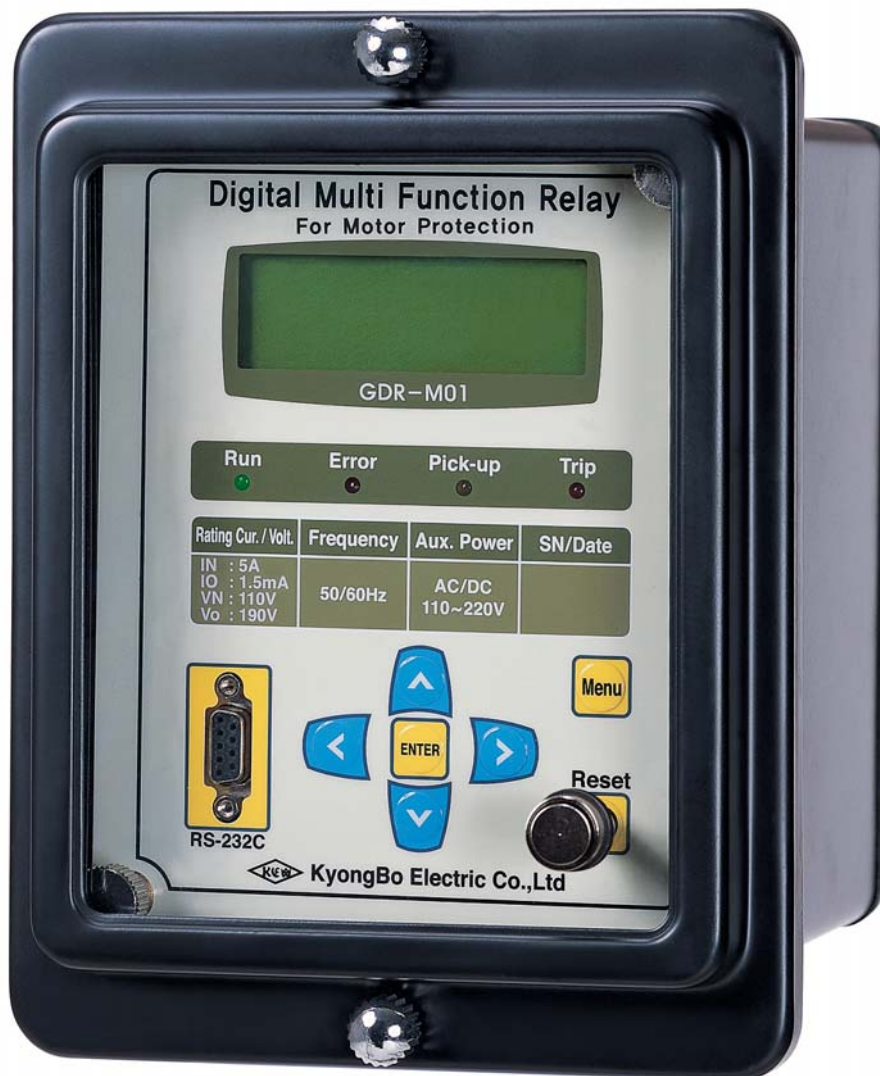


Digital Motor Protection Relay User's Manual

TYPE : GDR-M01

2007. 05. 29

Version 1.10



KyongBo Electric Co., Ltd.

Safety Caution

Please keep the safety caution to prevent any accident may happen by using the products incorrectly.

Up-right using after read carefully to manual.

User manual place to well-see.



Caution

Not following the instruction may result in serious injury or even death.



Danger

Not following the instruction may result in serious injury or property damage.

Indication Guide



Inhibition Indication.



Must Keep Subject.



Cuation



- **Please do not wiring when applied with power or on the operation.**

It may result in electric shock.



- **Please confirm grounding before operate.**

If you didn't put to earth, it may result electric shock, damage and fire.



- **Please do not wire or operate with wet hands.**

It may result in electric shock.



- **Please do not use any damaged cable.**

It may result in electric shock.



- **Please do not all the wiring operation with live busbar.**

It may result in electric shock or fire and property damage by charging voltage of the current transformer.



- **Please do not attempt to disassemble even when the power not applied.**

It may results in electric shock by charging current remained in the product.



- **Please do not operate, inspect, and install by yourself or with electric engineer.**

It may result in electric shock or fire.



- **Please use the ring terminal when wiring the cable.**

It may result in electric shock by bare wire.



- **Please put on terminal cover after terminal wiring.**

It may result in electric shock.



Warning



- **Apply the rated voltage to the power supply terminal.**

It may result in property damage or fire.



- **Please keep the rated load of output contact.**

It may result in property damage or fire.



- **Please keep away product from screws, metals, water, or oil.**

It may result in property damage or fire.



- **Pease avoid a direct ray of light.**

It may result in property damage.



- **Please keep the horizontality when products insert and withdraw.**

It may result in property damage.



- **Please store dry & clean Place.**

It may result in property damage.

Contents

1. General Features	10
2. Technical Data	11
2.1 Voltage, Current Input	11
2.2 Rated Control Source Voltage	11
2.3 Rated Frequency	11
2.4 Case	11
2.5 Time Over Current Element	12
2.6 Instantaneous Over Current Element	12
2.7 Selective Ground Element	13
2.8 Ground Element	13
2.9 Over Voltage Element	14
2.10 Under Voltage Element	14
2.11 Reverse Phase Element	14
2.12 Negative-Sequence Over Current Element	15
2.13 Output Contacts	15
2.14 Insulation Test	16
2.15 Mechanical Test	16
2.16 Noise Test	17
2.17 Temperature, Humidity Test	17
2.18 EMI : ElectroMagnetic Interference	18
2.19 Other Operating Condition	18
3. Protection Characteristics	19
3.1 Over Current Function	19
3.2 Selective Ground Function	21
3.3 Ground Function	22
3.4 Over Voltage Function	23
3.5 Under Voltage Function	24
3.6 Negative-Sequence Current Function	26
3.7 Reverse Phase Function	27

4. Subsidiary Function	28
4.1 Metering	28
4.2 Communication	28
4.2.1 RS-232C Communication	28
4.2.2 RS-485C Communication	29
4.3 Self Diagnosis Function	30
4.4 Fault Recording Function	30
5. Display Panel Construction	31
5.1 Front-side Display Panel Structure	31
5.2 Key Pad & Communication Connector	32
5.3 LED (Operating Indicators)	32
6. Display & Setting Modes	33
6.1 Key Control and LCD Form	33
6.1.1 LCD Main Display, Backlight On/Off	33
6.1.2 LCD Display & Key Control Principle	33
6.1.3 One-button Indication	33
6.1.4 Menu-Tree	33
6.1.5 Setting Modes	34
6.1.6 Measurement Display	36
6.1.7 Protection Setting	36
6.1.8 Self-Diagnosis Display	42
6.1.9 RS-485 Comm. Setting	43
6.1.10 System Config. Setting	43
6.1.11 Recorder	47
6.1.12 Test	48
7. PC Software	52
7.1 Program Manu	53
7.2 Communication Port Configuration	54
7.3 Setting Change Display	55
7.3.1 Setting	56
7.3.2 Status	56
7.3.3 Report	57
7.4 Help	58

Table Contents

【Table 2.1】	Voltage Input	11
【Table 2.2】	Rated Control Source Voltage	11
【Table 2.3】	Case	12
【Table 2.4】	Time Over Current Element	12
【Table 2.5】	Instantaneous Over Current Element	12
【Table 2.6】	Selective Ground Element	13
【Table 2.7】	Ground Element	13
【Table 2.8】	Over Voltage Element	14
【Table 2.9】	Under Voltage Element	14
【Table 2.10】	Reverse Phase Element	14
【Table 2.11】	Negative-Sequence Over Current Element	15
【Table 2.12】	Output Contact / Capacity	15
【Table 2.13】	Insulation Test	16
【Table 2.14】	Mechanical Test	16
【Table 2.15】	Noise Test	17
【Table 2.16】	Temperature, Humidity Test	17
【Table 2.17】	EMI Test	18
【Table 2.18】	Other Operating Condition	18
【Table 3.19】	Time Curve Characteristic	19
【Table 4.20】	Measuring Data	28
【Table 4.21】	Communication Method	29
【Table 5.22】	Key Pad & Communication Connector	32
【Table 5.23】	LED (Operating Indicators)	32
【Table 6.24】	Time OCR Menu	37
【Table 6.25】	INST. OCR Menu	38
【Table 6.26】	SGR Menu	39
【Table 6.27】	GR Menu	39
【Table 6.28】	OVR Menu	40
【Table 6.29】	UVR Menu	41
【Table 6.30】	NSOCR Menu	41
【Table 6.31】	RPR Menu	42
【Table 6.32】	RS-485 Comm. Setting	43
【Table 6.33】	T/S Connection Menus	45
【Table 6.34】	Setting Menus	50
【Table 7.35】	GDR-M01 Program Menus	53
【Table 7.36】	Communication Port Configuration	54

Figure Contents

【Figure 3.1】	INST. OCR(IOCR) Logic Diagram	20
【Figure 3.2】	Time OCR(TOCR) Logic Diagram	20
【Figure 3.3】	SGR Logic Diagram	21
【Figure 3.4】	GR Logic Diagram	22
【Figure 3.5】	OVR Logic Diagram (1 Phase)	23
【Figure 3.6】	OVR Logic Diagram (3 Phases)	24
【Figure 3.7】	UVR Logic Diagram (1 Phase)	25
【Figure 3.8】	UVR Logic Diagram (3 Phases)	25
【Figure 3.9】	NSOCR Logic Diagram	26
【Figure 3.10】	RPR Logic Diagram	27
【Figure 4.11】	RS-232C Circuit	29
【Figure 4.12】	RS-232C Connect	29
【Figure 4.13】	RS-485C Connect Diagram	30
【Figure 5.14】	Front Display	31
【Figure 6.15】	Menu Tree	34
【Figure 7.16】	GDR-M01 Main Display	52
【Figure 7.17】	Communication Port Setting	54
【Figure 7.18】	GDR-M01 Setting	55
【Figure 7.19】	GDR-M01 Status	56
【Figure 7.20】	GDR-M01 Report	57
【Figure 7.21】	Help	58
Appendix 1. Setting Value at Product Shipping		59

Appended Contents

Appended 1. Dimensioned Drawings Unit : mm	61
Appended 2. Internal Block Diagram)	62
Appended 3. External Connection Diagram	62
Appended 4. Over Current Element NI Characteristic Curve	63
Appended 5. Over Current Element VI Characteristic Curve	64
Appended 6. Over Current Element EI Characteristic Curve	65
Appended 7. Over Current Element LI Characteristic Curve	66
Appended 8. Over Current Element KNI(KEPCO Type) Characteristic Curve	67
Appended 9. Over Current Element KVI(KEPCO Type) Characteristic Curve	68
Appended 10. Over Current Element KLNI(KEPCO Type) Characteristic Curve	69
Appended 11. Over Current Element KLVI(KEPCO Type) Characteristic Curve	70
Appended 12. Over Current Element DT Characteristic Curve	71
Appended 13. Selective Ground / Ground Element NI Characteristic Curve	72
Appended 14. Selective Ground Element DT Characteristic Curve	73
Appended 15. Selective Ground Element Operation Characteristic	74
Appended 16. Ground Element DT Characteristic Curve	75
Appended 17. Over Voltage Element NI Characteristic Curve	76
Appended 18. Over Voltage Element DT Characteristic Curve	77
Appended 19. Under Voltage Element NI Characteristic Curve	78
Appended 20. Under Voltage Element DT Characteristic Curve	79

1. General Features

This is digital protective relay for 3phase electric motor of non-grounding or high resistance grounding lines that has protective element Over Current, Ground, Selective Ground, Negative-Sequence Current, Reverse Phase, Over Voltage, Under Voltage. This relay has variety operating time, operating current and operating voltage and can confirm fault information. Main feature follow.

Features

- Complete digital Over Current & Selective Ground/Ground & Over/Under Voltage & Negative-Sequence Current & Reverse Phase
- Variety Time Characteristic
 - OCR : 10 time characteristic curve
 - SGR / GR : DT, NI
 - OVR : DT, NI
 - UVR : DT, NI
 - NSOCR : DT
 - RPR : DT
- It change delay time 0.00 ~ 60.00sec (0.01sec Step) of contact output
- It can display on setting value and measurement through LCD
(4 × 20 LCD Display)
- Reliability improvement from variety self-diagnosis.
- It can set frequency follow rating frequency. (50 / 60Hz)
- 4 relay contact output can set 14 Mode and can use alarm mode.
 - Trip contact output(1a), Signal contact output(3a),
- When relay occur disorder, contact output operate for reliability improvement.
- Convenient PC Application
 - Setting change, Measurement confirm, Fault Information confirm, Status display, Remote Reset
- Contact Test
- When setting change, input password for security
- Variety communication support
 - Communication method : RS-232C, RS-485(SCADA)
 - Protocol : MODBUS
- EMC / EMI capability strengthen
- Application Standard : Standard of Korea Electrical Manufacturers Cooperative (KEMC 1120)

2. Technical Data

2.1 Voltage, Current Input

【Table 2.1】 Voltage Input

R a t e d V o l t a g e	Phase Voltage	AC 110V
	Zero Seq. Voltage	AC 190V
R a t e d C u r r e n t	Current	AC 5A
	Zero Seq. Current	AC 1.5 mA
O v e r l o a d T o l e r a n c e	Voltage	1.15 time of rated voltage / 3hour
	Current	2 time of rated voltage / 3hour 20 time of rated voltage / 2sec
	Zero Seq. Current	100 time of rated voltage / continuous
B u r d e n		Less than 0.5VA / Phase

2.2 Rated Control Source Voltage

【Table 2.2】 Rated Control Source Voltage

R a t e d C o n t r o l S o u r c e V o l t a g e	AC/DC 110 ~ 220V (free voltage)	
O v e r l o a d T o l e r a n c e	1.3 time of rated voltage / 3hour	
B u r d e n	Normal	Less than 30W
	Operation	Less than 70W

2.3 Rated Frequency

50Hz or 60Hz (Sine Waveform)

2.4 Case

【Table 2.3】 Case

C a s e S t r u c t u r e	Drawout
C a s e C o l o r	Munsell No. N1.5 (Black)
C a s e M a t e r i a l	Fe (Steel)

2.5 Time Over Current Element

【Table 2.4】 Time Over Current Element

Operating Value	2.0 ~ 12.5A (0.1A Step)	
Time Characteristic	NI, VI, EI, LI, KNI, KVI, KLNI, KLVI	0.1 ~ 10.0 (0.1 Step)
	DT	0.04 ~ 60.00Sec (0.01Sec Step)
Delay Time	0.00 ~ 60.00Sec (0.01Sec Step)	
Release Value	More than 95% of setting	
Accuracy	Within $\pm 5\%$ of setting	

2.6 Instantaneous Over Current Element

【Table 2.5】 Instantaneous Over Current Element

Operating Value	10 ~ 90A (1A Step)	
Time Characteristic	Instantaneous	$\leq 40\text{ms}$
	DT	0.04 ~ 60.00Sec (0.01Sec Step)
Delay Time	0.00 ~ 60.00Sec (0.01Sec Step)	
Release Value	More than 95% of setting	
Accuracy	Within $\pm 5\%$ of setting	

2.7 Selective Ground Element

【Table 2.6】 Selective Ground Element

Operating Current	0.9 ~ 250.0mA (0.1mA Step)	
Operating Voltage	5 ~ 100V (1V Step)	
Basis Angle	0° ~ 60° (1° Step)	
Operating Angle	± 90° of basis angle	
Time Characteristic	NI	0.1 ~ 10.0 (0.1 Step)
	DT	0.04 ~ 60.00Sec (0.01Sec Step)
Delay Time	0.00 ~ 60.00Sec (0.01Sec Step)	
Release Current	More than 95% of setting	
Accuracy	within ± 5% of setting	

2.8 Ground Element

【Table 2.7】 Ground Element

Operating Current	0.9 ~ 250.0mA (0.1mA Step)	
Time Characteristic	NI	0.1 ~ 10.0 (0.1 Step)
	DT	0.04 ~ 60.00Sec (0.01Sec Step)
Delay Time	0.00 ~ 60.00Sec (0.01Sec Step)	
Release Current	More than 95% of setting	
Accuracy	within ± 5% of setting	

2.9 Over Voltage Element

【Table 2.8】 Over Voltage Element

Operating Voltage	65 ~ 170V (1V Step)	
Time Characteristic	NI	0.1 ~ 10.0 (0.1 Step)
	DT	0.04 ~ 60.00Sec (0.01Sec Step)
Delay Time	0.00 ~ 60.00Sec (0.01Sec Step)	
Release Voltage	More than 95% of setting	
Accuracy	Within $\pm 5\%$ of setting	

2.10 Under Voltage Element

【Table 2.9】 Under Voltage Element

Operating Voltage	30 ~ 105V (1V Step)	
Time Characteristic	NI	0.1 ~ 10.0 (0.1 Step)
	DT	0.04 ~ 60.00Sec (0.01Sec Step)
Delay Time	0.00 ~ 60.00Sec (0.01Sec Step)	
Release Voltage	More than 95% of setting	
Accuracy	Within $\pm 5\%$ of setting	

2.11 Reverse Phase Element

【Table 2.10】 Reverse Phase Element

Operating Value	More than 40% Voltage of rated voltage when reverse voltage	
Time Characteristic	DT	0.04 ~ 60.00Sec (0.01Sec Step)
Delay Time	0.00 ~ 60.00Sec (0.01Sec Step)	
Release Value	More than 95% of setting	
Accuracy	Within $\pm 5\%$ of setting	

2.12 Negative-Sequence Over Current Element

【Table 2.11】 Negative-Sequence Over Current Element

Operating Value	Negative-Sequence 30 ~ 70% (1% step)	
Time Characteristic	DT	0.04 ~ 60.00Sec (0.01Sec Step)
Delay Time	0.00 ~ 60.00Sec (0.01Sec Step)	
Release Value	More than 95% of setting	
Accuracy	Within $\pm 5\%$ of setting	

2.13 Output Contacts

【Table 2.12】 Output Contact / Capacity

T / S1 Output Contact (Trip contact) - 1a Output Contact	
Rated Voltage	AC 250V, DC 125V
Continuo Apply Capacity	10A (AC 250V)
0.3sec Close Capacity	30A (DC 125V)
Close Capacity	6250VA
Material	Silver alloy
T / S2 ~ T / S4 Output Contact (Signal contacts) - 3a Output Contact	
Rated Voltage	AC 250V, DC 125V
Continuo Apply Capacity	5A (AC 250V)
0.5sec Close Capacity	5A (DC 125V)
Close Capacity	1250VA / 150W
Material	Gold-plate silver alloy
Healthy Alarm - 1b Output Contact	
Rated Voltage	AC 250V, DC 125V
Continuo Apply Capacity	1A (AC 250V)
Open Capacity	DC 125V, 30W, 시정수(25ms), 1A
Close Capacity	2500VA / 300W
Material	Silver alloy

2.14 Insulation Test

【Table 2.13】 Insulation Test

Insulation Resistance	DC 500V	Circuit - Earth	10MΩ	IEC60255-5
		Circuit - Circuit	5MΩ	
		Circuit - Terminal		
Power Frequency Withstand Voltage	50/60Hz, 1min	Circuit - Earth	2kV	IEC60255-5
		Circuit - Circuit	1kV	
		Circuit - Terminal		
Basic Impulse Insulation	1.2/50μs, Each 3Time Positive, Negative	Circuit - Earth	5kV	IEC60255-5
		Transformer - Transformer		
		Transformer - Control Circuit		
		Control Circuit - Control Circuit	3kV	
		Transformer - Terminal		
		Control Circuit - Terminal		

caution) AUX POWER and 485 communication terminal of this relay has surge protective circuit. So, don't do this test.

2.15 Mechanical Test

【Table 2.14】 Mechanical Test

Vibration	Vibration Response	10 ~ 150Hz, 0.5G, forward, backward, left, right, up, down 1time
	Vibration Endurance	10 ~ 150Hz, 1G, forward, backward, left, right, up, down 20time
Shock	Shock Response	5G, forward, backward, left, right, up, down, 3time
	Shock Withstand	15G, forward, backward, left, right, up, down, 3time
	Bump	10G, forward, backward, left, right, up, down, 1000time
Earthquake	1 ~ 8Hz	x : 3.5mm, y : 1.5mm, Sweep : 1time
	8 ~ 35Hz	x : 1G, y : 0.5G, Sweep : 1time

2.16 Noise Test

【Table 2.15】 Noise Test

1MHz burst disturbance	1MHz, 75ns, 400Hz, 2Sec	Common mode	2.5kV	IEC60255-22-1
		Differential mode	1.0kV	
EFT Burst	Apply Voltage	4kV		IEC60255-22-4
	Repeat Frequency	2.5kHz		
Electrostatic Discharge	Air discharge	8kV		IEC60255-22-2
	Contact discharge	6kV		
Lighting Surge	1.2/50 μ s, 8/20 μ s, 30sec, 3times	Common mode	2.0kV	IEC60255-22-5
		Differential mode	1.0kV	
R a d i a t e d e l e m a g n e t i c f i e l d	80MHz ~ 1GHz, 10V/m, 1sec			IEC60255-22-3
R a d i o F r e q u e n c y F i e l d s	150kHz ~ 80MHz, 10V/m, 1sec			IEC60255-22-6

2.17 Temperature, Humidity Test

【Table 2.16】 Temperature, Humidity Test

Temperature Range	Operation Temperature	-10℃ ~ +55℃
	Storage Temperature	-20℃ ~ +60℃
R e l a t i v e H u m i d i t y		Day Average 30% ~ 90%

2.18 EMI : ElectroMagnetic Interference

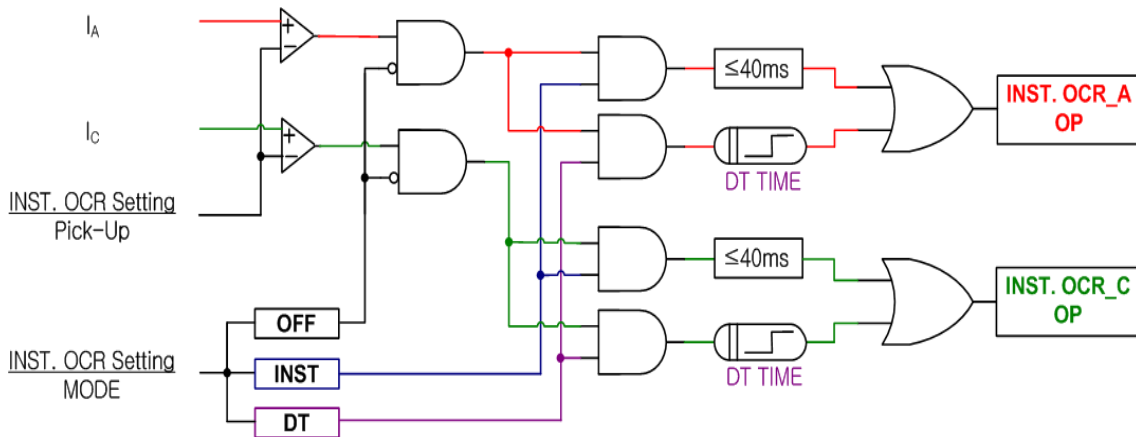
【Table 2.17】 EMI Test

N o i s e s T e r m i n a l V o l t a g e	Frequency(MHz)	Quasi-peak	Average
	0.15 ~ 0.5	79	66
	0.5 ~ 30	73	60
N o i s e s E l e c t r o S t r e n g t h	Frequency(MHz)	Quasi-peak	Limit Value (dBμV/m)
	30 ~ 230	50.5	
	230 ~ 1,000	57.5	

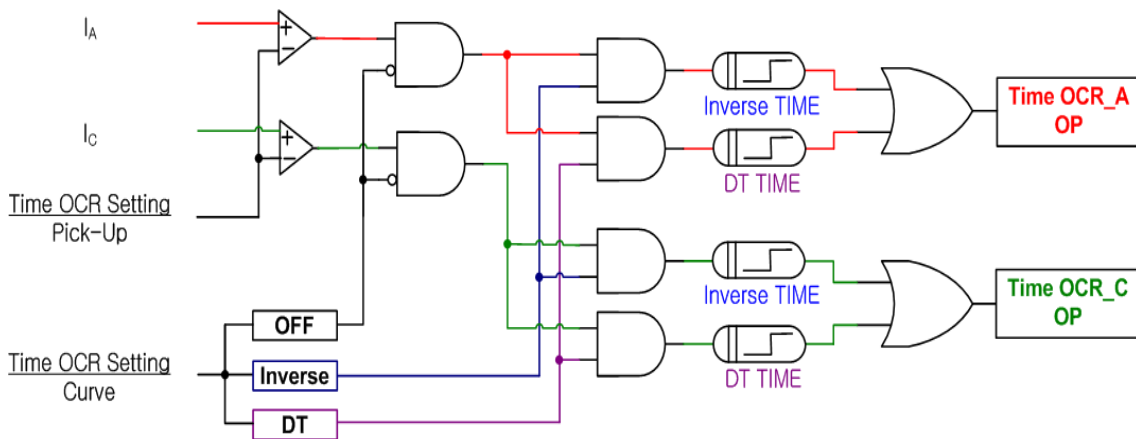
2.19 Other Operating Condition

【Table 2.18】 Other Operating Condition

A l t i t u d e	Less than 1000m
Status of do not exist abnormal vibration, shock, slope and electric magnetic	
Status of do not exist explosiveness dust, inflammable dust, inflammable/corrosiveness dust and salt.	



【Figure 3.1】 INST. OCR(IOCR) Logic Diagram



【Figure 3.2】 Time OCR(TOCR) Logic Diagram

3.2 Selective Ground Function

This relay has SGR protective element, when occur to fault at non-grounding system, fault is detected by V_n , occur to zero sequence voltage from 3rd voltage of GPT, and I_s , occur to zero current from ZCT.

If "DIRECTION" subject set "Enable", operate Selective Ground Relay. However, "DIRECTION" subject set "Disable", operate Nondirectional Ground Relay. Also, if "DIRECTION" subject set "Enable", set pickup of V_n .

Also, relay has inverse time characteristic and Definite Time characteristic because operating time setting is too easy. NI characteristic relate current and time equation that if current magnitude is larger, operation time is short.

Equation of Time curve characteristic NI by voltage and time is follow,

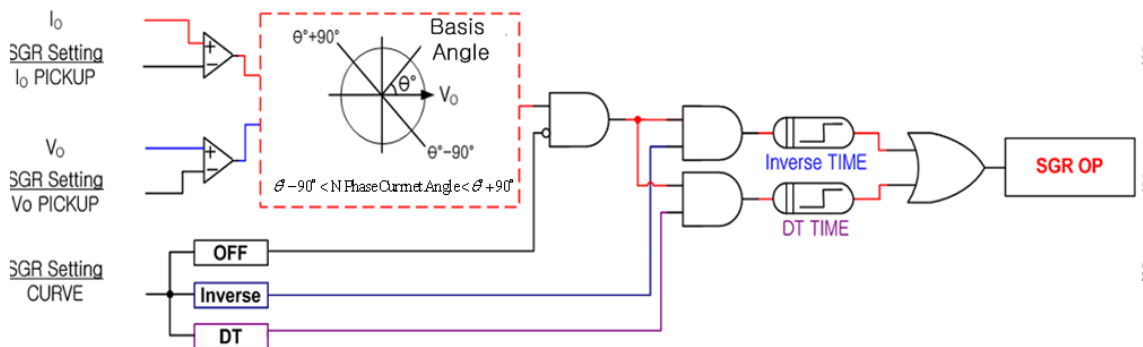
$$T = \left(\frac{16.8}{I^{0.95} - 1} + 0.05 \right) \times \frac{M}{10} (sec)$$

T = Operating Time

I = Input Voltage / Operating Setting

M = Operating Time Ratio

Selective Ground operate Logic Diagram follow,



[Figure 3.3] SGR Logic Diagram

3.3 Ground Function

This relay has Ground relay from protective ground fault that detect zero sequence current from ZCT.

If setting element "DIRECTION" set "DIR", operate SGR and set "NONE", operate GR.

Also, relay has inverse time characteristic and Definite Time characteristic because operating time setting is too easy. NI characteristic relate current and time equation that if current magnitude is larger, operation time is short.

Equation of Time curve characteristic NI by voltage and time is follow,

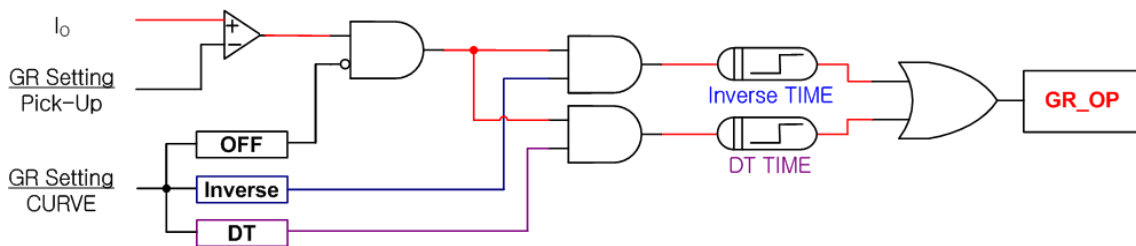
$$T = \left(\frac{16.8}{I^{0.95} - 1} + 0.05 \right) \times \frac{M}{10} (sec)$$

T = Operating Time

I = Input Voltage / Operating Setting

M = Operating Time Ratio

Ground operate Logic Diagram follow,



【Figure 3.4】 GR Logic Diagram

3.4 Over Voltage Function

This relay has Inverse Time and Definite Time characteristic for Over Voltage element. NI characteristic relate voltage and time equation that if voltage magnitude is larger, operation time is short.

This element operation divide to 1 Phase and 3 Phases operating. When relay set 1 phase (OVR×3), relay operate independence V_{AB} , V_{BC} , V_{CA} and relay set 3 phase (3Φ OVR×1), relay operate all phase Pick-Up.

Equation of Time curve characteristic NI by voltage and time is follow,

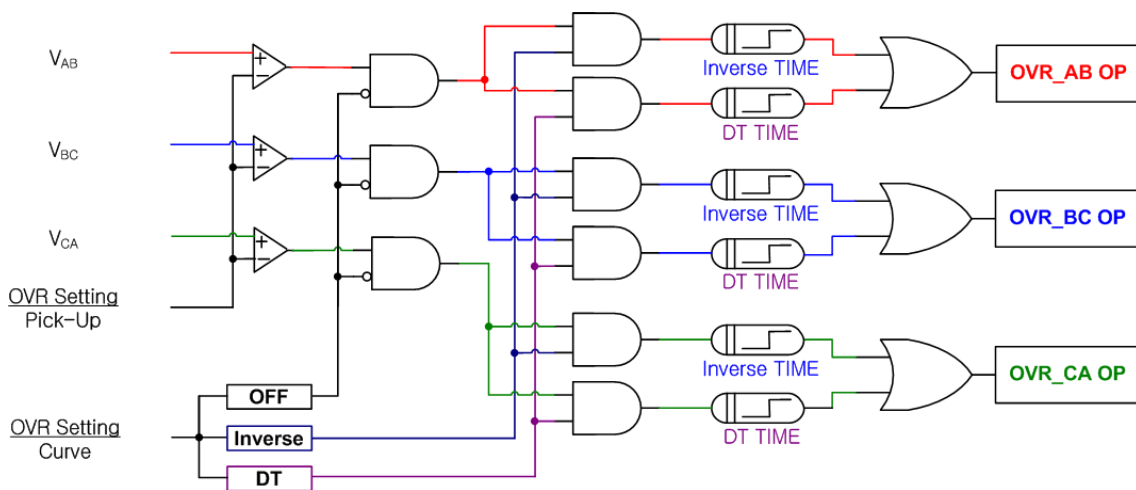
$$T = \left(\frac{10.5}{V^{1.75} - 1} \right) \times \frac{M}{10} \text{ (sec)}$$

T = Operating Time

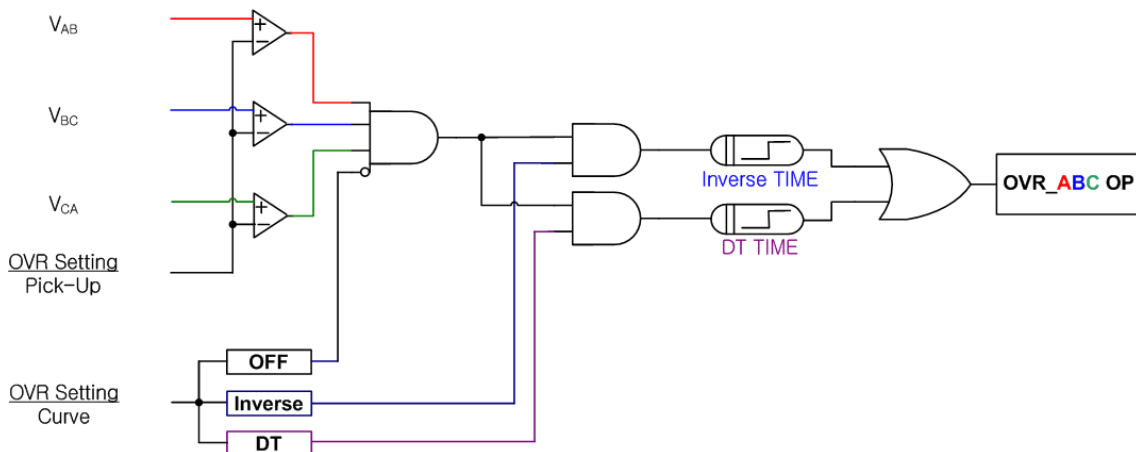
V = Input Voltage / Operating Setting

M = Operating Time Ratio

Over Voltage operate Logic Diagram follow,



[Figure 3.5] OVR Logic Diagram (1 Phase)



【Figure 3.6】 OVR Logic Diagram (3 Phases)

3.5 Under Voltage Function

This relay has Inverse Time and Definite Time characteristic for Under Voltage element.

Operated Under Voltage element has many release mode, at first that voltage is higher than setting, second that user push reset key. NI characteristic relate voltage and time equation that if voltage magnitude is smaller, operation time is short.

This element operation divide to 1 Phase and 3 Phases operating. Voltage of operating for Under Voltage element is lower than setting, after higher than setting, so, relay don't operate at first apply power or after reset release. For example, when relay set 1 phase (UVR×3), operate after each phase voltage apply higher than setting and 3 phase (3Φ UVR×1), operate after all phase voltage apply higher than setting.

Operated Under Voltage element has many release mode, that voltage is higher than setting, that user push reset key, and that release after RST-Time when RST-Mode is ON.

Equation of Time curve characteristic by voltage and time is follow,

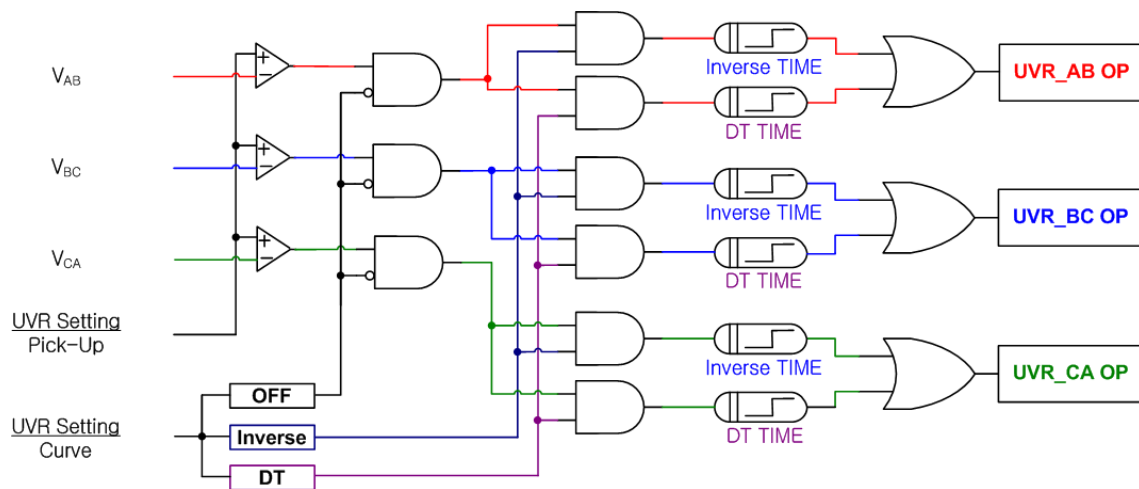
$$T = \left(\frac{8}{1 - V^{2.2}} \right) \times \frac{M}{10} \text{ (sec)}$$

T = Operating Time

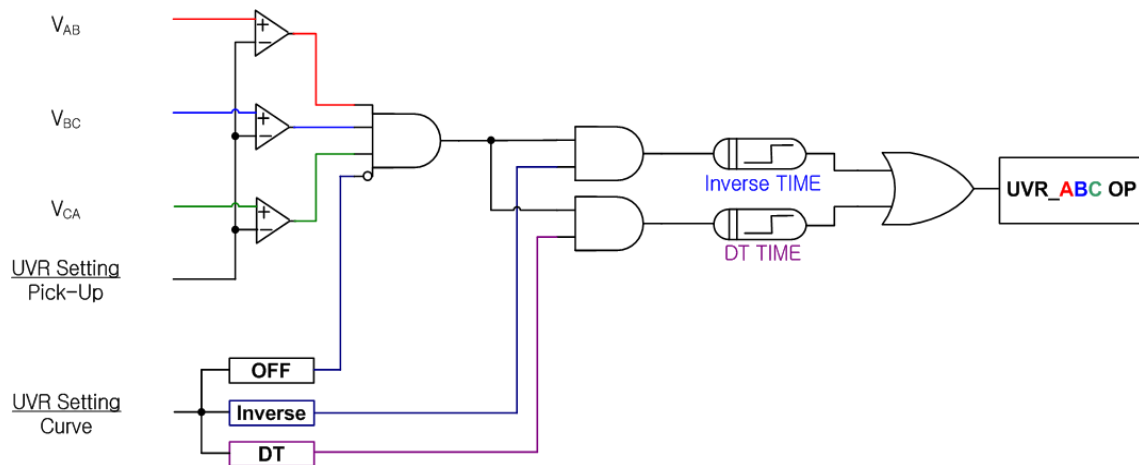
V = Input Voltage / Operating Setting

M = Operating Time Ratio

Under Voltage operate Logic Diagram follow,



【Figure 3.7】 UVR Logic Diagram (1 Phase)



【Figure 3.8】 UVR Logic Diagram (3 Phases)

3.6 Negative-Sequence Current Function

This relay has Definition Time for Negative Sequence Over Voltage element.

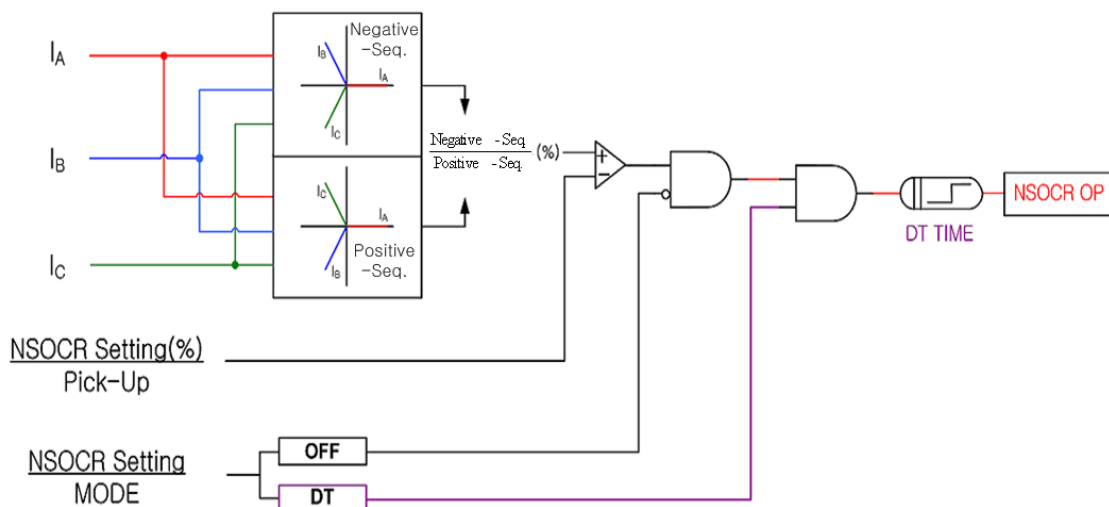
When motor come phase open according to inner problem or the other factor, motor stop rotate or continuous rotate. At this time, rotator of motor flow large current and motor has damage.

Negative-Sequence Current Element calculate 3 phase unbalanced current at this case and if unbalanced rate higher than setting(30 ~ 70%), operate DT (0.04 ~ 60.00 Sec).

Unbalanced current equation is follow,

$$\text{Unbalanced Current Ratio} = \frac{\text{Negative Sequence Current}}{\text{Positive Sequence Current}} \times 100 (\%)$$

Negative-Sequence Current operate Logic Diagram follow,



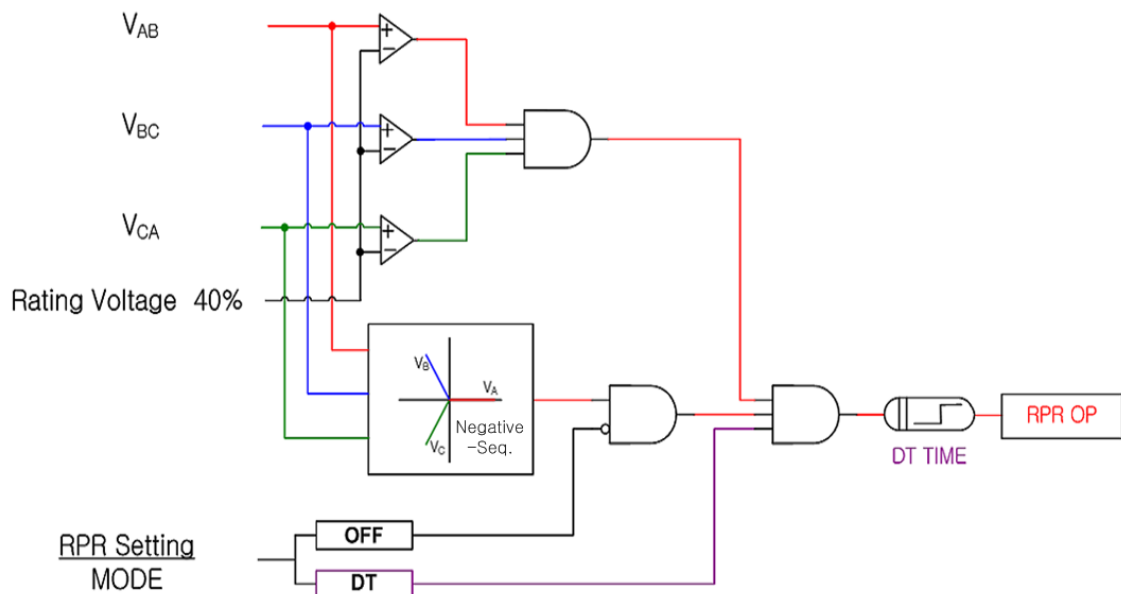
【Figure 3.9】 NSOCR Logic Diagram

3.7 Reverse Phase Function

This relay has Definition Time for Reverse Phase element.

This relay protective reverse phase input, that is element prevent backlashing. Relay compare 3phase angle dissimilarity, if relay detect angle exchange, operate DT (0.04 ~ 60.00 Sec). (However, when input voltage 40% of rated voltage, occur reverse phase) When use single phase motor, set "OFF".

Reverse Phase operate Logic Diagram follow,



【Figure 3.10】 RPR Logic Diagram

4. Subsidiary Function

4.1 Metering

This relay measure voltage, current, angle, Unbalanced current.

【Table 4.20】 Measuring Data

Section	Feature
Vab, Vbc, Vca	<ul style="list-style-type: none"> • Voltage RMS and angle metering. • Primary line-to-line voltage that input voltage exchange PT ratio. • Metering Range : 0 ~ 250V (When PT Ratio 1:1)
Ia, Ib, Ic	<ul style="list-style-type: none"> • Current RMS and angle metering. • Primary current that input current exchange CT ratio. • Metering Range : 0 ~ 200A (When CT Ratio 5:5)
Io	<ul style="list-style-type: none"> • ZCT secondary zero sequence current RMS and angle. • Use exclusive CT. • Metering Range : 0 ~ 350mA
Vo	<ul style="list-style-type: none"> • Zero sequence voltage RMS and angle metering. • Zero sequence voltage that input voltage exchange PT ratio. • Metering Range : 0 ~ 250V (When GPT Ratio 1:1)
Unbalanced Current	<ul style="list-style-type: none"> • Unbalanced Current is calculated by positive and negative sequence Current.
Angle	<ul style="list-style-type: none"> • Basis of angle is Vab.

However, indicate "FULL", when measuring data over metering range.

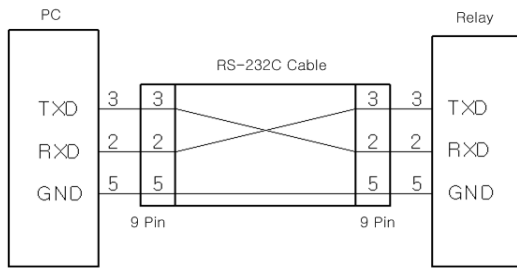
4.2 Communication

This relay provide communication method of common RS-232C / RS-485C and speed of maximum 19200 bps. Relay has 1 RS-232C port in front-side and RS-485C port in back-side. Front-side RS-232C port is used for setting change, confirm metering, confirm Fault information, LED indication, Remote Reset with PC tool and back-side RS-485C port is used for SCADA communication.

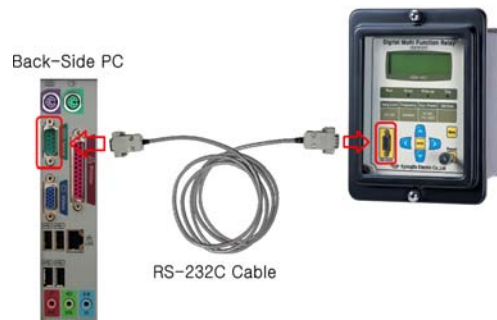
4.2.1 RS-232C Communication

RS-232C cable use cross-cable that crossed 2 and 3 pin like **【Figure 4.11】**. If you use direct-cable, you can't link communication.

When your PC don't have RS-232C, so you use USB port, must use cross-cable.



【Figure 4.11】 RS-232C Circuit



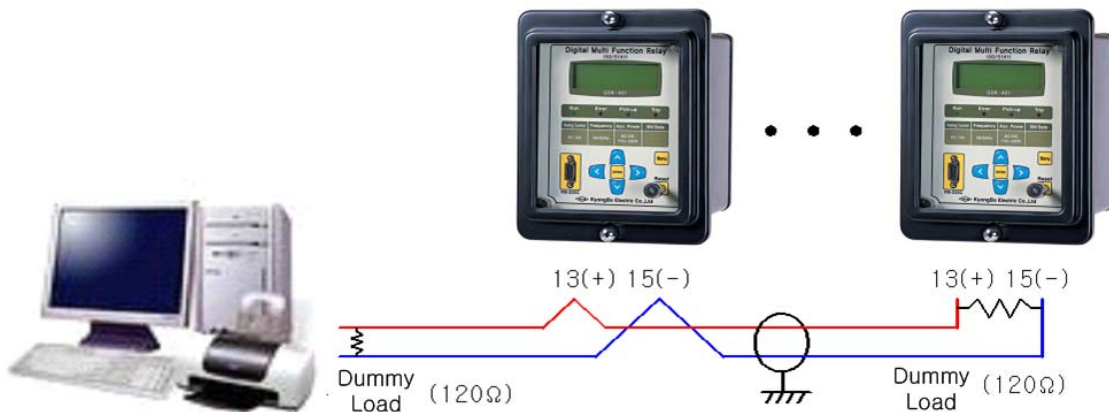
【Figure 4.12】 RS-232C Connect

【Table 4.21】 Communication Method

Communication Specification	M e t h o d	● RS-232 / RS-485
	P r o t o c o l	● MODBUS
Communication Standard (RS-485C)	D i s t a n c e	● 1.2km
	L i n e	● Common RS-485C Two-Pair cable
	S p e e d	● 300 ~ 19,200 bps
	M e t h o d	● Half-Duplex
	M a x i m u m input-output Voltage	● -7V ~ +12V
Communication Port	F r o n t D i s p l a y	<ul style="list-style-type: none"> ● RS232 1port. ● 300 ~ 19200 BPS, MODBUS Protocol
	B a c k - s i d e	<ul style="list-style-type: none"> ● RS485 1 Port. ● 300 ~ 19200 BPS, MODBUS Protocol ● Upper SCADA communication ● Terminal number : 9(+), 11(-), 12(Com)

4.2.2 RS-485C Communication

This relay provide isolated RS-485C Half Duplex communication method for linking SCADA system. In this communication method can linked multi-drop and communication distance is maximum 1.2km. RS-485C line end resistance is parallel 120Ω like **【Figure 4.13】 RS-485C Connection Diagram.**



【Figure 4.13】 RS-485 Connect Diagram

4.3 Self Diagnosis Function

Self-diagnosis function keep back non-operation and mal-operation though observation at all time. If this function detect error, error LED turn on and self-diagnosis unit display FAIL. Also, when relay occur error, protection element stop operation and keep up the LCD and LED until error is removed.

Self-diagnosis unit is follow,

- Power Fail
- CPU Watchdog Fail
- Memory Fail
- Setting Fail

4.4 Fault Recording Function

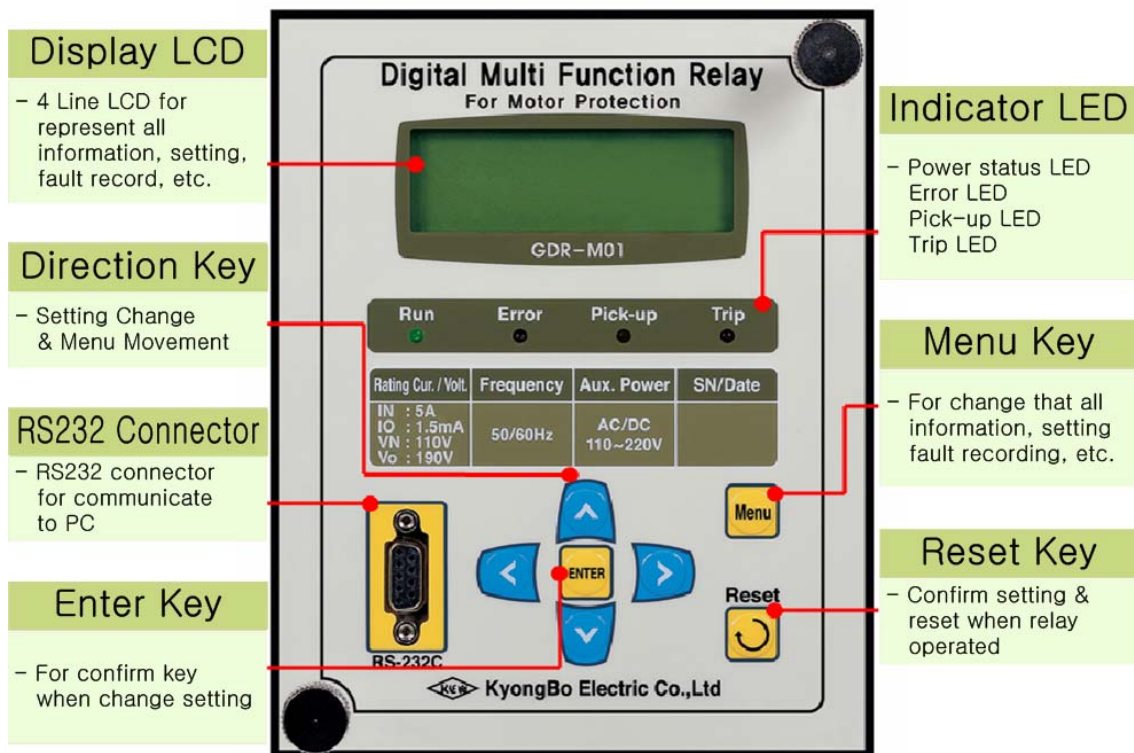
Relay has to record and save that current and voltage magnitude / angle, unbalanced current, operation status of protection element, relay operating time, operating count for conventional fault analysis. Also, when new operation occur, old fault recording is deleted and new fault recording is saved. Even though, rated control power is disappeared, keep saved data.

5. Display Panel Construction

5.1 Front-side Display Panel Structure

Front-side and control panel have 20×4 LCD, 17 LED, 10 Keypad and RS-232C connector like [Figure 5.14] .





When setting change, must input password, so other person don't change setting, and protective element run during relay control and setting change through LCD display.



[Figure 5.14] Front Display


5.2 Key Pad & Communication Connector

【Table 5.22】 Key Pad & Communication Connector

Direction Key 	Setting change and move to other menu use.
ENTER () Key	Key use confirm, when menu or setting confirm.
Reset () Key	Key use indicator reset, when relay operate.
Menu () Key	Key use for menu display.
RS-232C Connector	This is a RS-232C for Setting Tool PC application Program through communication.

5.3 LED (Operating Indicators)

【Table 5.23】 LED (Operating Indicators)

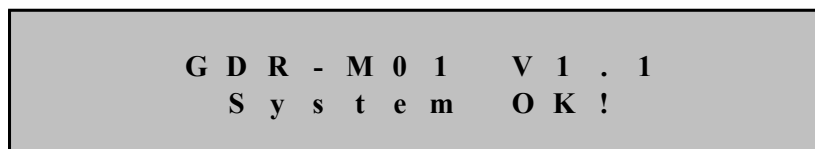
Run (Green)	This LED indicate normal operated CPU, when relay is supplied normal control power. If LED turn off during supplied normal control power, relay change or repair.
Error (Red)	This LED turn on red when relay detects error in device and protection element blocking. Detail relay error confirm relay menu through the LCD. If eliminate error, LED turn off.
Pick-up (Yellow)	When protection element become pick-up, Pick-Up LED turn on yellow. When protection element become release, Pick-Up LED turn off.
Trip (Red)	This LED is operation indicator of each protection element. When each protection element operate, the same time, each LED turn on red. This status LED keep up after release until push reset () Key.

6. Display & Setting Modes

6.1 Key Control & LCD Construction





6.1.1 LCD Main Display, Backlight On/Off


LCD display main after supplied control power.




When relay has a error, LCD display "System Error!" in stead of "System OK!". Backlight of LCD turn off after 3minute without control and measuring rotate auto.


6.1.2 LCD Display & Key Control Principle

Relay menu is made up tree structure and select to use left(), right(), up(), down() Key.

The place of (*) indicator is select unit and you want to move detail unit, push  Key.

You want to escape the present menu, push  Key.

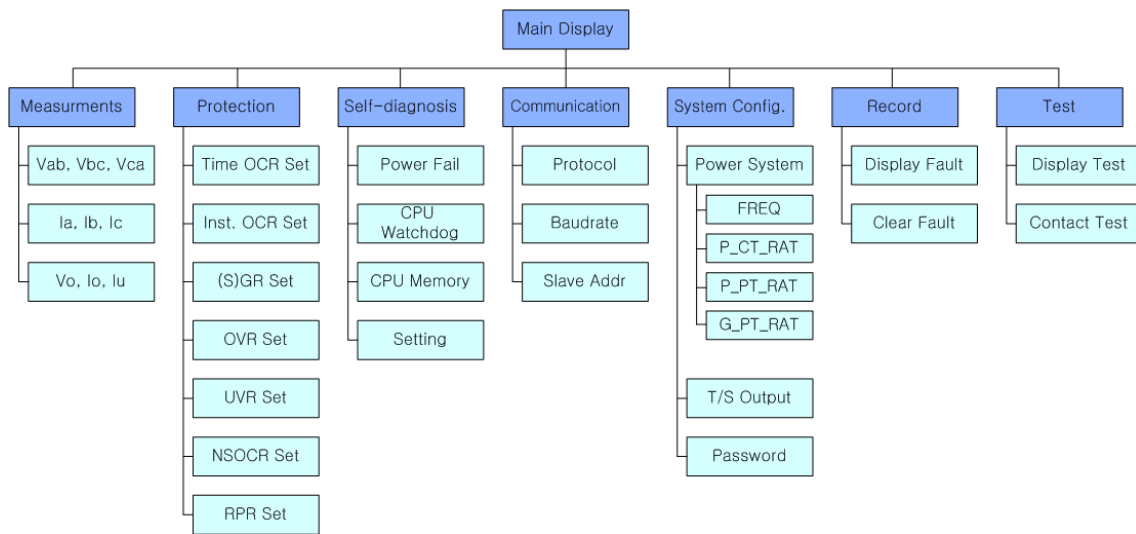
6.1.3 One-button Indication

If you do over again press Reset () Key, can watch measure data, Setting values, self-diagnosis throw LCD display. This function can confirm relay data without opening cover.

Reset Key use to indicator reset, when protection element operated.

6.1.4 Menu-Tree

Menu Tree represent relay all manu structure follow **【Figure 6.1】** . Each menu setting method describe 6.2 Setting.

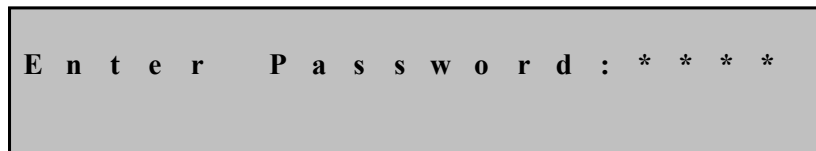





【Figure 6.15】 Menu Tree

6.1.5 Setting Modes

To right operate of this relay setting value match the power system. Setting and display elements of 7 are Measurement, Protection, Self-Diagnosis, RS-485 Comm., System Config, Recorder, Test.

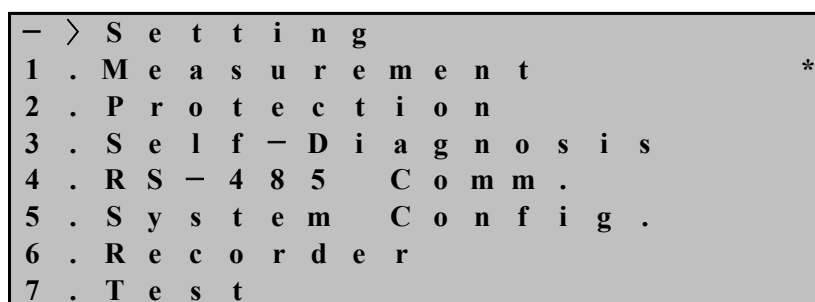
At main display, if you push Menu () Key, display follow enter password next figure.



- (1)  Key : Number change.
- (2)  Key : Position change.
- (3) ENTER () Key : Confirm password after enter password.

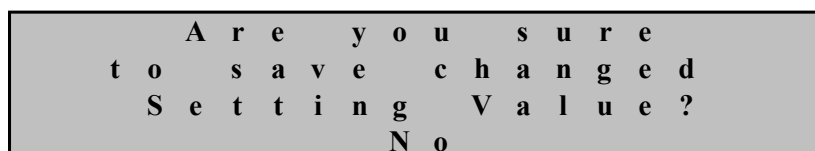
Password is composed of 4 position and each number made up from 0 to 9. First password value is “0000”, so directly push enter key exchange setting mode.

Setting main display is follow.



For example, if you want to change IOCG Pick-Up current, operate follow sequence.

- (1) Key push : (*) indicator move to 2.Protection.
- (2) Key push : Move to Protection display.
- (3) Key push : (*) indicator move to 2.Inst. OCR .
- (4) Key push : Move to Inst. OCR diplay.
- (5) Key push : (*) indicator move to 2.PICK-UP.
- (6) Key push : Present saving current value of 2.PICK-UP is flickering.
- (7) Key push : Change setting value.
- (8) ENTER () Key push : Changing setting value temporary saving.
- (9) Key push : Move to Protection display.
- (10) Key push : Move to Setting display.
- (11) Key push : Diplay follow. "No" is flickering.



- (12) Key push : Select Yes.
- (13) ENTER () Key push : Move to main display after saving change setting.

If you push ENTER () Key after select No at (12), change setting delete and keep old setting values.

Also, old setting values apply before press ENTER () Key at "Are you sure to save changed Setting Value? Yes".

All conctects setting do an upper example.

6.1.6 Measurement Display

Measurement display indicate measuring voltage and current.

Vab, Vbc, Vca mean line-to-line voltage, Ia, Ib, Ic mean phase current, Vo, Io, Iu mean zero-sequence voltage, zero-sequence current, unbalanced current ratio and indicate magnitude and angle.

That is, measuring data is primary values that are applied CT Ratio and PT Ration by secondary values.

However, zero-sequence current display secondary values.

— > M e a s u r e m e n t s			
V a b :	1 1 0 . 1	V , <	0 . 0 °
V b c :	1 0 9 . 9	V , <	2 3 9 . 8 °
V c a :	1 1 0 . 3	V , <	1 2 0 . 2 °
I a :	5 . 0 3	A , <	0 . 0 °
I b :	4 . 9 8	A , <	2 4 0 . 1 °
I c :	5 . 0 0	A , <	1 1 9 . 8 °
V o :	0 . 0	V , <	0 . 0 °
I o :	0 . 0 0	m A , <	0 . 0 °
I u :	0 . 0 0	%	

If you want to escape Measurement Display, press  Key. So, upper setting menu.

6.1.7 Protection Setting


Protection item has Time OCR, INST. OCR, SGR/GR, OVR, UVR, NSOCR and RPR.

In Setting, select 2. Protection, display follow,

— > P r o t e c t i o n		
1 .	T i m e	O C R *
2 .	I N S T	O C R
3 .	(S)	G R
4 .	O V R	
5 .	U V R	
6 .	N S O C R	
7 .	R P R	

If you want to escape this menu, press  Key. So, exchange main setting menu.

6.1.7.1 Protection ► Time OCR Setting

This is to set Time Over Current Element. In Protection, select () 1. Time OCR, display follow.

- >	T i m e O C R		
1 .	C U R V E	:	L I *
2 .	P I C K - U P	:	5 . 0 A
3 .	T - D I A L	:	1 0 . 0


If you want to escape Time OCR, press  Key.

Detail menu of Time OCR is follow,

【Table 6.24】 Time OCR Menu

Unit	Range	Step	Basis Value
CURVE	OFF, NI, VI, EI, LI, DT, KVI, KNI, KLVI, KLNI	-	KVI
PickUp	2.0 ~ 12.5A	0.1A	5.0A
Time Dial	0.1 ~ 10.0	0.1	10.0
DT-Time	0.04 ~ 60.00Sec	0.01Sec	-

6.1.7.2 Protection ► INST. OCR Setting

This is to set Instantaneous Over Current Element. In Protection, select () 2. INST. OCR, display follow.

- >	I N S T O C R		
1 .	M O D E	:	D T *
2 .	P I C K - U P	:	5 0 A
3 .	D T - T I M E	:	0 . 0 4 s

If you want to escape INST. OCR, press  Key.

Detail menu of INST. OCR is follow.

【Table 6.25】 INST. OCR Menu

Unit	Range	Step	Basis Value
MODE	OFF, INST, DT	-	DT
PickUp	10 ~ 90A	1A	50A
DT-Time	0.04 ~ 60.00Sec	0.01Sec	0.04Sec

6.1.7.3 Protection ▶ SGR / GR Setting

This is to set Selective Ground / Ground Element. In Protection, select ()
 3. (S)GR, display follow.


When DIRECTION unit set “DIR”, element operate SGR and set “NONE”, operate GR.

DIRECTION unit set “DIR”, when display.

- >	(S) G R S e t	
1 .	D I R E C T I O N :	D I R *
2 .	C U R V E :	N I
3 .	V o P I C K U P :	1 2 . 0 V
4 .	I o P I C K U P :	1 0 . 0 m A
5 .	R E F - P H A S E :	< 0 °
6 .	T - D I A L :	0 . 1

DIRECTION unit set “NONE”, when display.

- >	(S) G R S e t	
1 .	D I R E C T I O N :	N O N E *
2 .	C U R V E :	N I
3 .	I o P I C K U P :	1 0 . 0 m A
4 .	T - D I A L :	0 . 1

If you want to escape (S)GR, press  Key.

Detail menu of (S)GR is follow,


【Table 6.26】 SGR Menu

Unit	Range	Step	Basis Value
DIRECTION	DIR, NONE	-	DIR
CURVE	OFF, NI, DT	-	DT
Vo PICK-UP	5 ~ 100V	1V	60V
Io PICK-UP	0.9 ~ 250mA	0.1mA	1.0mA
T-DIAL	0.1 ~ 10.0	0.1	-
DT-TIME	0.04 ~ 60.00Sec	0.01Sec	0.04
REF-PHASE	0° ~ 60°	1°	45°

【Table 6.27】 GR Menu

Unit	Range	Step	Basis Value
DIRECTION	DIR, NONE	-	NONE
CURVE	OFF, NI, DT	-	DT
Io PICK-UP	0.9 ~ 250mA	0.1mA	1.0mA
T-DIAL	0.1 ~ 10.0	0.1	-
DT-TIME	0.04 ~ 60.00Sec	0.01Sec	0.04

6.1.7.4 Protection ► OVR Setting

This is to set Over Voltage Element. In Protection, select () 4. OVR, display follow.

- >	O V R S e t		
1 .	C U R V E	:	D T *
2 .	P H A S E	:	1 P H A S E
3 .	P I C K - U P	:	6 5 . 0 V
4 .	T - D I A L	:	0 . 1


If you want to escape OVR, press  Key.

Detail menu of OVR is follow.

【Table 6.28】 OVR Menu

Unit	Range	Step	Basis Value
CURVE	OFF, NI, DT	-	NI
PHASE	1, 3 PHASE	-	1 PHASE
PICK-UP	65 ~ 170V	1V	130V
T-DIAL	0.1 ~ 10.0	0.1	10.0
DT-TIME	0.04 ~ 60.00Sec	0.01Sec	-

6.1.7.5 Protection ► UVR Setting

This is to set Under Voltage Element. In Protection, select () 5. UVR, display follow.

- >	U V R	S e t	
1 .	C U R V E	:	D T *
2 .	P H A S E	:	1 P H A S E
3 .	P I C K - U P	:	1 0 5 . 0 V
4 .	T - D I A L	:	1 0 . 0
5 .	R S T - M O D E	:	O F F


If you want to escape UVR, press  Key.

Detail menu of UVR is follow.

【Table 6.29】 UVR Menu

Unit	Range	Step	Basis Value
CURVE	OFF, NI, DT	-	NI
PHASE	1, 3 PHASE	-	1 PHASE
PICK-UP	30 ~ 105V	1V	90V
T-DIAL	0.1 ~ 10.0	0.1	10.0
DT-TIME	0.04 ~ 60.00Sec	0.01Sec	-
RST Mode	ON, OFF	-	OFF
RST Time	0.1 ~ 180.0Sec	0.1Sec	-

6.1.7.6 Protection ▶ NSOCR Setting

This is to set Negative-Sequence Over Current Element. In Protection, select () 6. NSOCR, display follow.

- >	N S O C R S e t		
1 .	M O D E	:	D T *
2 .	P I C K - U P	:	3 0 %
3 .	D T - T I M E	:	0 . 0 4 s

If you want to escape NSOCR, press  Key.

Detail menu of NSOCR is follow.

【Table 6.30】 NSOCR Menu

Unit	Range	Step	Basis Value
MODE	OFF, DT	-	DT
PickUp	30 ~ 70%	1%	30 %
DT-Time	0.04 ~ 60.00Sec	0.01Sec	0.04Sec

6.1.7.7 Protec▶ RPR Setting

This is to set Reverse Phase Element. In Protection, select (▶) 7. RPR, display follow.

```

- > R P R   S e t
1 . M O D E       :   D T   *
2 . D T - T I M E :   0 . 0 4 s
    
```

If you want to escape RPR, press ◀ Key.

Detail menu of RPR is follow.

【Table 6.31】 RPR Menu

Unit	Range	Step	Basis Value
MODE	OFF, DT	-	DT
DT-Time	0.04 ~ 60.00Sec	0.01Sec	0.04Sec

6.1.8 Self-Diagnosis Display

This menu display self-diagnosis of each unit.

Diagnosis unit are Power, CPU WatchDog Timer, Memory, Setting and if each unit has error, LCD indicate “FAIL”, and LCD main display “System Error!” instead of “System OK!”, and Error LED turn on red.

Self-Diagnosis display follow.

```

- > S e l f - D i a g n o s i s
1 . P o w e r       :   O K   *
2 . C P U   W a t c h d o g :   O K
3 . M e m o r y     :   O K
4 . S e t t i n g   :   O K
    
```

If you want to escape Self-diagnosis, press ◀ Key. So, exchange upper menu.


6.1.9 RS-485 Comm. Setting

For setting of communication unit set Baudrate, Slave Addr.

In setting, select 4. RS-485 Comm., Comm. setting display follow.

```

- >   R S - 4 8 5   C o m m .
1 . P r o t o c o l       : M o d B u s *
2 . B a u d r a t e     : 1 9 2 0 0
3 . S l a v e   A d d r :           1
    
```

If you want to escape RS-485 Comm., press  Key. Exchange main display.

【Table 6.32】 RS-485 Comm. Setting

Unit	Range	Basis Value
Protocol	MODBUS	MODBUS
Baudrate	300, 600, 1200, 2400, 4800, 9600, 19200 (bps)	19200
Slave Addr	1 ~ 254	1


6.1.10 System Config. Setting

System Config. has Power system, T/S Output, Password etc. of detail menu.

In setting, select 5. System Config., System Config. setting display follow.

```

- >   S y s t e m   C o n f i g .
1 . P o w e r   S y s t e m           *
2 . T / S     O u t p u t
3 . P a s s w o r d
    
```


If you want to escape System Config., press  Key. Exchange main display.

6.1.10.1 System Config. ► Power system Setting

Power system has FREQ(frequency), P_CT_RAT, P_PT_RAT, P_PT_RAT of detail menu.

In System Config., select 1. Power system, Power System setting display follow.

- >	P o w e r	S y s t e m	
1 .	F R E Q	:	6 0 H z *
2 .	P _ C T _ R A T	:	5 : 5
3 .	P _ P T _ R A T	:	1 . 0 : 1
4 .	G _ P T _ R A T	:	1 . 0 : 1

If you want to escape Power System., press  Key. Exchange upper display.

• **System Config. ▶ Power system ▶ FREQ setting**

To use for relay of official frequency setting menu.

50Hz and 60Hz two unit, if power system frequency is 60Hz, select 60Hz.

• **System Config. ▶ Power system ▶ P_CT_RAT setting**

This manu set primary CT ratio of Phase. To set from 5 to 10000 with 5step. This relay is designed 5A to secondary rated current CT, so, you must select 5A to CT secondary rated current CT. For example, if you use 1000:5 CT, P_CT_RAT set 1000.

• **System Config. ▶ Power system ▶ P_PT_RAT setting**

This menu set primary PT ratio of Phase. To set from 0.1 to 3200.0 with 0.1step. For example, if you use 22900:110 PT, P_PT_RAT set 208.2.

• **System Config. ▶ Power system ▶ G_PT_RAT setting**

This menu set primary PT ratio of Ground. To set from 0.1 to 3200.0 with 0.1step. For example, if you use 6600:190 GPT, G_PT_RAT set 34.7.

6.1.10.2 System Config. ▶ T/S Output setting

T/S Output menu set connecting type and delay time of 4 contact output.

In System Config, select 2. T/S Output, T/S Output setting display follow.

- >	T / S	O u t p u t	
1 .	T / S 1		*
2 .	T / S 2		
3 .	T / S 3		
4 .	T / S 4		

If you set T/S output you want, to use   Key and move to (*) indicator at wish menu.

• **System Config. ▶ T/S Output ▶ T/S 1 setting**

T/S number menu set connecting type, return method and delay time of 4 contact output.

In T/S Output, select 1. T/S 1, display follow.

- >	T / S	1			
1 .	C O N	:		P R O T _ O R	*
2 .	R S T	:		S E L F	
3 .	D L Y	:		0 . 0 0 s	

Upper display, T/S 1 means contact output #1.

If you want to escape T/S1, press  Key. Exchange upper display.

• **System Config. ▶ T/S Output ▶ T/S 1 ▶ 1. CON setting**

This menu select operation status.

T/S output connection and mean follow.

【Table 6.33】 T/S Connection Menus


Connection	Description
OFF	Don't use.
PROT_OR	Any other protection element operate, output.
OCR	Inst OCR or Time OCR element operate, output.
Inst OCR	Inst OCR element operate, output.
Time OCR	Time OCR element operate, output.
OCR_A	A phase OCR element operate, output.
OCR_C	C phase OCR element operate, output.
OCR+(S)GR	OCR or (S)GR element operate, output.
(S)GR	(S)GR element operate, output.
OVR+UVR	OVR or UVR element operate, output.
OVR	OVR element operate, output.
UVR	UVR element operate, output.
NSOCR+RPR	NSOCR or RPR element operate, output.
NSOCR	NSOCR element operate, output.
RPR	RPR element operate, output.

• **System Config. ▶ T/S Output ▶ T/S 1 ▶ 2. RST setting**

This menu set to return method of contact output.

This relay has two method of Self Mode and Manual Mode.

Self Mode is auto retuning method and, Manual Mode is manual retuning method.

In other word, user want to contact output retuning, must push Reset () Key.

• **System Config. ▶ T/S Output ▶ T/S 1 ▶ 3. DLY setting**

At contact output retuning, you can set delay time throw this menu.

This menu is applicable to Self Mode and if Manual Mode isn't applicable to the menu.

If you DLY set 0.00, contact output return less than 40ms and if you want to return less than 100ms, set 0.06.

You can set from 0.00 to 60.00 with 0.01Sec step, if you set less than 100ms, error is ±35ms, if you set more than 100ms, error is ±5%.

6.1.10.3 System Config. ▶ Password setting

This manu is to change password 4 position and each number set from 0 to 9.

In System Config., select 3.Password, password setting display follow.


```

- > P a s s w o r d
  N e w P a s s w o r d : * * * *
    
```

In this display, if you press ENTER () Key after enter new password, come out confirm new password display.


```

- > P a s s w o r d
  N e w P a s s w o r d : * * * *
  C f m . P a s s w o r d : * * * *
    
```

In this display, enter new password agin and press ENTER () Key, come out under figure and exchange upper menu display.

```

- > P a s s w o r d
  N e w P a s s w o r d : * * * *
  C f m . P a s s w o r d : * * * *
  P a s s w o r d C o n f i r m e d
    
```

If you don't want to change password, press  Key, then escape this menu and exchange upper menu display.


6.1.11 Recorder

This menu indicate fault element and fault counter.

In Setting, select 6. Recorder, Recorder setting display follow.

```

- >   F a u l t   R e p o r t
1 . D i s p l a y   F a u l t s   *
2 . C l e a r     F a u l t s
      2           F a u l t s !
    
```

If you want to escape Recorder, press  Key. Exchange upper display.



6.1.11.1 Recorder ► 1.Display Fault


Display Fault displays latest fault recording. When new fault occur, delete oldest fault record and save new record.

In Recorder, select 1.Display Fault, Display Fault unit display follow.

```

- >   D i s p l a y   F a u l t s
1 . C o u n t e r   :           1 9 6   *
2 . E l e m e n t   :           I O C R   A
3 . T i m e        :           4 0 m s
4 . V a b :         0 . 0 V ,       0 . 0 °
5 . V b c : 2 5 0 . 0 V ,       4 4 . 4 °
6 . V c a :         0 . 0 V ,       4 4 . 3 °
7 . I a :          2 0 0 . 0 A ,    2 9 9 . 9 °
8 . I b :           0 . 0 0 A ,    1 3 3 . 2 °
9 . I c :           0 . 0 0 A ,    3 2 6 . 6 °
0   I o :           5 0 . 0 A ,    2 2 8 . 2 °
1   V o :           0 . 0 V ,       0 . 0 °
2   I u : 1 0 2 . 1 6 %
    
```

In upper display, if you want to confirm fault record, press  Key and so, you can confirm cumulation counter, operation element and relay operation time.

If you want to escape Display Fault, press  Key. Exchange upper display.



6.1.11.2 Recorder ▶ 2.Clear Fault Unit

This menu can delete saving fault recording.

In Recorder, select 2.Clear Fault, Clear Fault display follow.

```

- > C l e a r F a u l t s
    C l e a r A l l F a u l t s ?
        N o
    
```

In upper this display with flickering “No”, if you want to escape Clear Fault, press  Key, and, if you want to delete saving fault recording, press ENTER () Key after exchange “No” for “Yes”.

6.1.12 Test

Test menu can test display and contact.

In Setting, select 7. Test, test display follow.

```


- > T e s t
1 . D i s p l a y T e s t *
2 . C o n t a c t T e s t
    
```

If you want to escape Test, press  Key. Exchange main menu display.

6.1.12.1 Test ▶ Display Test




This menu can be test of LCD and LED error existence and nonexistence.

In Test, select 1.Display Test, under display follow.

In Display Test, if you don't want to Display Test that press  Key, escape this menu and exchange upper menu display.

```

- > D i s p l a y T e s t
    A r e y o u s u r e
    t o t e s t D i s p l a y ?
        N o
    
```

In upper display for Display Test, press   Key so, exchange from “No” to “Yes” and press ENTER () Key, if so, move to Test menu after TEST of LCD

and all LED flicker 3time.

If you do Display Test, follow under display.



```
T E S T T E S T T E S T T E S T T E S T T E S T
T E S T T E S T T E S T T E S T T E S T T E S T
T E S T T E S T T E S T T E S T T E S T T E S T
T E S T T E S T T E S T T E S T T E S T T E S T
```



6.1.12.2 Test ▶ Contact Test


This menu can be error existence and nonexistence of contact output that exchange contact output.

In Test, select 2. Contact Test, under display follow.

```
- > C o n t a c t T e s t
1 . T / S 1 : O f f *
2 . T / S 2 : O f f
3 . T / S 3 : O f f
4 . T / S 4 : O f f
5 . H . A l a r m : O n
```

You want to test contact output select T/S1 ~ T/S4 and, to press  Key, change On, press ENTER () Key, contact output is energized and return off as sound click.

If you want to test Healthy Alarm, select contact output and later, to press  Key, change On, press ENTER () Key, contact output is energized and return on as sound click.

If you want to escape Contact Test, press  Key. Exchange upper menu display.

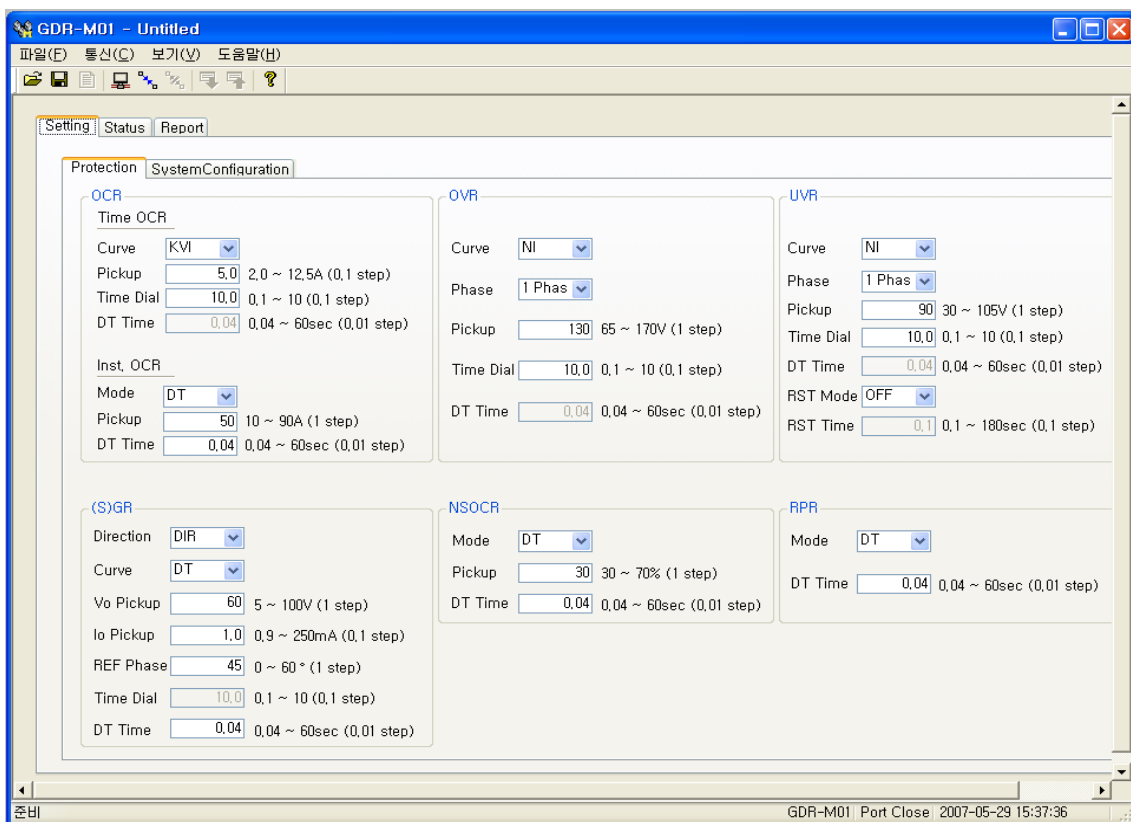
【Table 6.34】 Setting Menus

Setting (Menu)	1.Measurements		Vab∠θ°, Vbc∠θ°, Vca∠θ°, Ia∠θ°, Ib∠θ°, Ic∠θ°, Vo∠θ°, Io∠θ°, Iu(%)		
	2.Protection	1.Time OCR	1.Curve	OFF, NI, VI, EI, LI, DT, KVI, KNI,, KLVI, KLNI	
			2.PickUp	2.0~12.5A (0.1A Step)	
			3.Time Dial	0.1~10.0 (0.1Step)	
			4.DT_Time	0.04~60.00Sec (0.01Sec Step)	
		2.INST. OCR	1.Mode	OFF, INST, DT	
			2.PickUp	10~90A (1A Step)	
			3.DT_Time	0.04~60.00Sec (0.01Sec Step)	
		3.(S)GR	SGR	1.Direction	DIR
				2.Curve	OFF, DT, NI
				3.Vo PickUp	5~100V (1V Step)
				4.Io PickUp	0.9~250.0mA (0.1mA Step)
				5.REF-Phase	0°~60° (1° Step)
				6.Time Dial	0.1~10.0 (0.1 Step)
			GR	7.DT_Time	0.04~60.00Sec (0.01Sec Step)
				1.Direction	NONE
				2.Curve	OFF, DT, NI
				3.Io PickUp	0.9~250.0mA (0.1mA Step)
		4.OVR	4.Time Dial	0.1~10.0 (0.1 Step)	
			4.DT_Time	0.04~60.00Sec (0.01Sec Step)	
			5.UVR	1.Curve	OFF, NI, DT
				2.Phase	1Phase, 3Phase
	3.Pick-Up	65~170V (1V Step)			
	4.Time Dial	0.1~10.0 (0.1 Step)			
	6.NSOCR	1.Curve	OFF, NI, DT		
		2.Phase	1Phase, 3Phase		
		3.Pick-Up	30~105V (1V Step)		
7.RPR	4.Time Dial	0.1~10.0 (0.1 Step)			
	6.NSOCR	1.Mode	OFF, DT		
		2.PickUp	30~70% (1% Step)		
7.RPR	3.DT_Time	0.04~60.00Sec (0.01Sec Step)			
	1.Mode	OFF, DT			
		3.DT_Time	0.04~60.00Sec (0.01Sec Step)		

Setting (Menu)	3.Self-Diagnosis		Power, CPU Watchdog, Memory, Setting		
	4.RS-485 Comm.	1.Protocol		MODBUS	
		2.Baudrate		300, 600, 1200, 2400, 4800, 9600, 19200 (bps)	
		3.Slave Addr		1 ~ 254	
	5.System Config.	1.Power System	1.FREQ		50Hz or 60Hz
			2.P_CT_RAT		5 ~ 10000 : 5 (5 Step)
			3.P_PT_RAT		0.1 ~ 3200.0 : 1 (0.1 Step)
			4.G_PT_RAT		0.1 ~ 3200.0 : 1 (0.1 Step)
		2.T/S Output	T/S 1~4	1.CON	OFF, PROT_OR, OCR, Inst OCR, Time OCR, OCR_A, OCR_C, OCR+(S)GR, (S)GR, OVR+UVR, OVR, UVR, NSOCR+RPR, NSOCR, RPR
				2.RST	SELF or MANUAL
				3.DLY	0.00~60.00Sec (0.01Sec Step)
		3.Password		New Password : ****	
		6.Recorder	1.Display Faults		Counter, Element, Time, Vab$\angle\theta^\circ$, Vbc$\angle\theta^\circ$, Vca$\angle\theta^\circ$, Ia$\angle\theta^\circ$, Ib$\angle\theta^\circ$, Ic$\angle\theta^\circ$, Vo$\angle\theta^\circ$, Io$\angle\theta^\circ$, Iu(%)
			2.Clear Faults		Clear All Faults? Yes or No
	7.Test	1.Display Test		Are you sure to Display Test? Yes or No	
		2.Contact Test		T/S 1~4, H.Alarm : On or Off	

7. PC Software

GDR-M01 can use PC Tool like relay menu that every kind setting, fault information, status, data change and confirm. PC perform operation that connect RS-232C communication port of PC and relay print-side, and use MODBUS with communication protocol. Also, relay possible RS-485 communication to use back-side terminal. When relay change setting, repeat changing work, however, if you use GDR-M01, it work once, and save working data, so, if you do same working, it so open save file therefore so easy. Connected all working data is saved and again open. Under display is main display at operated GDR-M01.











【Figure 7.16】 GDR-M01 Main Display

7.1 Program Menu

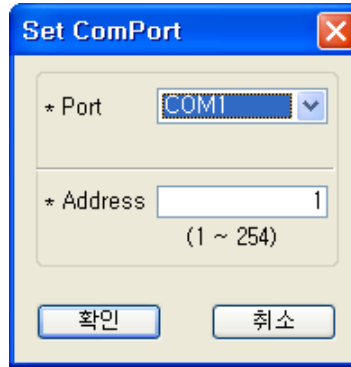
Basic menu of GDR-M01 is composed Communication Setting menu, File input and output menu, Relay relate Setting menu, and detail refer to **【Table 7.1】** .

【Table 7.35】 GDR-M01 Program Menus

● Program Menu	
 Comm	Select Com. port of PC (Refer to 7.2 Com. port setting)
 Connect	Connect relay and PC communication and initialization.합니다.
 Disconnect	Disconnect Communication.
 Open	Open established Setting File.
 Save	Save Setting(System, Protection).
 Report	Save Setting(Relay Information, System, Protection, Fault) with text file.
 PC → Relay	Sent to relay that changing System, Protection setting.
 Relay → PC	Upload from relay of all GDR-M01 setting.
Exit(X)	Exit program.

7.2 Communication Port Configuration

This function use to select Com-port in 15port that don't used because of another equipment. Also, RS-232C communication protocol is MODBUS, so PC software use with RS-485.



[Figure 7.17] Communication Port Setting

[Table 7.36] Communication Port Configuration

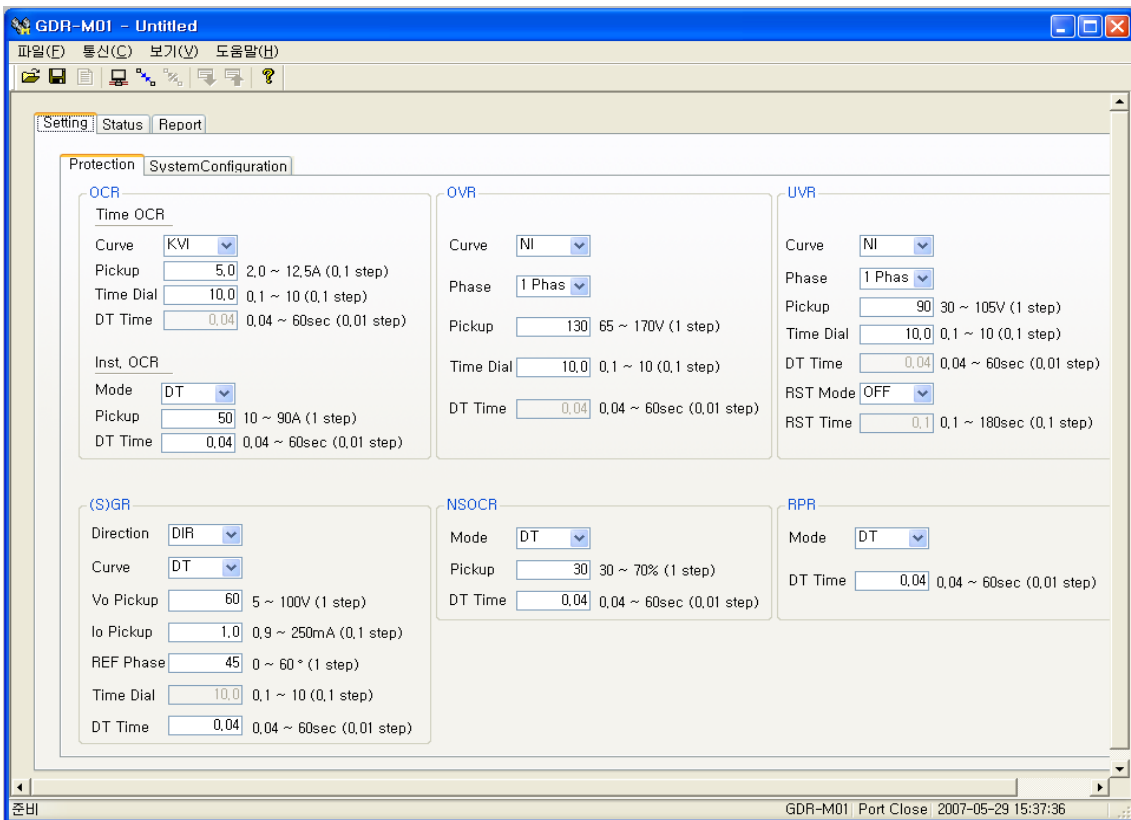
• Communication	
Port	COM1 ~ COM15
	Communication Port
ADDR	1~254 RS-485C use at communication
	Slave Address (MODBUS Protocol) for RS-485C

7.3 Setting Change Display

When execute GDR-M01 Setting Tool, come out Setting, Status, Report contents display. In here, if click Relay → PC (↕) button, confirm system composition and saving data of relay, and, in setting display, if click PC → Relay (↕) button, send to relay PC setting. Also, if click Save (💾) button, contents of setting displays are saved (*.gdr) file, and, if click Open (📂) button, you can open saved file. If click Report (📄) button, you can save report with (*.txt) file.

7.3.1 Setting

In Setting display, you can set up Protection Element and System Configuration. Setting item is composed Time OCR(Time Over Current Element), INST. OCR(Instantaneous Over Current Element), (S)GR(Selective Ground / Ground Element), OVR(Over Voltage Element), UVR(Under Voltage Element), NSOCR(Negative-Sequence Over Current Element), RPR(Reverse Phase Element), Power System and T/S Output etc, description of each element equal to relay menu composition display, so refer to “6. Display and Setting Mode”.

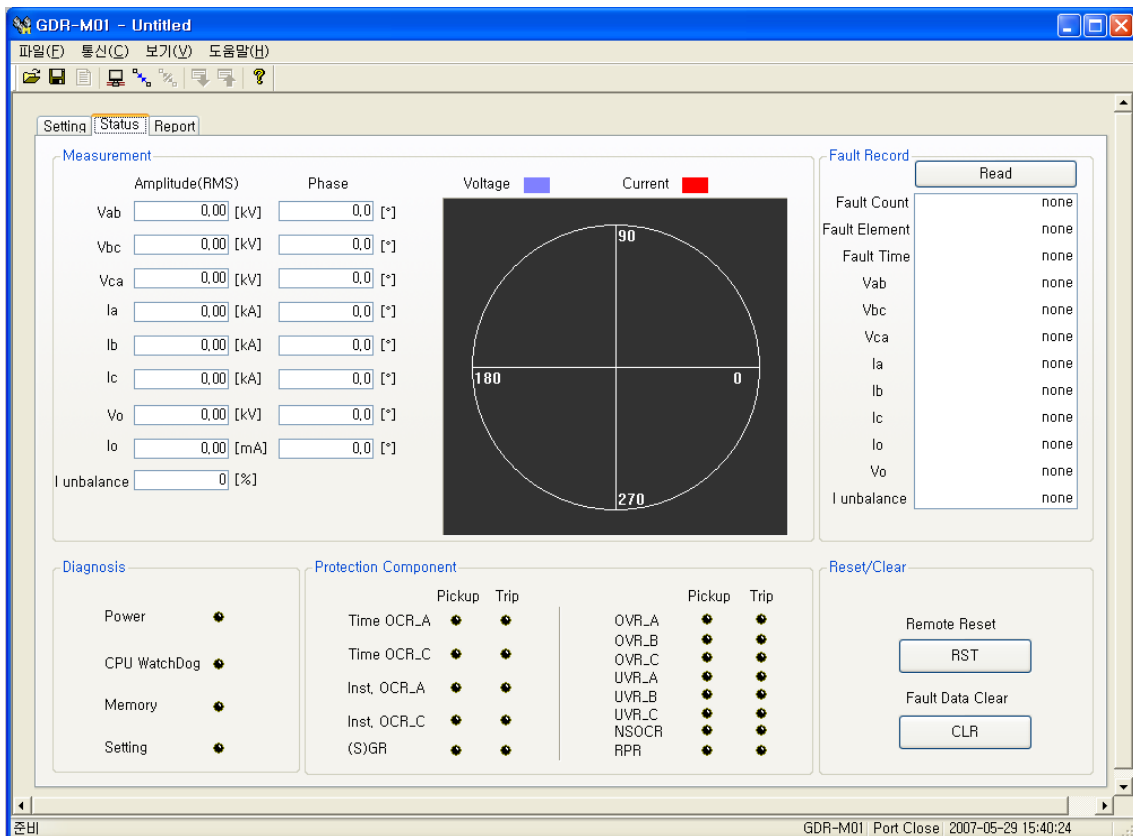


【Figure 7.18】 GDR-M01 Setting

7.3.2 Status

Status display represent one screen that is composed Measurement, Fault Record, State.


Description of this item equal to relay menu composition display, so refer to “6. Display and Setting Mode”.



【Figure 7.19】 GDR-M01 Status

Measurement unit of GDR-M01 is kV, kA, mA, %.

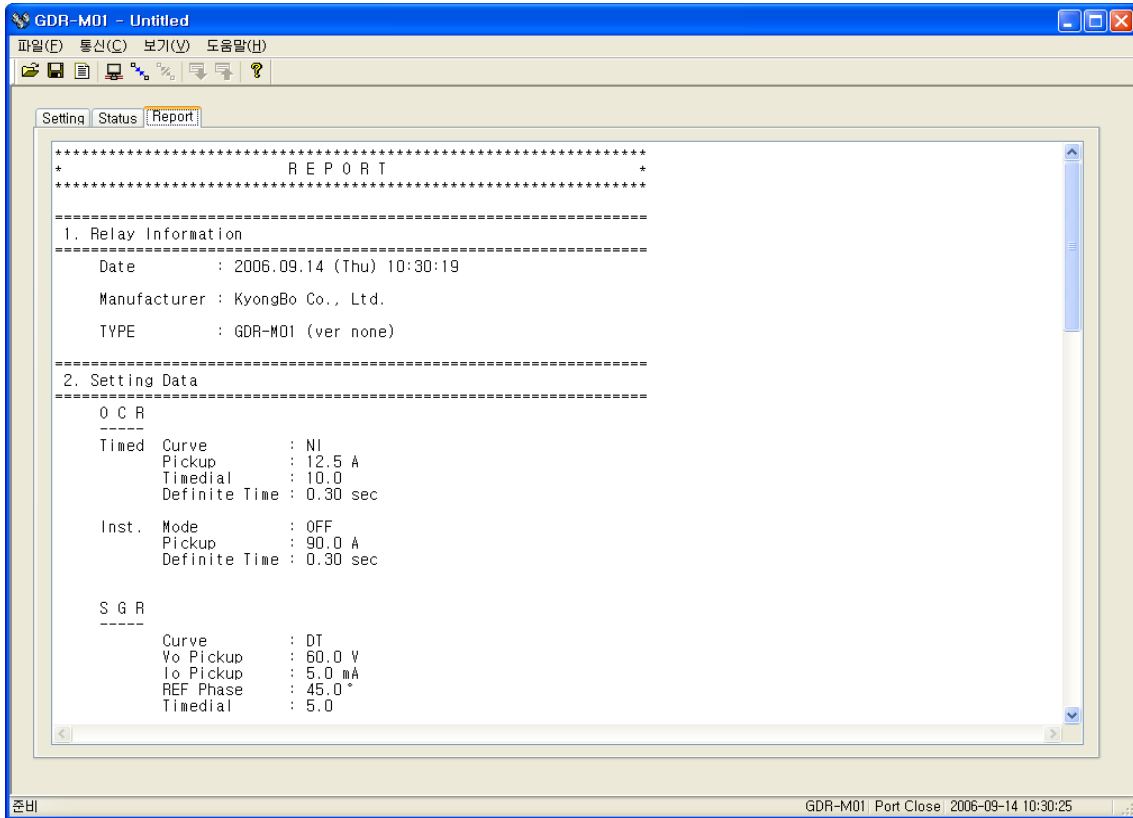
Click Read button, relay shows last fault recording.

Click RST button, it operate remote Indicator Reset like relay Reset () Key.

Click CLR button, it operate remote Clear Fault like Recorder ▶ 2.Clear Fault of relay menu.

7.3.3 Report

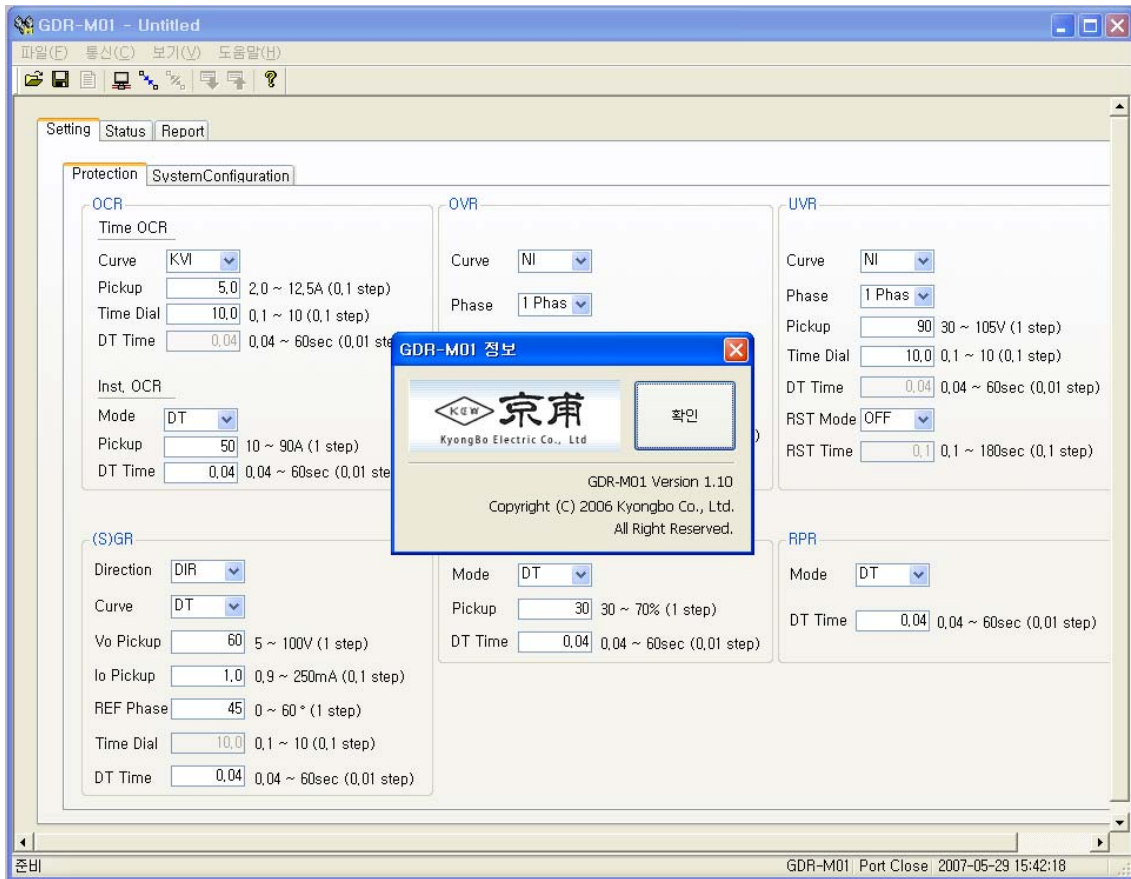
You can save relay information(Relay Information, Setting Data, System Configuration, Fault Record) txt file throw connected relay and PC.



【Figure 7.20】 GDR-M01 Report

7.4 Help

This menu is known description of Setting Tool, A/S support, internet homepage, E-mail address, address, telephon number etc.



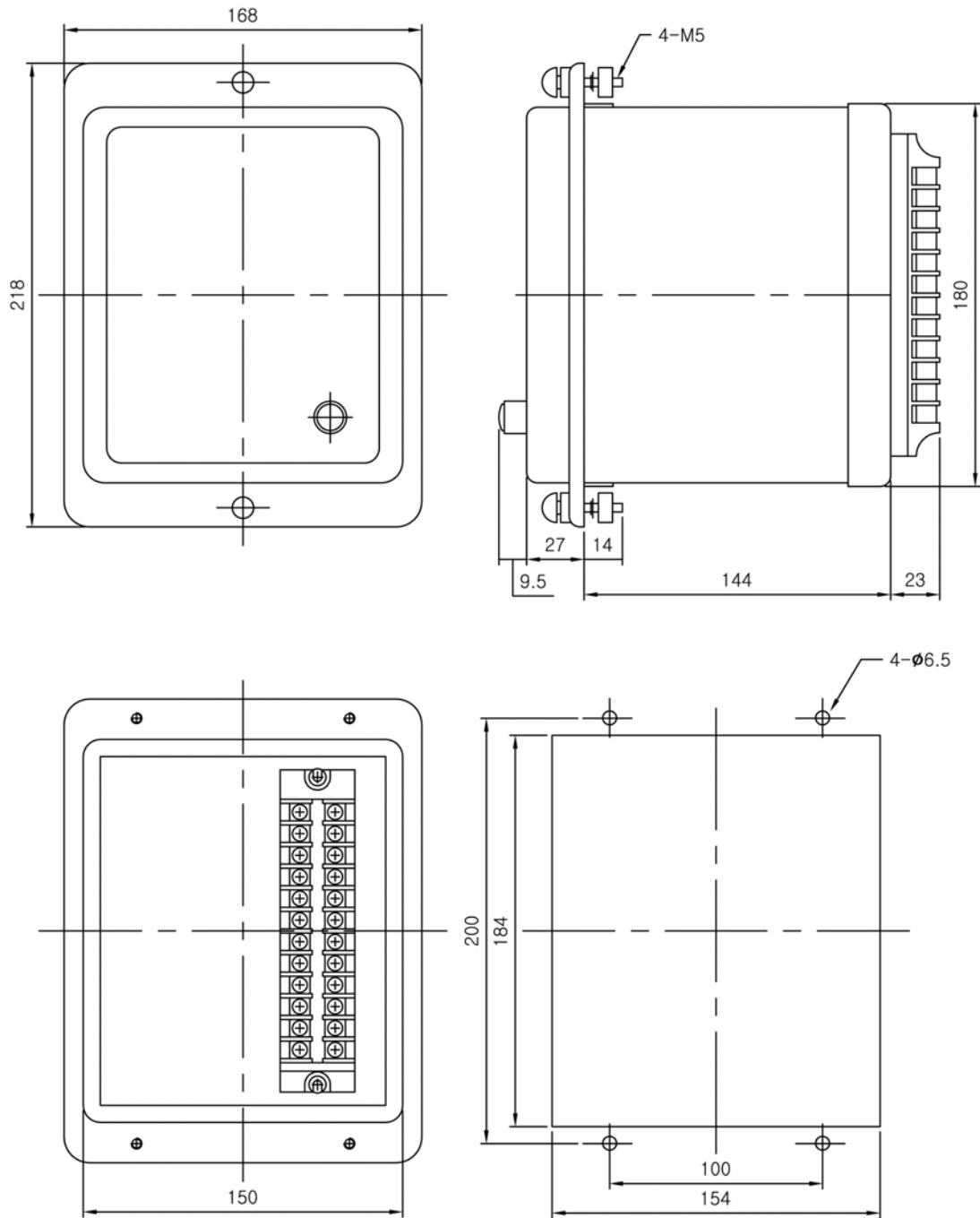
【Figure 7.21】 Help

Appendix 1. Setting Value at Product Shipping

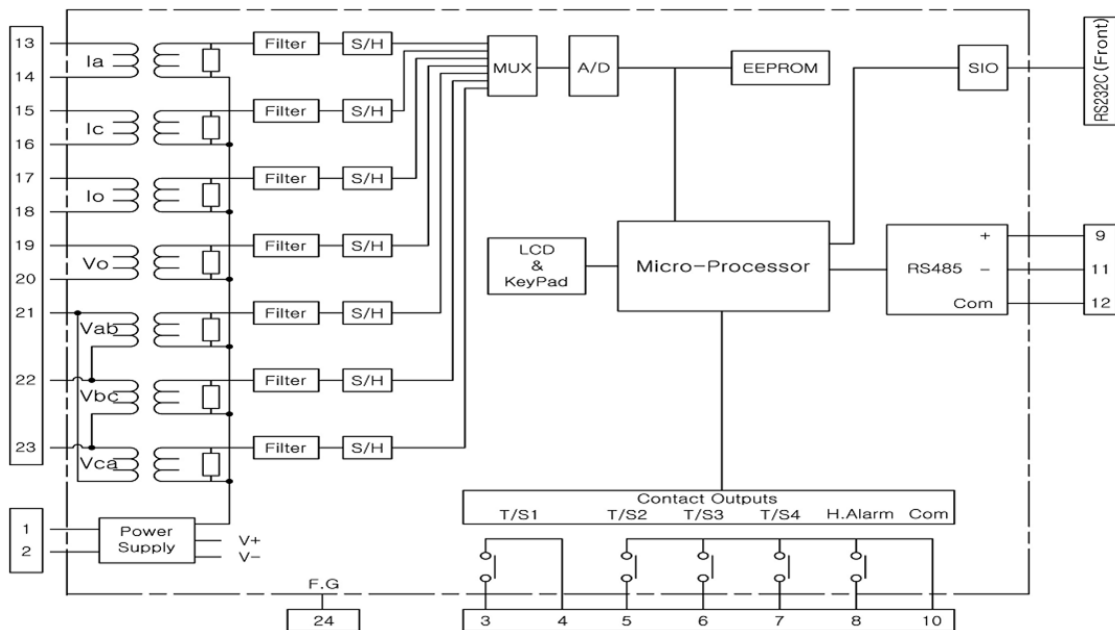
Setting (Menu)	2. Protection	1. Time OCR	1. Curve	KVI
			2. PickUp	5 A
			3. Time Dial	10
			4. DT_Time	-
		2. INST. OCR	1. Mode	DT
			2. PickUp	50 A
			3. DT_Time	0.04 Sec
		3. (S)GR	1. Direction	DIR
			2. Curve	DT
			3. Vo PickUp	60 V
			4. Io PickUp	1 mA
			5. REF-Phase	45°
			6. Time Dial	-
			7. DT_Time	0.04 Sec
		4. OVR	1. Curve	NI
			2. Phase	1 Phase
			3. Pick-Up	130 V
			4. Time Dial	10
		5. UVR	1. Curve	NI
			2. Phase	1 Phase
			3. Pick-Up	90 V
			4. Time Dial	10
			5. RST Mode	OFF
			6. RST Time	-
		6. NSOCR	1. Mode	DT
			2. PickUp	30 %
			3. DT_Time	0.04 Sec
		7. RPR	1. Mode	DT
			2. DT_Time	0.04 Sec

Setting (Menu)	4. RS-485 comm.	1. Baudrate		19200 bps	
		2. Slave Addr		1	
	5. System Config.	1. Power System	1. FREQ		60
			2. P_CT_RAT		5 : 5
			3. P_PT_RAT		1 : 1
			4. G_PT_RAT		1 : 1
		2. T/S Output	T/S1	1. CON	PROT-OR
				2. RST	Self
				3. DLY	0.00 Sec
			T/S2	1. CON	OCR + (S)GR
				2. RST	Self
				3. DLY	0.00 Sec
			T/S3	1. CON	OVR + UVR
				2. RST	Self
				3. DLY	0.00 Sec
			T/S4	1. CON	NSOCR + RPR
				2. RST	Self
3. DLY	0.00 Sec				
3. Password			0000		

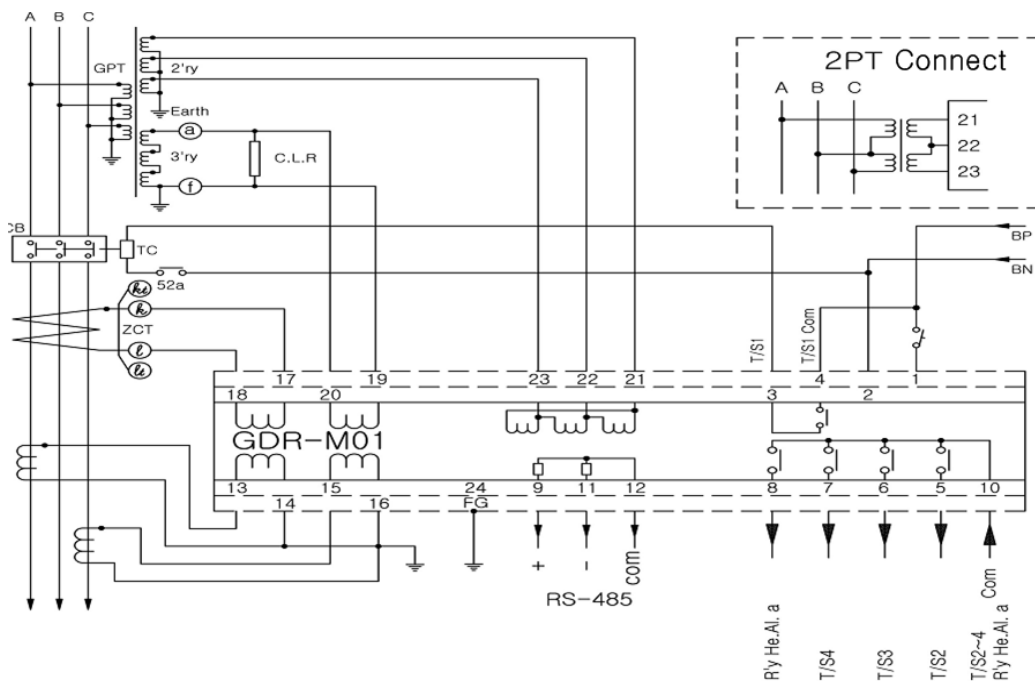
Appended 1. Dimensioned Drawings Unit : mm



Appended 2. Internal Block Diagram



Appended 3. External Connection Diagram



- *Notice :
- 1) This Connection Diagram is example, so change for your need.
 - 2) R'y.He.Al contact output has no error status, when apply rated control source.

Appended 4. Over Current Element NI Characteristic Curve

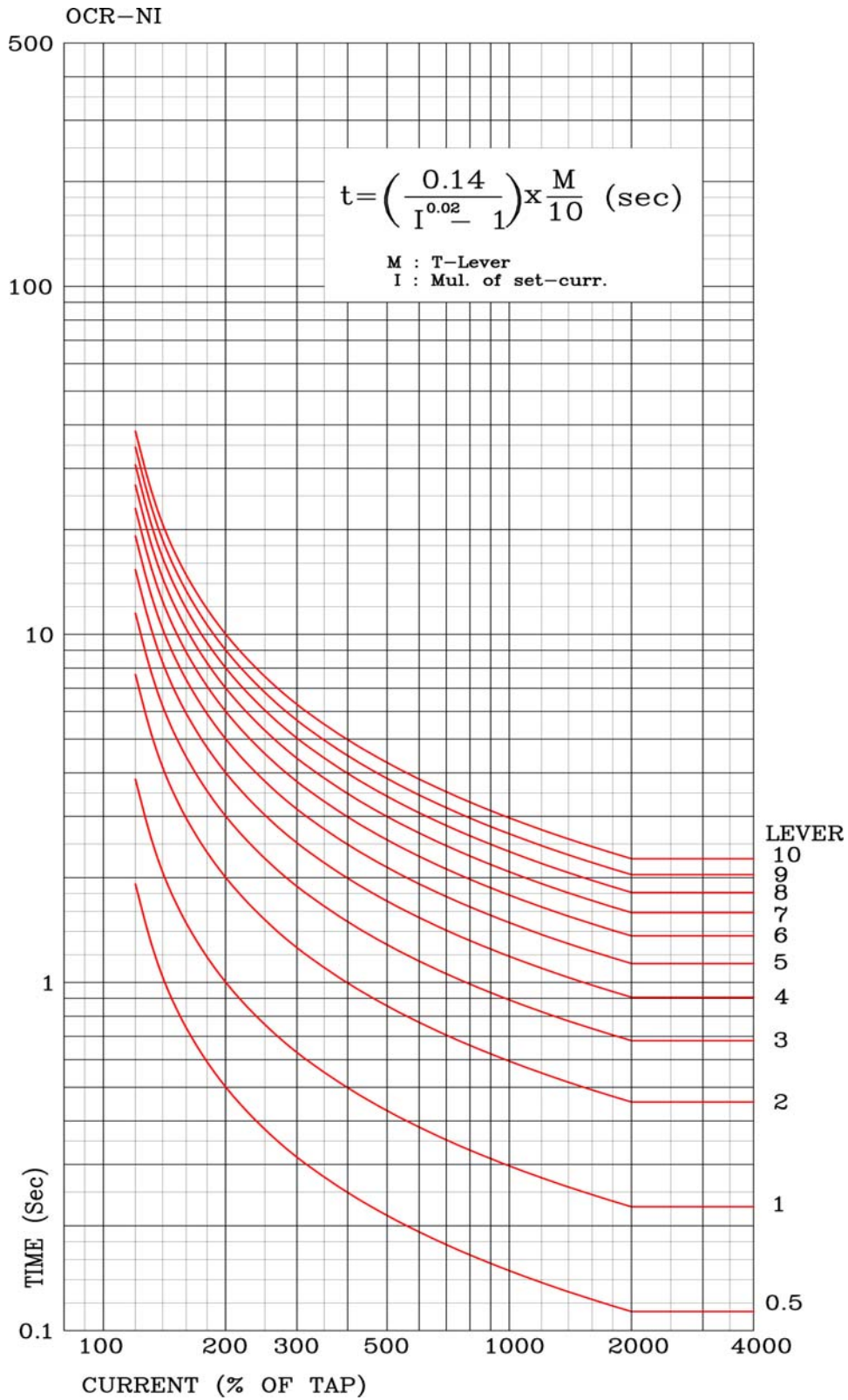
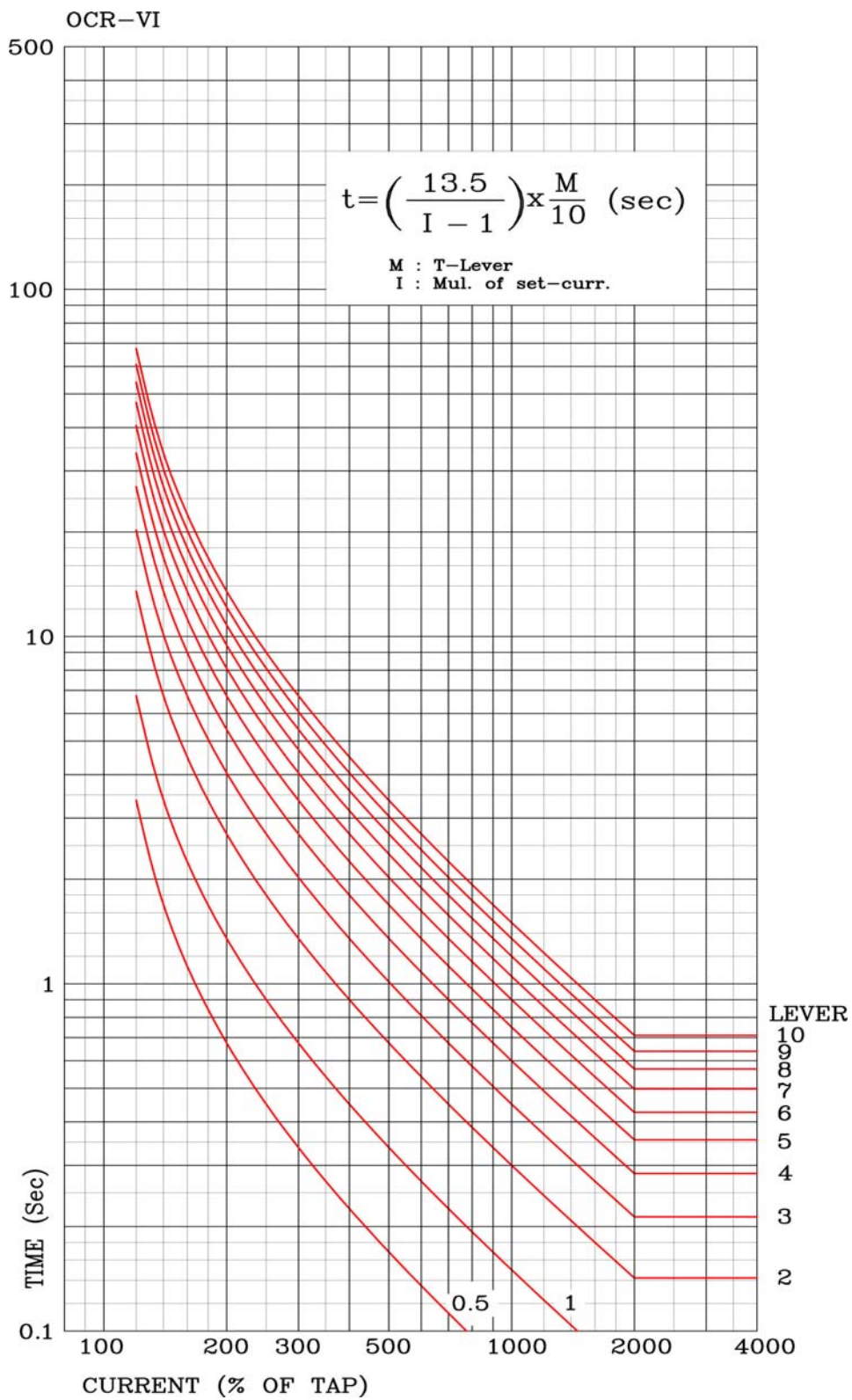
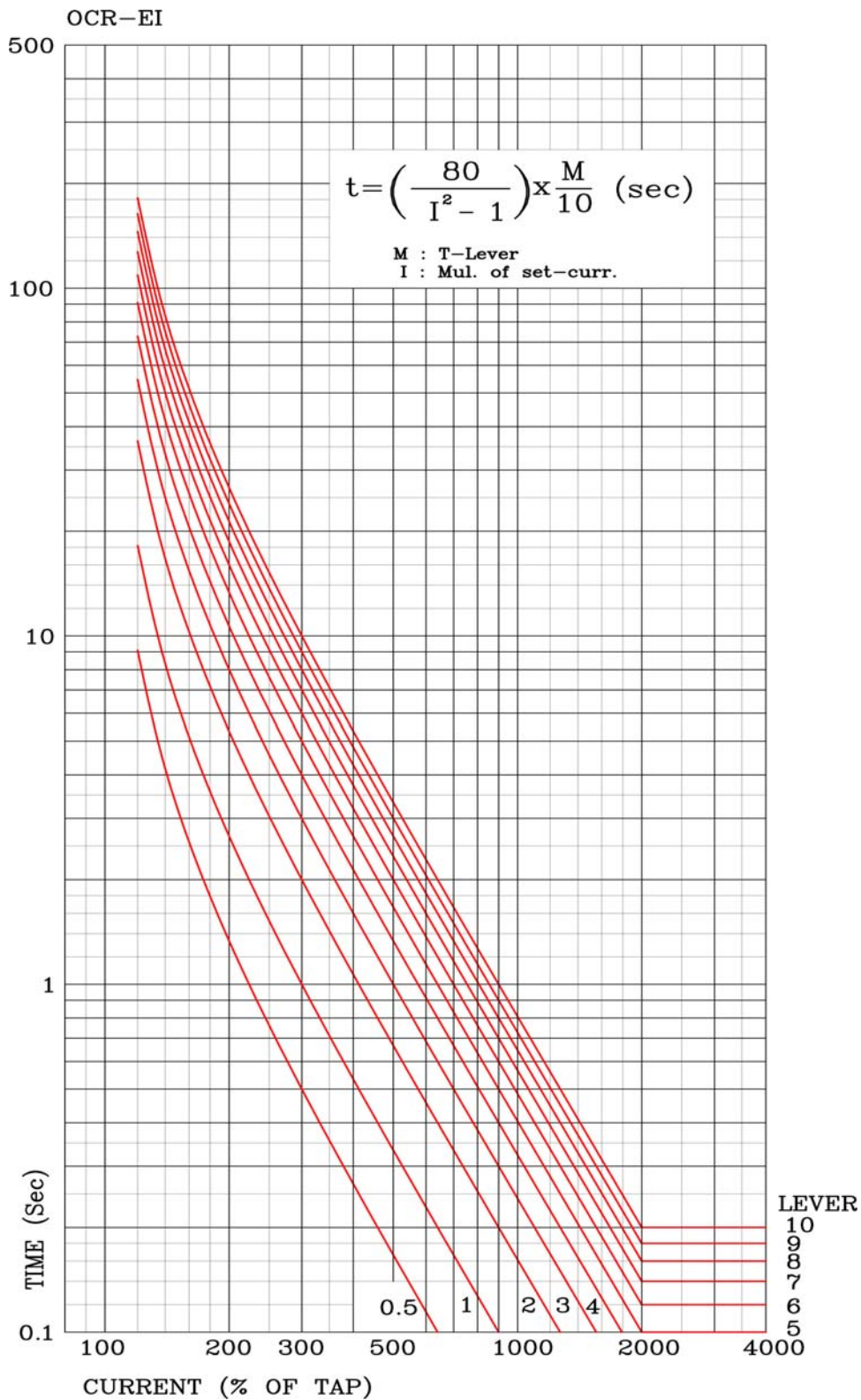


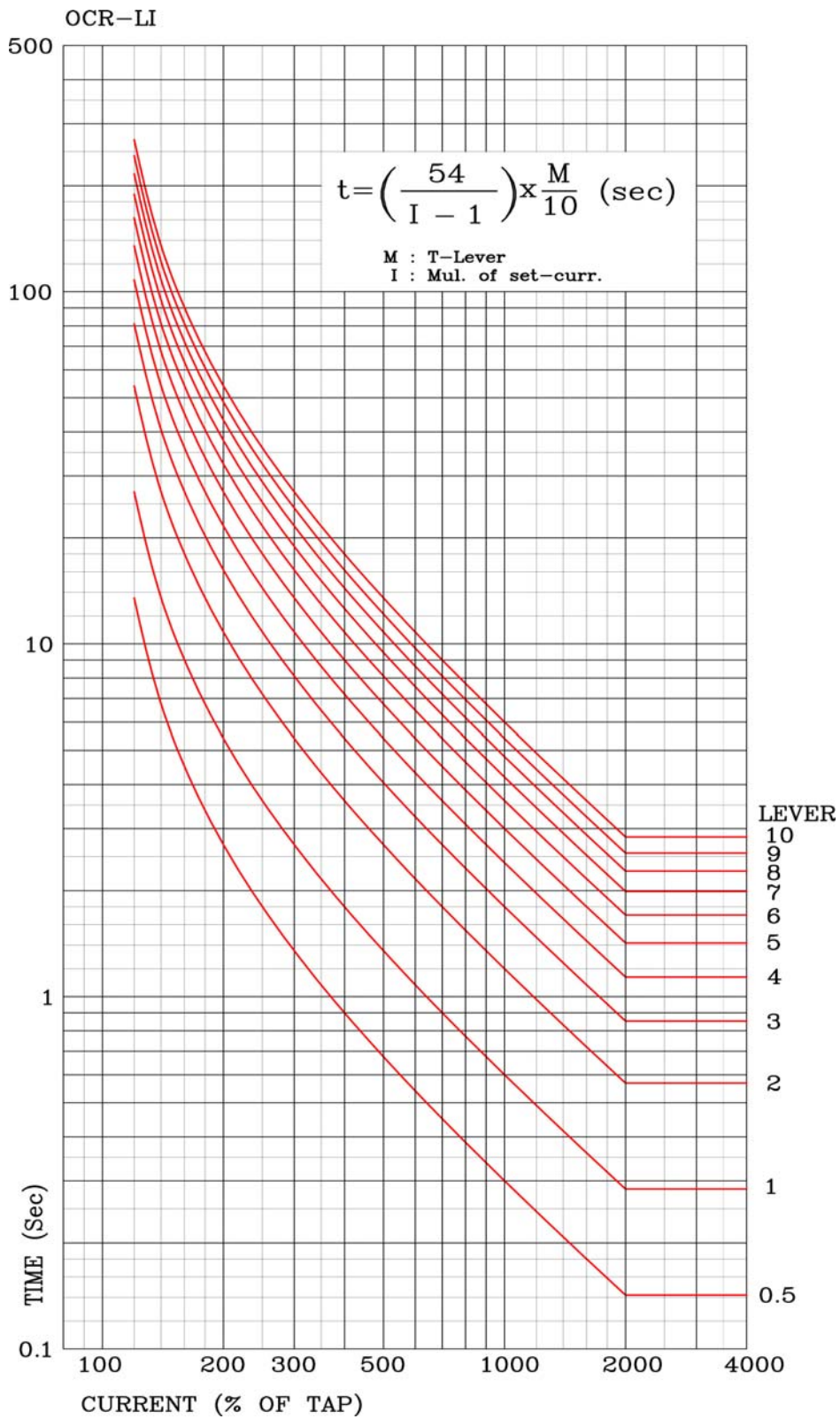
Chart Map 5. Over Current Element VI Characteristic Curve



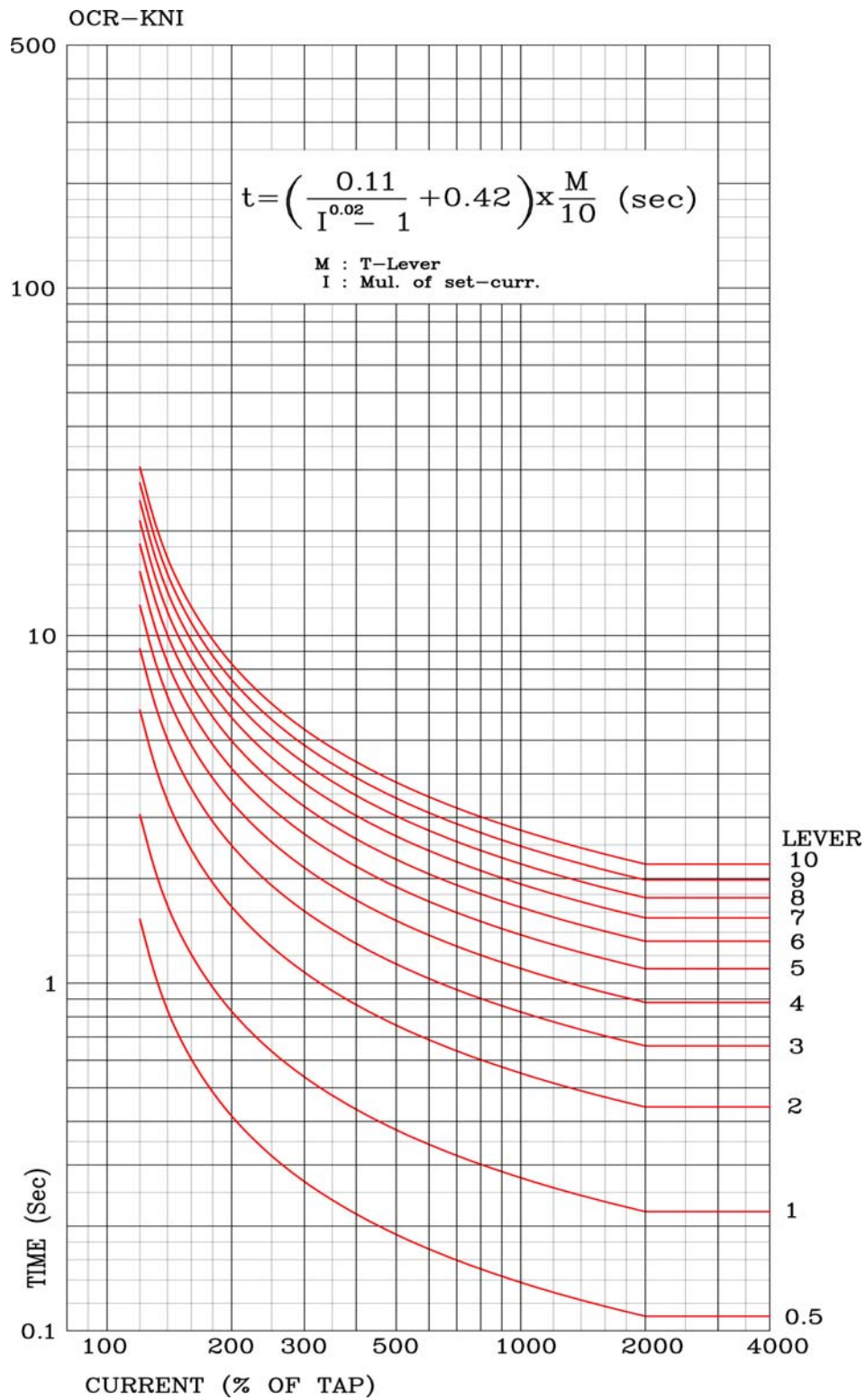
Appended 6. Over Current Element EI Characteristic Curve



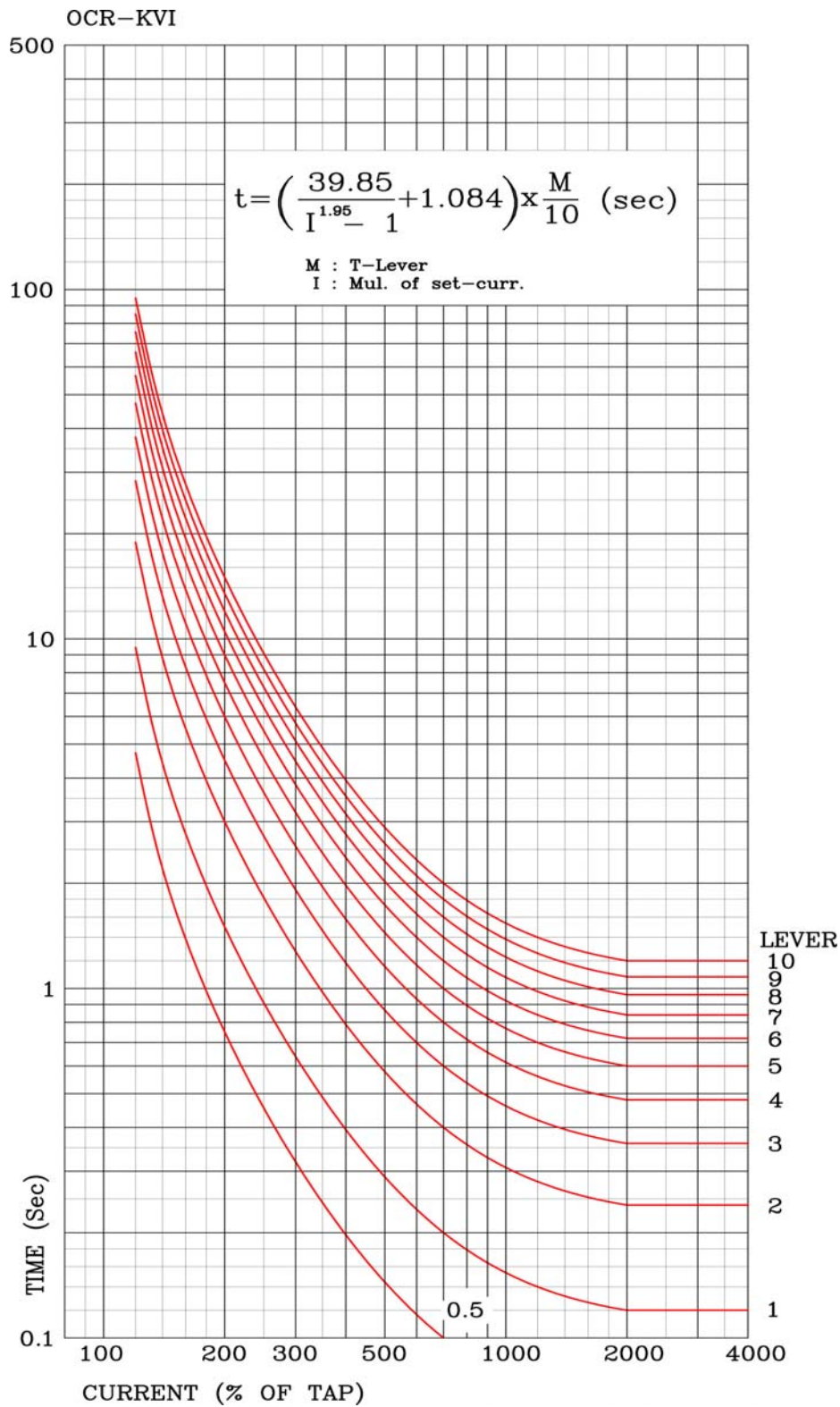
Char Map 7. Over Current Element LI Characteristic Curve



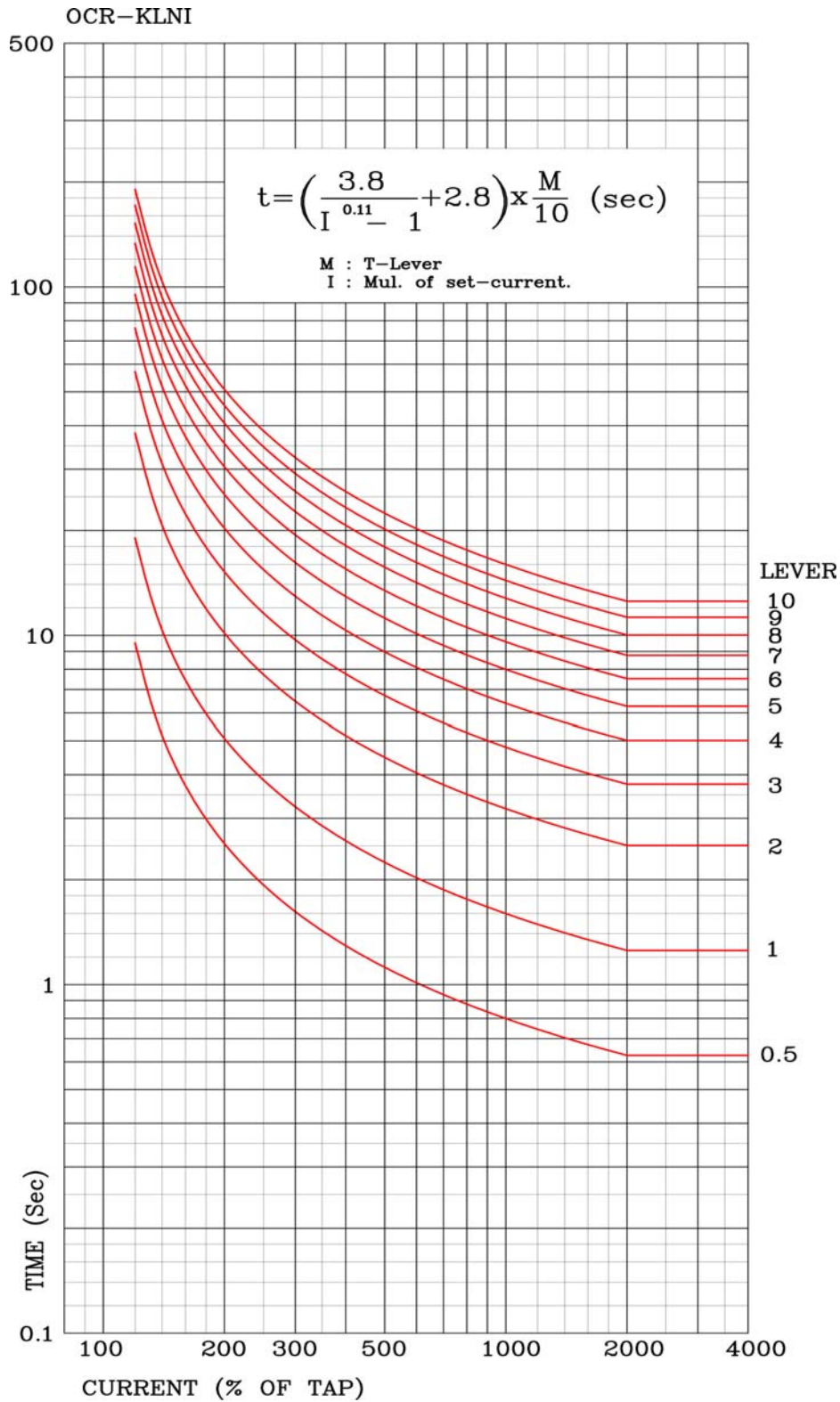
Appended 8. Over Current Element KNI(KEPCO Type) Characteristic Curve



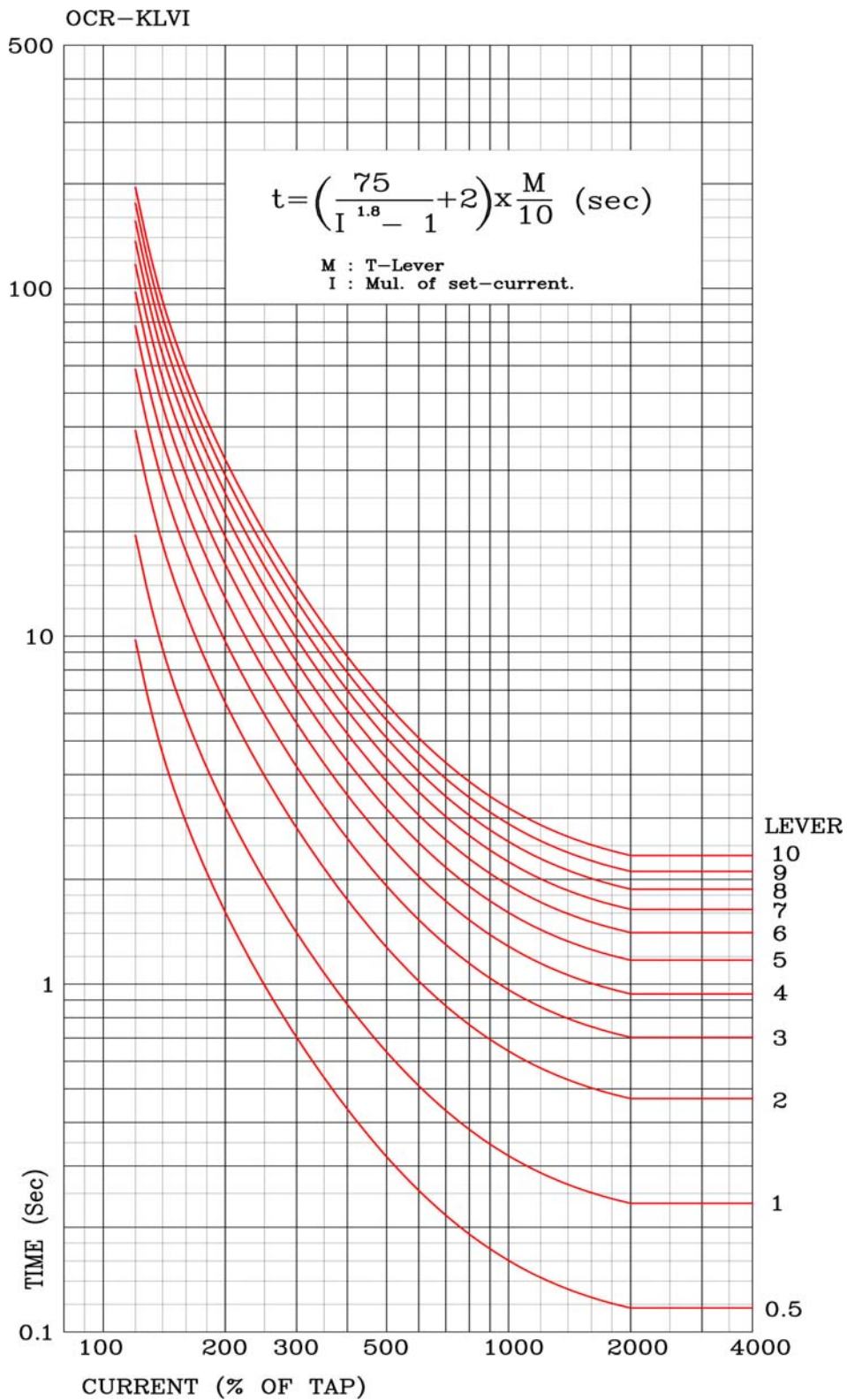
Appended 9. Over Current Element KVI(KEPCO Type) Characteristic Curve



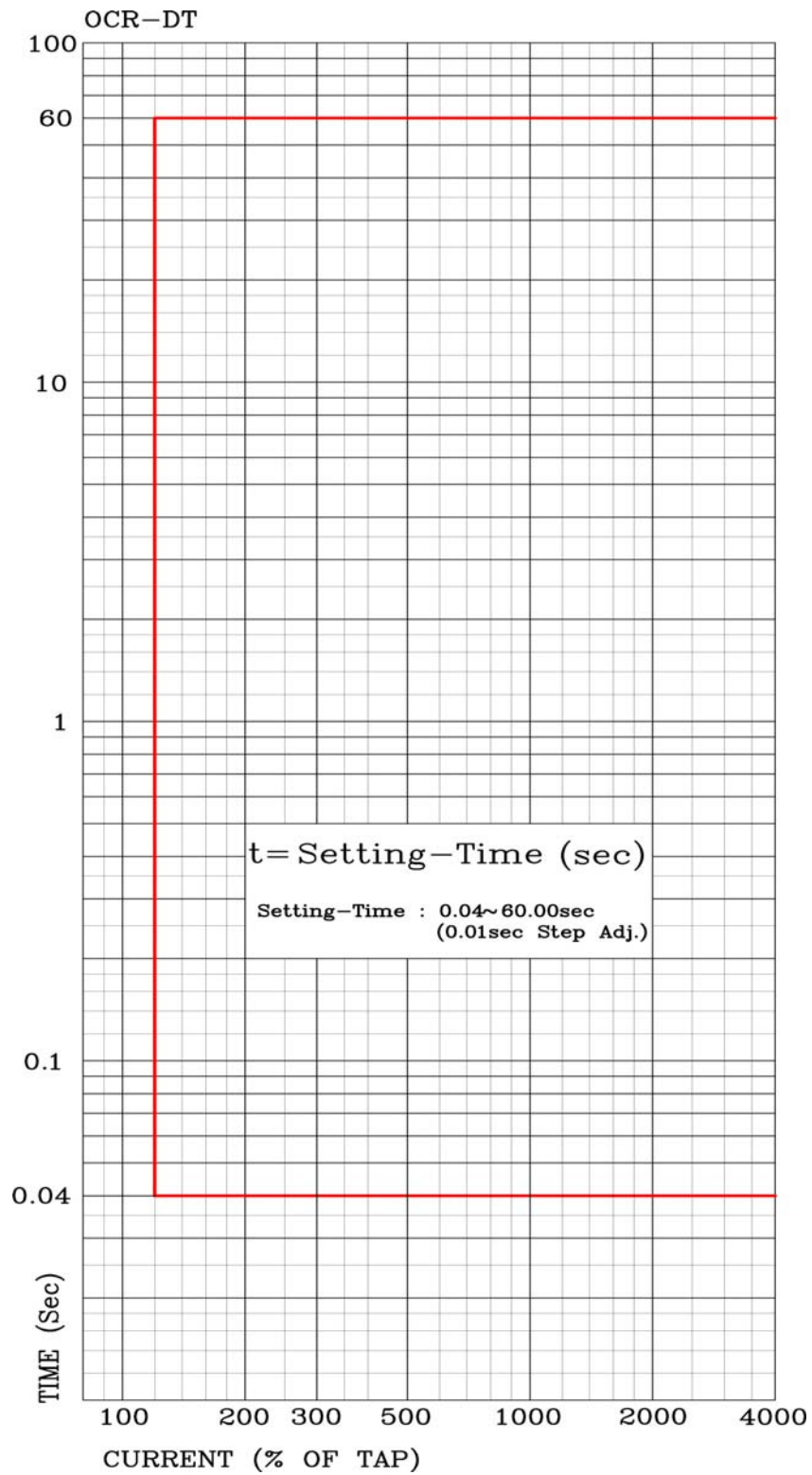
Appended 10. Over Current Element KLNI(KEPCO Type) Characteristic Curve



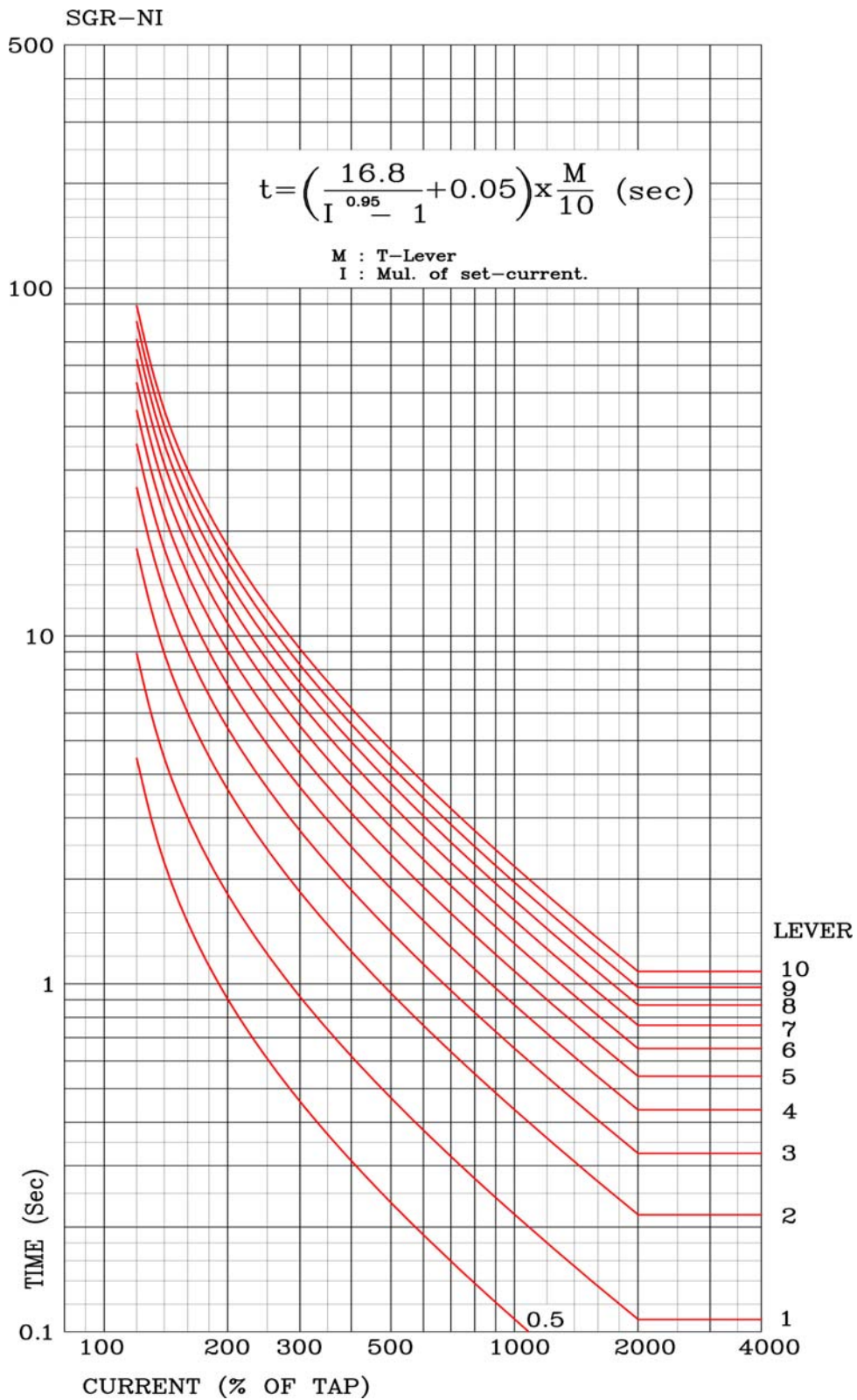
Appended 11. Over Current Element KLVI_(KEPCO Type) Characteristic Curve



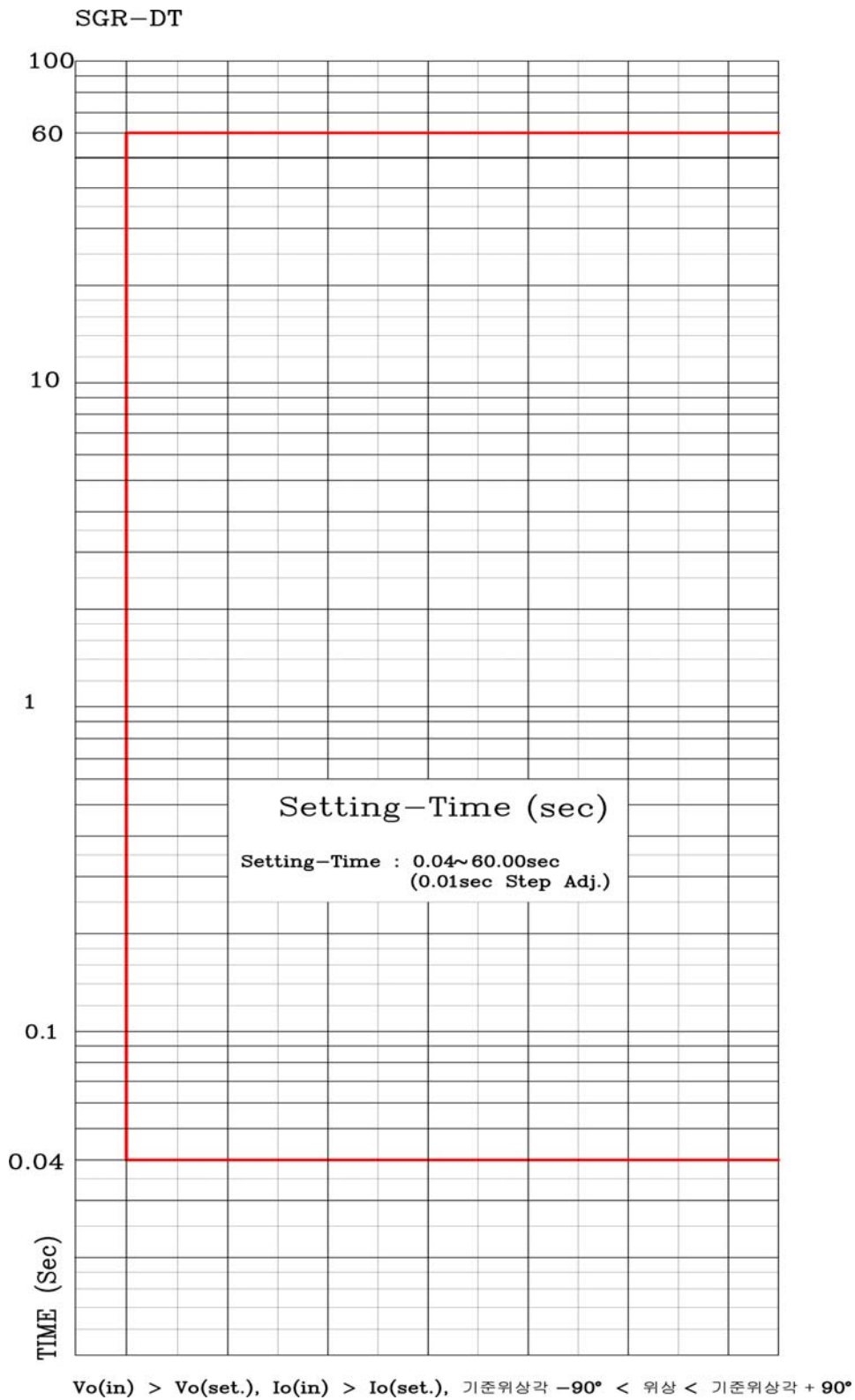
Appended 12. Over Current Element DT Characteristic Curve



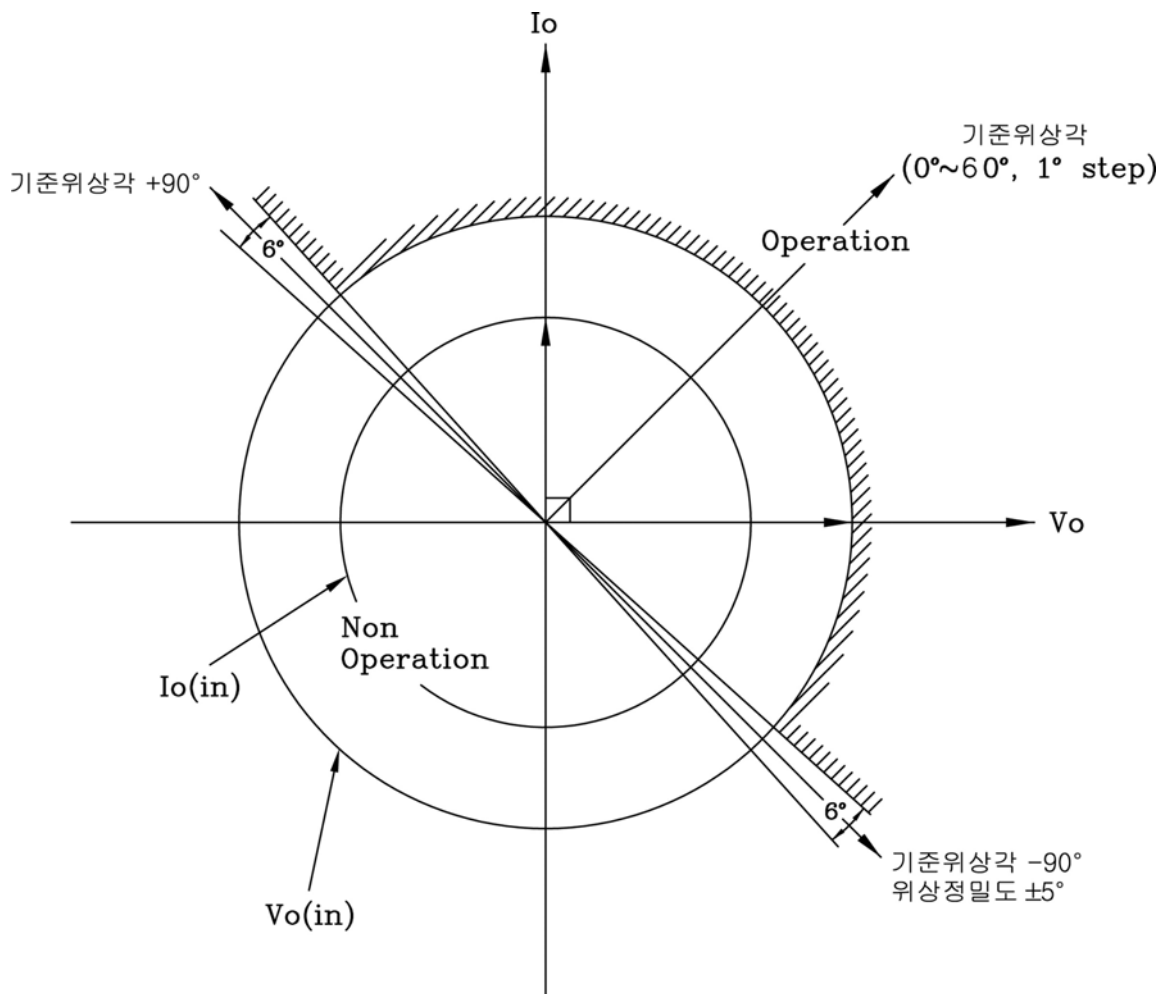
Char Map 13. Selective Ground / Ground Element NI Characteristic Curve



Char Map 14. Selective Ground Element DT Characteristic Curve

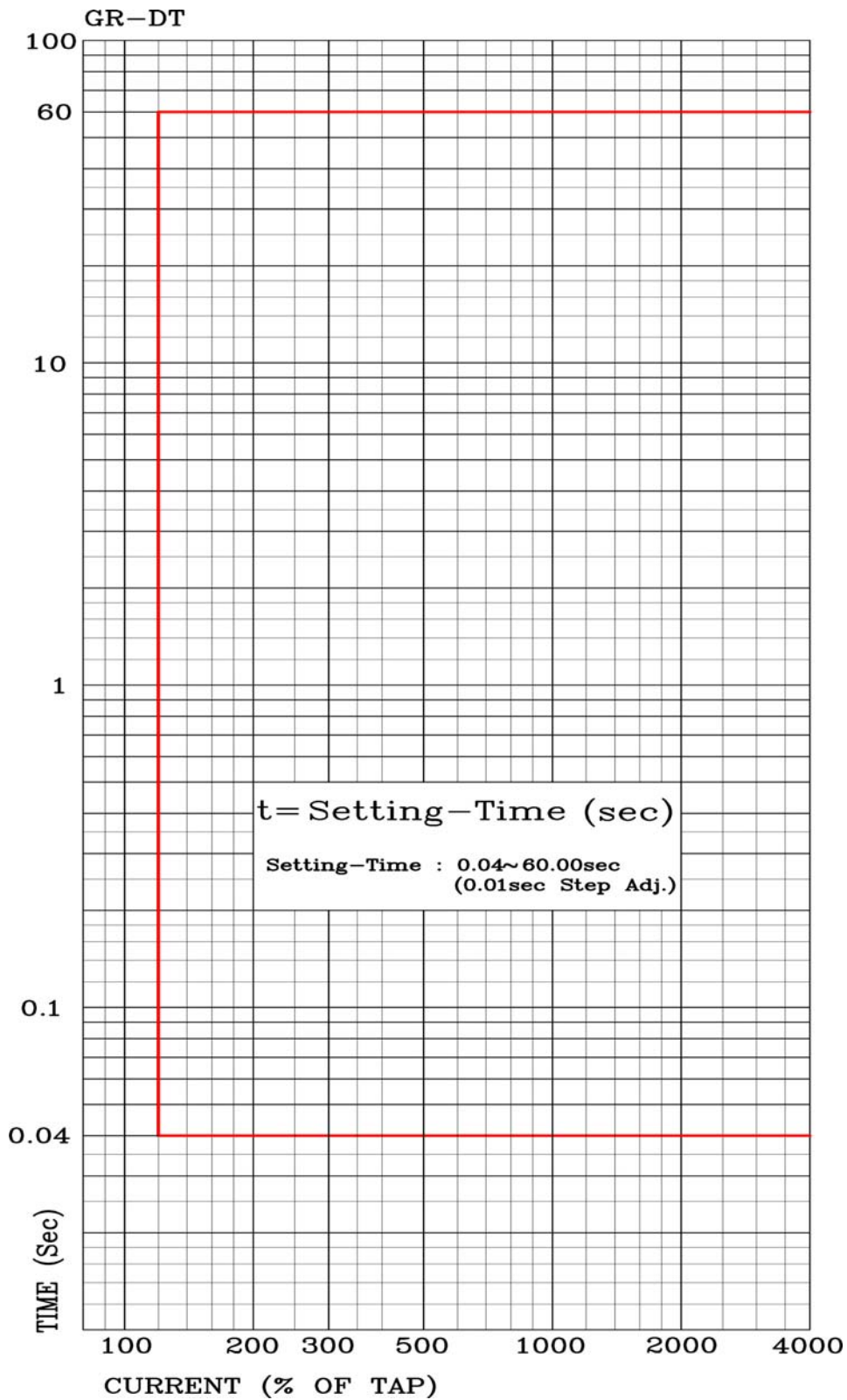


Char Map 15. Selective Ground Element Operation Characteristic

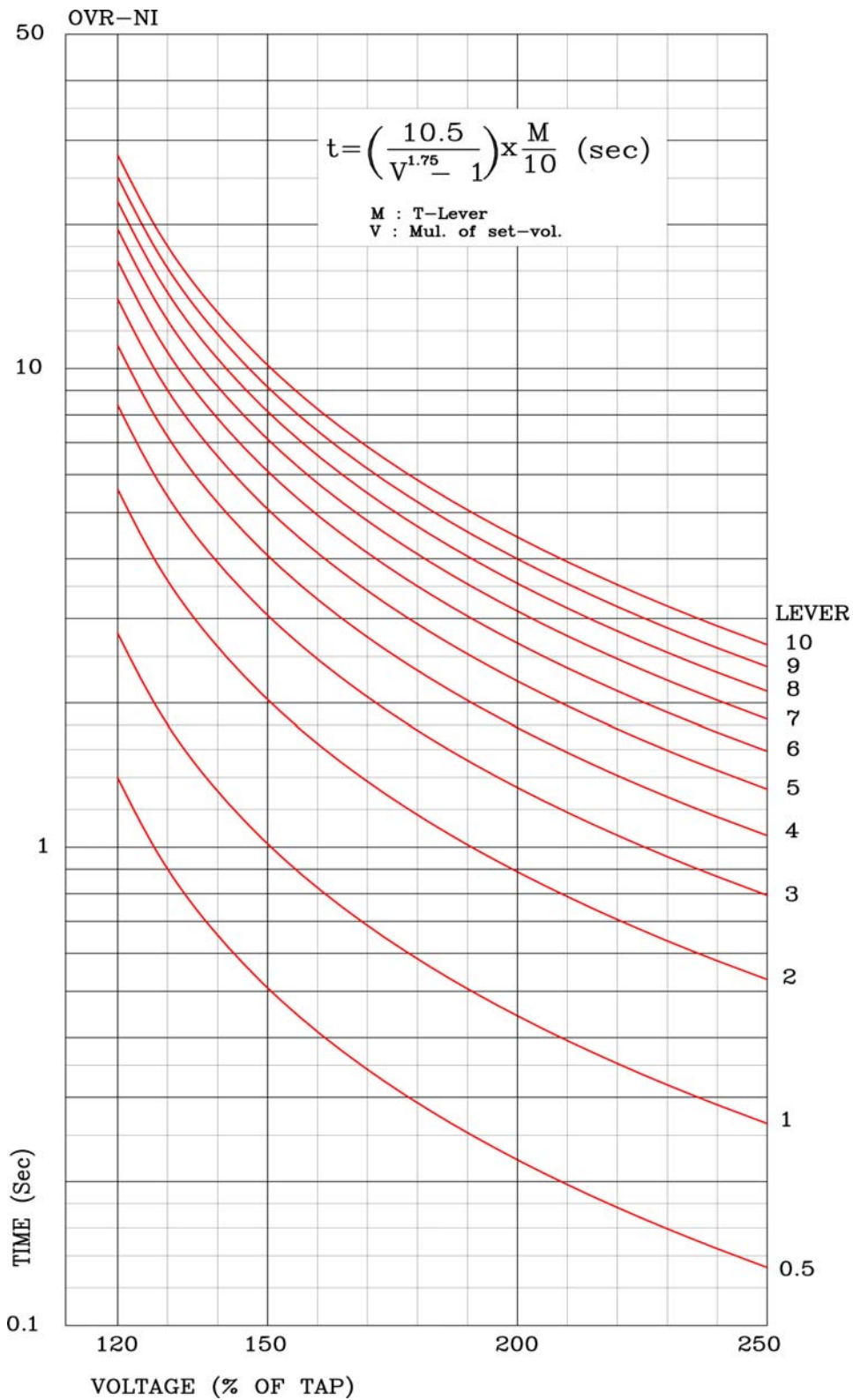


$V_o(in) > V_o(set)$. $I_o(in) > I_o(set)$. 기준위상각 $-90^\circ < \text{위상} < \text{기준위상각} +90^\circ$

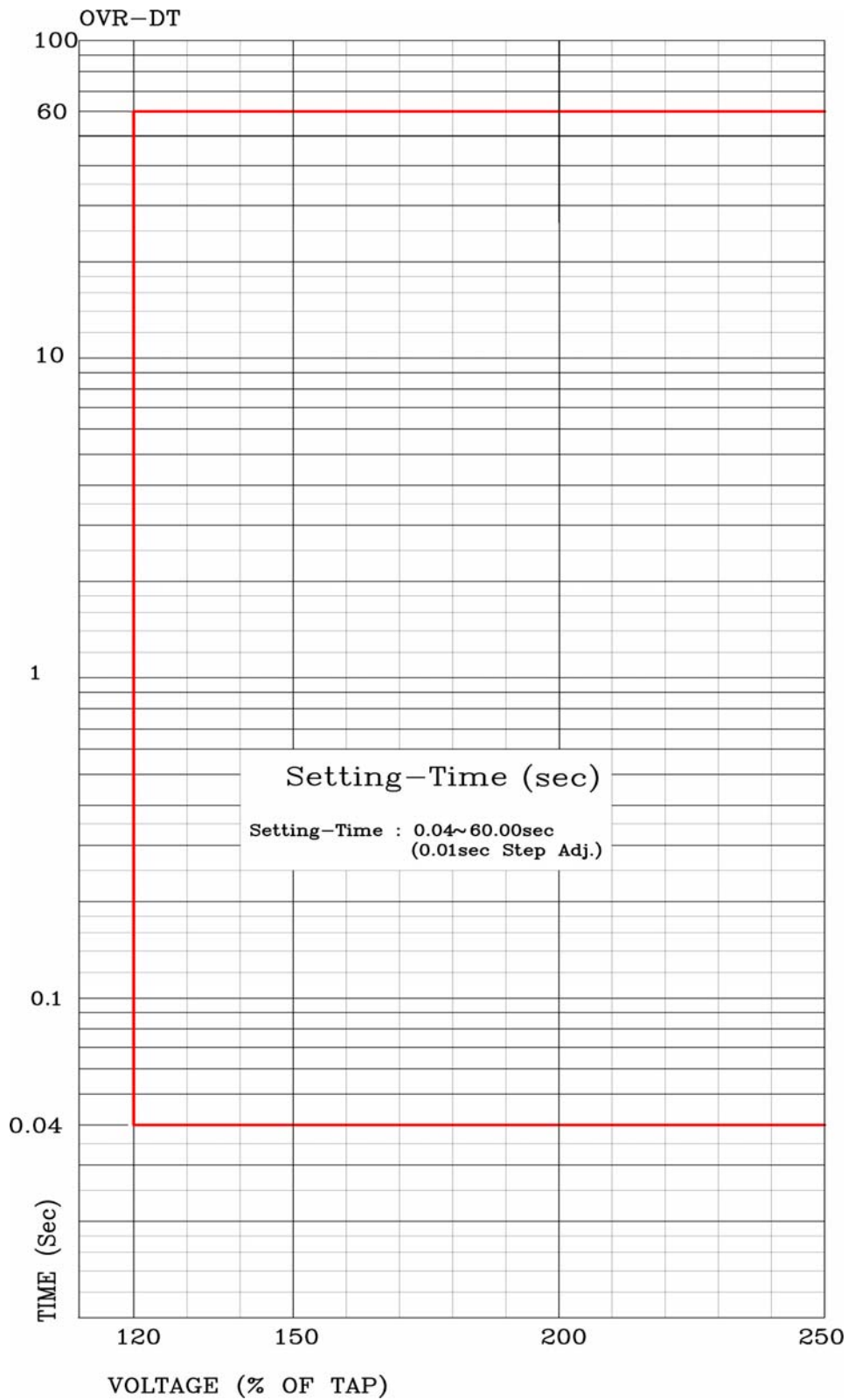
Char Map 16. Ground Element DT Characteristic Curve



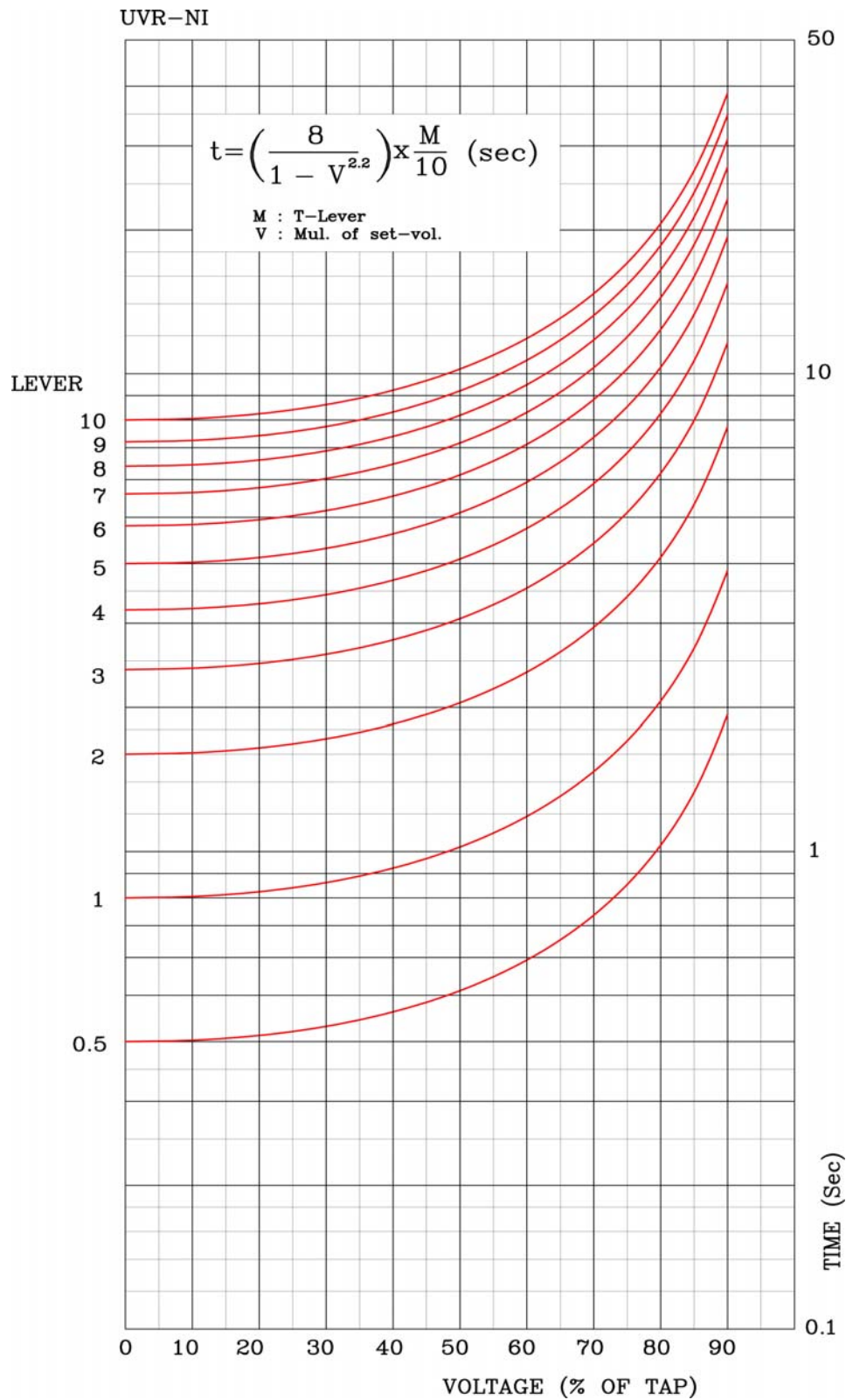
Char Map 17. Over Voltage Element NI Characteristic Curve



Appended 18. Over Voltage Element DT Characteristic Curve



Appended 19. Under Voltage Element NI Characteristic Curve



Appended 20. Under Voltage Element DT Characteristic Curve

