TOYO

Digital Type Multi-function Relay

DIGITAL Multi-function Relay [50/51 x3] [50N/51N] [59/27 x3] [47]

INTRODUCTION

- **Microprocessor Type** digital multi-function feeder protection relay.
- **Protection Elements**: overcurrent 50/51, ground overcurrent 50N/51N, overvoltage 59, undervoltage 27, selective ground overcurrent 67G, directional ground overcurrent 67N, negative sequence overvoltage 47, and ground overvoltage 64(59G).
- **Metering Functions**: 3-phase voltage / current / phase angles, positive and negative sequence voltage / current, 3-phase active / reactive / apparent power, energy, frequency, and power factor.
- **Selectable Time Characteristics**: IEC definite time DT, long time inverse LI, normal inverse time NI, very inverse time VI, and extremely inverse time EI. Also, it provides simulated time characteristics of TOYO mechanical induction types of relays.
- **Self-diagnosis Functions**: control power, memory, CPU, setting value range, event / fault waveform transmission, measurements, and relay state observation. It also has a NC contact serves as system_error indication (watchdog).
- **Password Protection** when changing the relay settings and circuit breaker control (open / close, local / remote).
- **1024 Event Records and 6 Fault Waveform Records** with time stamp, all data including relay settings and real time clock are stored permanently even if the control power is lost. Waveform sampling rate is 32sample/cycle, and 168cycle x6.
- **10 Programmable Relay Output Contacts** which can be set to each 55 modes for tripping and alarming. ALL contacts are latchable (ANSI 86), and their operation can be tested by manual trip command via setting.

SPECIFICATIONS

Power Supply

Rated Voltage	AC/DC 80~260V
Overload	130%/3hr.
Burden	Standby<30W , Operate<70W

Voltage Input

Rated Voltage	AC 63.5~190V_{L-L}
Overload	115%/3hr.
Burden	<0.5VA/phase

Current Input

Rated Current (In)	Three Phase	AC 5A
	Zero Phase	AC 1.5mA (w/ specific ZCT)
Overload	Three Phase	2In/3hr.
		20In/2sec.
		40In/1sec.
	Zero Phase	100In/continuous
Burden		<0.5VA/phase

Output Contacts

TRIP : T/S1 ~ T/S3 (1a x3) , silver alloy	
Close Circuit Capacity	16A / AC 250V / continuous
	30A / DC 125V / 0.3sec. / Resistive Load
Opening Capacity	5A / AC 250V / CosØ=0.1
ALARM : T/S4 ~ T/S9 (1a x6) + T/S10 (1b x1) , silver alloy	
Close Circuit Capacity	5A / AC 250V / continuous
	5A / DC 125V / 0.3sec. / Resistive Load
Opening Capacity	1A / AC 250V / CosØ=0.1
	1A / DC 125V / 25ms (energization time)

Input Contacts

2 points (52a + 52b) for CB Status Only	
Input Voltage	Max. AC/DC 250V
Reflecting Time	<10ms

Communication

Front : RS232 x1	19200bps(fixed), No Parity / 8 Bit / 1 Stop
Back : RS485 x1	300~19200bps, No Parity / 8 Bit / 1 Stop
Protocol	Modbus RTU
Manager Software	Configuration and waveform reading (option)

Housing

Hot Plugging Draw-out Type (no interruption) Metal Casing	
CT automatically short-circuited when drawn-out	
Protection Class	Front IP40 , Rear IP20 , indoor use
Dimensions	W164 x H218 x D224 mm
Weight	5.0kg

Insulation Test <IEC 60255-5>

Insulation Resistance	DC 500V	Circuit to Ground	10MΩ
		Between Circuits	5MΩ
		Between Terminals	
Power Frequency Withstand Voltage	50/60Hz 1min.	Circuit to Ground	2KV
		Between Circuits	
		Communication Circuit to Ground	
		Between Terminals	1KV
Impulse Withstand Voltage	1.2/50us impulse wave	Circuit to Ground	5KV
		Bewteen Circuits	
		Between Terminals	3KV

Electromagnetic Compatibility <IEC 60255-22>

1 MHz Damped Oscillating Wave	2.5kV MC ; 1KV MD
Fast Transient Bursts	4kV ; 2.5kHz
Electrostatic Discharge	8kV air ; 6kV contact
Immunity to Radio Fields	10 V/m ; 80MHz~1GHz
Immunity to Conducted RF Disturbances	10V ; 150kHz~80MHz

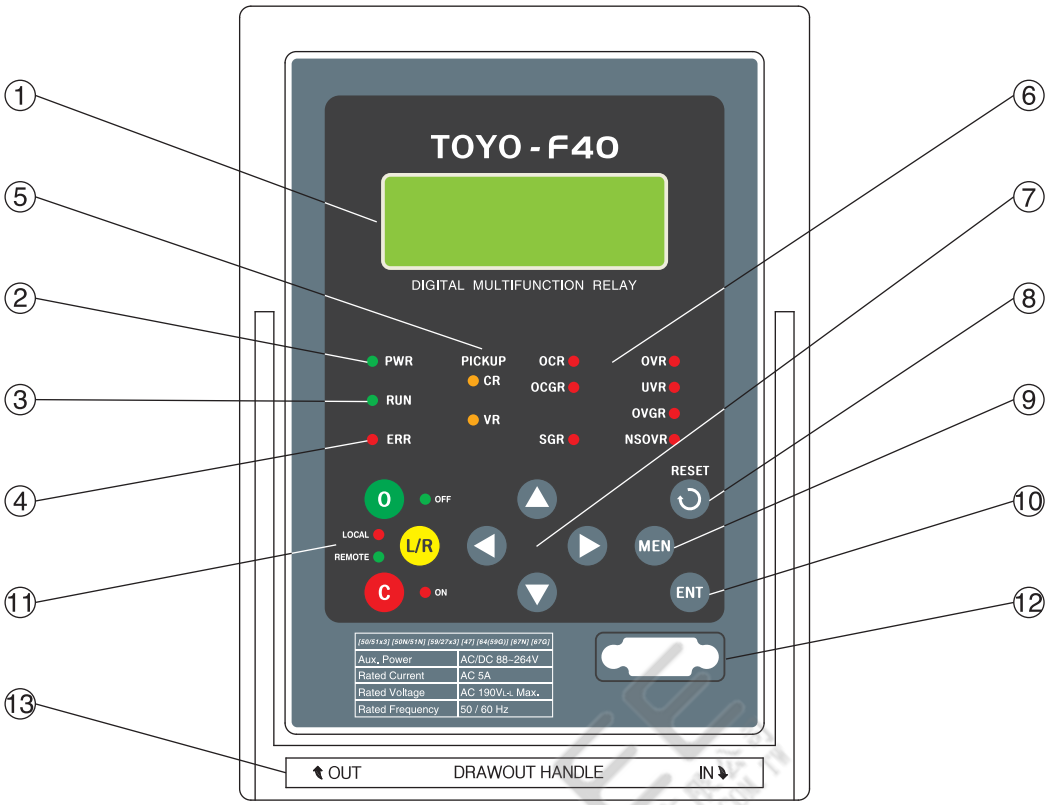
Mechanical Test <IEC 60255-21>

Vibration	Response	10~150Hz ; 0.5G ; 1 time
	Endurance	10~150Hz ; 1G ; 20 times
Shock	Response	5G ; 3 times
	Withstand	15G ; 3 times
	Bump	10G ; 1000 times
Earthquake	1~8.5Hz	x: 3.5mm , y: 1.5mm sweep: 1 time
	8.5~35Hz	x: 1G , y: 0.5G sweep: 1 time

Temperature/Humidity Test <IEC 60068-2>

Operation Temperature	-25ºC~70ºC
Storage Temperature	-30ºC~75ºC
Relative Humidity	RH30~95%

■ PANEL COMPOSITION



LCD / LED

1. LCD Display			Setting value, measurement value, operation display
2. PWR		green	When given control power, LED ON
3. RUN		green	Relay is healthy and functioning
4. ERR		red	System error, check the "Self-Diagnosis" menu Reset manually by pressing the reset key
5. PICK-UP		yellow	When protection element pick-up, LED ON CR: current relay VR: voltage relay
6. TRIP		red	When protection element operate, LED ON Reset manually by pressing the reset key
11. CB Control	OFF	green	When CB is open/off, LED ON
	LOCAL	red	Indicating Local / Remote control mode Mode switching is done by pressing the L/R key
	REMOTE	green	
	ON	red	When CB is close/on, LED ON

Key Pad

7. Direction Key	(UP)	Move menu, change setting value
	(DOWN)	Move menu, change setting value
	(LEFT)	Esc, back to previous layer, cancel editing value
	(RIGHT)	Enter, go to next layer, start editing value
8. (RESET)		Manually reseting the "ERR" and "TRIP" LED, and the output contact set to "MANUAL"
9. (MENU)		Go to Menu Tree Display
10. (CONFIRM)		Confirm and save the changed setting value
11. CB Control	(OPEN)	CB open (password needed)
	(Local/Remote)	Switch the CB control mode between Local / Remote Password needed when switching modes
	(CLOSE)	CB close (password needed)
12. RS-232 Communication Port		Must use 2-3 crossed cable
13. Drawout Handle		To draw out the relay unit (remove screw first)

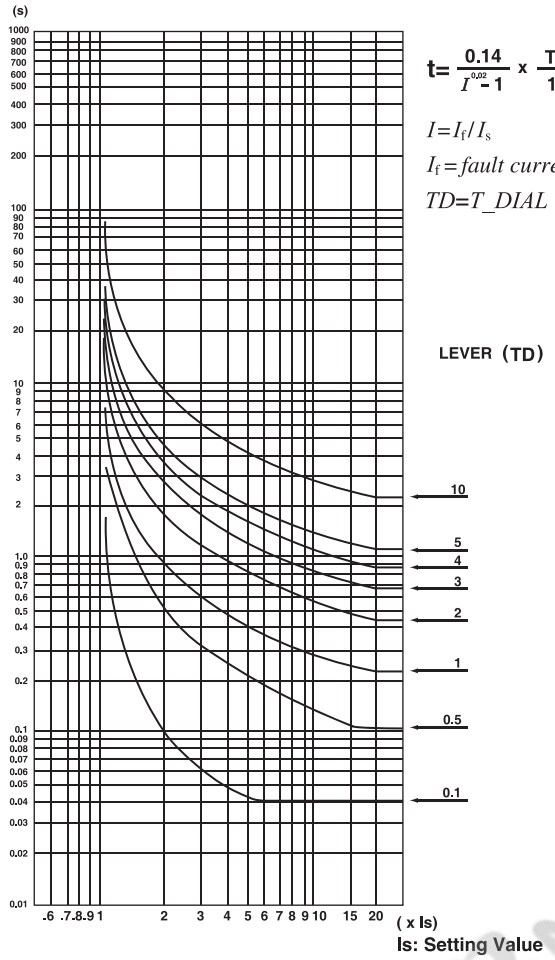
PROTECTION ELEMENTS & METERING FUNCTIONS

Functions		Setting Ranges	Tripping Curves	T_DIAL (Lever , TD)
ANSI 27 undervoltage (UVR)				
		5~170V (1V step)	UV Inverse Time	0.05~10.00 (0.05 step)
			DT	0.04~60.00s (0.01s step)
ANSI 47 negative sequence overvoltage (NSOVR)				
		5~170V (1V step)	DT	0.04~60.00s (0.01s step)
ANSI 50/51 phase overcurrent (OCR)				
Delay		0.2~16.0A (0.1A step)	NI, VI, EI, LI	0.05~10.00 (0.05 step)
			DT	0.04~60.00s (0.01s step)
Instant		1.0~100.0A (0.5A step)	DT, INST	inst <40ms ; 0.04~60.00s (0.01s step)
ANSI 50N/51N ground overcurrent (OCGR)				
Delay		0.1~10.0A (0.1A step)	NI, VI, EI, LI	0.05~10.00 (0.05 step)
			DT	0.04~60.00s (0.01s step)
Instant		0.5~50.0A (0.1A step)	DT, INST	inst <40ms ; 0.04~60.00s (0.01s step)
ANSI 59 overvoltage (OVR)				
		5~170V (1V step)	OV Inverse Time	0.05~10.00 (0.05 step)
			DT	0.04~60.00s (0.01s step)
ANSI 64(59G) ground overvoltage (OVGR)				
Delay		5~170V (1V step)	NI_Trip	0.05~10.00 (0.05 step)
			NI_Alarm	0.05~10.00 (0.05 step)
			DT	0.04~60.00s (0.01s step)
Instant		10~170V (1V step)	DT, INST	inst <40ms ; 0.04~60.00s (0.01s step)
ANSI 67N directional ground overcurrent (DOCGR)				
Current	Delay	0.1~10.0A (0.1A step)	NI, VI, EI, LI	0.05~10.00 (0.05 step)
			DT	0.04~60.00s (0.01s step)
	Instant	0.5~50.0A (0.1A step)	DT	inst ; 0.04~60.00s (0.01s step)
Voltage		5~170V (1V step)		
Direction		forward / reverse		
Characteristic Angle (MTA)		-90°~+90° (1° step)		Operation Phase Angle MTA±90°
ANSI 67G selective ground overcurrent (SGR)				
Current		0.9~250.0mA (0.1m A step)	NI	0.05~10.00 (0.05 step)
			DT	0.04~60.00s (0.01s step)
Voltage		5~170V (1V step)		
Direction		forward / reverse		
Characteristic Angle (MTA)		-90°~+90° (1° step)		Operation Phase Angle MTA±90°
Release Delay Time (for ALL elements)				0.00~200.00s (0.01s step)
Release Value (for ALL elements)				>95% of setting value
Operation Accuracy (for ALL elements)				<±3% of setting value

Measurements		**Range**
Voltage	rms and phase angle V_{L-L}, V_{L-N}, V_0 (residual voltage)	0~190V_{L-L}, PT Ratio: 0.1~6500
Phase Current	rms and phase angle I_A, I_B, I_C, I_N	0~5A, CT Ratio: 5~3000
Zero Phase Current	measured with specific ZCT, rms and phase angle I_S	0~1000mA, CT Ratio: 5~3000
Sequence Voltage	rms and phase angle ; positive V_1, negative V_2, zero sequence V_0	0~190V_{L-L}, PT Ratio: 0.1~6500
Sequence Current	rms and phase angle ; positive I_1, negative I_2, zero sequence I_0	0~5A, CT Ratio: 5~3000
Frequency	A-phase voltage standard	30.000~100.000Hz
Power	total and per phase P, Q, S	0~62500MW/phase
Energy	KWH, KVARH	0~999.99MWH
Power Factor	total and per phase PF	

■ TIME CHARACTERISTICS

Normal Inverse



$$t = \frac{0.14}{I^{0.02} - 1} \times \frac{TD}{10}$$

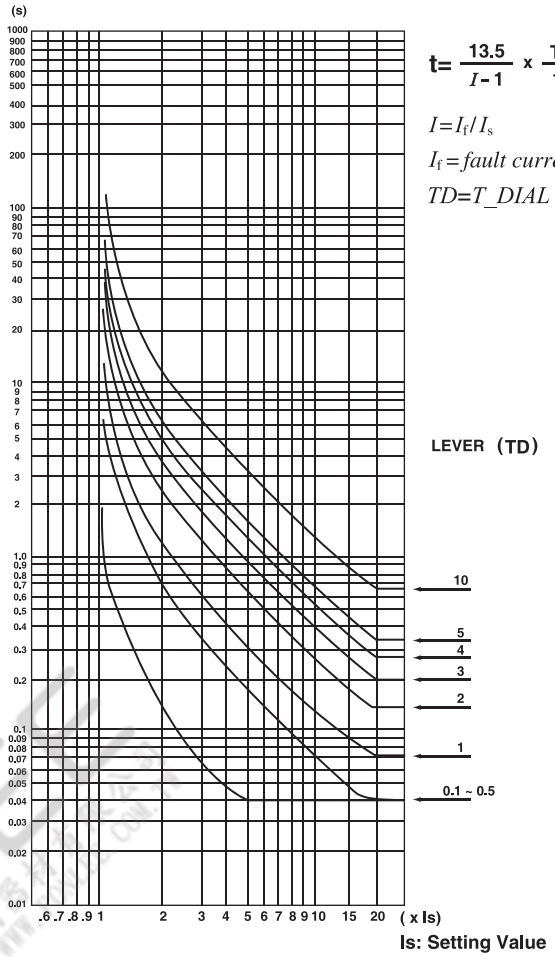
$I = I_f / I_s$

I_f = *fault current*

TD=T_DIAL

Is: Setting Value

Very Inverse



$$t = \frac{13.5}{I - 1} \times \frac{TD}{10}$$

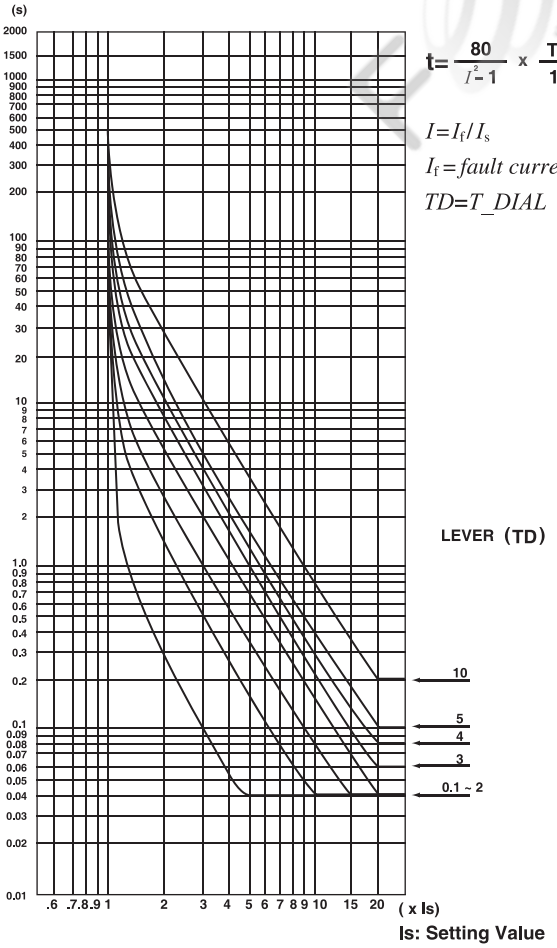
$I = I_f / I_s$

I_f = *fault current*

TD=T_DIAL

Is: Setting Value

Extremely Inverse



$$t = \frac{80}{I^2 - 1} \times \frac{TD}{10}$$

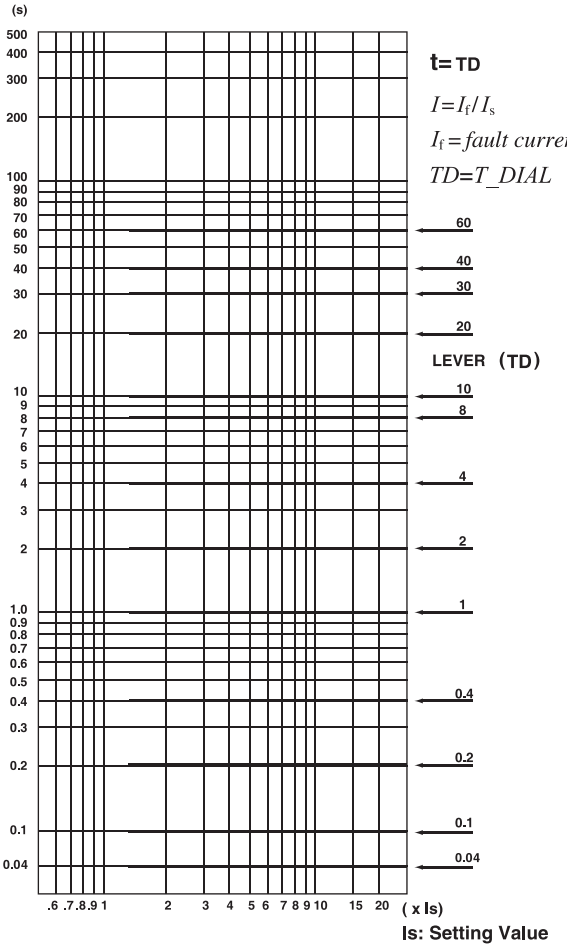
$I = I_f / I_s$

I_f = *fault current*

TD=T_DIAL

Is: Setting Value

Definite Time



$$t = TD$$

$I = I_f / I_s$

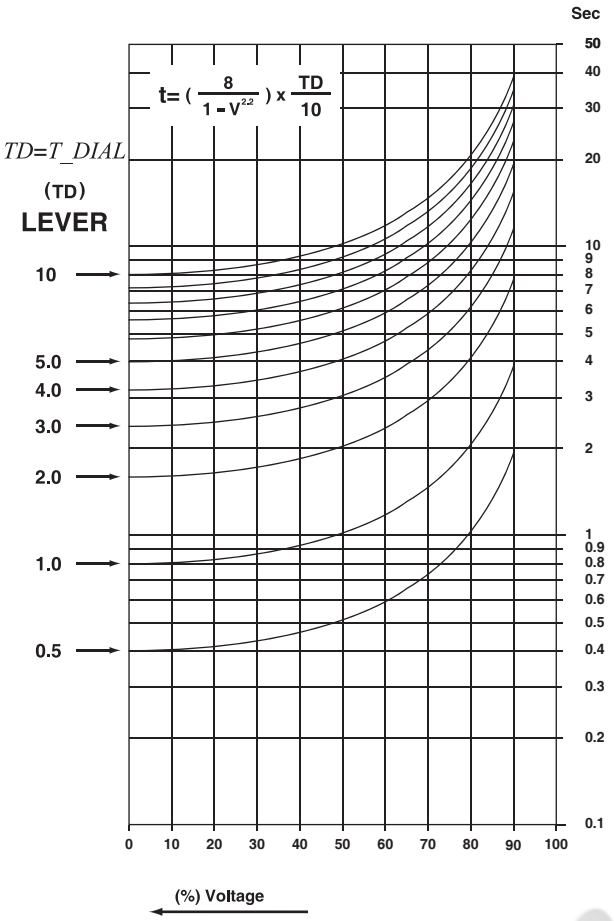
I_f = *fault current*

TD=T_DIAL

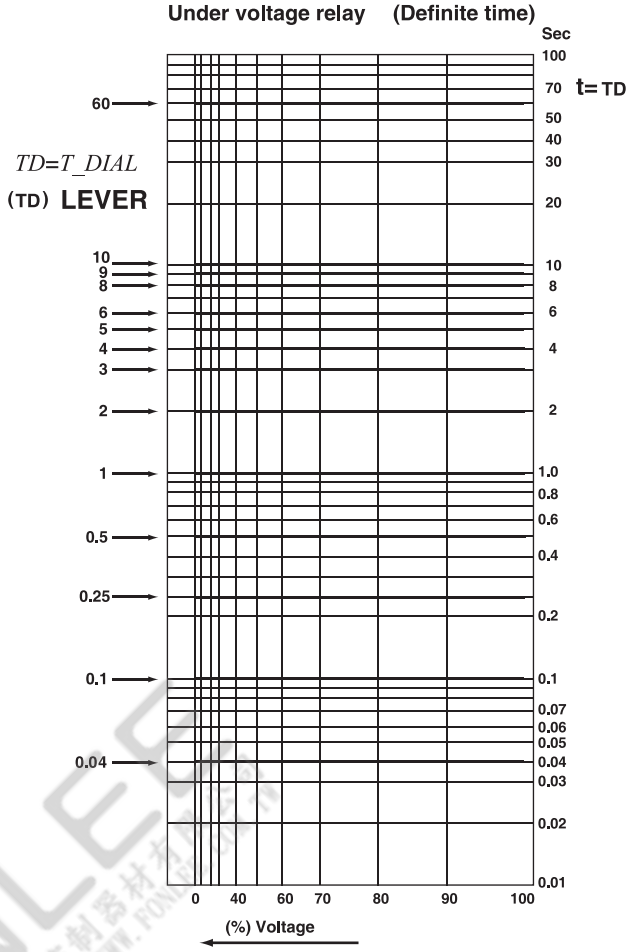
Is: Setting Value

■ TIME CHARACTERISTICS

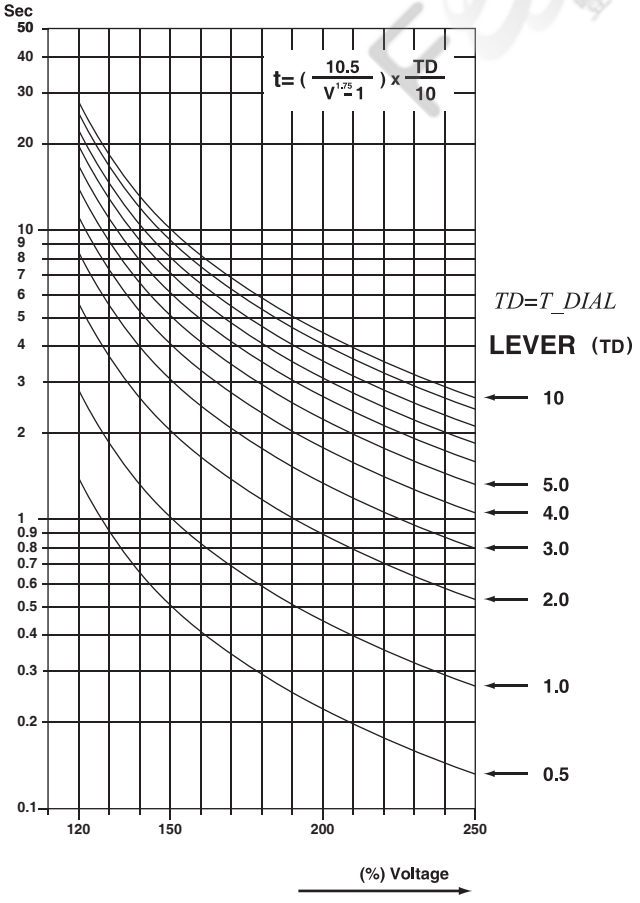
Under voltage relay (Inverse time)



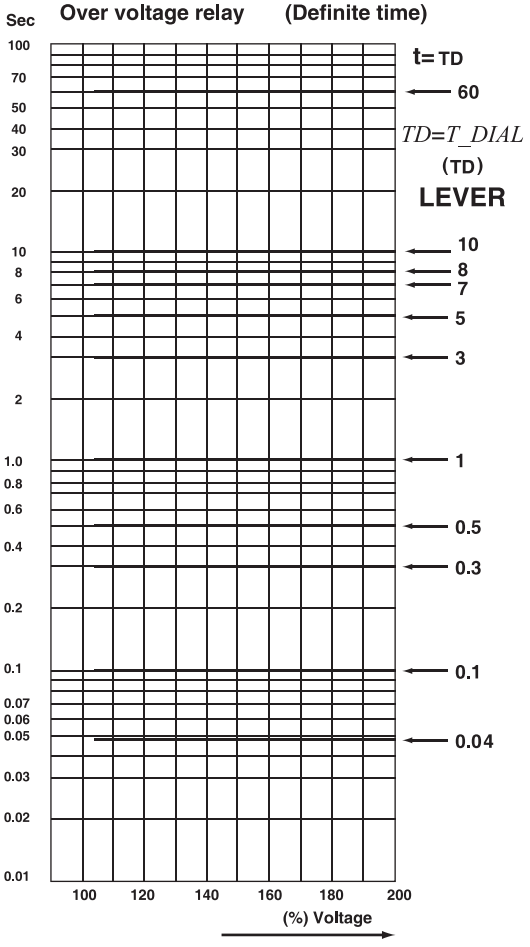
Under voltage relay (Definite time)



Over voltage relay (Inverse time)

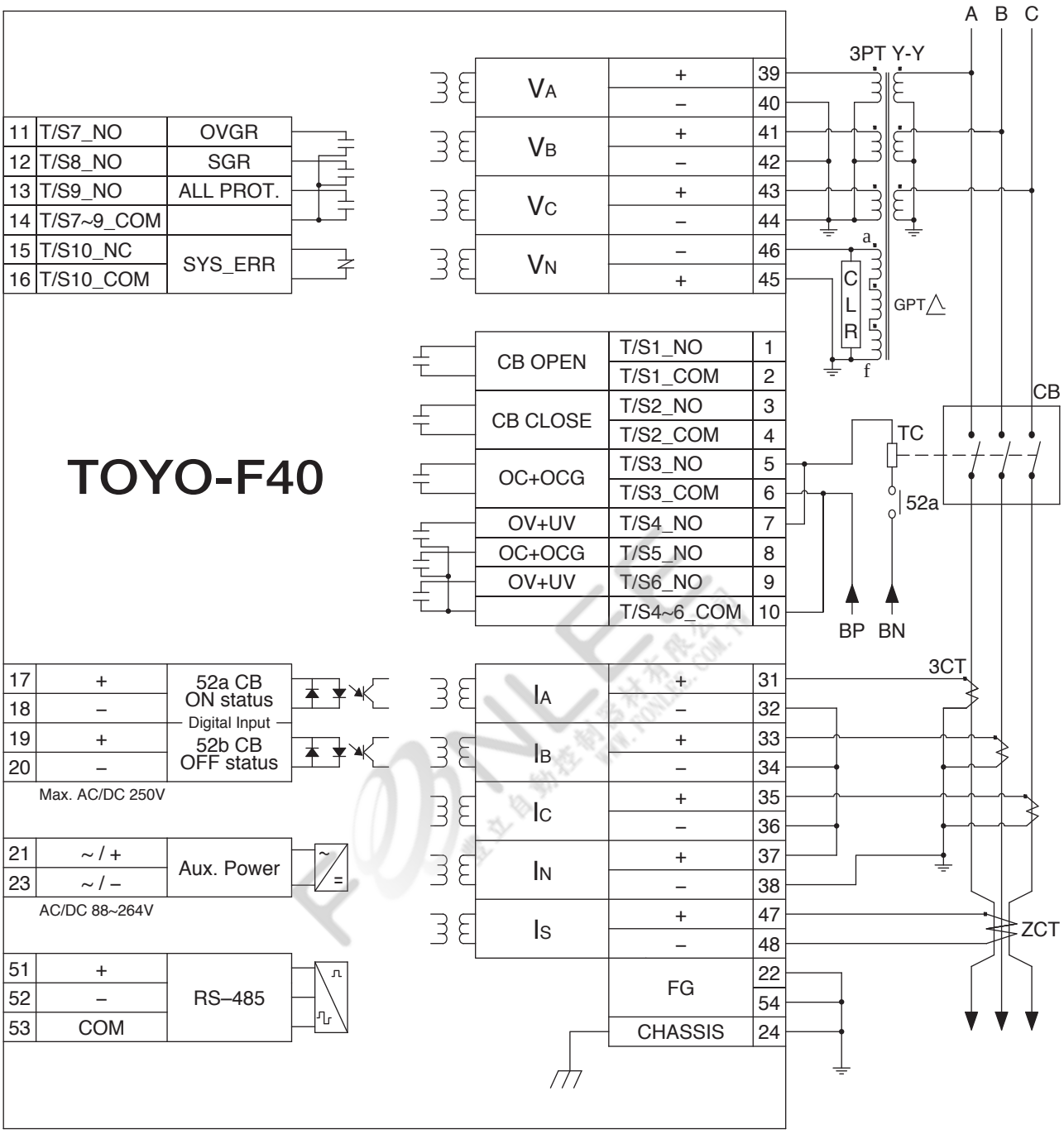


Over voltage relay (Definite time)

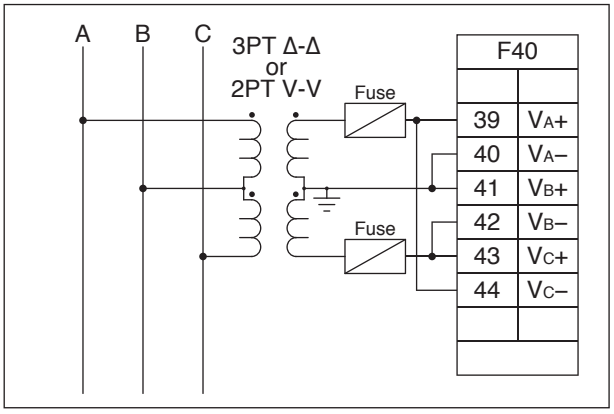


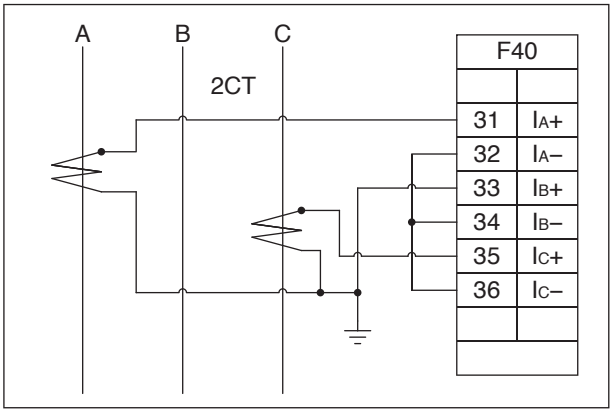
■ WIRINGS

Wiring Reference



2PT/2CT Wiring Reference





DIMENSIONS

TOYO-F40 Draw Out Type (unit:mm)