
	96	Remote start command.
	97	Remote stop command.
	98	Remote interlock command.
	99	PLC start command.
	100	PLC stop command.
	101	PLC interlock command.
	102	Starter input selection changed.
	103	Back spin timer start.
	104	Back spin timer stop.
	105	DC brake timer start.
	106	DC brake timer stop.
	+0x8000	Add to above to indicate that the simulator was active.

Table 22.1.z: Modbus format table continue.

23 Part Numbers

NewElec KG_KH-RTU Ordering Information Description.	Part No	Bin No.
KG-RTU 1 Amp	FPR1200	
KG-RTU 5 Amp	FPR1201	
KG-RTU 10 Amp	FPR1202	
KG-RTU 25 Amp	FPR1203	
KG-RTU 50 Amp	FPR1204	
KG-RTU 100 Amp	FPR1205	
KH-RTU 1 Amp	FPR1206	
KH-RTU 5 Amp	FPR1207	
KH-RTU 10 Amp	FPR1208	
KH-RTU 25 Amp	FPR1209	
KH-RTU 50 Amp	FPR1210	
KH-RTU 100 Amp	FPR1211	
Comms Cable	CAB0012	
USB to RS486 converter	CAB0013	

Table 14.0: Ordering info

24 Revision History

Revision History		
Date	**Revision**	**Description**
19 Oct 2022	01B-03	Submission for release.
24 Feb 2023	01C-00	Added the new external reset lookup table.

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