Littelfuse®
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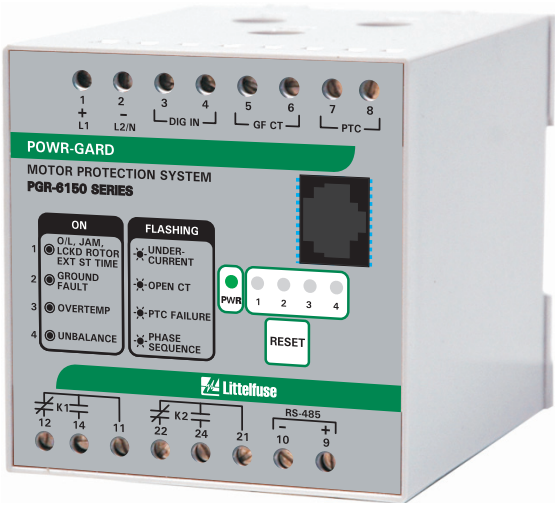
POWR-GARD®
Motor Protection
PGR-6150 SERIES
Motor Protection System

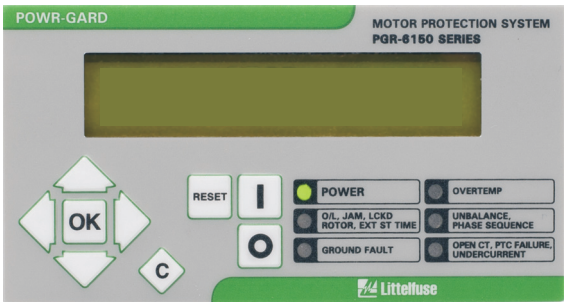
PGR-6150

Motor Protection System

September 29, 2010

REVISION 1





1. GENERAL HANDLING

1.1. Unpacking and Inspection

The PGR-6150 must only be handled by qualified personnel and special care must be taken to protect its parts from damage during unpacking and installation.

Inspect the PGR-6150 at delivery to ensure no damage occurred during transport. Inform Littelfuse Inc. immediately if the product is deemed to be defective.

1.2. Handling Electronic Equipment

Relays contain electronic components that are sensitive to electrostatic discharge.

To ensure that electronic parts are not damaged due to electrostatic discharge, do not remove the plastic housing.

1.3. Installation

Please read documentation carefully before installing and commissioning the motor protection system.

Check polarity and voltage before energizing the relay.

The equipment must be used within the stipulated electrical and environmental limits.

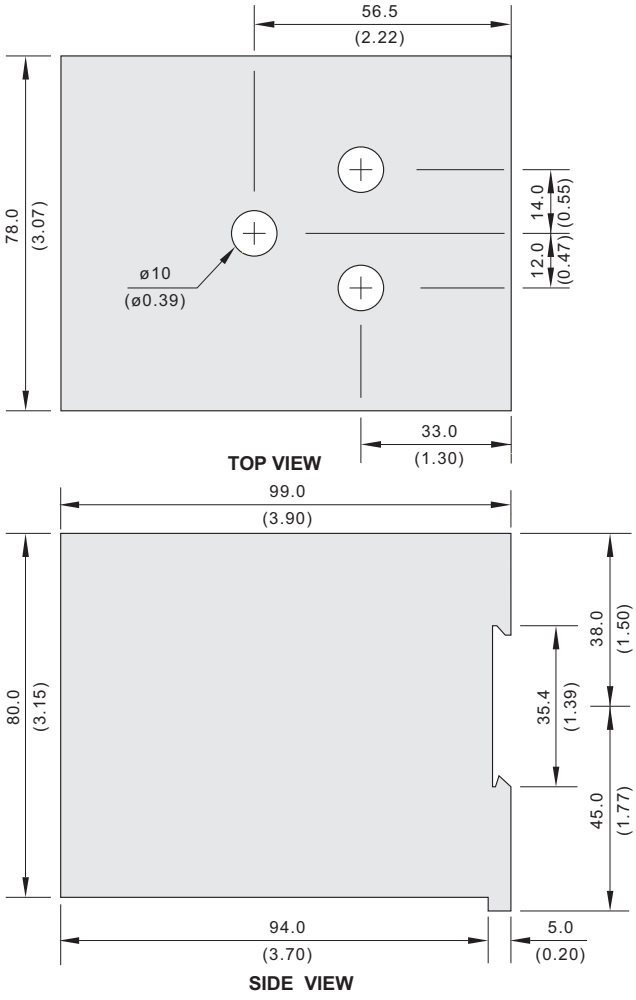
NOTE: Current transformer circuits: Do not open a live CT secondary circuit. The high voltage produced as a result could damage the insulation and present a personnel hazard.

1.4. Storage

Relays should be stored in a dry and dust-free environment.

2. DIMENSIONS

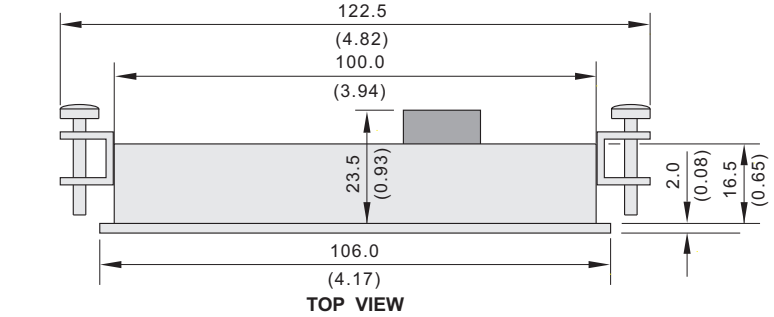
2.1. PGR-6150



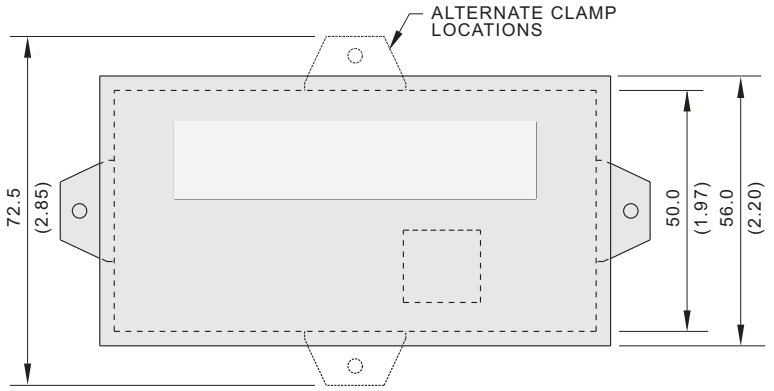
NOTES:

DIMENSIONS IN MILLIMETRES (INCHES).

2.2. PGR-6150-OPI



TOP VIEW



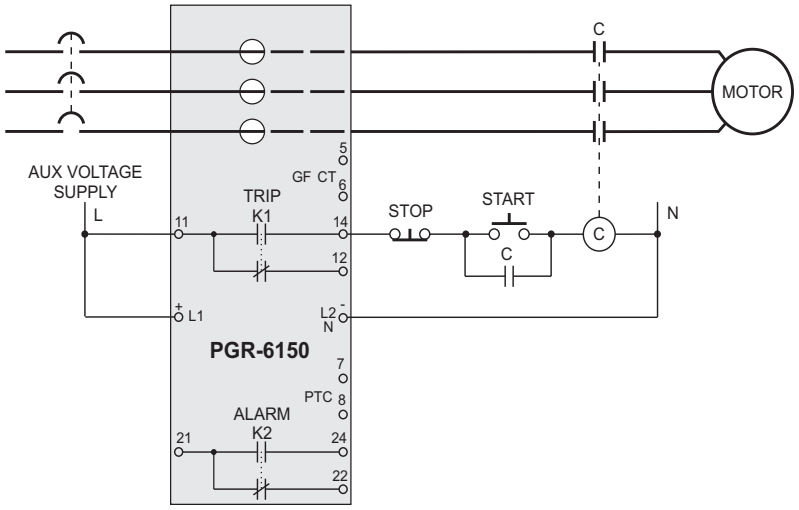
FRONT VIEW

NOTES:

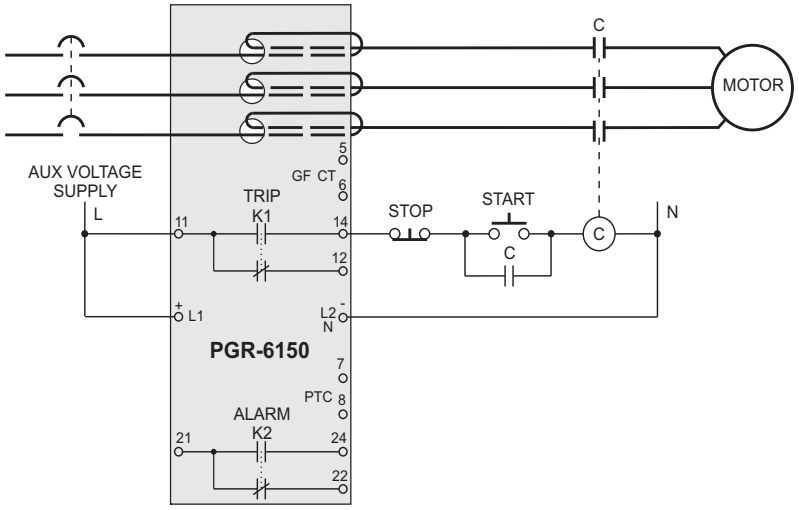
DIMENSIONS IN MILLIMETRES (INCHES).

3. CONNECTION DIAGRAMS

3.1. Direct Connection

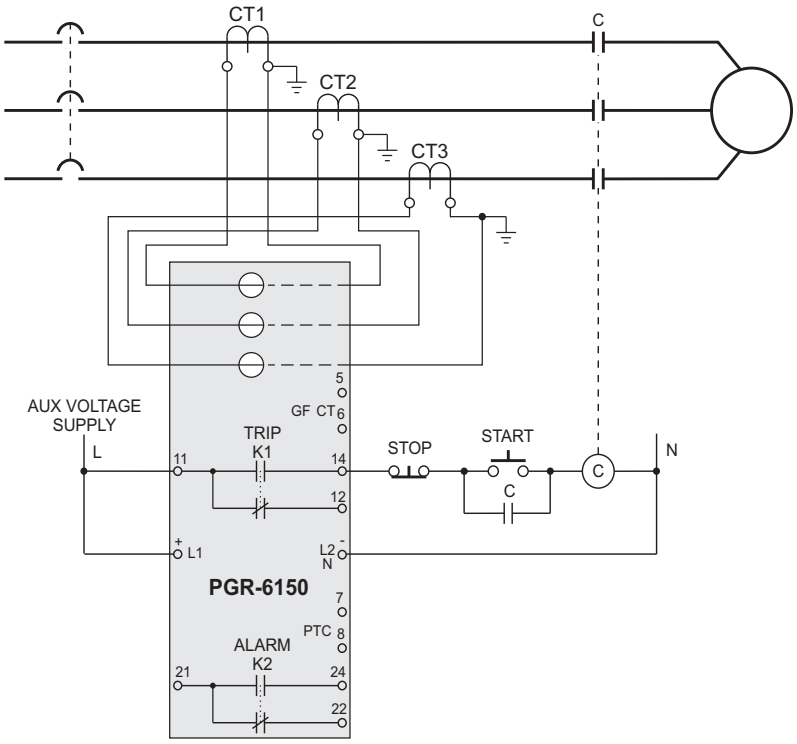


3.2. Multiple Pass Connection



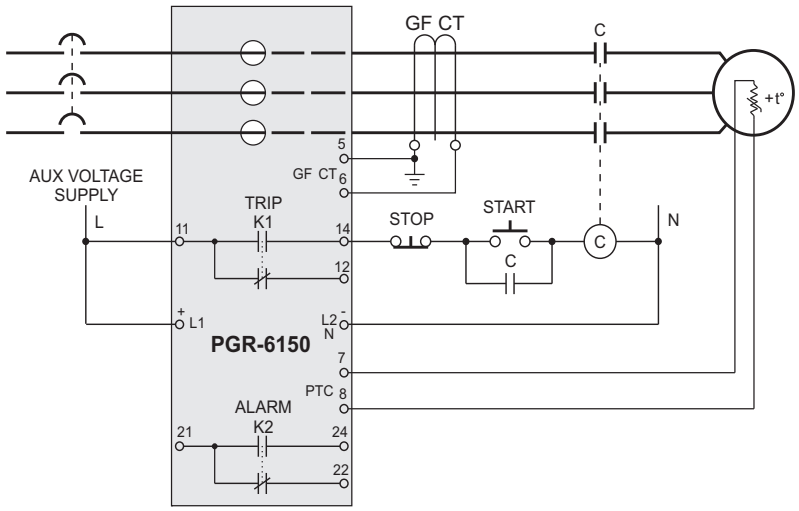
For motors with nominal current below the minimum relay set-point value, multiple turns can be used. Set the value I_B and CT Turns Ratio as explained in Section 6.2.1.

3.3. External CT Connection



For motors with nominal current over the maximum relay current set-point value, combine the relay with current transformers. Set the value I_B and CT Turns Ratio as explained in Section 6.2.1.

3.4. PTC and Ground-Fault Connection



4. PGR-6150 BASE-MODULE TERMINALS

DIG IN	24 Vac/dc digital input
GF CT	Ground-fault current transformer connection
PTC	PTC temperature sensor connection
+	RS-485 connection +
-	RS-485 connection -
14	Output K1 contact normally open
12	Output K1 contact normally closed
11	Output K1 common
24	Output K2 contact normally open
22	Output K2 contact normally closed
21	Output K2 common
+ L1	Supply voltage (+ for direct current)
- L2/N	Supply voltage (- for direct current)

5. DESCRIPTION

5.1. General

The PGR-6150 is a modular system that provides integrated protection, metering and data logging functions. The PGR-6150 base module can operate as a stand-alone unit or with the operator interface PGR-6150-OPI, the voltage module PGA-0160, and the input/output module PGA-0180. The base module can be programmed using the PGR-6150-OPI or using SCADA communications through the RS-485 port.

5.2. Features

5.2.1. Protection

- Overload
- Phase unbalance
- Phase loss
- Phase sequence
- PTC overtemperature
- Jam
- Locked rotor
- Calculated definite-time ground fault
- Calculated inverse-time ground fault
- Measured definite-time ground fault
- Measured inverse-time ground fault
- Undercurrent
- Excessive-start-up time

5.2.2. Metering

- Line currents
- Zero-sequence current
- Ground-fault current
- Thermal image
- Frequency
- Positive-sequence current
- Negative-sequence current
- Average-phase current

5.2.3. Data Logging

- Four fault records
  - Date of event
  - Line currents
  - Frequency
  - Overload
  - Current unbalance
  - PTC overtemperature
  - PTC fault
  - Jam
  - Locked rotor
  - Ground-fault current
- Trip counters
  - Number of overloads
  - Number of overtemperature
  - Number of jams
  - Number of locked rotors
  - Number of ground faults
  - Number of startups
- Startup maximum current
- Last startup maximum current
- Last startup average current
- Operating hours

5.2.4. Inputs and Outputs

- One digital input
- One trip output relay
- One alarm output relay
- PTC input
- Ground-fault current transformer input
- Relay closing time delay
- RJ-45 24 Vdc output to PGR-6150-OPI and optional voltage and input/output modules
- RS-485 communications
- 1 Power On LED
- 4 LED status indicators

5.2.5. Operator Interface

- 2 x 20 LCD display
- Display control and programming keys
- 6 programmable LED status indicators

The four status LEDs on the PGR-6150 give indication of faults on the system being monitored. The system checks both equipment malfunction and external input connections. LED functions are labelled on the front face of the PGR-6150.

An adjustable power-up timer from 0 to 3600 s allows motors to be started in a staggered sequence.

The trip and alarm output relay contacts operate in failsafe mode.

The algorithm used to measure the currents calculates the RMS (Root Mean Square) value. 16 samples per cycle are used. The sampling frequency is determined by the system frequency setting. It can be set to 50, 60 Hz, or variable. The accuracy of the measurement is 2% over the whole range. The variable frequency sampling is only valid for models with alternating supply as the alternating supply signal is taken as reference to calculate the line frequency (45 Hz to 65 Hz).

The PGR-6150 information can be accessed from the PGR-6150-OPI or from an RS-485 communications port on terminals 9 and 10, which allows for the PGR-6150 to be included as part of a SCADA system. The Modbus RTU protocol is used.

Each LED on the PGR-6150-OPI is programmable and can be set as latching or none latching and/or as flashing or not flashing.

The PGR-6150-OPI is also equipped with a start button and a stop button. To use the start function “I”, a PGA-0180 Input/Output module is required.

The RESET button can be used to reset the output relays and latched LED’s and to test the LED’s both on the main module and the operator interface.

5.3. Ordering Information

PGR-6150-24	24/48 Vdc Base Module
PGR-6150-120	120/240 Vac/dc Base Module
PGR-6150-OPI	Operator Interface
ACCESSORIES	
PGC-6035	Ground-fault current transformer, 35 mm
PGC-6060	Ground-fault current transformer, 60 mm
PGC-6080	Ground-fault current transformer, 80 mm
PGC-6110	Ground-fault current transformer, 110 mm
PGC-6210	Ground-fault current transformer, 210 mm
PGA-0160	Voltage Module
PGA-0180	Input/Output Module

6. PGR-6150 PROTECTIVE FUNCTIONS AND CONTROL

6.1. Power Supply

- The PGR-6150 comes with a 110/240 Vac/dc, 5 W power supply.

The PGR-6150 generates 24 Vdc available through the RJ-45 port to supply auxiliary modules.

6.2. Protective Functions

6.2.1. General Settings

The equipment's general settings are as follows:

General Settings					
Description	Mínimum	Maximum	Step	Unit	Default
Nominal current I_B	4	25	0.01	A	4
CT turns ratio	1	2000	1	-	1
Frequency	-	-	50Hz/60Hz/var	Hz	50
Motor start limit	1	8	0.01	x I_B	1.5
Motor starting time	1	200	1	s	60
Phase sequence	-	-	ABC/ACB	-	ABC
PGR-6150 Initial time	0	3600	1	s	0

To protect the motor, the “Nominal current (I_B)”, must be set to the value stated on the motor nameplate.

If the “nominal current” is below the minimum relay current set-point value, pass cables through the relay “n” time. “I_B“ set value will be “I_N x n”, where I_N is the nominal current shown on the motor nameplate.

If the “nominal current” is greater than the maximum relay current set-point range, use external current transformers. “I_B“ set-point value will be the nominal current shown on the motor nameplate divided by the CT Turns Ratio.

The “motor start limit” and "motor starting time" settings are used to adjust motor start up limits. A trip will result when this limit is exceeded.

NOTE: For “Motor starting time” choose a value between 1 and 200. It is possible to deactivate this function by setting the value to 0. A value 0f 0 is not recommended as it may result in motor damage.

The frequency can be adjusted to 50 Hz, 60 Hz and variable frequency (with the equipment maintaining measurement accuracy and time within a range of 45 Hz to 65 Hz). The variable frequency setting applies to models with alternating supply voltage.

The “phase sequence” setting is set to match the phase rotation of the installation.

The “PGR-6150 initial time" is used to delay motor starting in applications where a staggered start is required.

6.2.2. Overload

The overload function meets international standard IEC 947-4-1 and IEC 255-8.

A mathematically based thermal model is used to simulate the motor's thermal condition. The model combines two thermal images: A heating image and a cooling image. The heating image represents the thermal condition of the windings of the stator and rotor, and the cooling image represents the thermal condition of the motor housing.

This heating and cooling thermal model ensures that the motor is operated in a safe zone.

Time to trip depends on the trip class selected, the circulating current and the previous motor thermal condition.

The thermal image is calculated based on the following equation:

$$\theta = 100 \times (I/I_t)^2 \times (1 - e^{-t/\zeta}) + \theta'_0 \times e^{-t/\zeta}$$

Where:

- I, maximum current of the three phases
- I_t, trip threshold current
- ζ, thermal constant.
- θ'_0, initial thermal condition

The trip time comes from the equation:

$$t = \zeta \times \ln \{ [(I/I_t)^2 - (\theta'_0 / 100)] / [(I/I_t)^2 - 1] \}$$

The trip time accuracy is 5%.

The algorithm uses the maximum current of the three phase currents. If the maximum current is greater than 15% of the adjusted current I_B, the heating thermal constant is applied. If the maximum current is less than 15% of the adjusted current I_B, the cooling thermal constant is applied.

The overload function trips when the thermal image reaches a value of 100%.

A thermal image adjustable level is established to generate an alarm. Should a trip occur, the overload function is reset when the thermal image drops below the set alarm level.

The thermal constant has the following values:

- ζ heating = 37 x trip class
- ζ cooling = 90 x trip class

If there is external ventilation,

- ζ cooling = (90 x trip class) / 4
-

Overload					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	yes
Service factor	1	2	0.01	I_B	1.15
Trip class	-	-	5,10,15,20,25,30,35,40,45	-	5
External ventilation	-	-	Yes/No	-	No
Alarm	20	95	1	%	80

The PGR-6150 allows for overload function settings between 1 and 2 times I_B. Note however that standard IEC-947-4-1 recommends the tap setting to be between 1.05 and 1.20 times I_B.

6.2.3. Phase Unbalance

The unbalance function is applied on a three phase system made up of three phase currents (IA, IB, IC). The average current of the three values is taken as reference. The function is operative when the average current is greater than 10% of the motor set current I_B and becomes inoperative if the average current is less than 8%.

A dynamic operating band is established based on the average current. An excursion of a phase current outside of this band for the selected time delay results in an unbalance trip. The band upper and lower limits are defined by the % unbalance setting. A 5% hysteresis value is applied for the reset level.

The unbalance reset and activate limits are determined as follows, based on the % unbalance setting (value d1%):

Upper limit activation	$I_{average}$* (100 + d1)%
Upper limit reset	$I_{average}$* (100 + d1– 5)%
Lower limit activation	$I_{average}$* (100 - d1)%
Lower limit reset	$I_{average}$* (100 - d1+ 5)%

Once the function has been activated, and the phase current drops below the upper reset limit or rises above the lower reset limit, the function is instantly reset.

Two different time delays apply: one applies when the motor is starting, and the other when the motor is in operation. As a result, a possible phase loss can be detected in the motor start up and a fast trip can be executed.

Unbalance					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	yes
% Unbalance (d1)	5	30	1	%	30
Starting trip time	0.02	20	0.001	s	0.6
Running trip time	0.02	20	0.001	s	5

6.2.4. Phase Loss

The phase loss function is applied on a three phase system made up of three phase currents (IA, IB, IC). The average current of the three values is taken as reference. The function is operative if the average current is greater than 10% of the nominal current I_B and becomes inoperative if the average current is less than 8%.

Based on the average current, a lower limit is established resulting from the % unbalance setting (d2) and 5% reset hysteresis.

Lower limit activation	Iaverage* (100 – d2)%
Lower limit reset	Iaverage* (100 – d2+ 5)%

The criteria is applied to the three phases. If a phase current is less than the lower limit for the selected time delay, an unbalance trip occurs.

There is only one operating time, regardless of whether the motor is starting up or in operation.

Phase loss					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	yes
% Unbalance (d2)	10	100	1	%	30
Time	0.02	20	0.001	s	5

6.2.5. Phase Sequence

The sequence function is activated when the phase sequence detected is not in accordance with the phase sequence setting (ABC/ACB).

The phase sequence detection algorithm is based on the determination of the positive and negative sequence of the fundamental currents component.

The function is operative if the positive sequence current or the negative sequence current is greater than 10% of the current I_B setting and stops operating if the positive sequence current and the negative sequence current is less than 8%.

Phase sequence					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no
Time	0.02	2	0.001	s	0.02

6.2.6. PTC

PTC sensor protection should be applied in the following cases:

- Motors with a high number of starts/stops
- Motor operating at speeds lower than the range it is designed for
- When there is a restricted air supply
- In intermittent operations and/or constant braking
- High air temperatures

PTC sensor short circuit or open circuit and overtemperature are detected. Overtemperature activates the trip contact, while a PTC sensor open circuit and short circuit activate the alarm contact. The PTC sensor protection limits are preset and cannot be changed by the user.

	Activation resistance	Reset resistance
Overtemperature	> 3,600 Ω	< 1,800 Ω
Short circuit	< 20 Ω	> 30 Ω
Open circuit	> 4,000 Ω	< 3,900 Ω

PTC					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no

The trip time is 500 ms.

The PTC sensor current is 1 mA and a maximum of 2.3 V is used.

Maximum cold resistance	1,500 Ω
Minimum cold resistance	50 Ω

6.2.7. Jam

This function detects a motor jam and is disabled during motor start up.

JAM					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no
Pickup	1	3.5	0.01	I_B	2.5
Operating time	0.02	50	0.001	s	10

This function is enabled after the motor start-up sequence has been completed. See Section 6.2.14

6.2.8. Locked Rotor

This function detects a locked rotor and is disabled during motor start up.

Locked rotor					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no
Pickup	3.5	6	0.01	I_B	3.5
Time	1	30	0.001	s	5

This function is enabled after the motor start-up sequence has been completed. See Section 6.2.14

6.2.9. Calculated Definite-Time Ground Fault

This function detects motor ground-fault current based on phase currents.

I_0>> GF CALC DEF					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no
Pickup	0.1	1	0.01	I_B	0.1
Time	0.02	5	0.001	s	1

This function is enabled after the motor start-up sequence has been completed. See Section 6.2.14

6.2.10. Calculated Inverse-Time Ground Fault

This protection function can be set by using five parameters:

I_0> GF CALC INVERSE					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no
Curve	-	-	(1*)	-	Inverse
Dial	0.05	1.25	0.01	-	1.25
Pickup	0.1	1	0.01	I_B	1.00
Time	0.02	5	0.001	s	0.2

(1*) Inverse, Very inverse, Extremely inverse, Definite time

If the option "Definite time" is selected for the curve setting, the unit behaves like an instantaneous overcurrent unit. In this case, the time parameter is active.

If a curve “Inverse”, “Very inverse” or “Extremely inverse” is selected for the curve setting, the trip time depends on the curve, dial and pickup settings.

If the unit operates as definite time, the function is activated at 100% of the set pickup value, and it deactivates at 95%.

If the unit operates with a curve, the function is activated at 110% of the set pickup value, and it deactivates at 100%.

The reset is instantaneous in both cases.

The activation time is accurate to ±5% or ±30 ms, whichever is greater.

The curves used are IEC255-4/BS-142, which are described in Section 6.2.17.

6.2.11. Measured Definite-Time Ground Fault

This option requires a ground-fault current transformer.

I_G>> GF MEASURED DEF					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no
Pickup	100	15,000	1	mA	100
Time	0.02	5	0.001	s	0,2

This function is enabled after the motor start-up sequence has been completed. See Section 6.2.14

6.2.12. Measured Inverse-Time Ground Fault

This option requires a ground-fault current transformer.

I_G> GF MEASURED INV					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no
Curve	-	-	(1*)	-	Inverse
Dial	0.05	1.25	0.01	-	1.25
Pickup	100	450	1	mA	100
Time	0.02	5	0.001	s	0.2

(1*) Inverse, Very inverse, Extremely inverse, Definite time

If the option "Definite time" is selected for the curve setting, the unit behaves like an instantaneous overcurrent unit. In this case, the time parameter is active.

If a curve “Inverse”, “Very inverse” or “Extremely inverse” is selected for the curve setting, the time depends on the curve, dial and pickup settings.

If the unit operates as definite time, the function is activated at 100% of the set pickup value, and it deactivates at 95%.

If the unit operates with a curve, the function is activated at 110% of the set pickup value, and it deactivates at 100%. The reset is instantaneous in both cases.

The activation time is accurate to ±5% or ±30ms, whichever is greater.

The curves used are IEC255-4/BS-142, which are described in Section 6.2.17.

6.2.13. Undercurrent

The undercurrent function is not enabled during motor start-up.

I < Undercurrent					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no
Pickup	0.3	1	0.01	I_B	0.5
Time	0.02	200	0.001	s	1

Activation is at 100% of the pickup value and reset at 105%. The reset is instantaneous.

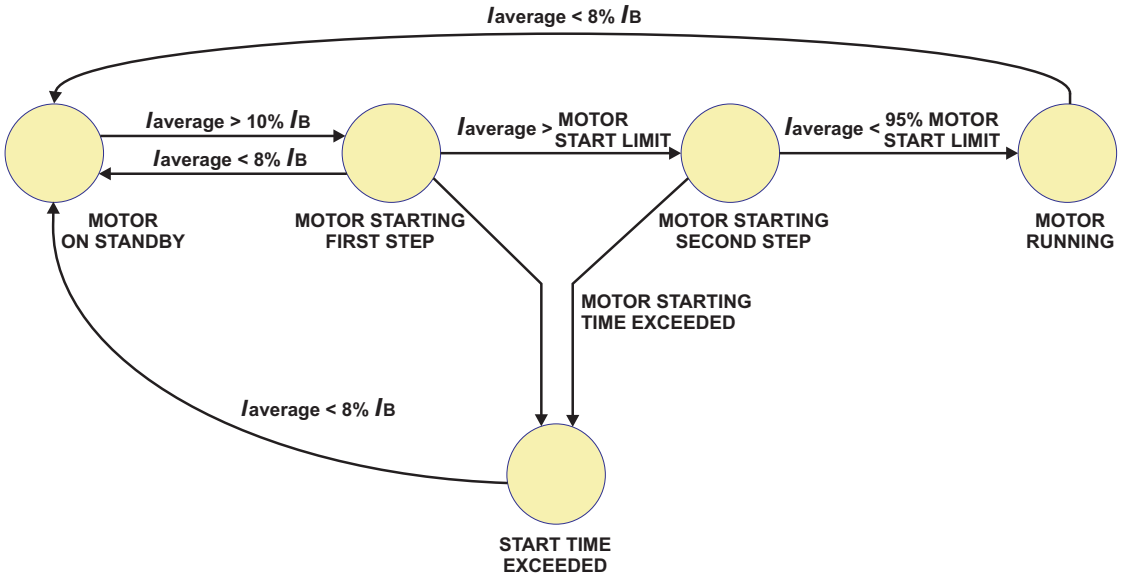
The accuracy of the operation time is equal to the set time plus a maximum of 30 ms.

6.2.14. Motor-Start-Up Monitoring

The settings for motor start up are in the General Settings:

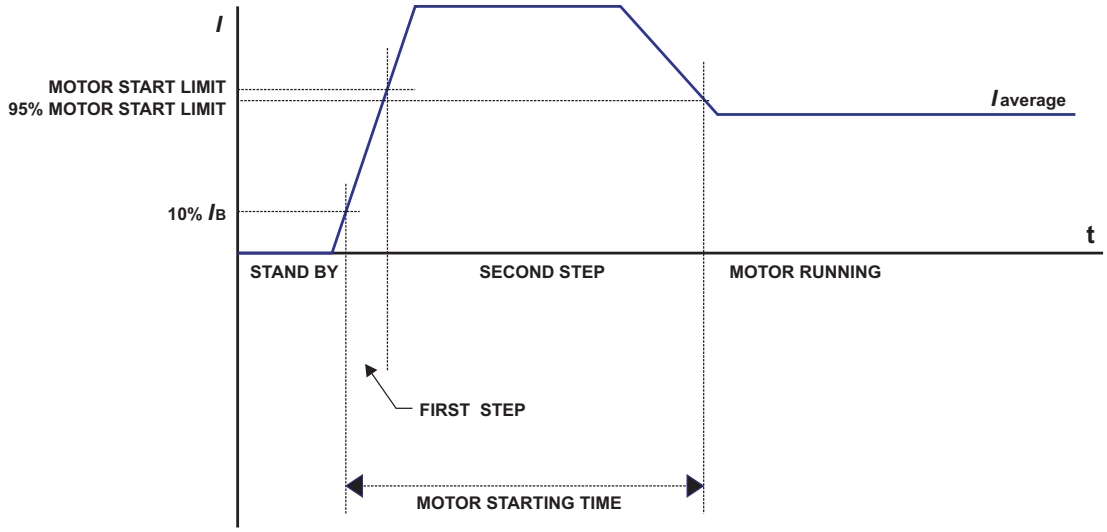
Motor start up monitoring					
Description	Minimum	Maximum	Step	Unit	Default
Function enabled	-	-	yes/no	-	no
Motor start limit	1	8	0.01	I_B	1.5
Motor starting time	1	200	0.001	s	60

MOTOR START FLOWCHART



The motor is considered to be on standby when the average current is less than 8% of the nominal current I_B. The PGR-6150 switches to the “Motor starting first step” stage when the average current is greater than 10% of the nominal current I_B. It switches to “Motor starting second step" when the average current is greater than the “Motor start limit”, “Motor running” mode is reached when the average current is less than 95% of the “Motor start limit”.

In “Motor first step” and “Motor second step” the start-up time is monitored. If the measured start-up time is greater than the “Motor starting time” selected, the start up will be aborted due to a “Start time exceeded” condition.



There are two status bits in the miscellaneous group, related to motor monitoring: “Motor running” and “Start time exceeded”.

The following statistics are related to motor start up:

- Number of starts
- Maximum start current:
- Last start maximum current:
- Last start average current:
- Measured start time (second step time)
- Number of operating hours (motor in operation)
-

6.2.15. PGR-6150 SETTINGS Summary

Description	Minimum	Maximum	Step	Unit	Default
GENERAL					
Nominal current I_B	4	25	0.01	A	4
CT turns ratio	1	2,000	1	-	1
Frequency	-	-	50Hz/60Hz/var (1*)	-	50 Hz
Motor start limit	1	8	0.01	I_B	1.5
Motor starting time	1	200	1	s	60
Phases sequence	-	-	ABC/ACB	-	ABC
PGR-6150 initial time	0	3,600	1	s	0

Description	Minimum	Maximum	Step	Unit	Default
OVERLOAD					
Function enabled	-	-	yes/no	-	yes
Service factor	1	2	0.01	I_B	1.15
Trip class	-	-	5,10,15,20,25,30,35,40,45	-	5
External ventilation	-	-	Yes/No	-	No
Alarm	20	95	1	%	80
UNBALANCE					
Function enabled	-	-	yes/no	-	yes
% Unbalance	5	30	1	%	30
Starting trip time	0.02	20	0.001	s	0.6
Running trip time	0.02	20	0.001	s	5
PHASE LOSS					
Function enabled	-	-	yes/no	-	yes
% Unbalance	10	100	1	%	30
Time	0.02	20	0.001	s	5
SEQUENCE					
Function enabled	-	-	yes/no	-	no
Time	0.02	2	0.001	s	0.02
PTC					
Function enabled	-	-	yes/no	-	no
JAM					
Function enabled	-	-	yes/no	-	no
Pickup	1	3.5	0.01	I_B	2.5
Operating time	0.02	50	0.001	s	10
LOCKED ROTOR					
Function enabled	-	-	yes/no	-	no
Pickup	3.5	6	0.01	I_B	3.5
Operating time	1	30	0.001	s	5
I_0>> GF CALC DEF					
Function enabled	-	-	yes/no	-	no
Pickup	0.1	1	0.01	I_B	0.1
Operating time	0.02	5	0.001	s	1

Description	Minimum	Maximum	Step	Unit	Default
I_0> GF CALC INVERSE					
Function enabled	-	-	yes/no	-	no
Curve	-	-	(2*)	-	Inverse
Dial	0.05	1.25	0.01	-	1.25
Pickup	0.1	1	0.01	I_B	1.00
Operating time	0.02	5	0.001	s	0.2
I_G>> GF MEASURED DEF					
Function enabled	-	-	yes/no	-	no
Pickup	100	15,000	1	mA	100
Operating time	0.02	5	0.001	s	0.2
I_G> GF MEASURED INV					
Function enabled	-	-	yes/no	-	no
Curve	-	-	(2*)	-	Inverse
Dial	0.05	1.25	0.01	-	1.25
Pickup	100	450	1	mA	100
Operating time	0.02	5	0.001	s	0.2
I< UNDERCURRENT					
Function enabled	-	-	yes/no	-	no
Pickup	0.3	1	0.01	I_B	0.5
Operating time	0.02	200	0.001	s	1
COMMUNICATION					
Modbus address (3*)	1	255	1	-	1
RESET					
Enable OPI	-	-	yes/no	-	no
Enable command	-	-	yes/no	-	no
Enable input	-	-	yes/no	-	no
Reset type	-	-	(4*)	-	Manual
Reset time	0.02	200	0.001	s	0.1

(1*) The frequency can be set to values of 50Hz, 60Hz, and variable frequency in a range of 45 Hz to 65 Hz. The variable frequency only applies to models with alternating supply voltage.

(2*) Inverse, very inverse, extremely inverse and definite time curves.

(3*) The Modbus address can only be modified from the PGR-6150-OPI. The other settings can be modified from the PGR-6150-OPI and communications.

(4*) The reset types are: Automatic, Automatic time delay, and Manual.

6.2.16. Overload curves

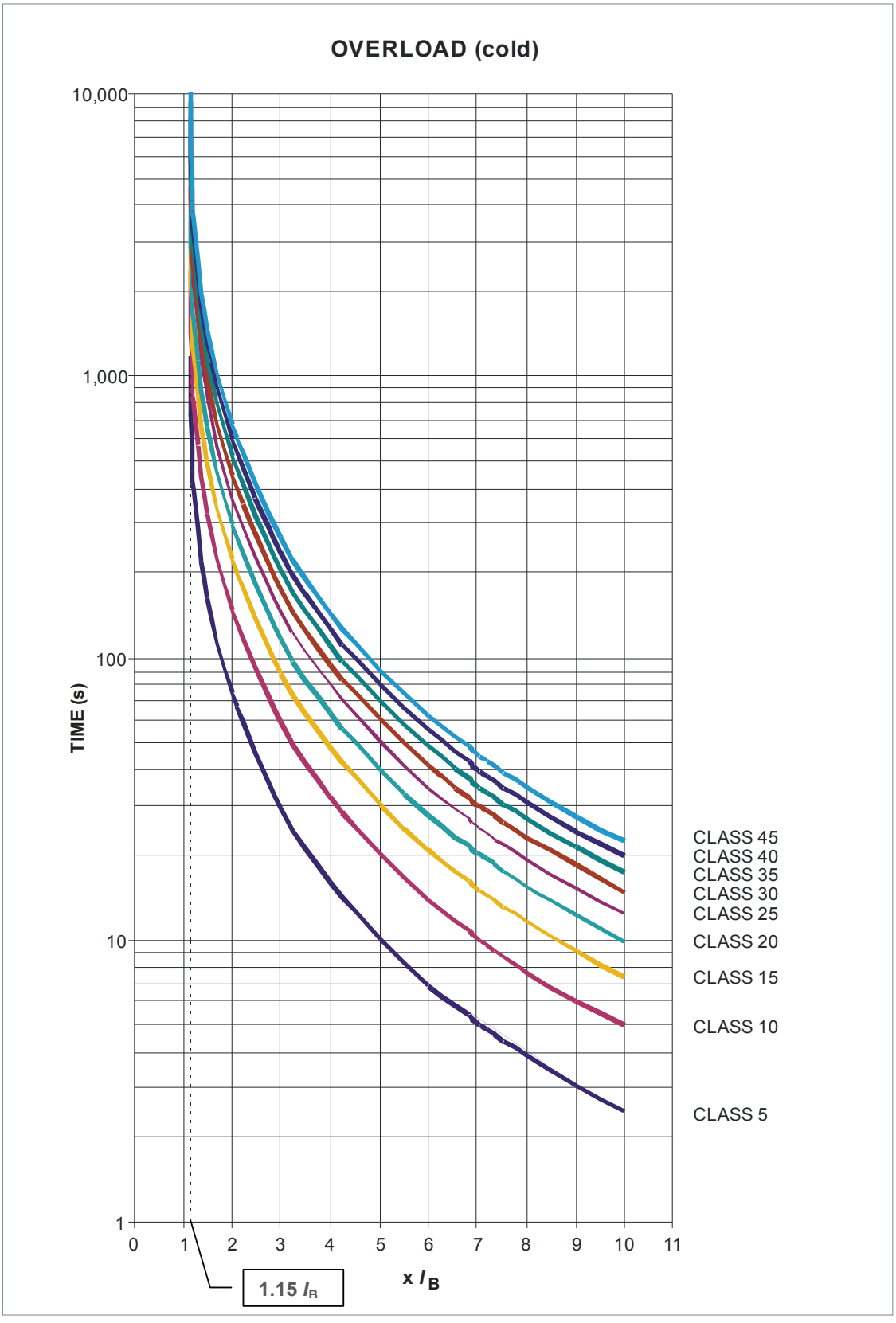
The first graph shows the class 5, 10, 15, 20, 25, 30, 35, 40 and 45 trip curves starting from an initial thermal condition of 0% (cold).

The following graphs show individually the class 5, 10, 15, 20, 25, 30, 35, 40 and 45 trip curves with initial thermal conditions of 0% (cold), 60% (hot 60%), 75% (hot 75%).

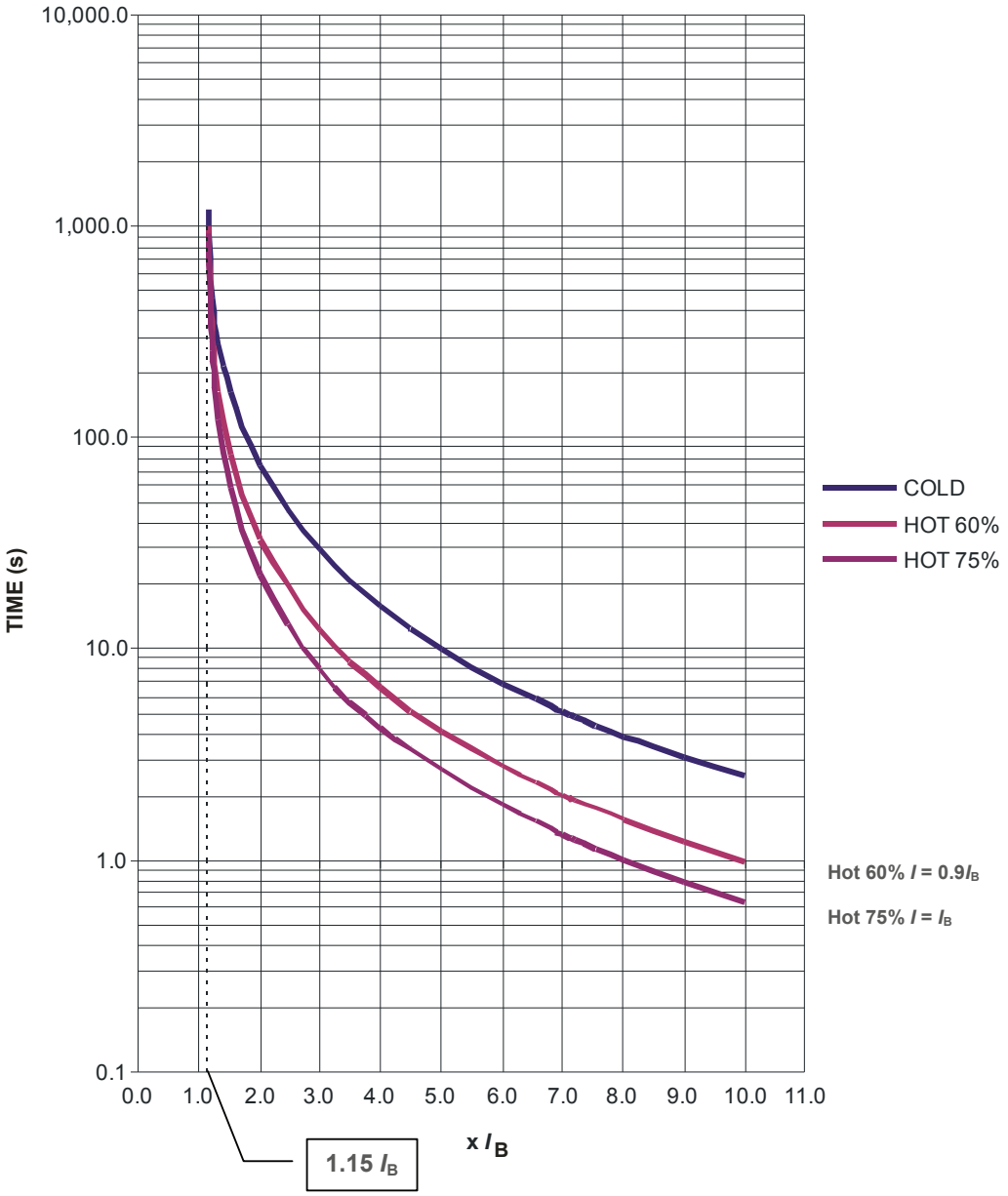
The 60% hot thermal curves represent the trip time starting from an initial thermal condition of 60% which is reached when $I = 0.9\ I_B$ and service factor = 1.15.

The 75% hot thermal curves represents the trip time starting from an initial thermal condition of 75% which is reached when $I = I_B$ and service factor = 1.15.

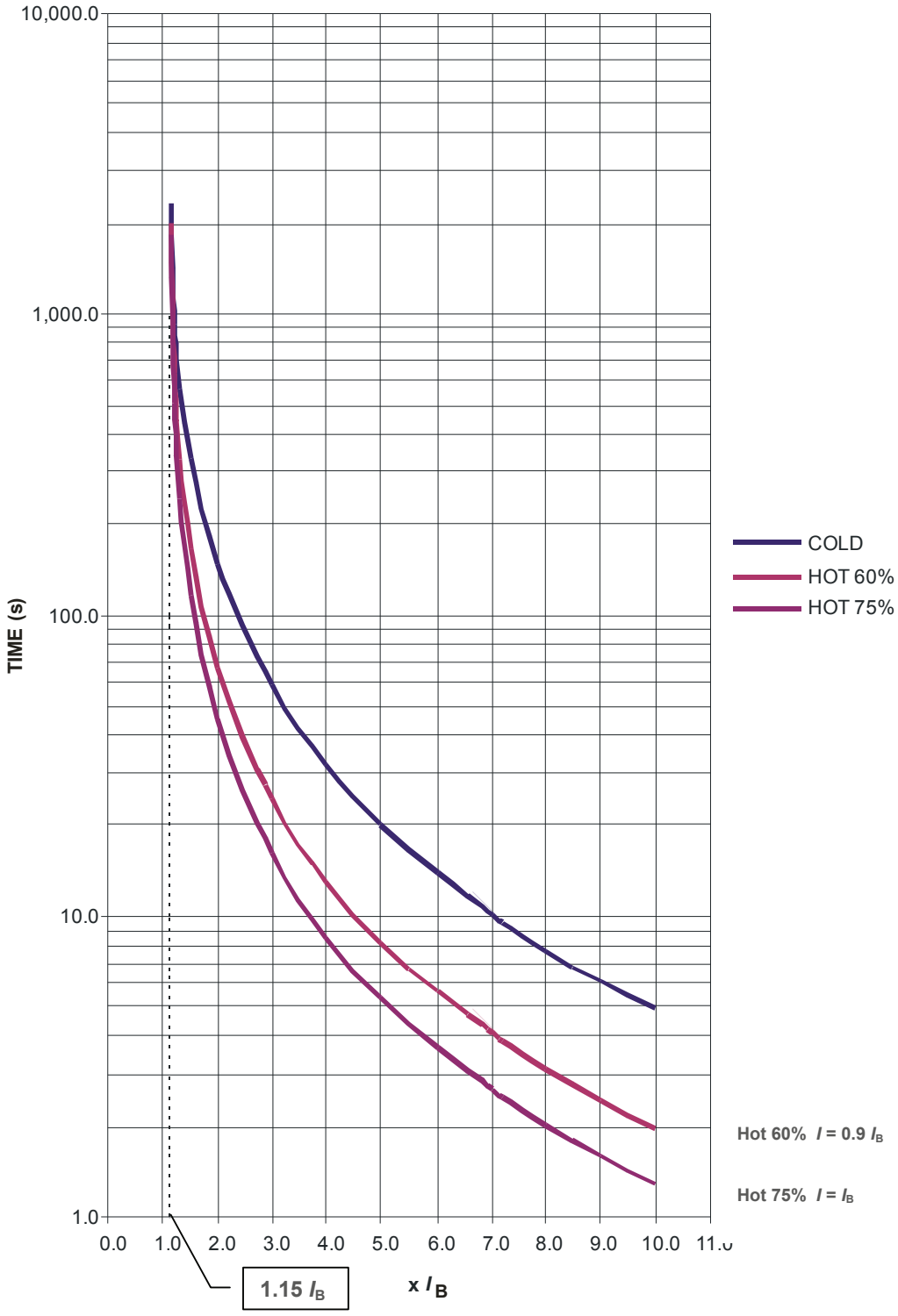
The x axis represents the current in multiples of I_B and the y axis represents time in seconds. The curves have been represented for an overload pickup current of $1.15\ I_B$. (service factor = 1.15.)


OVERLOAD (cold)
10,000
1,000
100
10
1
TIME (s)
0
1
2
3
4
5
6
7
8
9
10
11
x I_B
1.15 I_B
CLASS 45
CLASS 40
CLASS 35
CLASS 30
CLASS 25
CLASS 20
CLASS 15
CLASS 10
CLASS 5

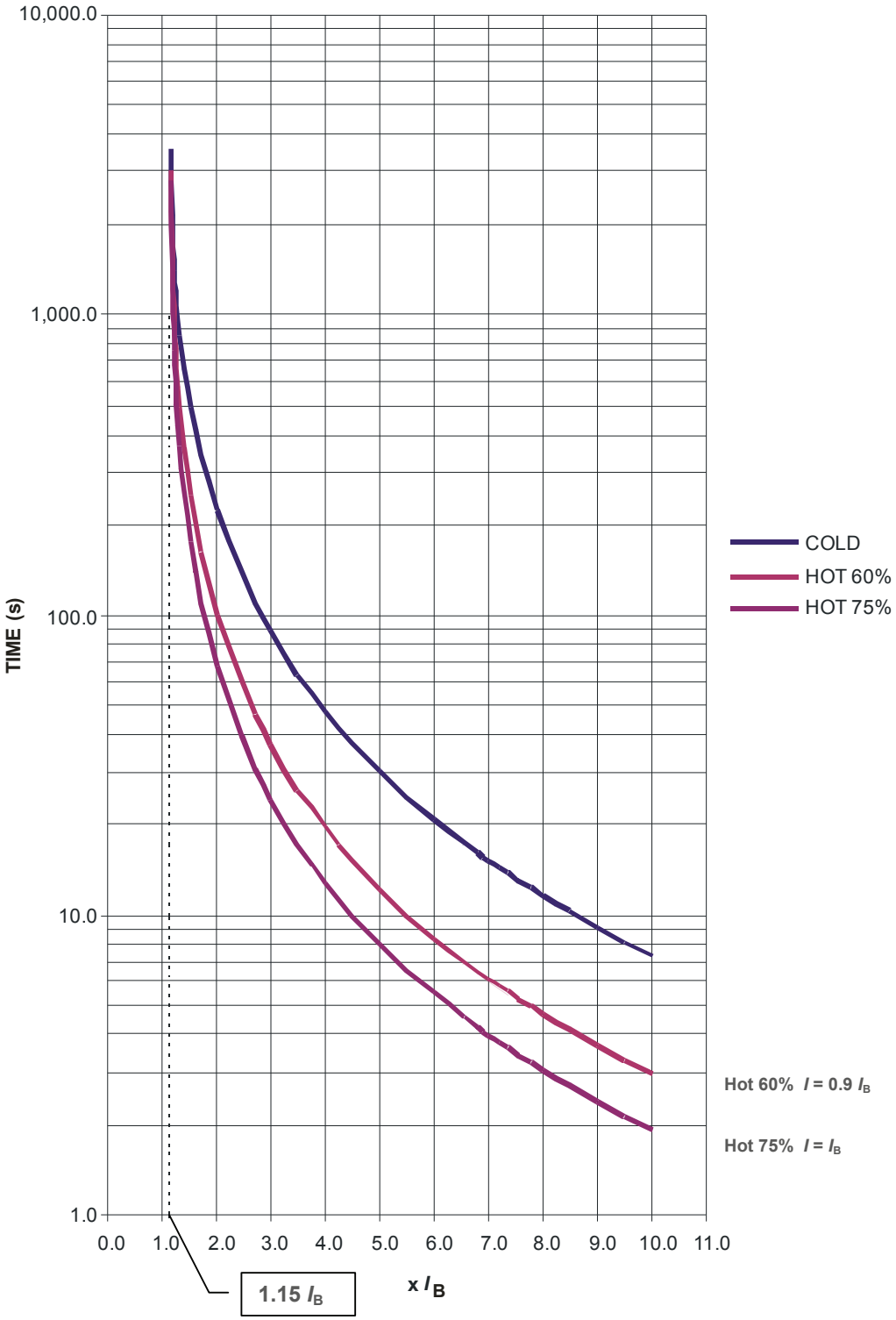
OVERLOAD CLASS 5



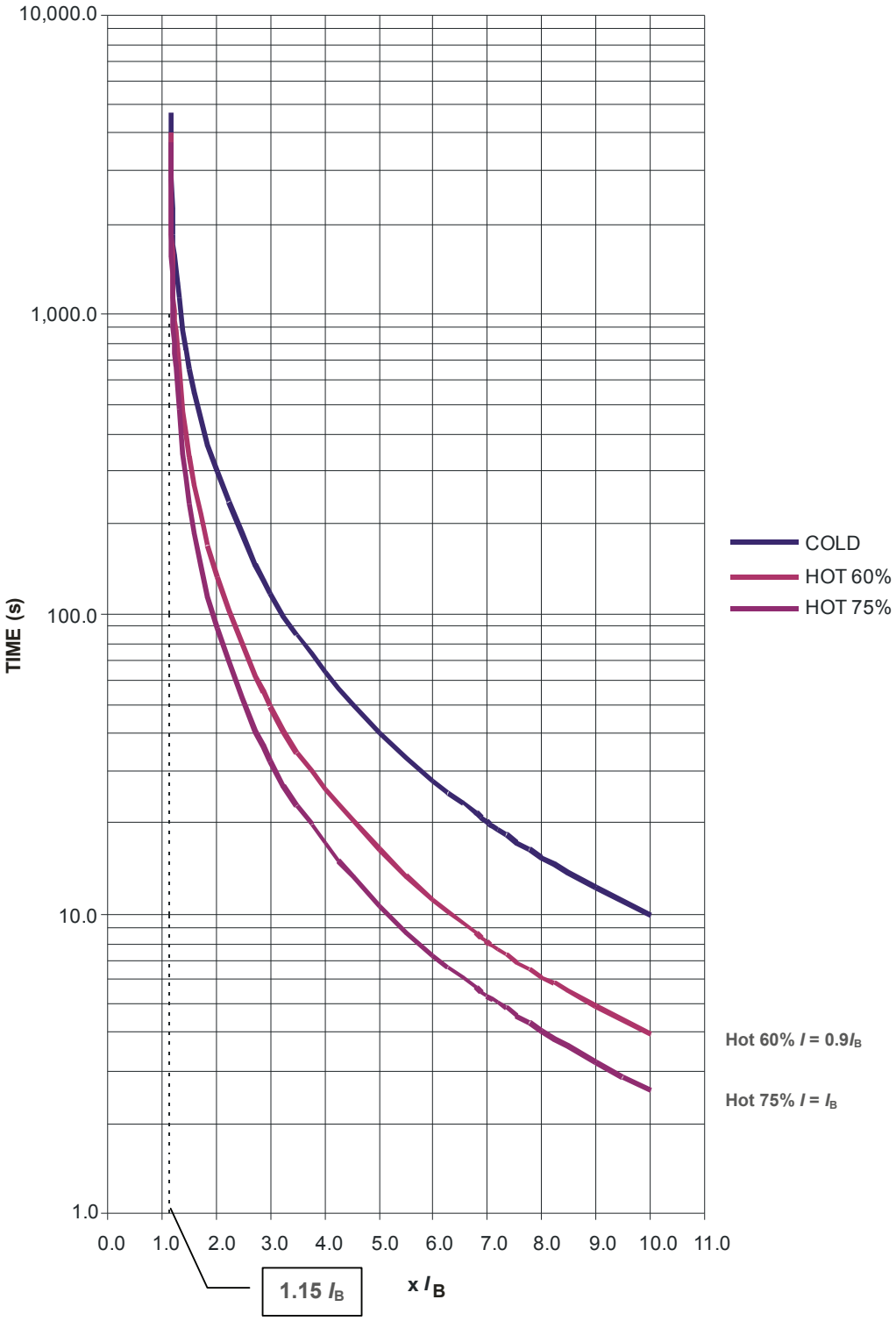
OVERLOAD CLASS 10



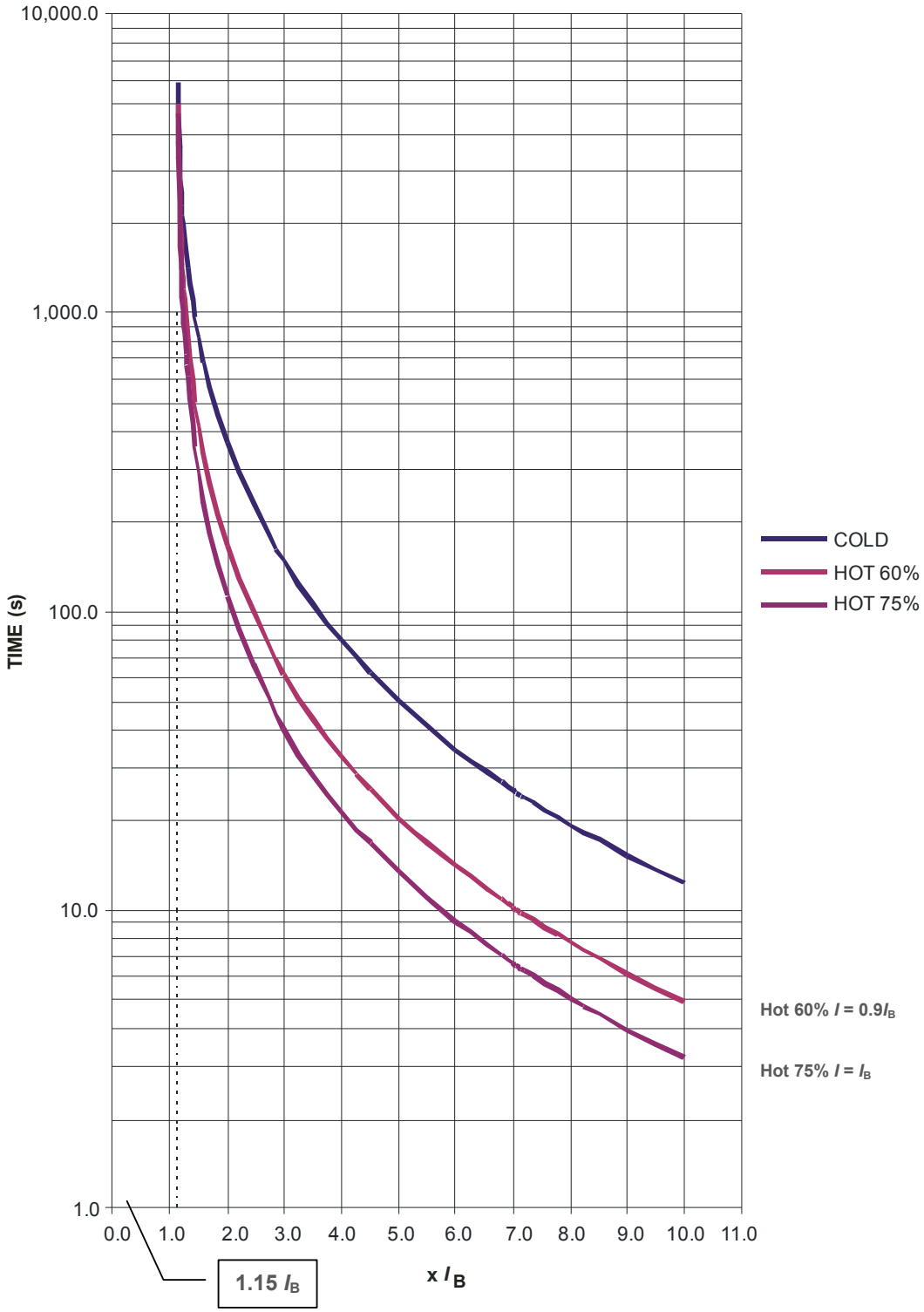
OVERLOAD CLASS 15



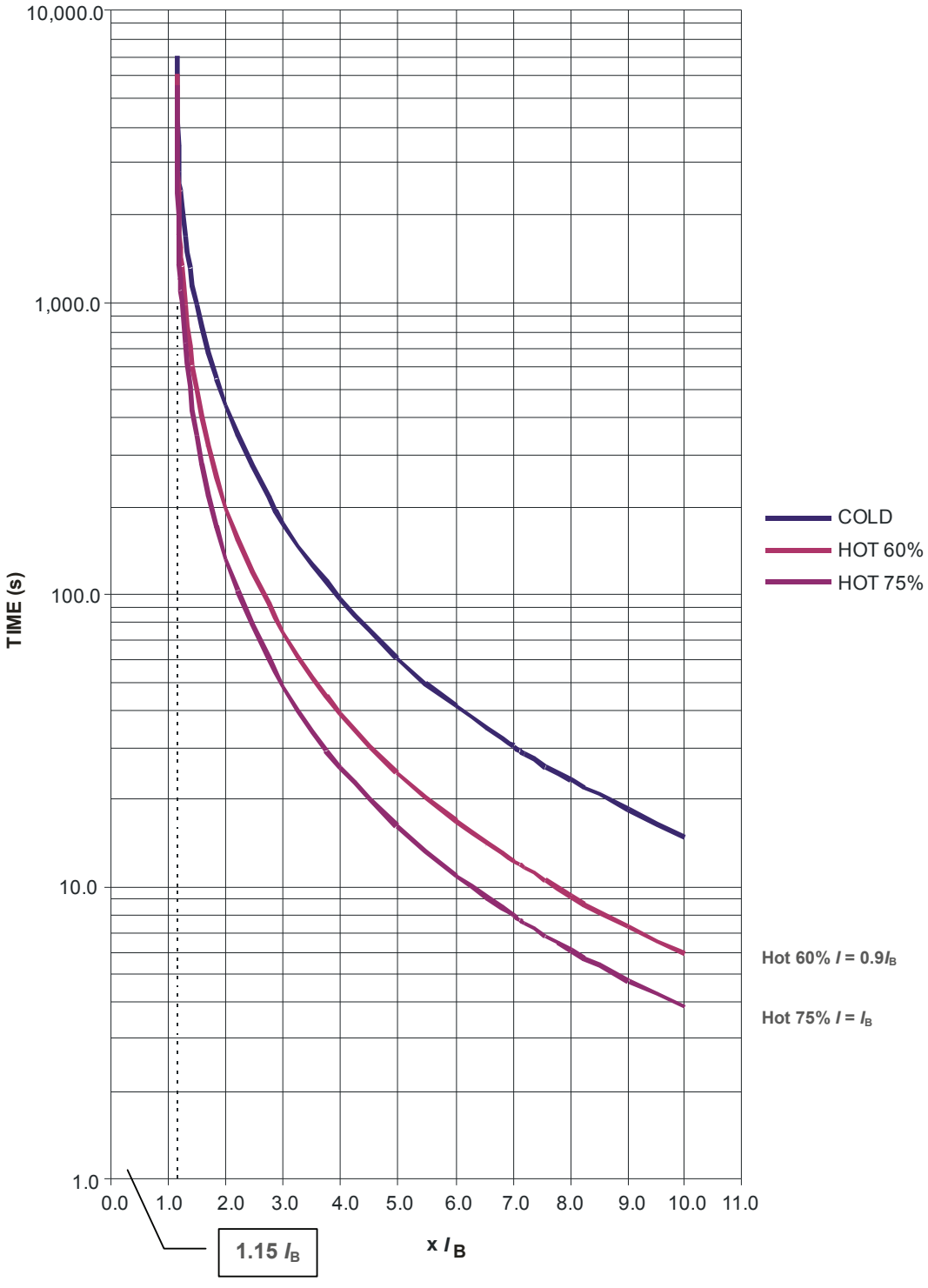
OVERLOAD CLASS 20



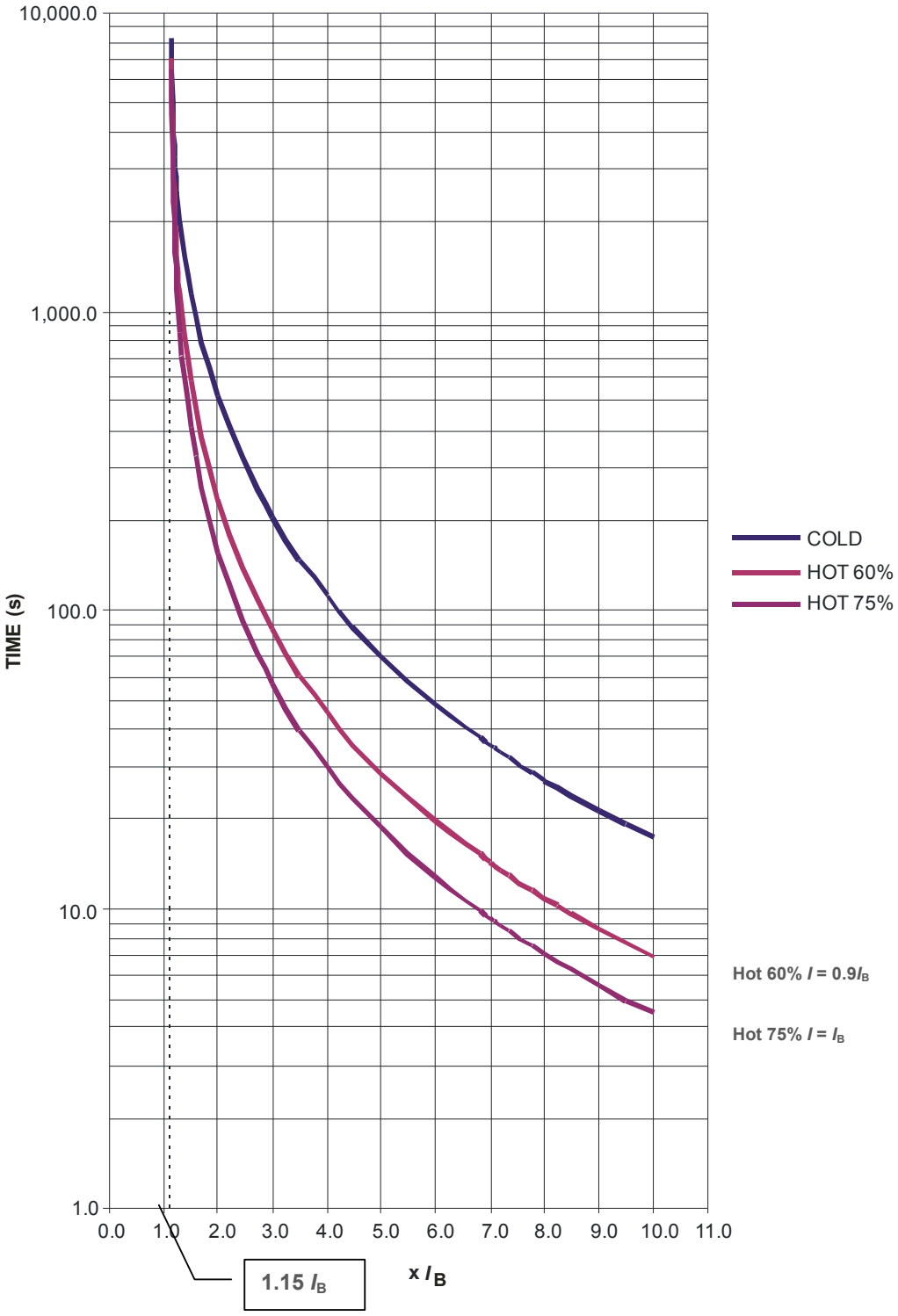
OVERLOAD CLASS 25

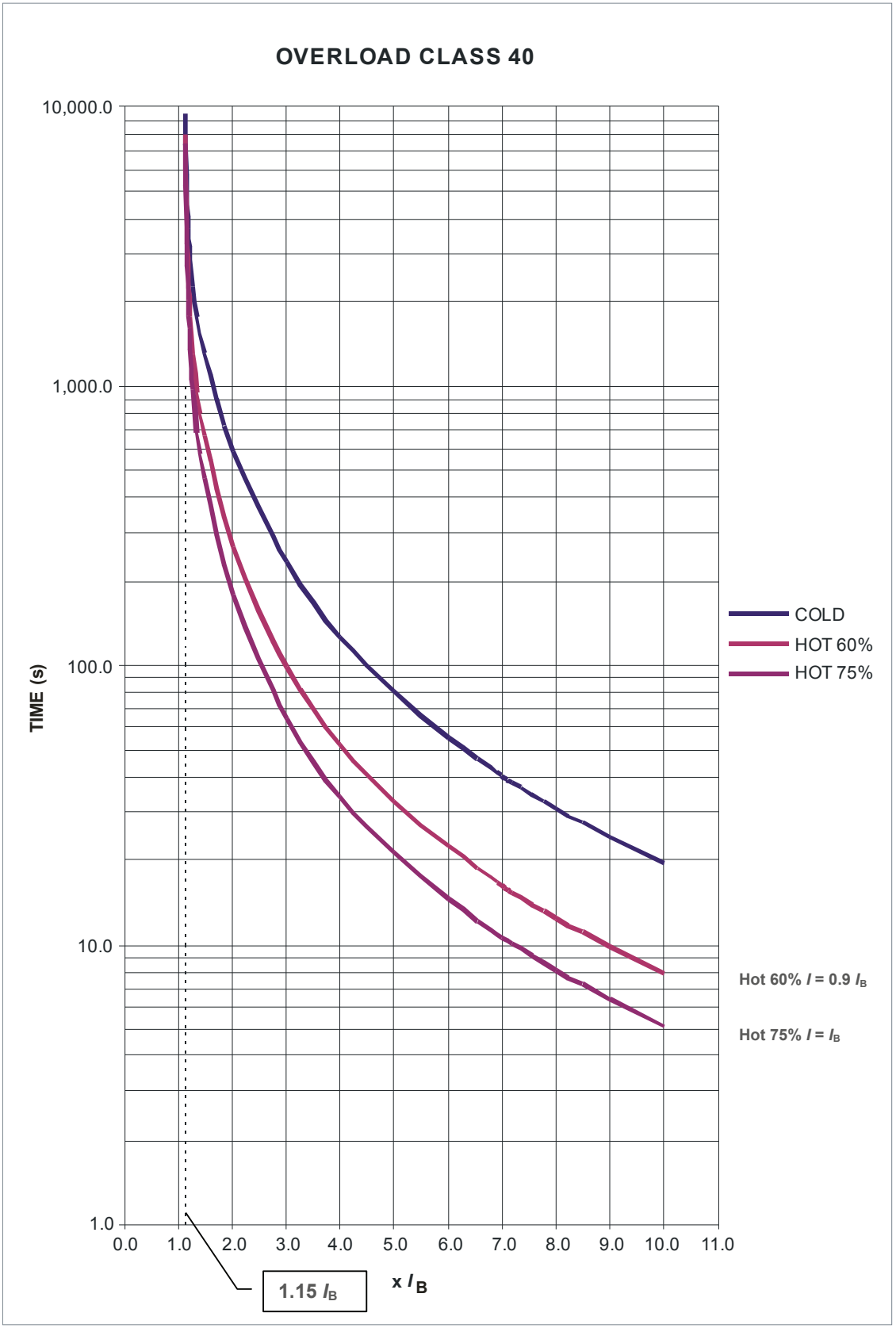


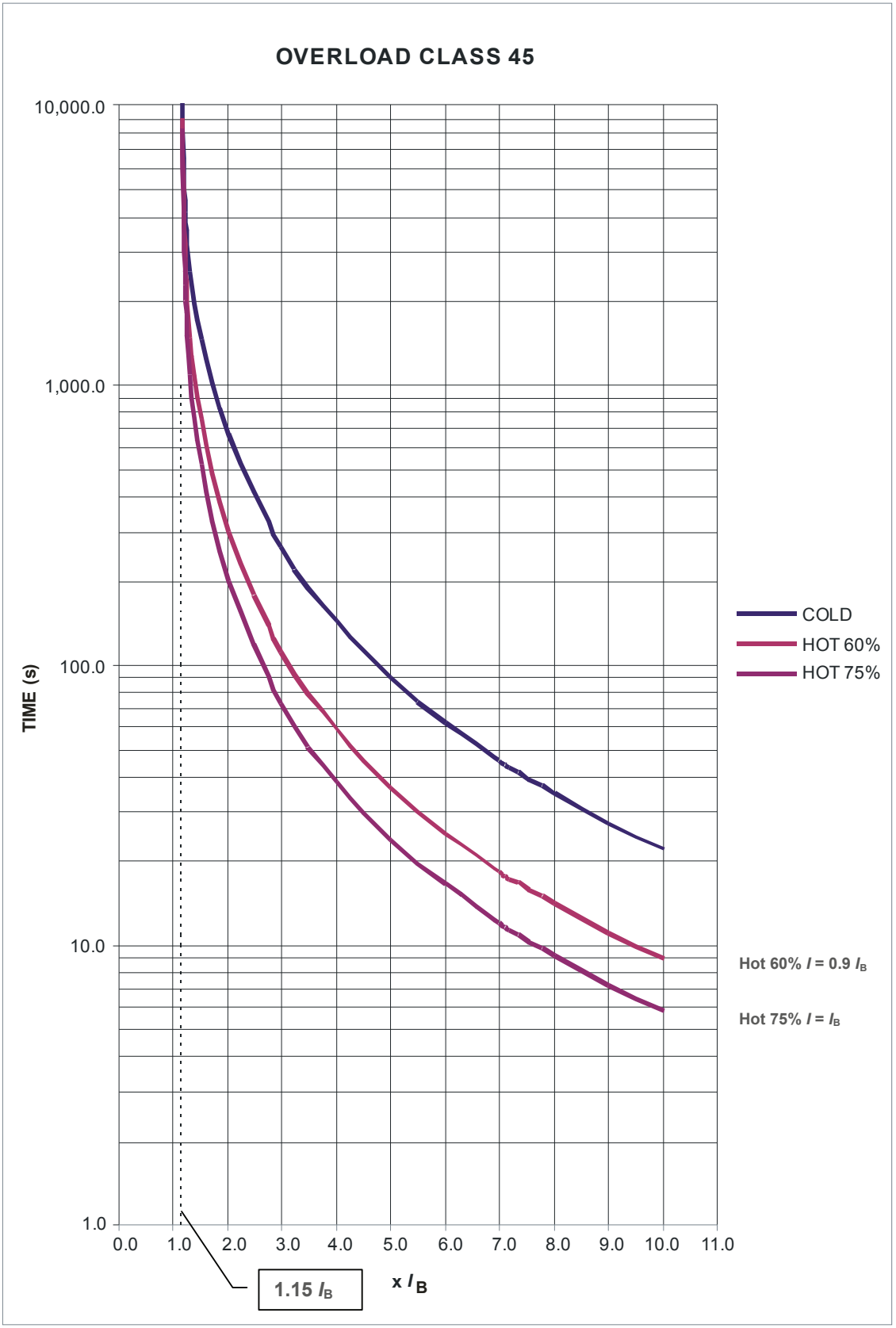
OVERLOAD CLASS 30



OVERLOAD CLASS 35




OVERLOAD CLASS 40
10,000.0
1,000.0
100.0
10.0
1.0
TIME (s)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
x I B
1.15 IB
COLD
HOT 60%
HOT 75%
Hot 60% I = 0.9 IB
Hot 75% I = IB


OVERLOAD CLASS 45
10,000.0
1,000.0
100.0
10.0
1.0
TIME (s)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
x I B
1.15 I B
COLD
HOT 60%
HOT 75%
Hot 60% I = 0.9 I B
Hot 75% I = I B

6.2.17. IEC255-4/BS-142 Curves

The PGR-6150 relay complies with the curves in Standard IEC255-4/BS-142:

- Inverse Curve
- Very Inverse Curve
- Extremely Inverse Curve

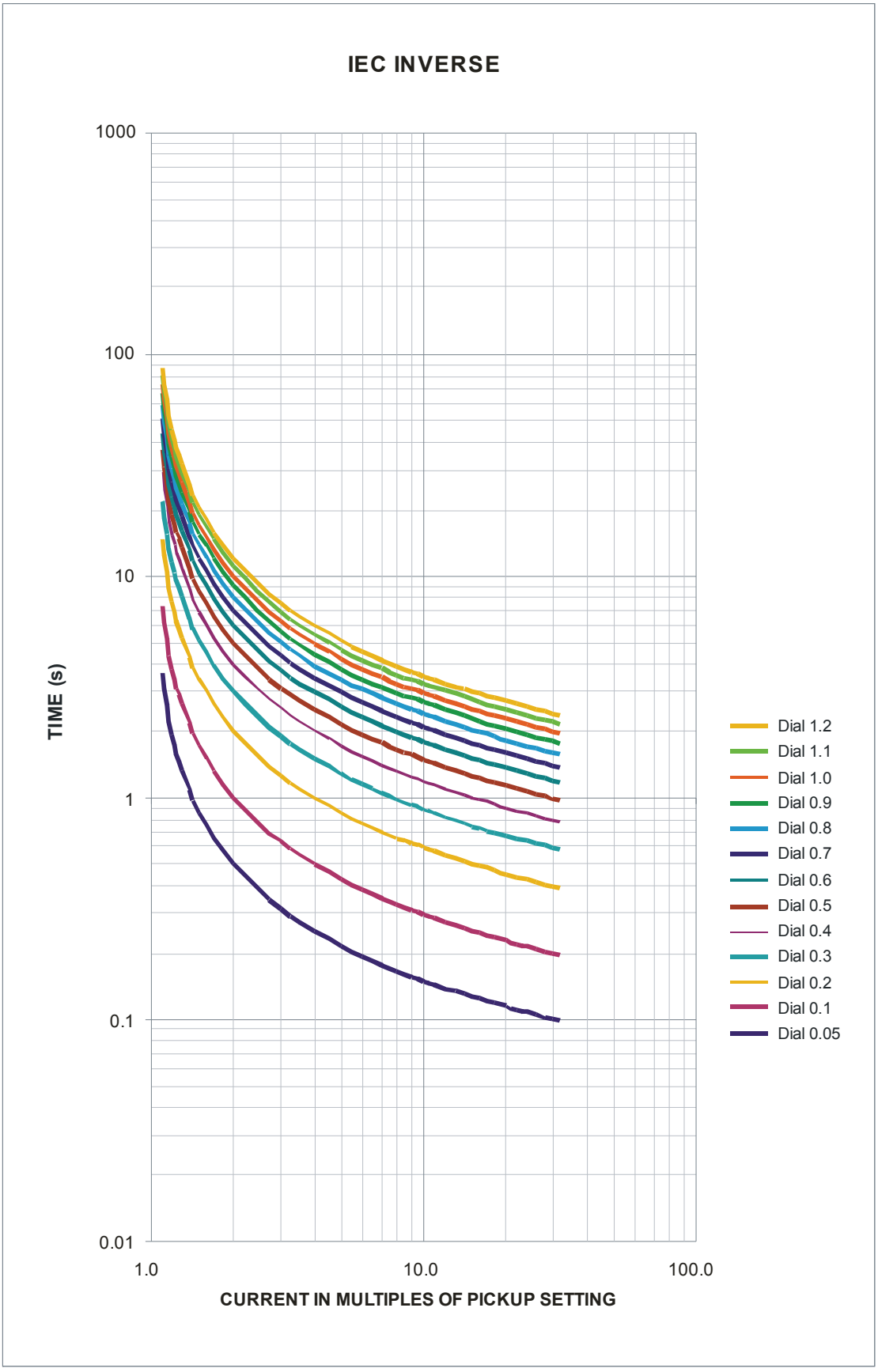
The following equation defines the time, in seconds, as a function of the current:

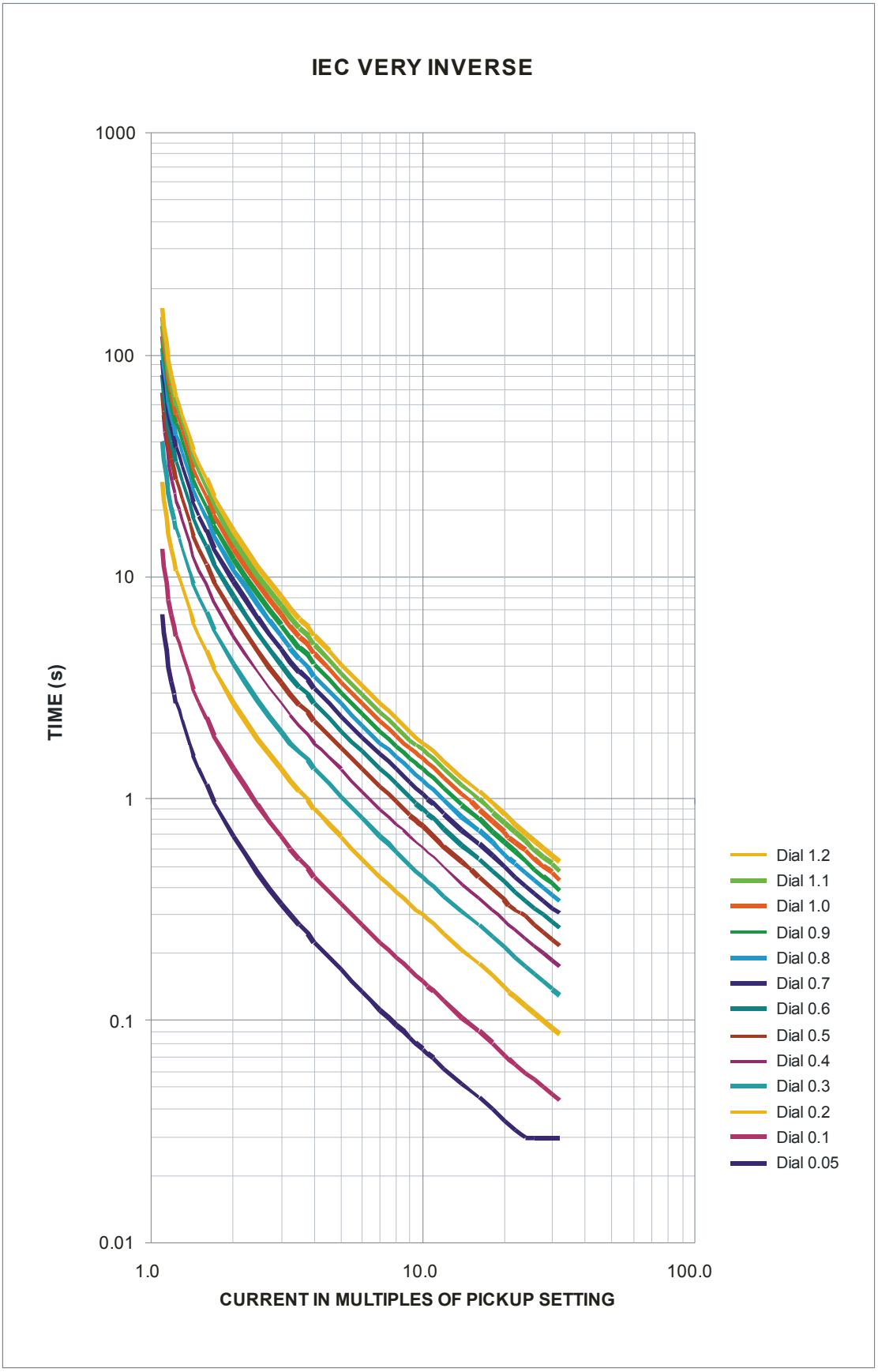
$$t = \frac{A \times D}{V^P - Q} + B \times D + K$$

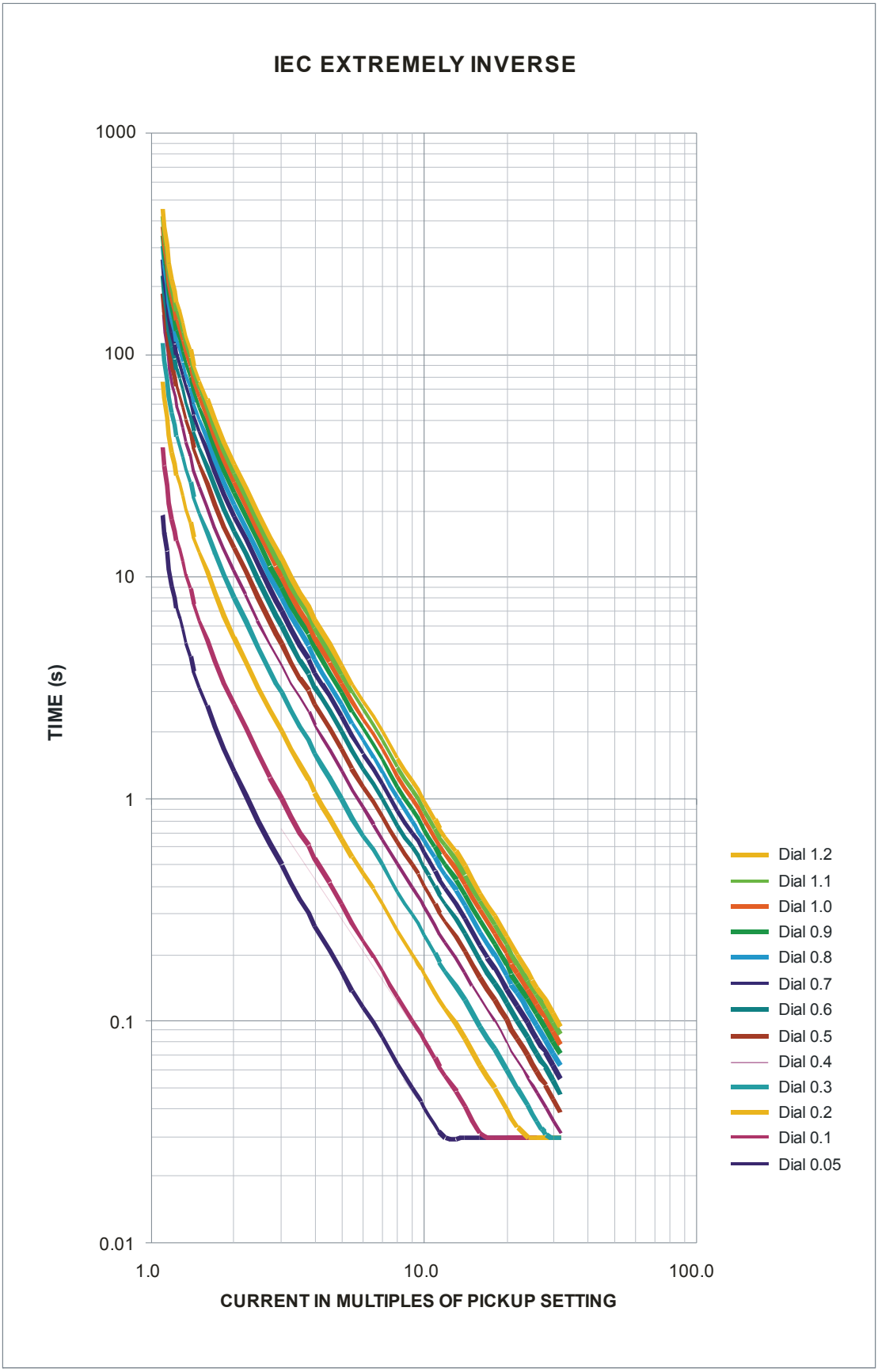
$$V = \frac{I}{Ipickup}$$

Parameters:	A	P	Q	B	K
Extremely Inverse	80	2	1	0	0
Very Inverse	13.5	1	1	0	0
Inverse	0.14	0.02	1	0	0

Where D is the dial setting and I_{pickup} is the initial operating current, set by the user.


IEC INVERSE
1000
100
10
1
0.1
0.01
TIME (s)
1.0
10.0
100.0
CURRENT IN MULTIPLES OF PICKUP SETTING
Dial 1.2
Dial 1.1
Dial 1.0
Dial 0.9
Dial 0.8
Dial 0.7
Dial 0.6
Dial 0.5
Dial 0.4
Dial 0.3
Dial 0.2
Dial 0.1
Dial 0.05


IEC VERY INVERSE
1000
100
10
1
0.1
0.01
TIME (s)
1.0
10.0
100.0
CURRENT IN MULTIPLES OF PICKUP SETTING
Dial 1.2
Dial 1.1
Dial 1.0
Dial 0.9
Dial 0.8
Dial 0.7
Dial 0.6
Dial 0.5
Dial 0.4
Dial 0.3
Dial 0.2
Dial 0.1
Dial 0.05


IEC EXTREMELY INVERSE
1000
100
10
1
0.1
0.01
TIME (s)
1.0
10.0
100.0
CURRENT IN MULTIPLES OF PICKUP SETTING
Dial 1.2
Dial 1.1
Dial 1.0
Dial 0.9
Dial 0.8
Dial 0.7
Dial 0.6
Dial 0.5
Dial 0.4
Dial 0.3
Dial 0.2
Dial 0.1
Dial 0.05

6.3. Monitoring and control

6.3.1. Metering

The following metering options are provided: three phase currents (IA, IB, IC), neutral current (I0) calculated as a digital sum of the phase currents, ground-fault current (IG) measured by a ground-fault current transformer, positive-sequence current, negative-sequence current, average current of the three phases, thermal image measurement (%) and line frequency.

The ground current value is obtained in two ways:

- By means of an external ground-fault current transformer which monitors three phases (IG). The PGR-6150 will also check that the ground-fault current transformer is not in an open circuit.
- If the three phase motor is directly connected to ground via a sufficiently low impedance, the ground current value is obtained by adding the currents measured by the three internal PGR-6150 transformers (I0).

The current measurements (IA, IB, IC, I0, IG) are RMS values. 16 samples per cycle are used. The sampling frequency is set based on the frequency setting (50 Hz, 60 Hz, or variable). The measurement accuracy is ±2% over the frequency range of 45 to 65 Hz. The variable frequency sampling is only valid on models supplied with alternating voltage, as the supply voltage is taken as the frequency reference.

Below are the residual neutral and phase measurement ranges of the PGR-6150:

Range I_B	4 to 25 A
Residual neutral and phase measurement range with no external current transformers. Transformer Ratio = 1	1 to 150 A
Residual neutral and phase measurement range with external current transformers. Transformer Ratio = *R*	*R* to 150*R* A

6.3.2. States

The states are real time information regarding the state of the PGR-6150. The PGR-6150 states can be accessed through the PGR-6150-OPI and communications.

All the equipment states are listed below:

STATES
OVERLOAD
Alarm
Trip
UNBALANCE
Phase A Trip
Phase B Trip
Phase C Trip
Function Trip
Phase A Pickup
Phase B Pickup
Phase C Pickup
Function Pickup
PHASE LOSS
Phase A Trip
Phase B Trip
Phase C Trip
Function Trip
Phase A Pickup
Phase B Pickup
Phase C Pickup
Function Pickup
SEQUENCE
Pickup
Trip
PTC
Overtemperature trip
Open circuit alarm
Short circuit alarm

STATES
JAM
Phase A Trip
Phase B Trip
Phase C Trip
Function Trip
Phase A Pickup
Phase B Pickup
Phase C Pickup
Function Pickup
LOCKED ROTOR
Phase A Trip
Phase B Trip
Phase C Trip
Function Trip
Phase A Pickup
Phase B Pickup
Phase C Pickup
Function Pickup
I_0>> GF CALC DEF
Pickup
Trip
I_0> GF CALC INVERSE
Pickup
Trip
I_G>> GF MEASURED DEF
Pickup
Trip
I_G> GF MEASURED INV
Pickup
Trip

STATES
I < UNDERCURRENT
Phase A Trip
Phase B Trip
Phase C Trip
Function Trip
Phase A Pickup
Phase B Pickup
Phase C Pickup
Function Pickup
RELAY OUTPUTS
Relay K1
Relay K2
DIGITAL INPUT
Input 1
MISCELLANEOUS
Motor Running
Start Time Excessive
GF CT Open
Output Enable
Settings Error
Configuration Error
Trip Report Error
Statistics Error
Protection Alarm
Protection Trip

The “Equipment Alarm” consists of the following:

Overload: Alarm
PTC: Short-circuit
PTC: Open circuit
Miscellaneous: GF CT Open
Miscellaneous: Settings Error
Miscellaneous: Configuration Error

The “Protection Trip” consists of the following:

Overload: Function trip
Unbalance: Function trip
Phase Loss: Function trip
Sequence: Function trip
PTC: Overtemperature trip
Jam: Function trip
Locked rotor: Function trip
I0>> GF Calc Def: Function trip
I0> GF Calc Inverse: Function trip
IG>> GF Measured Def: Function trip
IG> Measured Inv: Function trip
I< Undercurrent: Function trip
Start Time Excessive

6.3.3. Ground-Fault Current-Transformer Monitoring

The ground-fault current transformer connection is checked if the IG> function or the IG>> function, or both, are enabled. If it is detected that the transformer connection has opened, the "GF CT open" status bit is activated after a 1 second delay.

6.3.4. Time-Delayed PGR-6150 Start

On power-up, the “PGR-6150 Initial Time” parameter can be used to delay the activation of the output relay. This enables motors to be started up sequentially. The time delay is adjustable 0 to 3600 seconds (1 hour).

The "Miscellaneous" states group includes an “Enable Outputs " bit. During the equipment start up time delay, this bit is at 0, thus preventing the physical outputs from being activated. Once the “PGR-6150 Initial Time” is reached, this bit switches to 1 and the relay outputs are enabled.

6.3.5. Reset

The three reset types on the PGR-6150 are as follows:

- Automatic reset
- Automatic time delay reset
- Manual reset

If automatic reset has been selected, the PGR-6150 is reset when the trip condition is removed.

If automatic time delay reset has been selected, the equipment is reset when the trip condition is removed and the reset time has elapsed.

In manual reset mode the PGR-6150 is reset when a reset command is received. The reset command can be issued by network communications, the PGR-6150-OPI, or the digital input.

6.3.6. Thermal-Image Reset

There are two thermal-image reset commands.

- Reset of the thermal image to 75%, which can be issued from the PGR-6150-OPI and network communications.
- Reset of the thermal image to 0%, which can be issued from network communications.

6.3.7. Reset/Test Button

The “Test/Reset” button has two functions.

A short press of the “Test/Reset” button tests the PGR-6150 and PGR-6150-OPI LED’s simultaneously, with the following sequence: Lit for one second, off for one second, lit for one second and off permanently.

Holding down the “Test/Reset” key for 3 seconds resets the LED’s and the latched outputs.

6.3.8. Reports/Event Records

Up to four fault reports are stored in non-volatile memory. A fault report is generated when relay K1 is activated (trip). They can be displayed via the PGR-6150-OPI or network communications.

The information related to each fault report is as follows:

- Date
- I_A
- I_B
- I_C
- I_0
- I_G
- Thermal image
- Frequency
- Average current
- I1
- I2
- Overload: trip
- Unbalance: Phase A trip
- Unbalance: Phase B trip
- Unbalance: Phase C trip
- Phase loss: Phase A trip
- Phase loss: Phase B trip
- Phase loss: Phase C trip
- PH Sequence: Trip
- PTC: Overtemperature
- PTC: Short-circuit
- PTC: Open circuit

- Jam: Phase A trip
- Jam: Phase B trip
- Jam: Phase C trip
- Locked rotor: Phase A trip
- Locked rotor: Phase B trip
- Locked rotor: Phase C trip
- I_0>>: Trip
- I_0>: Trip
- I_G>>: Trip
- I_G>: Trip
- I<: Phase A trip
- I<: Phase B trip
- I<: Phase C trip
- Push Button
- Digital Input
- Relay K1
- Relay K2
- Motor: Running
- Start Time Exceeded
- GF CT open
- Output Enable

To obtain more detailed information on how to access *Reports* see Section 9.4.11.

6.3.9. Statistics

The PGR-6150 records the following statistics:

- Number of starts
- Start maximum current
- Maximum last start current
- Average last start current
- Average start time
- Running hours
- Number of overload trips
- Number of overemperature trips
- Number of jam trips
- Number of locked rotor trips
- Number of ground-fault trips

6.3.10. Commands

The following table lists the available commands:

Test LED's	PGR-6150: Short press test/reset button
	PGR-6150-OPI: Short press test/reset button
	Communication: Control 44
Outputs and LED's reset	PGR-6150: Test/reset button held down
	PGR-6150-OPI: Test/reset button held down
	Communication: Control 47
Statistics reset	PGR-6150-OPI: Control menu
	Communication: Control 51
Operation hours reset	PGR-6150-OPI: Control menu
	Communication: Control 53
Thermal image reset to 75%	PGR-6150-OPI: Control menu
	Communication: Control 54
Motor stop command	PGR-6150-OPI: Stop key
	Communication: Control 57

To facilitate the overload function tests, the following commands are included which are only available from communication:

Thermal image reset to 75%	Communication: Control 54
Thermal image reset to 0%	Communication: Control 55

6.3.11. Digital Input

A digital input is provided and assigned the reset function.

6.3.12. Outputs

There are two relay outputs, relay K1 is the trip relay and relay K2 is the alarm relay. Both relays operate in fail-safe mode.

6.3.13. PGR-6150 Base Module LED's

PWR	Constant	Equipment OK
	Flashing	-
1	Constant	Overload trip Jam trip Locked rotor trip Excessive start time
	Flashing	Undercurrent trip
2	Constant	Ground-fault trip
	Flashing	CT connection alarm
3	Constant	Overtemperature trip
	Flashing	PTC failure
4	Constant	Phase unbalance trip Phase loss trip
	Flashing	Phase sequence trip

Once activated, the LED's are latched. Holding down the "Test/Reset" key (3 seconds) resets the LED's and the latched outputs.

If the PGR-6150 supply voltage is removed LED signalling is lost.

6.3.14. Adjustable PGR-6150-OPI LED's

The user can program the six PGR-6150-OPI LED's. The LED's can be set as latched or not latched, and as flashing or constant, with the possibility of all the combinations:

Not latched	On
Not latched	Flashing
latched	On
latched	Flashing

If the LED's have been set as latched, once activated they maintain on. Holding down the "Test/Reset" key for 3 seconds resets the LED's and the latched outputs.

If the PGR-6150-OPI supply voltage is removed LED signalling is lost.

The following States can be assigned to the LED's

- Not configured
- Overload: alarm
- Overload: trip
- Unbalance: Phase A pick up
- Unbalance: Phase B pick up
- Unbalance: Phase C pick up
- Unbalance: Pick up
- Unbalance: Phase A trip
- Unbalance: Phase B trip
- Unbalance: Phase C trip
- Unbalance: trip
- Phase loss: Phase A pick up

- Phase loss: Phase B pick up
- Phase loss: Phase C pick up
- Phase loss: Pick up
- Phase loss: Phase A trip
- Phase loss: Phase B trip
- Phase loss: Phase C trip
- Phase loss: trip
- Sequence: Pick up
- Sequence: trip
- PTC: overtemperature
- PTC: Short circuit
- PTC: Open circuit
- Jam: Phase A pick up
- Jam: Phase B pick up
- Jam: Phase C pick up
- Jam: Pick up
- Jam: Phase A trip
- Jam: Phase B trip
- Jam: Phase C trip
- Jam: trip
- Locked rotor: Phase A pick up
- Locked rotor: Phase B pick up
- Locked rotor: Phase C pick up
- Locked rotor: Pick up
- Locked rotor: Phase A trip
- Locked rotor: Phase B trip
- Locked rotor: Phase C trip
- Locked rotor: trip
- I_0>>: Pick up
- I_0>>: trip
- I_0>: Pick up
- I_0>: trip
- I_G>>: Pick up
- I_G>>: trip
- I_G>: Pick up
- I_G>: trip
- I<: Phase A pick up
- I<: Phase B pick up
- I<: Phase C pick up
- I<: Pick up
- I<: Phase A trip
- I<: Phase B trip
- I<: Phase C trip
- I<: trip
- Digital Input
- Push Button
- GF CT open
- Configuration error
- Settings error
- Reports error
- Protection alarm
- Protection trip
- Motor : Running
- Start time exceeded
- Output enable

To obtain more detailed information on how to assign *States* to LED's see Sections 9.4.8 and 9.4.10.

6.3.15. Self-Diagnostics

Diagnostic algorithms are run continuously when the PGR-6150 is operating.

The following status bits are associated with this process:

Configuration error	Problem in the configurations saved in e2prom. Defaults are loaded.
Settings error	Problem in the setting saved in e2prom. The setting is not saved.
Reports error	Problem in the reports saved in e2prom. The reports are lost.

6.3.16. Date-Time Synchronization

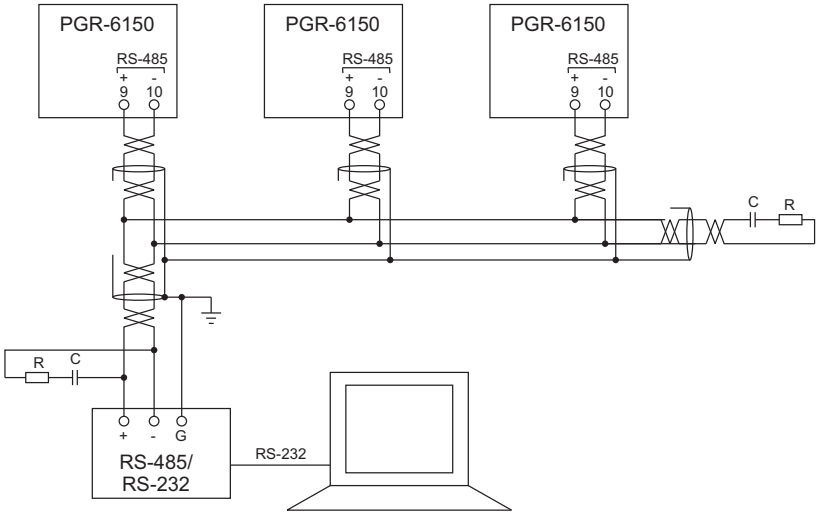
The PGR-6150 includes a Real Time Clock. The PGR-6150 time can be set using the PGR-6150-OPI or by using network communications. Without supply voltage, RTC maintains the date and time for 72 hours at 60ºC.

6.3.17. RS-485 Communications

The PGR-6150 has an RS-485 port to communicate with a remote computer or a SCADA system. It uses Modbus RTU (19200, no parity, 8 bit, 1 stop bit). For the memory map and Modbus documentation see Section 11.

Up to 32 devices can be connected to one bus; each with a different Modbus address. The Modbus address can be set using the PGR-6150-OPI.

To minimize communications errors due to noise, use shielded cable. Observe polarity: "+" terminals connect to "+", etc. For very long cable lengths use resistors at each end of the cable. The resistor value should be equal to the impedance of the cable.



6.3.18. Modbus RTU Protocol

The protocol documentation and the Modbus memory map are shown in Section 11.

6.3.19. User Password

Settings are protected by a user password. The password consists of four digits. The PGR-6150 leaves the factory with the password "5555" which can be changed by the user.

When a setting is modified, the PGR-6150-OPI requests the user password and initiates a session if the correct password is entered. This session closes if no key is pressed for five minutes.

When using communications, the user password field is requested in the settings confirmation sections. If the password entered does not match the PGR-6150 password, the settings changes are rejected.

6.2.20. PGR-6150 Base Module Test Program

The PGR-6150 is equipped with a test menu which can be accessed by the PGR-6150-OPI to test the LED's and relay outputs.

The following table shows the components that can be tested, along with their status depending on whether they are activated or deactivated:

LED 1	Deactivated	LED 1 off
	Activated	LED 1 on
LED 2	Deactivated	LED 2 off
	Activated	LED 2 on
LED 3	Deactivated	LED 3 off
	Activated	LED 3 on
LED 4	Deactivated	LED 4 off
	Activated	LED 4 on
LED 5	Deactivated	LED 5 off
	Activated	LED 5 on
Relay K1	Deactivated	Output 1 deactivated
	Activated	Output 1 activated
Relay K2	Deactivated	Output 2 deactivated
	Activated	Output 2 activated

The following key sequence is used to access the test menu: from the main menu, press the keys "◄", "▼", and "►" in sequence and then press and hold the "OK" key until the "TEST-DISPLAY" appears. Press the "►" key to access the "TEST-PBM" menu, and press "OK", to access the test menu for the PGR-6150 base module. Navigate the various menu items using the "▲" and "▼" keys. Each item can be activated or deactivated by pressing "OK" on it (if the item is deactivated, it is activated by pressing OK; if the item is activated, it is deactivated by pressing "OK"). Press the "C" key to exit the test menu.

For more detailed information on navigating through menus see Section 9.

6.3.21. PGR-6150-OPI Operator Interface Test Program

The PGR-6150-OPI is equipped with a test menu to test LED's and programming keys.

LED 1	Deactivated	LED 1 off
	Activated	LED 1 on
LED 2	Deactivated	LED 2 off
	Activated	LED 2 on
LED 3	Deactivated	LED 3 off
	Activated	LED 3 on
LED 4	Deactivated	LED 4 off
	Activated	LED 4 on
LED 5	Deactivated	LED 5 off
	Activated	LED 5 on
LED 6	Deactivated	LED 5 off
	Activated	LED 5 on
Keys	Deactivated	No key has been pushed
	Up	The "▲" up key was pushed
	Down	The "▼" down key was pushed
	Left	The "◄" left key was pushed
	Right	The "►" right key was pushed
	OK	The "OK" key was pushed
	C	The "C" key was pushed
	Start	The "I" start key was pushed
	Stop	The "O" stop key was pushed
	Reset	The "RESET" key was pushed

The following key sequence is used to access to the test menu: from the main menu, press the keys "◄", "▼", and "►" in sequence and then press and hold the "OK" key until the "TEST-DISPLAY" appears. Press the "OK" key to access to the PGR-6150-OPI test menu. Use the "▲" and "▼" keys to browse through the different menu items. Each item can be activated or deactivated by pressing "OK" on it (if the item is deactivated, it is activated by pressing OK; if the item is activated, it is deactivated by pressing "OK"). To exit the PGR-6150-OPI test menu from any status, except the "Key" status, press the "C" key. To exit the PGR-6150-OPI test menu from the "Key" status, press and hold the "C" key.

To obtain more detailed information about navigating the menus see Section 9.

6.3.22. PGR-6150-OPI LCD Contrast

Pressing the "▲" key increases the LCD contrast. Pressing the "▼" key reduces the LCD contrast. When the power is cycled the LCD contrast is reset to its default value.

7. TECHNICAL SPECIFICATIONS AND STANDARDS

7.1. Technical specifications

General	Motor rated current: 4 to 25 A (step 0.01)
	CT Turns Ratio: 1 to 2,000
	Frequency: 50Hz/60Hz/variable frequency (45Hz – 65Hz)
	Phase sequence ABC/ACB
	Time delayed equipment start: 0 to 3,600 s (step 1 s)
Overload	Function enabled: yes/no
	Service Factor: 1 to 2 I_B (step 0.01)
	Trip class: 5, 10, 15, 20, 25, 30, 35, 40 and 45
	Independent mechanical ventilation: yes/no (yes, cooling thermal constant /4)
	Alarm: 20 to 100% (step 1)
	Maximum current of the three phases
	Heating thermal constant: 37 x trip class
	Cooling thermal constant: 90 x trip class
	Heating I > 15% I_B
	Cooling I < 15% I_B
	Activation level: 100% thermal image
	Reset level: alarm level setting
Unbalance	Function enabled: yes/no
	%Unbalance (d): 1 to 30% (step 1)
	Starting trip time: 0.02 to 20 s (step 0.001 s)
	Running trip time: 0.02 to 20 s (step 0.001 s)
	Reference: Average current of phases IA, IB, IC
	Upper limit, activation level: (100 + d)%
	Upper limit, reset level: (100 + d – 5)%
	Lower limit, activation level: (100 – d)%
	Lower limit, reset level: (100 – d + 5)%

Phase loss	Function enabled: yes/no
	%Unbalance (d): 10 to 100% (step 1)
	Operating time: 0.02 to 20s (step 0.001)
	Reference: Average current of phases IA, IB, IC
	Activation level: (100 – d)%
	Reset level: (100 – d + 5)%
Sequence	Function enabled: Yes/no
	Operating time: 0.02 to 2 s (step 0.001)
PTC	Function enabled: yes/no
	Overtemperature, activation level: > 3,600 Ω
	Overtemperature, reset level: < 1,800 Ω
	Short circuit, activation level: < 20Ω
	Short circuit, reset level: > 30 Ω
	Open circuit, activation level: > 4,000 Ω
	Open circuit, reset level: < 3,900 Ω
	Operating time: 500 ms
Jam	Function enabled: yes/no
	Pickup: 1 to 3.5 times I_B (Step 0.01)
	Operating time: 0.02 to 50 s (Step 0.001)
	Activation level: 100% pickup
	Reset level: 95% pickup
Locked rotor	Function enabled: yes/no
	Pickup: 3.5 to 6 times I_B (Step 0.01)
	Motor starting up time: 0.02 to 200 s (Step 0.001)
	Motor operation time: 0.02 to 30 s (Step 0.001)
	Activation level: 100% pickup
	Reset level: 95% pickup
I_0>> GF Calc Def	Function enabled: yes/no
	Pickup: 0.1 to 1 times I_B (Step 0.01)
	Operating time: 0.02 to 5 s (Step 0.001)
	Activation level: 100% pickup
	Reset level: 95% pickup

I_0> GF Calc Inverse	Enable function: yes/no
	Pickup: 0.1 to 1 times I_B (Step 0.01)
	IEC 255-4/BS-142 Curves
	Operating time: Inverse curve, very inverse curve, extremely inverse curve. Defined time : 0.02 to 300 s (Step 0.01 s)
	Dial: 0.05 to 1.25
	Curve activation level 110% pickup
	Curve reset level 100% pickup
	Defined time activation level 100% pickup
	Defined time reset level 95% pickup
	Timer accuracy: 5% or 30 ms (whichever is greater)
I_G>> GF Measured Def	Function enabled: yes/no
	Pickup: 100 to 15000 mA (Step 1 mA)
	Operating time: 0.02 to 5 s (step 0.001)
	Activation level: 100% pickup
	Reset level: 95% pickup
I_G> GF Measured Inv	Function enabled: yes/no
	Pickup: 100 to 450 mA (Step 1 mA)
	IEC 255-4/BS-142 Curves
	Operating time: Inverse curve, very inverse curve, extremely inverse curve. Defined time : 0.02 to 300 s (Step 0.01 s)
	Dial: 0.05 to 1.25
	Curve activation level 110% pickup
	Curve reset level 100% pickup
	Defined time activation level 100% pickup
	Defined time reset level 95% pickup
	Timer precision: 5% or 30 ms (whichever is greater)
I< Undercurrent	Function enabled: yes/no
	Pickup: 0.3 to 1 times I_B (Step 0.01)
	Operating time: 0.02 to 200 s (Step 0.001)
	Activation level: 100% pickup
	Reset level: 105% pickup

Motor start monitoring	Start up threshold: 1 to 8 times I_B (Step 0.01)
	Activation level: 100% pickup
	Reset level: 95% pickup
	Maximum start up time: 1 to 200 s (Step 0.001)
RTC memory	Real Time Clock – up to 72 hours without power
Digital input	24 Vac/dc
Relay outputs	Ith: 5 A AC15 – 250 V, 2 A DC13 – 30 V, 2 A
Current measurement	RMS
	Sampling: 16 samples/cycle
	2% Accuracy
Frequency measurement	✓
Thermal image measurement	✓
Communications	RS-485 port: ModBus RTU
Power	110/230 Vac/dc or 24/48 Vdc
Max. nominal motor voltage	1,000 Vac
Power consumption	5 W maximum
Electrical life	5 x 10^5 operations
Mechanical life	10^6 operations
Environmental conditions	Operating temperature : -10 to 60ºC
	Storage temperature: -20 to 70ºC
	Relative humidity: 95%
	Altitude: 3,000 m
Mechanical Characteristics	Protection degree: IP20
	Weight: 0.5 Kg.
	Mounting: DIN Rail
	Terminals (Max. Section / Max. Torque): 2.5 mm^2, No. 22-12 AWG / 0.2 N-m, 1.8 in.lb

7.2. Standards

- EN 50263 (1999) Electromagnetic compatibility (EMC) – Product standard for measuring relays and protection equipment.
- EN 55011 Industrial, scientific and medical (ISM) – Limits and methods of measurement of radio disturbance characteristics.
- EN 55022 Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
- IEC 61000-4-2 Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test
- IEC 61000-4-3 Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
- IEC 61000-4-4 Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – electrical fast transient/burst immunity test
- IEC 61000-4-5 Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test
- IEC 61000-4-6 Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields
- EC 61000-4-8 Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 8: Power frequency magnetic field immunity test
- IEC 61000-4-10 Electromagnetic compatibility (EMC) – Part 4-10: Testing and measurement techniques – Damped oscillatory magnetic field immunity test
- IEC 61000-4-11 Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests
- IEC 61000-4-12 Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Oscillatory wave immunity test

8. ACCESSORIES

8.1. Ground-Fault Current Transformer

To prevent ground-fault relay trips during high load currents, a minimum pickup current setting is recommended as defined by the following table.

Type	Ø CT Internal diameter (mm (inches))	Ø CT Minimum pickup (mA)
PGC-6035	35 (1.377)	25
PGC-6060	60 (2.362)	25
PGC-6080	80 (3.150)	100
PGC-6110	110 (4.330)	250
PGC-6210	210 (8.268)	250

It is also recommended that the conductors be positioned as centrally as possible in the ground-fault current transformer.

8.2. Cable Section

The PGR-6150 wiring must have the following characteristics:

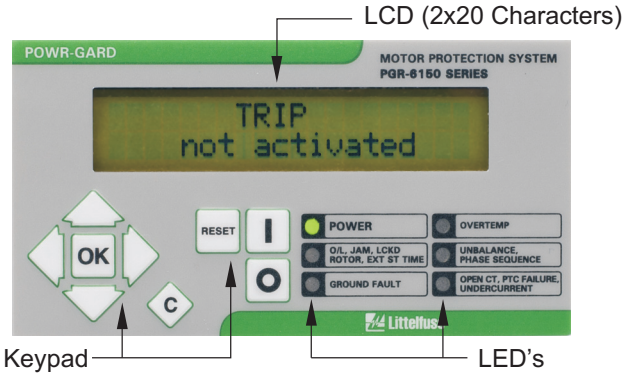
Terminal section:	2.5 mm^2 – No. 22-12 AWG
Screw torque:	0.2 N-m – 1.8 in.lb

8.3. PGR-6150 to PGR-6150-OPI Connection Cable

The PGR-6150 base module is connected to the PGR-6150-OPI by means of a 1 meter (39”) RJ-45 connection cable supplied with the PGR-6150-OPI.

9. PGR-6150-OPI OPERATOR INTERFACE

9.1. PGR-6150-OPI Front Panel



9.2. LED Indicators

The module's front panel is equipped with six LEDs that have user-selectable functions. A blank LED legend overlay is provided.

The default LED configuration is shown below:

LED 1	●	POWER
LED 2	●	Overload / Jam / Locked Rotor / Extended Start up Trip
LED 3	●	Ground-Fault Trip
LED 4	●	Overtemperature Trip
LED 5	●	Phase Unbalance, Phase Loss, Phase Sequence Trip
LED 6	✸	GF CT open circuit alarm, PTC sensor failure alarm, Undercurrent trip

LED 6 is set to flashing.

LED indicator operation can be checked from the module test menu, see Section 6.3.21.

9.3. LCD and Keypad

A 2x20 alphanumeric liquid crystal display (LCD) provides the user access to settings, metering, states, and fault reports. All of this information is arranged in a system of menus.

A keypad is used to navigate through the menu system. The ▲ ▼ and ◄ ► keys are used to navigate through the menus, the options in each menu, and the values for the settings.

The "**OK**" key is used to select the menus and the options, and to confirm changes to values. The "**C**" key is used to delete and to go back through the menu levels.

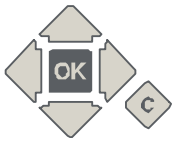
Press the "RESET" key once to check the operation of all LED's. Hold down the "RESET" key to reset the outputs and latched LED's.

Press the "O" key to cause a trip and stop the motor. To use the motor start function "I" a PGA-0180 Input/Output module is required.

9.4. Menus

9.4.1. Standby Mode

The *Standby Mode* screen displays the part number and POWR-GARD. The first menus can be accessed by pressing "OK": States, Metering, Settings, etc. The PGR-6150 returns to the *Standby Mode* screen after five minutes if no key is pressed.



PGR-6150
POWR-GARD

Accessing the menus:

The keys ▲, ▼, ◄ and ► are used to navigate through the different options and menus. The "**OK**" key is used to accept and to enter a menu or an option. The "**C**" key is used to move up through the menu levels.

A password is not required to view metering or settings menus.

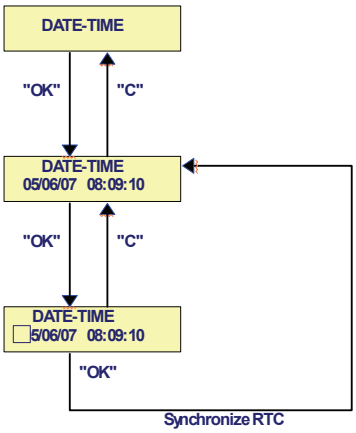
A 4 character password must be entered to modify settings and control. Once the password has been entered, a 5 minute session is established. After a key has not been pressed for this time, the password is erased and it must be entered again to execute the password protected operations.

To navigate from one item to another within a parameter use the ◄ and ► keys. To increase values, use the ▲ and ▼ keys.

9.4.2. Date-Time Menu

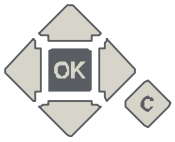
Scroll through the menus until the *Date-Time Menu* is reached. Press "OK" to access the date-time display screen. Press "OK" again to access the date-time modification screen. Use the "◄" and "►" keys to position the curser to a date-time digit. Use the ▲ and ▼ keys to set the correct values. Once the new date and time have been entered, press "OK" to synchronise the RTC (Real Time Clock) of the PGR-6150 base module. The date-time display will show the updated date, and time. Press "C" to return to the menu system.

The RTC will maintain the date and time up to 72 hours without power.



9.4.3. Version

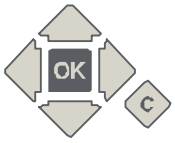
The PGR-6150 *Version Menu* can be accessed from the standby mode by sequentially pressing the keys "◄", "▼", "►", and "▲". This displays the software version of the processor. Press the "C" key to return to the standby mode screen.



PGR-6150
1.02

9.4.4. Communications Menu

The *Communication* parameters can be viewed by sequentially pressing the "◄", "▼", "►", and "▲ and OK" keys from the standby mode screen.



Communication:
19200-N-8-1

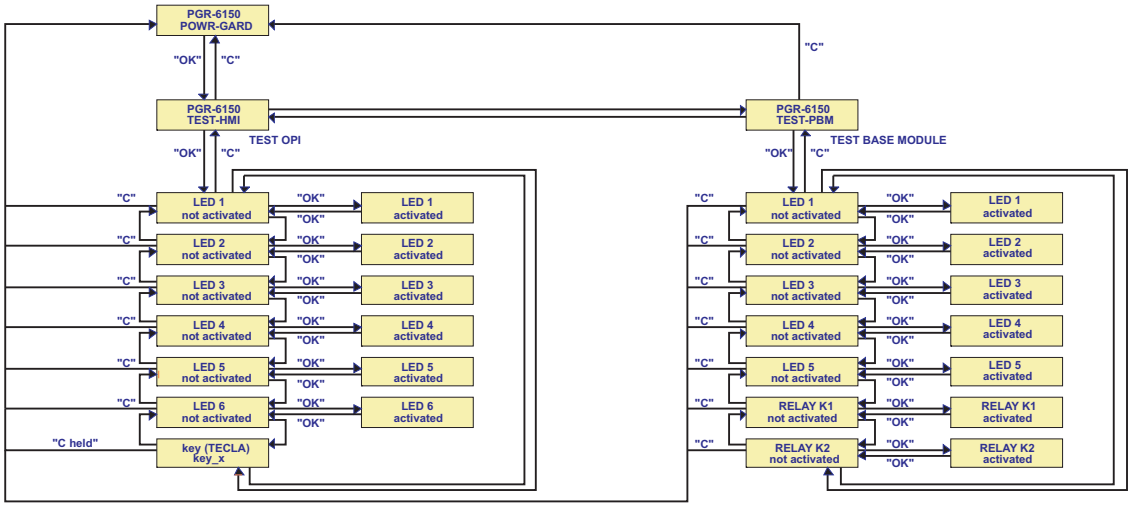
- Communication speed
- Parity
- Number of data bits
- Number of stop bits

The Modbus address is set in the Settings Menu see Section 9.4.9.

9.4.5. Test Menu

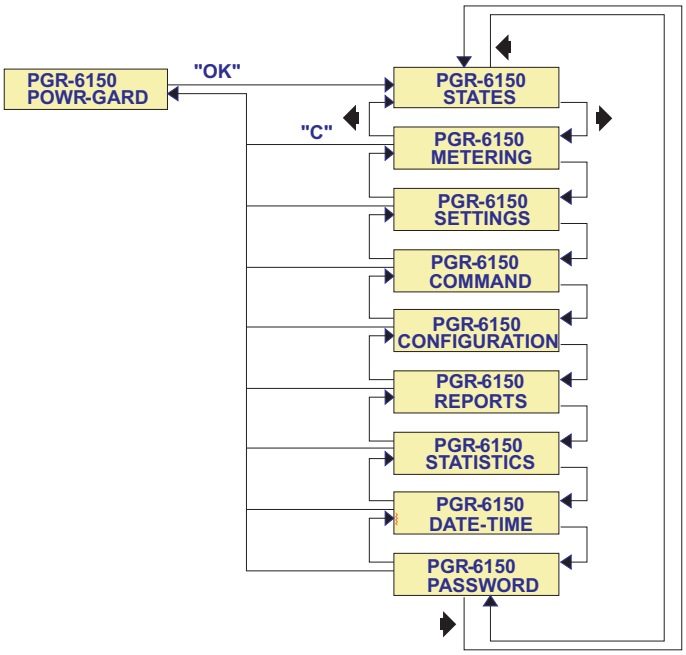
The *Test HMI* (OPI TEST) is accessed from the Standby Mode screen by sequentially pressing the "◄", "▼" and "►" keys, and then holding down the "OK" key.

In the *Test Menu*, press "OK" to access the submenu and use the "◄" and "►" keys to choose to perform the test on the PBM base module or on the HMI (OPI). Press "OK" to access the components that can be tested.



CAUTION: The PGR-6150 output relays are activated when the outputs are tested.

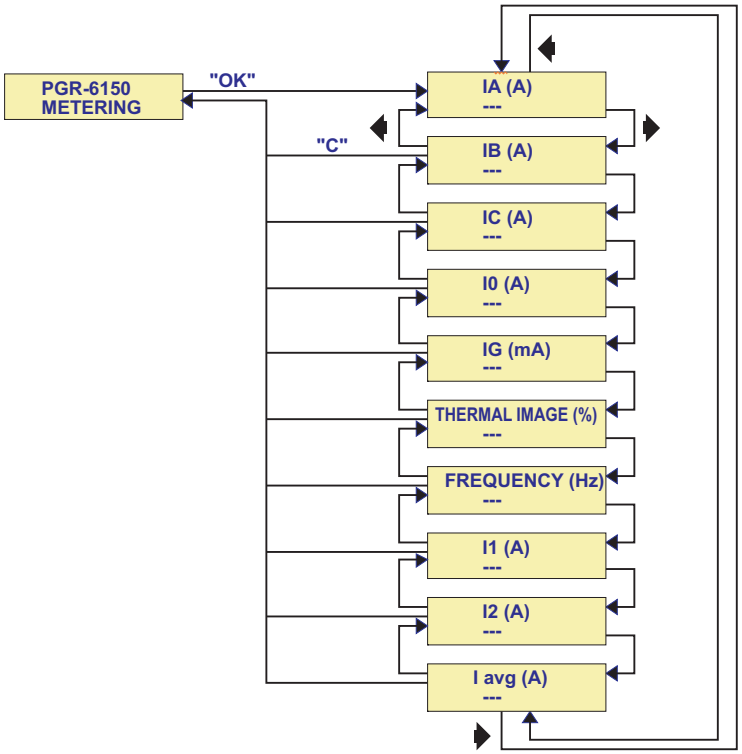
9.4.6. Functions Menu



Press the "**OK**" key to access the first level from the main screen. Use the "◄" and "►" keys to move from one menu section to another in the first level. Use the "**C**" key to return to a higher level.

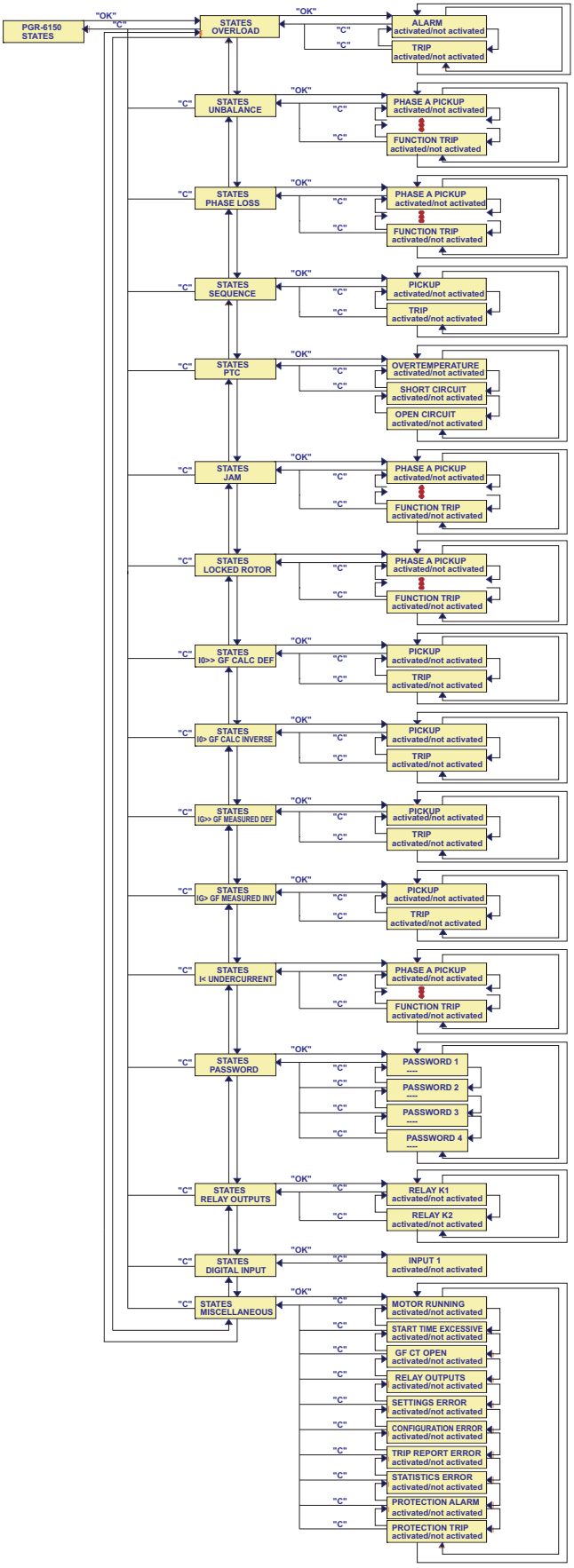
9.4.7. Metering Menu

In the Standby Mode screen, press the "OK" key to access the first line of menus. Use the "◄" and "►" keys to position the cursor over the *Metering Menu* and press "OK". Use the "◄" and "►" keys to scroll through the values.



9.4.8. States Menu

In the Standby Mode screen, press the “OK” key to access the first line of menus. Use the “◄” and “►” keys to position the cursor over the *States Menu* screen and press “OK”. Use the “◄” and “►” keys to position the cursor over a group of states, and press the “OK” key to access the states that belong to this group. Use the “◄” and “►” keys to browse through the different states. The display shows whether or not each state is active. The message “(*)” appears next to the title “STATES” if any of the states in that group are active.



9.4.9. Settings Menu

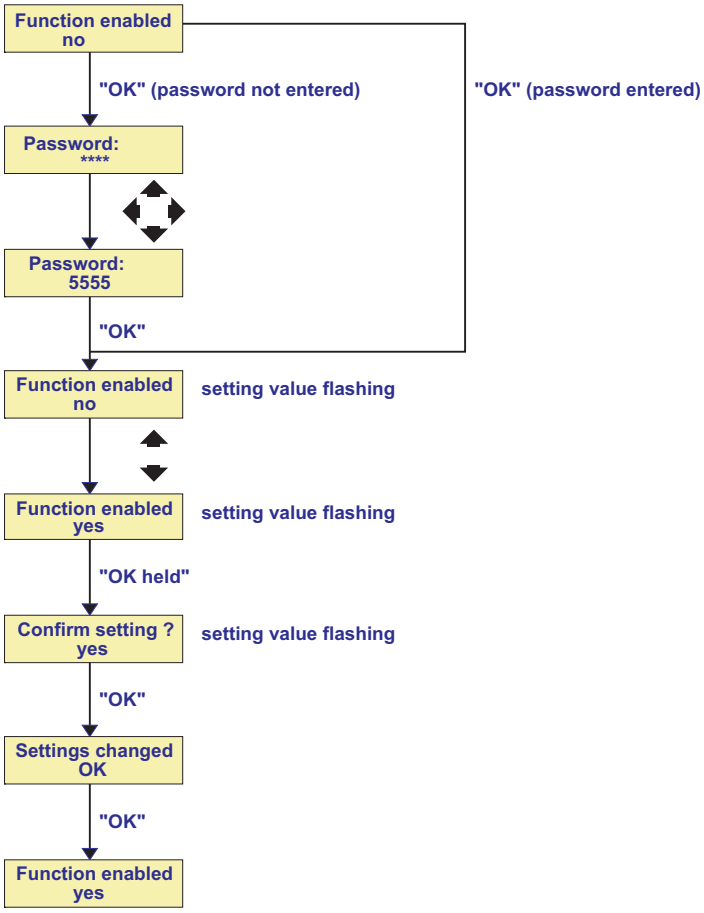
From the Standby Mode screen, press the “OK” key to access the first line of menus. Use the “◄” and “►” keys to position the cursor over the *Settings Menu* screen and press “OK”. This takes you to the settings group line. Use the “◄” and “►” keys to position the cursor over a settings group, and press the “OK” key to access the settings that belong to this group. Use the “◄” and “►” keys to move through the different settings. The information that appears underneath the setting name is its value.

A password must be entered before any settings can be changed. Once a password has been entered an editing session has been established. The editing session is cancelled when the keypad has been inactive for five minutes.

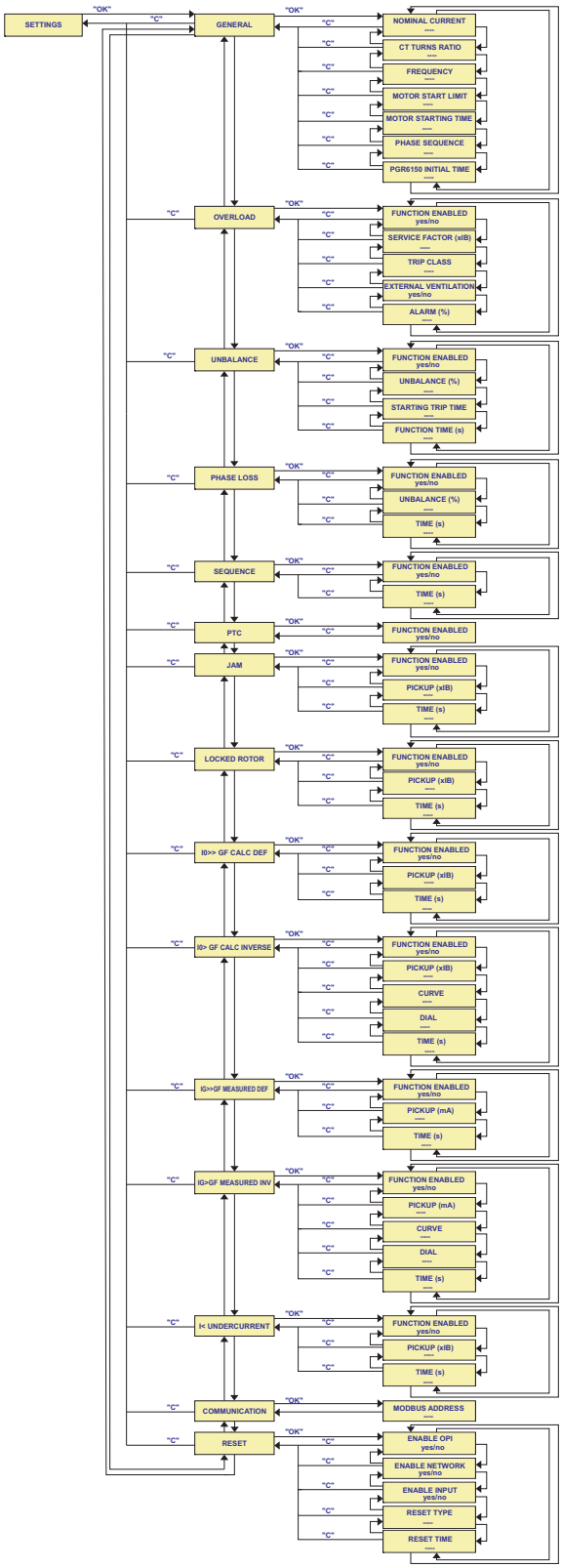
The factory setting password is 5555. To change the password see Section 9.4.13.

The keys ▲, ▼, ◄ and ► are used to enter the password. ▲ and ▼ are used to introduce a value or a character, and the ◄ and ► keys are used to move from one character to another. Press "**OK**” to validate the password.

Shown below is the sequence of steps to follow to change a setting:

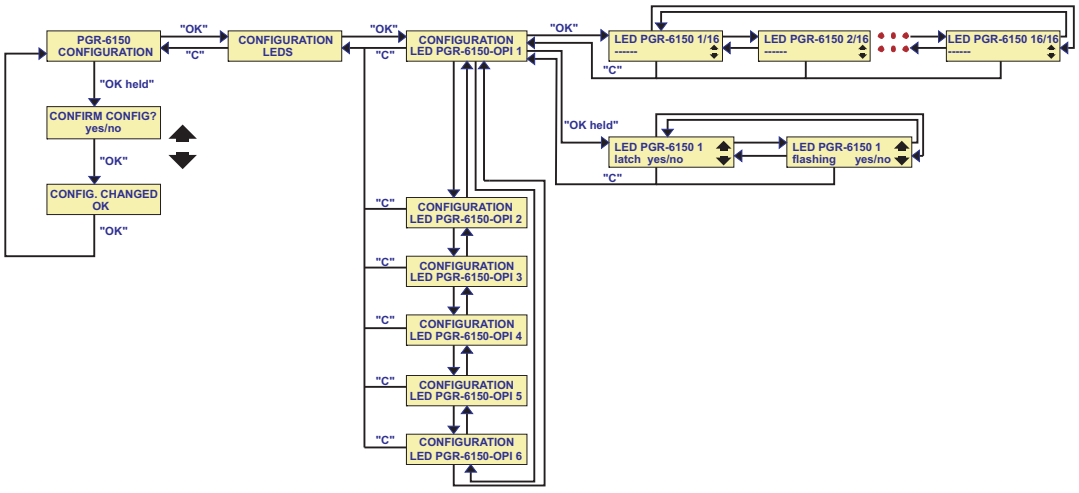


Navigation through the *Settings Menu*:



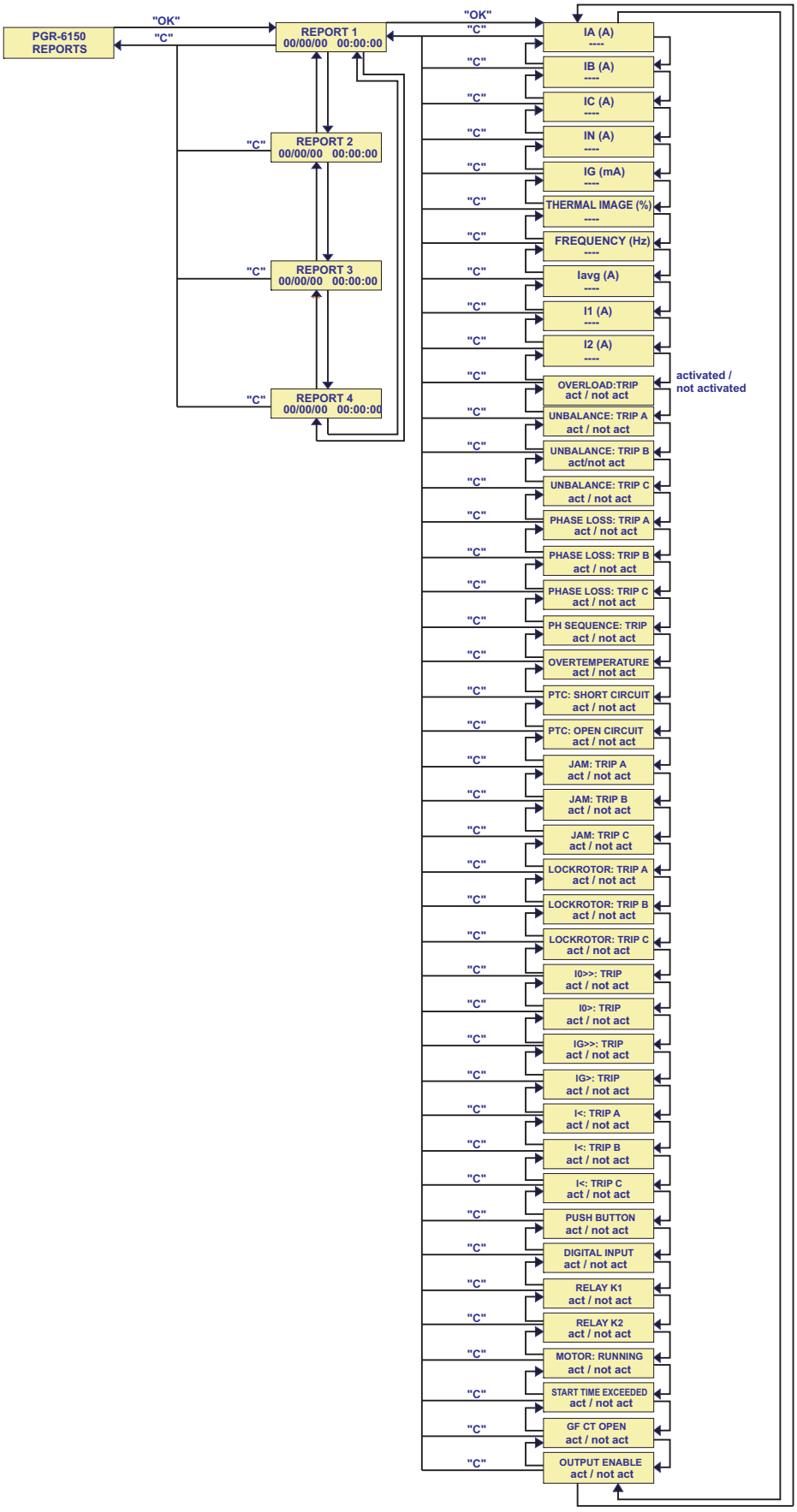
9.4.10. Configuration Menu

From the Standby Mode screen, press the “OK” key to access the first line of menus. Use the “◄” and “►” keys to position the cursor over the *Configuration Menu* and press “OK”. Only the LED’s on the PGR-6150-OPI can be configured. Press “OK” and use the “◄” and “►” keys to select the required option. The configurations are then set by pressing the "OK" key.



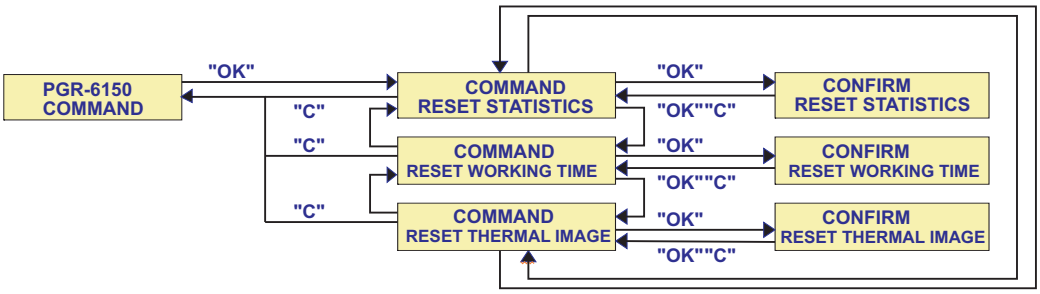
9.4.11. Reports Menu

From the Standby Mode screen, press the “OK” key to access the first line of menus. Use the “◄” and “►” keys to position the cursor over the *Reports Menu* and press “OK”. The first report is shown with the date and time of the report displayed. Use the “◄” and “►” keys to access one of the four reports and press “OK”. Use the “◄” and “►” keys to navigate through the information in the report.


PGR-6150 REPORTS
"OK"
"C"
REPORT 1 00/00/00 00:00:00
REPORT 2 00/00/00 00:00:00
REPORT 3 00/00/00 00:00:00
REPORT 4 00/00/00 00:00:00
IA (A) ----
IB (A) ----
IC (A) ----
IN (A) ----
IG (mA) ----
THERMAL IMAGE (%) ----
FREQUENCY (Hz) ----
Iavg (A) ----
I1 (A) ----
I2 (A) ----
OVERLOAD:TRIP act / not act
UNBALANCE: TRIP A act / not act
UNBALANCE: TRIP B act/not act
UNBALANCE: TRIP C act / not act
PHASE LOSS: TRIP A act / not act
PHASE LOSS: TRIP B act / not act
PHASE LOSS: TRIP C act / not act
PH SEQUENCE: TRIP act / not act
OVERTEMPERATURE act / not act
PTC: SHORT CIRCUIT act / not act
PTC: OPEN CIRCUIT act / not act
JAM: TRIP A act / not act
JAM: TRIP B act / not act
JAM: TRIP C act / not act
LOCKROTOR: TRIP A act / not act
LOCKROTOR: TRIP B act / not act
LOCKROTOR: TRIP C act / not act
I0>>: TRIP act / not act
I0>: TRIP act / not act
IG>>: TRIP act / not act
IG>: TRIP act / not act
I<: TRIP A act / not act
I<: TRIP B act / not act
I<: TRIP C act / not act
PUSH BUTTON act / not act
DIGITAL INPUT act / not act
RELAY K1 act / not act
RELAY K2 act / not act
MOTOR: RUNNING act / not act
START TIME EXCEEDED act / not act
GF CT OPEN act / not act
OUTPUT ENABLE act / not act
activated / not activated

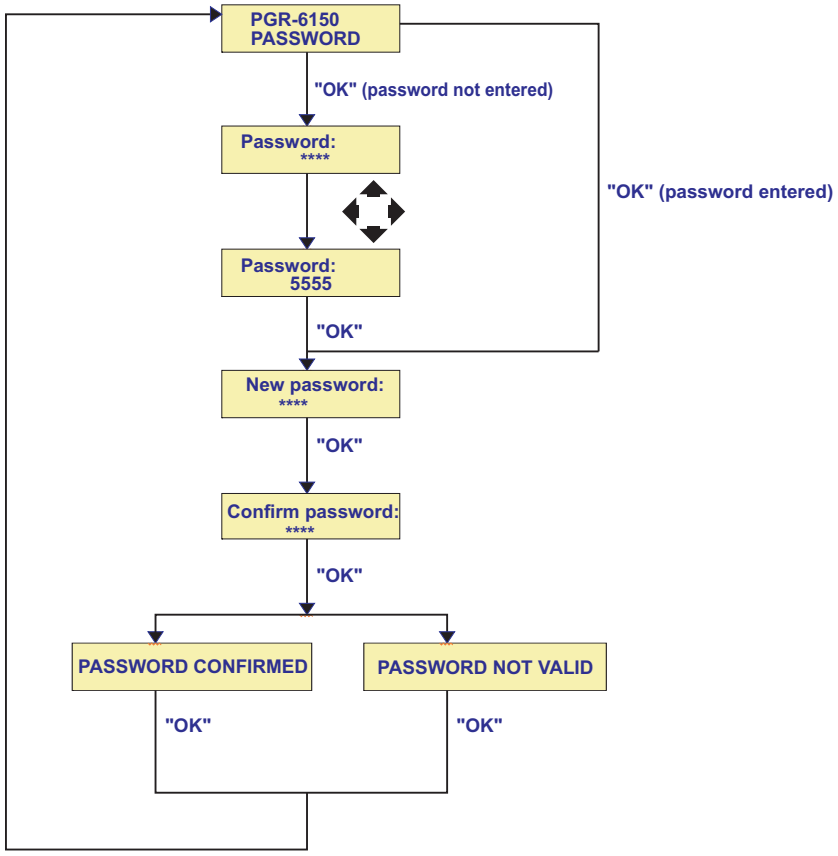
9.4.12. Command Menu

From the Standby Mode screen, press the “OK” key to access the first line of menus. Use the “◄” and “►” keys to view the *Command Menu* and press “OK”. Use the “◄” and “►” keys to view the command to execute and press “OK”. Press “OK” a second time to confirm the command.



9.4.13. Password Menu

From the Standby Mode screen, press the “OK” key to access the first line of menus. Use the “◄” and “►” keys to view the *Password Menu* and press “OK”.



10. COMMISSIONING

10.1. Checklist for Commissioning

A checklist is provided in Section12- APPENDIX.

10.2. Inspection

10.2.1. Visual Inspection

Make sure that wiring has been installed as per connection diagrams.

10.2.2. Current Transformers

The high voltage that is generated in the secondary circuits of current transformers can cause death and could damage the facility. Therefore, the secondary circuits of current transformers should never be opened when primary current is present.

10.3. Commissioning

Before the initial start up of a motor system it is recommended that a complete test of the system and the PGR-6150 is performed. See Section 12 for a checklist and a Settings Register.

Once the system is running, access the *Metering Menu* of the PGR-6150 to verify that the Metering values are correct.

Maintenance: Littelfuse recommends a minimum of one system inspection per year, to run through the PGR-6150 *Test Menu*, as well as to check *Metering* values.

11. MODBUS RTU PROTOCOL

This document describes the steps to follow to read and write data to the PGR-6150, using Modbus RTU protocol. The memory map is described in Section 11.8.

Only the master can initiate a message transaction. Messages can be addressed to individual slaves or they can be broadcast messages. Broadcast messages are executed on the slaves but unlike individually addressed messages, the slaves do not generate a reply. To broadcast a message, the 0 address is used.

Each byte of data is transmitted asynchronously and is made up of: 1 start bit, 8 data bits and 1 stop bit. The speed is 19,200 bit/s.

Message synchronization is accomplished by detection of an idle communication line. The communication line is considered idle when no communication exists for an equivalent delay of 3.5 characters.

The first byte received after idle-line detection is interpreted as the address byte of the next message. Message bytes must be transmitted in a continuous stream until the completed message has been sent. If a delay of more than 3.5 characters exists within the message, the message is discarded.

Response messages from the PGR-6150 are delayed by 3.5 characters.

The PGR-6150 Modbus protocol supports the following functions

- Read Holding Registers (Function Code 3).
- Write Multiple Registers (Function Code 16).

The following table shows the generic package format that is valid for transmission and reception. However, each function has its own characteristics, as will be described further on.

11.1. Modbus Package Format

Slave Address	1 byte	Each device on a communications bus must have a unique address. All the relay ports shall use this address which can be set at a value of between 1 and 247. Slave address 0 indicates a broadcast message. All the communications bus slaves shall perform the requested action, but none shall reply to the master. The Broadcast shall only be accepted for writing.
Function Code	1 byte	Function codes supported are 3 for reading and 13 for writing. When the slave must reply with an exception to one of these messages, this is indicated by setting the most significant bit of the corresponding function to 1. An exception for function 3 shall be indicated with 83 as a function code, and an exception for function 16 or 0x10 in hexadecimal, shall be indicated with 0x90.
Data	N bytes	Data consists of a variable number of bytes, depending on the function code. It can include: Addresses, data lengths, settings, exception codes or commands.
CRC	2 bytes	Two byte CRC code. Modbus RTU includes a 16 bit cyclic redundancy check (CRC) in each message, for error detection. If the slave detects an erroneous message, based on an incorrect CRC, it will not perform any actions, nor will it reply to the master. The CRC bit order is LSB-MSB.
Dead time	Time required to transmit 3.5 bytes	A message is considered terminated when no data is received for a period of 3.5 bytes: 15 ms at 2,400 bps 2 ms at 19,200 bps…etc.

11.2. Function Codes

HEX DEC CODE	Modbus Name	Definition	Comments
0x03 **3**	Read Holding Registers	Reading of any value	This function allows the master to read 1 or more consecutive registers of a relay. The registers are always 16 bits, with the most significant byte first. A maximum of 60 registers can be read in a single READ.
0x10 **16**	Preset Multiple Registers	Writing	This function allows one or more registers to be written representing one or more settings. The registers have 2 byte length values, transmitted with the most significant byte first. A maximum of 60 registers can be written in a single WRITE.

11.3. Error Responses and Exceptions

The following error codes are defined by the Modbus protocol:

01	**ILLEGAL FUNCTION**	Message function not supported.
02	**ILLEGAL DATA ADDRESS**	The master is attempting to perform an operation to an unsupported address.
03	**ILLEGAL DATA VALUE**	The slave has detected that the value sent by the master is invalid.

11.4. Types of Data

Type	Number of Registers	Description	
TYPE_ULONG	**2**	Numerical data: unsigned long	
TYPE_ULONG_100	**2**	Numerical data: unsigned long scaled to 100	
TYPE_ULONG_1000	**2**	Numerical data: unsigned long scaled to 1000	
TYPE_ULONG_10000	**2**	Numerical data: unsigned long scaled to 10000	
TYPE_UINT	**1**	Numerical data: unsigned integer	
TYPE_BIT_0	**1**	Bit data: Register bit 0 (LSB)	
TYPE_BIT_1	**1**	Bit data: Register bit 1	
TYPE_BIT_2	**1**	Bit data: Register bit 2	
TYPE_BIT_3	**1**	Bit data: Register bit 3	
TYPE_BIT_4	**1**	Bit data: Register bit 4	
TYPE_BIT_5	**1**	Bit data: Register bit 5	
TYPE_BIT_6	**1**	Bit data: Register bit 6	
TYPE_BIT_7	**1**	Bit data: Register bit 7	
TYPE_BIT_8	**1**	Bit data: Register bit 8	
TYPE_BIT_9	**1**	Bit data: Register bit 9	
TYPE_BIT_10	**1**	Bit data: Register bit 10	
TYPE_BIT_11	**1**	Bit data: Register bit 11	
TYPE_BIT_12	**1**	Bit data: Register bit 12	
TYPE_BIT_13	**1**	Bit data: Register bit 13	
TYPE_BIT_14	**1**	Bit data: Register bit 14	
TYPE_BIT_15	**1**	Bit data: Register bit 15 (MSB)	
TYPE_ENUM_ENABLE	**1**	Num. data	0: No
			1: Yes

TYPE	Number of Registers	Description	
TYPE_ENUM_CLASS	**1**	Num. data	0: Trip class 5
			1: Trip class 10
			2: Trip class 15
			3: Trip class 20
			4: Trip class 25
			5: Trip class 30
			6: Trip class 35
			7: Trip class 40
			8: Trip class 45
TYPE_ENUM_CURVE	**1**	Num. data	0: Definite time
			1: Inverse curve
			2: Very inverse curve
			3: Extremely inverse curve
TYPE_ENUM_FREQ	**1**	Num. data	0: 50 Hz
			1: 60 Hz
			2: Variable frequency
TYPE_ENUM_SEQUEN	**1**	Num. data	0: A-B-C
			1: A-C-B
TYPE_ENUM_RESET	**1**	Num. data	0: Automatic reset
			1: Automatic time delay reset
			2: Manual reset

11.5. Data Reading

All data appearing in the memory map is read using the Modbus function 3.

11.6. Set Point Writing

The set points are read in the settings reading area and are written in the settings writing area.

A set of set points are written as follows:

A set of set points are written as a group in the settings writing area.

The settings confirmation command is sent for this group.

11.7. Command

The following commands are available:

Description	Command Number
Overload set point confirmation	1
Phase unbalance set point confirmation	2
Phase loss set point confirmation	3
Phase sequence set point confirmation	4
PTC set point confirmation	5
Jam set point confirmation	6
Locked rotor set point confirmation	7
Calculated ground-fault definite-time set-point confirmation	8
Calculated ground-fault inverse-time set-point confirmation	9
Measured ground-fault definite-time set-point confirmation	10
Measured ground-fault inverse-time set-point confirmation	11
Communication set-point confirmation	12
General set-points confirmation	13
LED testing	44
Set-point confirmation	45
Outputs and LED's reset	47
Synchronization	48
Reset set-point confirmation	49
Commands reset	50
Statistics reset	51
Undercurrent set-point confirmation	52
Operating-hours-counter reset	53
Reset thermal image to 0%	55
Reset thermal image to 75%	54
Reset thermal image to 25%	58
Reset thermal image to 99%	59

To execute a command, write (with function 16) the command number and equipment key in the command area (address 0x4000).

The numbers key_0, key_1, key_2 and key_3 are the ASCII relating to the key digit.

For example, if the equipment key is "1234" and we send command number 36, the following must be written in the command area:

0x4000	**Command number**	
0x4001	key_1	key_0
0x4002	key_3	key_2

0x4000	**36**	
0x4001	32	31
0x4002	34	33

11.8. PGR-6150 Memory Map

Metering

Address	Number of Registers	Description	Format
0x0000	2	Phase A current	TYPE_ULONG_100
0x0002	2	Phase B current	TYPE_ULONG_100
0x0004	2	Phase C current	TYPE_ULONG_100
0x0006	2	Neutral current I0	TYPE_ULONG_100
0x0008	2	Ground-fault current IG	TYPE_ULONG
0x000A	2	Thermal image	TYPE_ULONG_10000
0x000E	2	Frequency	TYPE_ULONG_100
0x0010	2	Positive sequence I1	TYPE_ULONG_100
0x0012	2	Negative sequence I2	TYPE_ULONG_100
0x0014	2	Average current Iavg	TYPE_ULONG_100

Status

Address	Number of Registers	Description	Format
0x0040	1	**Overload**	
		Alarm bit	TYPE_BIT_0
		Trip bit	TYPE_BIT_1
0x0041	1	**Unbalance**	
		Phase A pick up bit	TYPE_BIT_0
		Phase B pick up bit	TYPE_BIT_1
		Phase C pick up bit	TYPE_BIT_2
		Function pick up bit	TYPE_BIT_3
		Phase A trip bit	TYPE_BIT_4
		Phase B trip bit	TYPE_BIT_5
		Phase C trip bit	TYPE_BIT_6
		Function trip bit	TYPE_BIT_7

Status			
Address	**Number of Registers**	**Description**	**Format**
0x0042	1	**Phase loss**	
		Phase A pick up bit	TYPE_BIT_0
		Phase B pick up bit	TYPE_BIT_1
		Phase C pick up bit	TYPE_BIT_2
		Function pick up bit	TYPE_BIT_3
		Phase A trip bit	TYPE_BIT_4
		Phase B trip bit	TYPE_BIT_5
		Phase C trip bit	TYPE_BIT_6
		Function trip bit	TYPE_BIT_7
0x0043	1	**Sequence**	
		Pick up bit	TYPE_BIT_0
		Trip bit	TYPE_BIT_1
0x0044	1	**PTC**	
		Overtemperature bit	TYPE_BIT_1
		Short circuit bit	TYPE_BIT_3
		Open circuit bit	TYPE_BIT_5
0x0045	1	**Jam**	
		Phase A pick up bit	TYPE_BIT_0
		Phase B pick up bit	TYPE_BIT_1
		Phase C pick up bit	TYPE_BIT_2
		Function pick up bit	TYPE_BIT_3
		Phase A trip bit	TYPE_BIT_4
		Phase B trip bit	TYPE_BIT_5
		Phase C trip bit	TYPE_BIT_6
		Function trip bit	TYPE_BIT_7
0x0046	1	**Locked rotor**	
		Phase A pick up bit	TYPE_BIT_0
		Phase B pick up bit	TYPE_BIT_1
		Phase C pick up bit	TYPE_BIT_2
		Function pick up bit	TYPE_BIT_3
		Phase A trip bit	TYPE_BIT_4
		Phase B trip bit	TYPE_BIT_5
		Phase C trip bit	TYPE_BIT_6
		Function trip bit	TYPE_BIT_7

Status			
Address	**Number of Registers**	**Description**	**Format**
0x0048	1	**Calculated ground-fault definite time**	
		Pick up bit	TYPE_BIT_0
		Trip bit	TYPE_BIT_1
0x0049	1	**Calculated ground-fault inverse time**	
		Pick up bit	TYPE_BIT_0
		Trip bit	TYPE_BIT_1
0x004A	1	**Measured ground-fault definite time**	
		Pick up bit	TYPE_BIT_0
		Trip bit	TYPE_BIT_1
0x004B	1	**Measured ground-fault inverse time**	
		Pick up bit	TYPE_BIT_0
		Trip bit	TYPE_BIT_1
0x004C	1	**Undercurrent**	
		Phase A pick up bit	TYPE_BIT_0
		Phase B pick up bit	TYPE_BIT_1
		Phase C pick up bit	TYPE_BIT_2
		Function pick up bit	TYPE_BIT_3
		Phase A trip bit	TYPE_BIT_4
		Phase B trip bit	TYPE_BIT_5
		Phase C trip bit	TYPE_BIT_6
		Function trip bit	TYPE_BIT_7
0x004D	1	**Digital input**	
		Input 1 bit	TYPE_BIT_1
		Trip block input bit	TYPE_BIT_2
		Reset input bit	TYPE_BIT_3
0x0051	1	**Outputs**	
		Relay K1 bit	TYPE_BIT_0
		Relay K2 bit	TYPE_BIT_1
		PGR-6150 1 LED	TYPE_BIT_2
		PGR-6150 2 LED	TYPE_BIT_3
		PGR-6150 3 LED	TYPE_BIT_4
		PGR-6150 4 LED	TYPE_BIT_5
		PGR-6150 5 LED	TYPE_BIT_6

Status			
Address	**Number of Registers**	**Description**	**Format**
0x0051	1	PGR-6150-OPI 1 LED	TYPE_BIT_7
		PGR-6150-OPI 2 LED	TYPE_BIT_8
		PGR-6150-OPI 3 LED	TYPE_BIT_9
		PGR-6150-OPI 4 LED	TYPE_BIT_10
		PGR-6150-OPI 5 LED	TYPE_BIT_11
		PGR-6150-OPI 6 LED	TYPE_BIT_12
0x0057	1	**Miscellaneous**	
		Motor operation bit	TYPE_BIT_2
		Ground-fault current transformer open bit	TYPE_BIT_3
		Settings error bit	TYPE_BIT_4
		Configuration error bit	TYPE_BIT_5
		Reports error bit	TYPE_BIT_6
		Protection alarm bit	TYPE_BIT_7
		Protection trip bit	TYPE_BIT_8
		Excessive start up time motor trip	TYPE_BIT_11
		Statistics error bit	TYPE_BIT_12
		Enable outputs bit	TYPE_BIT_13
		Trip disenabling bit	TYPE_BIT_14

Date reading			
Address	**Number of Registers**	**Description**	**Format**
0x0081	1	Date: seconds	TYPE_UINT
0x0082	1	Date: minutes	TYPE_UINT
0x0083	1	Date: hour	TYPE_UINT
0x0084	1	Date: day	TYPE_UINT
0x0085	1	Date: month	TYPE_UINT
0x0086	1	Date: Year	TYPE_UINT

Settings reading			
Address	**Number of Registers**	**Description**	**Format**
0x0088	**10**	**Overload set points**	
0x0088	2	Function enabled	TYPE_ENUM_ENABLE
0x008A	2	Service factor	TYPE_ULONG_100
0x008C	2	Trip class	TYPE_ENUM_CLASS
0x008E	2	Independent mechanical ventilation	TYPE_ENUM_ENABLE
0x0090	2	Alarm	TYPE_ULONG
0x0092	**8**	**Unbalance set points**	
0x0092	2	Function enabled	TYPE_ENUM_ENABLE
0x0094	2	% Unbalance	TYPE_ULONG
0x0096	2	Starting trip time	TYPE_ULONG_1000
0x0098	2	Running trip time	TYPE_ULONG_1000
0x009A	**6**	**Phase loss set points**	
0x009A	2	Function enabled	TYPE_ENUM_ENABLE
0x009C	2	% Unbalance	TYPE_ULONG
0x009E	2	Operating time	TYPE_ULONG_1000
0x00A0	**4**	**Sequence set points**	
0x00A0	2	Function enabled	TYPE_ENUM_ENABLE
0x00A2	2	Operating time	TYPE_ULONG_1000
0x00A4	**2**	**PTC set point**	
0x00A4	2	Function enabled	TYPE_ENUM_ENABLE
0x00A6	**6**	**Jam set points**	
0x00A6	2	Function enabled	TYPE_ENUM_ENABLE
0x00A8	2	Pickup	TYPE_ULONG_100
0x00AA	2	Operating time	TYPE_ULONG_1000
0x00AC	**6**	**Locked rotor set points**	
0x00AC	2	Function enabled	TYPE_ENUM_ENABLE
0x00AE	2	Pickup	TYPE_ULONG_100
0x00B0	2	Operating time	TYPE_ULONG_1000
0x00B8	**6**	**Calculated ground-fault definite time set points**	
0x00B8	2	Function enabled	TYPE_ENUM_ENABLE
0x00BA	2	Pickup	TYPE_ULONG_100
0x00BC	2	Operating time	TYPE_ULONG_1000

Settings reading			
Address	**Number of Registers**	**Description**	**Format**
0x00BE	**10**	**Calculated ground-fault inverse time set points**	
0x00BE	2	Function enabled	TYPE_ENUM_ENABLE
0x00C0	2	Pickup	TYPE_ULONG_100
0x00C2	2	Curve	TYPE_ENUM_CURVE
0x00C4	2	Dial	TYPE_ULONG_100
0x00C6	2	Operating time	TYPE_ULONG_1000
0x00C8	**6**	**Measured ground-fault definite-time set points**	
0x00C8	2	Function enabled	TYPE_ENUM_ENABLE
0x00CA	2	Pickup	TYPE_ULONG_100
0x00CC	2	Operating time	TYPE_ULONG_1000
0x00CE	**10**	**Measured ground-fault inverse-time set points**	
0x00CE	2	Function enabled	TYPE_ENUM_ENABLE
0x00D0	2	Pickup	TYPE_ULONG_100
0x00D2	2	Curve	TYPE_ENUM_CURVE
0x00D4	2	Dial	TYPE_ULONG_100
0x00D6	2	Operating time	TYPE_ULONG_1000
0x00D8	**6**	**Undercurrent set points**	
0x00D8	2	Function enabled	TYPE_ENUM_ENABLE
0x00DA	2	Pickup	TYPE_ULONG_100
0x00DC	2	Operating time	TYPE_ULONG_1000
0x00DE	**2**	**Communication set point**	
0x00DE	2	Modbus address	TYPE_ULONG
0x00E0	**10**	**General Settings set points**	
0x00E0	2	Nominal current IB	TYPE_ULONG_100
0x00E2	2	Transformer turns ratio	TYPE_ULONG
0x00E4	2	Frequency	TYPE_ENUM_FREQ
0x00E6	2	Motor start up limit	TYPE_ULONG_100
0x00E8	2	Motor start up time	TYPE_ULONG_1000
0x00EA	2	Phase sequence	TYPE_ENUM_SEQUEN
0x00EC	2	Equipment start up time delay	TYPE_ULONG

Settings reading			
Address	**Number of Registers**	**Description**	**Format**
0x00EE	**10**	**Reset set points**	
0x00EE	2	Enable PGR-6150-OPI	TYPE_ENUM_ENABLE
0x00F0	2	Enable command	TYPE_ENUM_ENABLE
0x00F2	2	Enable input	TYPE_ENUM_ENABLE
0x00F4	2	Reset type	TYPE_ENUM_RESET
0x00F6	2	Reset time	TYPE_ULONG_1000
0x00F8	**8**	**Keys**	
0x00F8	2	Key 1	TYPE_ULONG
0x00FA	2	Key 2	TYPE_ULONG
0x00FC	2	Key 3	TYPE_ULONG
0x00FE	2	Key 4	TYPE_ULONG

Date and time writing			
Address	**Number of Registers**	**Description**	**Format**
0x0181	1	Date synchronization: seconds	TYPE_UINT
0x0182	1	Date synchronization: minutes	TYPE_UINT
0x0183	1	Date synchronization: hour	TYPE_UINT
0x0184	1	Date synchronization: day	TYPE_UINT
0x0185	1	Date synchronisation: month	TYPE_UINT
0x0186	1	Date synchronisation: year	TYPE_UINT

Settings writing			
Address	**Number of Registers**	**Description**	**Format**
0x0188	**10**	**Overload set points**	
0x0188	2	Function enabled	TYPE_ENUM_ENABLE
0x018A	2	Pickup	TYPE_ULONG_100
0x018C	2	Trip class	TYPE_ENUM_CLASS
0x018E	2	External ventilation	TYPE_ENUM
0x0190	2	Alarm	TYPE_ULONG

Settings writing			
Address	**Number of Registers**	**Description**	**Format**
0x0192	**8**	**Unbalance set points**	
0x0192	2	Function enabled	TYPE_ENUM_ENABLE
0x0194	2	% Unbalance	TYPE_ULONG
0x0196	2	Starting trip time	TYPE_ULONG_1000
0x0198	2	Running trip time	TYPE_ULONG_1000
0x019A	**6**	**Phase loss set points**	
0x019A	2	Function enabled	TYPE_ENUM_ENABLE
0x019C	2	%Unbalance	TYPE_ULONG
0x019E	2	Operating time	TYPE_ULONG_1000
0x01A0	**4**	**Sequence set points**	
0x01A0	2	Function enabled	TYPE_ENUM_ENABLE
0x01A2	2	Operating time	TYPE_ULONG_1000
0x01A4	**2**	**PTC set point**	
0x01A4	2	Function enabled	TYPE_ENUM_ENABLE
0x01A6	**6**	**Jam set points**	
0x01A6	2	Function enabled	TYPE_ENUM_ENABLE
0x01A8	2	Pickup	TYPE_ULONG_100
0x01AA	2	Operating time	TYPE_ULONG_1000
0x01AC	**6**	**Locked rotor set points**	
0x01AC	2	Function enabled	TYPE_ENUM_ENABLE
0x01AE	2	Pickup	TYPE_ULONG_100
0x01B0	2	Operating time	TYPE_ULONG_1000
0x01B8	**6**	**Calculated ground-fault definite-time set points**	
0x01B8	2	Function enabled	TYPE_ENUM_ENABLE
0x01BA	2	Pickup	TYPE_ULONG_100
0x01BC	2	Operating time	TYPE_ULONG_1000
0x01BE	**10**	**Calculated ground-fault inverse-time set points**	
0x01BE	2	Function enabled	TYPE_ENUM_ENABLE
0x01C0	2	Pickup	TYPE_ULONG_100
0x01C2	2	Curve	TYPE_ENUM_CURVE
0x01C4	2	Dial	TYPE_ULONG_100
0x01C6	2	Operating time	TYPE_ULONG_1000

Settings writing			
Address	**Number of Registers**	**Description**	**Format**
0x01C8	**6**	**Measured ground-fault definite-time set points**	
0x01C8	2	Function enabled	TYPE_ENUM_ENABLE
0x01CA	2	Pickup	TYPE_ULONG_100
0x01CC	2	Operating time	TYPE_ULONG_1000
0x01CE	**10**	**Measured ground-fault inverse-time set points**	
0x01CE	2	Function enabled	TYPE_ENUM_ENABLE
0x01D0	2	Pickup	TYPE_ULONG_100
0x01D2	2	Curve	TYPE_ENUM_CURVE
0x01D4	2	Dial	TYPE_ULONG_100
0x01D6	2	Operating time	TYPE_ULONG_1000
0x01D8	**6**	**Phase undercurrent function set points**	
0x01D8	2	Enable function	TYPE_ENUM_ENABLE
0x01DA	2	Pickup	TYPE_ULONG_100
0x01DC	2	Operating time	TYPE_ULONG_1000
0x01DE	**2**	**Communication set point**	
0x01DE	2	Modbus address	TYPE_ULONG
0x01E0	**10**	**General Settings set points**	
0x01E0	2	Nominal current I_B	TYPE_ULONG_100
0x01E2	2	Transformer turns ratio	TYPE_ULONG
0x01E4	2	Frequency	TYPE_ENUM_FREQ
0x01E6	2	Motor start limit	TYPE_ULONG_100
0x01E8	2	Motor start up time	TYPE_ULONG_1000
0x01EA	2	Phase sequence	TYPE_ENUM_SEQUEN
0x01EC	2	Equipment start up time delay	TYPE_ULONG
0x01EE	**10**	**Reset set points**	
0x01EE	2	Enable PGR-6150-OPI	TYPE_ENUM_ENABLE
0x01F0	2	Enable command	TYPE_ENUM_ENABLE
0x01F2	2	Enable input	TYPE_ENUM_ENABLE
0x01F4	2	Reset type	TYPE_ENUM_RESET
0x01F6	2	Reset time	TYPE_ULONG_1000
0x01F8	**8**	**Keys set**	
0x01F8	2	Key 1	TYPE_ULONG
0x01FA	2	Key 2	TYPE_ULONG
0x01FC	2	Key 3	TYPE_ULONG
0x01FE	2	Key 4	TYPE_ULONG

Reports			
Address	**Number of Registers**	**Description**	**Format**
0x0A80	**49**	**Report 1**	
0x0A80	8	Date-time	TYPE_DATE
0x0A88	2	Phase A current measurement	TYPE_ULONG_100
0x0A8A	2	Phase B current measurement	TYPE_ULONG_100
0x0A8C	2	Phase C current measurement	TYPE_ULONG_100
0x0A8E	2	Neutral current measurement I0	TYPE_ULONG_100
0x0A90	2	Ground-fault-current measurement IG	TYPE_ULONG
0x0A92	2	Thermal image measurement	TYPE_ULONG_10000
0x0A94	2	Frequency measurement	TYPE_ULONG_100
0x0A96	2	Average current measurement	TYPE_ULONG_100
0x0A98	2	Positive sequence current measurement	TYPE_ULONG_100
0x0A9A	2	Negative sequence current measurement	TYPE_ULONG_100
0x0A9C	1	Overload: Trip	TYPE_BIT_1
0x0A9D	1	Unbalance: Phase A trip	TYPE_BIT_4
		Unbalance: Phase B trip	TYPE_BIT_5
		Unbalance: Phase C trip	TYPE_BIT_6
0x0A9E	1	Phase loss: Phase A trip	TYPE_BIT_4
		Phase loss: Phase B trip	TYPE_BIT_5
		Phase loss: Phase C trip	TYPE_BIT_6
0x0A9F	1	Sequence: Trip	TYPE_BIT_1
0x0AA0	1	PTC: Overtemperature	TYPE_BIT_1
		PTC: Short circuit	TYPE_BIT_3
		PTC: Open circuit	TYPE_BIT_5
0x0AA1	1	Jam: Phase A trip	TYPE_BIT_4
		Jam: Phase B trip	TYPE_BIT_5
		Jam: Phase C trip	TYPE_BIT_6
0x0AA3	1	Locked rotor: Phase A trip	TYPE_BIT_4
		Locked rotor Phase B trip	TYPE_BIT_5
		Locked rotor Phase C trip	TYPE_BIT_6
0x0AA4	1	I0>>: Trip	TYPE_BIT_1
0x0AA5	1	I0>: Trip	TYPE_BIT_1
0x0AA6	1	IG>>: Trip	TYPE_BIT_1
0x0AA7	1	IG>: Trip	TYPE_BIT_1

Reports

Address	Number of Registers	Description	Format
0x0A80	**49**	**Report 1 *continued***	
0x0AA8	1	I<: Phase A trip	TYPE_BIT_4
		I<: Phase B trip	TYPE_BIT_5
		I<: Phase C trip	TYPE_BIT_6
0x0AA9	1	Button	TYPE_BIT_0
		Digital Input	TYPE_BIT_1
0x0AAA	1	Relay K1	TYPE_BIT_0
		Relay K2	TYPE_BIT_1
0x0AAC	1	Motor : Running	TYPE_BIT_2
		Ground-fault current transformer open	TYPE_BIT_3
		Motor: Start time exceeded	TYPE_BIT_11
		Enable outputs	TYPE_BIT_13
0x0AB1	**49**	**Report 2**	
0x0AB1	8	Date-time	TYPE_DATE
0x0AB9	2	Phase A current measurement	TYPE_ULONG_100
0x0ABB	2	Phase B current measurement	TYPE_ULONG_100
0x0ABD	2	Phase C current measurement	TYPE_ULONG_100
0x0ABF	2	Neutral current measurement I0	TYPE_ULONG_100
0x0AC1	2	Earth leakage current measurement IG	TYPE_ULONG
0x0AC3	2	Thermal image measurement	TYPE_ULONG_10000
0x0AC5	2	Frequency measure	TYPE_ULONG_100
0x0AC7	2	Average current measurement	TYPE_ULONG_100
0x0AC9	2	Positive sequence current measurement	TYPE_ULONG_100
0x0ACB	2	Negative sequence current measurement	TYPE_ULONG_100
0x0ACD	1	Overload: Trip	TYPE_BIT_1
0x0ACE	1	Unbalance: Phase A trip	TYPE_BIT_4
		Unbalance: Phase B trip	TYPE_BIT_5
		Unbalance: Phase C trip	TYPE_BIT_6
0x0ACF	1	Phase loss: Phase A trip	TYPE_BIT_4
		Phase loss: Phase B trip	TYPE_BIT_5
		Phase loss: Phase C trip	TYPE_BIT_6
0x0AD0	1	Sequence: Trip	TYPE_BIT_1

Reports			
Address	**Number of Registers**	**Description**	**Format**
0x0A80	**49**	**Report 2 *continued***	
0x0AD1	1	PTC: Overtemperature	TYPE_BIT_1
		PTC: Short circuit	TYPE_BIT_3
		PTC: Open circuit	TYPE_BIT_5
0x0AD2	1	Jam: Phase A trip	TYPE_BIT_4
		Jam: Phase B trip	TYPE_BIT_5
		Jam: Phase C trip	TYPE_BIT_6
0x0AD3	1	Locked rotor: Phase A trip	TYPE_BIT_4
		Locked rotor Phase B trip	TYPE_BIT_5
		Locked rotor Phase C trip	TYPE_BIT_6
0x0AD5	1	I0>>: Trip	TYPE_BIT_1
0x0AD6	1	I0>: Trip	TYPE_BIT_1
0x0AD7	1	IG>>: Trip	TYPE_BIT_1
0x0AD8	1	IG>: Trip	TYPE_BIT_1
0x0AD9	1	I<: Phase A trip	TYPE_BIT_4
		I<: Phase B trip	TYPE_BIT_5
		I<: Phase C trip	TYPE_BIT_6
0x0ADA	1	Button	TYPE_BIT_0
		Digital input	TYPE_BIT_1
0x0ADB	1	Relay K1	TYPE_BIT_0
		Relay K2	TYPE_BIT_1
0x0ADD	1	Motor : Running	TYPE_BIT_2
		Ground -fault current transformer open	TYPE_BIT_3
		Motor: Start time exceeded	TYPE_BIT_11
		Enable outputs	TYPE_BIT_13
0x0AE2	**49**	**Report 3**	
0x0AE2	8	Date-time	TYPE_DATE
0x0AEA	2	Phase A current measurement	TYPE_ULONG_100
0x0AEC	2	Phase B current measurement	TYPE_ULONG_100
0x0AEE	2	Phase C current measurement	TYPE_ULONG_100
0x0AF0	2	Neutral current measurement I0	TYPE_ULONG_100
0x0AF2	2	Earth leakage current measurement IG	TYPE_ULONG
0x0AF4	2	Thermal image measurement	TYPE_ULONG_10000

Reports

Address	Number of Registers	Description	Format
0x0A80	**49**	**Report 3 *continued***	
0x0AF6	2	Frequency measurement	TYPE_ULONG_100
0x0AF8	2	Average current measurement	TYPE_ULONG_100
0x0AFA	2	Positive sequence current measurement	TYPE_ULONG_100
0x0AFC	2	Negative sequence current measurement	TYPE_ULONG_100
0x0AFE	1	Overload: trip	TYPE_BIT_1
0x0AFF	1	Unbalance: Phase A trip	TYPE_BIT_4
		Unbalance: Phase B trip	TYPE_BIT_5
		Unbalance: Phase C trip	TYPE_BIT_6
0x0B00	1	Phase loss: Phase A trip	TYPE_BIT_4
		Phase loss: Phase B trip	TYPE_BIT_5
		Phase loss: Phase C trip	TYPE_BIT_6
0x0B01	1	Sequence: trip	TYPE_BIT_1
0x0B02	1	PTC: overtemperature	TYPE_BIT_1
		PTC: Short circuit	TYPE_BIT_3
		PTC: Open circuit	TYPE_BIT_5
0x0B03	1	Jam: Phase A trip	TYPE_BIT_4
		Jam: Phase B trip	TYPE_BIT_5
		Jam: Phase C trip	TYPE_BIT_6
0x0B04	1	Locked rotor: Phase A trip	TYPE_BIT_4
		Locked rotor: Phase B trip	TYPE_BIT_5
		Locked rotor: Phase C trip	TYPE_BIT_6
0x0B06	1	I0>>: Trip	TYPE_BIT_1
0x0B07	1	I0>: Trip	TYPE_BIT_1
0x0B08	1	IG>>: Trip	TYPE_BIT_1
0x0B09	1	IG>: Trip	TYPE_BIT_1
0x0B0A	1	I<: Phase A trip	TYPE_BIT_4
		I<: Phase B trip	TYPE_BIT_5
		I<: Phase C trip	TYPE_BIT_6
0x0B0B	1	Button	TYPE_BIT_0
		Digital input	TYPE_BIT_1
0x0B0C	1	Relay K1	TYPE_BIT_0
		Relay K2	TYPE_BIT_1

Reports			
Address	**Number of Registers**	**Description**	**Format**
0x0A80	**49**	**Report 3 *continued***	
0x0B0E	1	Motor : Running	TYPE_BIT_2
		Ground-fault current transformer open	TYPE_BIT_3
		Motor: Start time exceeded	TYPE_BIT_11
		Enable outputs	TYPE_BIT_13
0x0B13	**49**	**Report 4**	
0x0B13	8	Date-time	TYPE_DATE
0x0B1B	2	Phase A current measurement	TYPE_ULONG_100
0x0B1D	2	Phase B current measurement	TYPE_ULONG_100
0x0B1F	2	Phase C current measurement	TYPE_ULONG_100
0x0B21	2	Neutral current measurement I0	TYPE_ULONG_100
0x0B23	2	Earth leakage current measurement IG	TYPE_ULONG
0x0B25	2	Thermal image measurement	TYPE_ULONG_10000
0x0B27	2	Frequency measurement	TYPE_ULONG_100
0x0B29	2	Average current measurement	TYPE_ULONG_100
0x0B2B	2	Positive sequence current measurement	TYPE_ULONG_100
0x0B2D	2	Negative sequence current measurement	TYPE_ULONG_100
0x0B2F	1	Overload: Trip	TYPE_BIT_1
0x0B30	1	Unbalance: Phase A trip	TYPE_BIT_4
		Unbalance: Phase B trip	TYPE_BIT_5
		Unbalance: Phase C trip	TYPE_BIT_6
0x0B31	1	Phase loss: Phase A trip	TYPE_BIT_4
		Phase loss: Phase B trip	TYPE_BIT_5
		Phase loss: Phase C trip	TYPE_BIT_6
0x0B32	1	Sequence: Trip	TYPE_BIT_1
0x0B33	1	PTC: Overtemperature	TYPE_BIT_1
		PTC: Short circuit	TYPE_BIT_3
		PTC: Open circuit	TYPE_BIT_5
0x0B34	1	Jam: Phase A trip	TYPE_BIT_4
		Jam: Phase B trip	TYPE_BIT_5
		Jam: Phase C trip	TYPE_BIT_6

Reports

Address	Number of Registers	Description	Format
0x0a80	**49**	**Report 4 *continued***	
0x0B35	1	Locked rotor: Phase A trip	TYPE_BIT_4
		Locked rotor: Phase B trip	TYPE_BIT_5
		Locked rotor: Phase C trip	TYPE_BIT_6
0x0B37	1	I0>>: Trip	TYPE_BIT_1
0x0B38	1	I0>: Trip	TYPE_BIT_1
0x0B39	1	IG>>: Trip	TYPE_BIT_1
0x0B3A	1	IG>: Trip	TYPE_BIT_1
0x0B3B	1	I<: Phase A trip	TYPE_BIT_4
		I<: Phase B trip	TYPE_BIT_5
		I<: Phase C trip	TYPE_BIT_6
0x0B3C	1	Button	TYPE_BIT_0
		Input	TYPE_BIT_1
0x0B3D	1	Output 1	TYPE_BIT_0
		Output 2	TYPE_BIT_1
0x0B3F	1	Motor : Running	TYPE_BIT_2
		Ground-fault current transformer open	TYPE_BIT_3
		Motor: Start time exceeded	TYPE_BIT_11
		Enable outputs	TYPE_BIT_13

Statistics

Address	Rec No.	Description	Format
0x0B80	2	Number of motor starts.	TYPE_ULONG
0x0B82	2	Motor start maximum current	TYPE_ULONG_100
0x0B84	2	Last motor start maximum current	TYPE_ULONG_100
0x0B86	2	Motor start up average current	TYPE_ULONG_100
0x0B88	2	Motor start time	TYPE_ULONG_1000
0x0B8A	2	Number of overload faults	TYPE_ULONG
0x0B8C	2	Number of PTC faults	TYPE_ULONG
0x0B8E	2	Number of jam faults	TYPE_ULONG
0x0B90	2	Number of locked rotor faults	TYPE_ULONG
0x0B92	2	Number of ground faults	TYPE_ULONG
0x0B96	2	Number of operating hours	TYPE_ULONG

12. APPENDIX

12.1. Identification:

Model: PGR-6150-.....
Serial No: .....
Software Version: .....

12.2. Checks:

Wiring Connections: ❒

Test menu:

PGR-6150 LED 1:	❒	PGR-6150 LED 2:	❒
PGR-6150 LED 3:	❒	PGR-6150 LED 4:	❒
PGR-6150 LED 5:	❒		
PGR-6150 Relay K1:	❒	PGR-6150 Relay K2:	❒
PGR-6150-OPI LED 1:	❒	PGR-6150-OPI LED 2:	❒
PGR-6150-OPI LED 3:	❒	PGR-6150-OPI LED 4:	❒
PGR-6150-OPI LED 5:	❒	PGR-6150-OPI LED 6:	❒
PGR-6150-OPI up key:	❒	PGR-6150-OPI down key:	❒
PGR-6150-OPI right key:	❒	PGR-6150-OPI left key:	❒
PGR-6150-OPI OK key:	❒	PGR-6150-OPI C key:	❒
PGR-6150-OPI RESET key:	❒	PGR-6150-OPI “I” start key:	❒
PGR-6150-OPI “O” stop key:	❒		

12.3. Settings:

12.3.1. General:

Nominal current I_B ..... A
Transformer turns ratio .....
Frequency ❒ 50 Hz ❒ 60 Hz ❒ Variable (45-65Hz)
Motor start up time … … … … … s
Phase sequence ❒ A-B-C ❒ A-C-B

12.3.2. Overload:

Function Enabled ❒ Yes ❒ No
Service Factor……..
Class ❒ 5 ❒ 10 ❒ 15 ❒ 20 ❒ 25 ❒ 30 ❒ 35 ❒ 40 ❒ 45
External ventilation ❒ Yes ❒ No
Alarm..... %

12.3.3. Unbalance:

Function Enabled ❒ Yes ❒ No

%Unbalance …….. %

Start up time … … … … … s

Operating time … … … … … s

12.3.4. Phase loss:

Function Enabled ❒ Yes ❒ No

% Unbalance..... %

Time … … … … … s

12.3.5. Sequence:

Function Enabled ❒ Yes ❒ No

Time … … … … … s

12.3.6. PTC:

Function Enabled ❒ Yes ❒ No

12.3.7. Jam:

Function Enabled ❒ Yes ❒ No

Current pickup …… x I_B

Time … … … … … s

12.3.8. Locked rotor:

Function Enabled ❒ Yes ❒ No

Current pickup …….. x I_B

Time ..... s

12.3.9. Calculated Ground Fault Definite Time I_0>>:

Function Enabled ❒ Yes ❒ No

Current pickup …… x I_B

Time ..... s

12.3.10. Calculated Ground Fault Inverse Time I_0>:

Function Enabled ❒ Yes ❒ No

Current pickup …… x I_B

Curve ❒ Definite ❒ Inverse ❒ Very Inverse ❒ Extremely Inverse

Dial .....

Time … … … … … s

12.3.11. Measured Ground Fault Definite Time IG>>:

Function Enabled ❒ Yes ❒ No

Current pickup ……..... mA

Time … … … … … s

12.3.12. Measured Ground Fault Inverse Time IG>:

Function Enabled ❒ Yes ❒ No

Current pickup..... mA

Curve ❒ Definite ❒ Inverse ❒ Very Inverse ❒ Extremely Inverse

Dial.....

Time … … … … … s

12.3.13. Communications:

Modbus address .....

12.3.14 Reset:

Enabled PGR-6150-OPI ❒ Yes ❒ No

Enabled command ❒ Yes ❒ No

Enabled input ❒ Yes ❒ No

Reset type ❒ Automatic ❒ Timed delayed automatic ❒ Reset

Reset time… … … … … s

12.4. Comments:

Person in charge of commissioning…….. Date ……..

Notes:

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