

TOYO *Digital* CO+LCO Protection Relay Operation Manual

3CO+LCO (50/51/50N/51N)

1. Models

TDOG - 31 (fixed type) TDOG - 31D (draw-out type)

2. Main Function

TOYO-TDOG protection relay is micro-processing type, with LCD display showing all information about the state of settings and input current value of each phase. Selectable operating time curves consist of *definite time*, *normal inverse time*, *very inverse time*, and *extremely inverse time*. When activating, not only a signal will be generated to trip the breaker, also a RS485 output and a set of CO/LCO contacts are provided for central monitoring, and the latest 32 trippings will be recorded. The power supply is AC/DC dual purpose. For draw-out type, CT will be automatically short-circuited after being drawn out.

3. Panel Layout

4 x 20 LCD Display

Displaying all information about the state of settings and input current value of each phase.

LED Indicator

RUN	CPU running normally
PICKUP	turning on when fault occurs
COMM	RS-485 communicating
R.S.T.N	indication of fault phase
INST	instantaneous fault indication
POWER	aux. power normal

Control Key

MODE	enter main setup menu
ENTER	confirm / select / next item
ESC	cancel / return
▲ ▼ ◀ ▶	scroll / change values
CPU RESET	restart the CPU
TRIP RESET	clear lamp (reset tripping indications)



4. Setting Illustration

MAIN MENU

(press MODE once)

- | | |
|-----------------|--|
| 1. SYSTEM SETUP | 1. set up system frequency & CT ratio |
| 2. RELAY SETUP | 2. set up output contact ON time |
| 3. COMM SETUP | settings regarding protection such as CO/LCO、instantaneous、lever、time curve selection...etc. |
| 4. FAULT MEMORY | settings of RS-485 communication |
| 5. SECURITY SET | check up tripping history |
| 6. TIME SET | set up password |
| 7. SELF TEST | set up date & time |
| | check the state of lamps & contacts |

[MAIN MENU] #1/3
* 1. SYSTEM SETUP
2. RELAY SETUP
3. COMM SETUP

[MAIN MENU] #2/3
4. FAULT MEMORY
5. SECURITY SET
6. TIME SET

[MAIN MENU] #3/3
7. SELF TEST

Attention ! In the end of EACH setup item it will show up : **Are You Sure? [N]** ,
use **▲**、**▼** key to change N to [Y] and then press Enter ,
so that the new value can be saved and the setting be completed

• SYSTEM SETUP

(press ENTER at 「1. SYSTEM SETUP」 of the main menu)

[SYS Set Menu]
SYS Freq [60] Hz
C/T Rat [400] / 5 [A]

SYS Freq: frequency setup · use ▲、▼ key to select 50/60 Hz ◦

C/T Rat: CT ratio setup · use ▲、▼、◀、▶ key to set the primary CT ◦

(Ex: for 400/5A · please set [400])

• RELAY SETUP

(press ENTER at 「2. RELAY SETUP」 of the main menu)

[RELAY SETUP] #1/2
* 1. Time Delayed OCR
2. Inst OCR
3. Time Delayed OCGR

[RELAY SETUP] #2/2
4. Inst OCGR

1. CO Time Delay

(press ENTER at 「1. Time delay OCR」)

[Time OCR set]	
CURVE [EI]	TOC [XX.X]
LEVER [XX.X]	LOCK? [N]

use ▲、▼、◀、▶ key to change setting values

DT (Definite Time)

NI (Normal Inverse)

VI (Very Inverse)

EI (Extremely Inverse)

CURVE: time curve—DT、VI、NI、EI； **TOC:** over current； **LEVER:** time curve lever

LOCK: Y=locked、N=unlocked。

Caution ! If LOCK=Y, even when fault occurs, RELAY will NOT trip, LED lamps will NOT turn on, either。

2. CO Instantaneous

(press ENTER at 「2. Inst OCR」)

[Inst OCR set]	
IOC [XXX]	LOCK? [N]

use ▲、▼、◀、▶ key to change setting values

IOC: instantaneous over current；

LOCK: Y=locked、N=unlocked。

Caution ! If LOCK=Y, even when fault occurs, RELAY will NOT trip, LED lamps will NOT turn on, either。

3. LCO Time Delay

(press ENTER at 「3. Time delay OCGR」)

[Time OCGR set]	
CURVE [EI]	TOCG [XX.X]
LEVER [XX.X]	LOCK? [N]

use ▲、▼、◀、▶ key to change setting values

DT (Definite Time)

NI (Normal Inverse)

VI (Very Inverse)

EI (Extremely Inverse)

CURVE: time curve—DT、VI、NI、EI； **TOCG:** earth fault over current；

LEVER: time curve lever； **LOCK:** Y=locked、N=unlocked。

Caution ! If LOCK=Y, even when fault occurs, RELAY will NOT trip, LED lamps will NOT turn on, either。

4. LCO Instantaneous

(press ENTER at 「4. Inst OCGR」)

[Inst OCGR set]	
IOCG [XXX]	LOCK? [N]

use ▲、▼、◀、▶ key to change setting values

IOCG: instantaneous earth fault over current； **LOCK:** Y=locked、N=unlocked。

Caution ! If LOCK=Y, even when fault occurs, RELAY will NOT trip, LED lamps will NOT turn on, either。

• COMM SETUP

(press ENTER at 「3. COMM SETUP」 of the main menu)

```
[ COMM Set Menu ]  
  
DEVICE ID [XX]  
COMM SPEED [XXXX]
```

use ▲、▼、◀、▶ key to change setting values

DEVICE ID: set up relay ID for RS485 communication ◦

COMM SPEED: set up communication baud rate (bps) ◦

• FAULT MEMORY

(press ENTER at 「4. FAULT MEMORY」 of the main menu)

```
[ FAULT MEMORY ]  
  
1. FAULT RECORD  
2. CLEAR FAULT MEM
```

use ▲、▼ key to select items

1. Check up fault records

(press ENTER at 「1. FAULT RECORD」)

```
[ FAULT REC ] #01/32  
FAULT TYPE {PHASE} = A  
Op_Time = ms  
<YY.MM.DD.hh.mm.ss>
```

use ▲、▼ key to check up fault records

FAULT REC: up to 32 fault records (automatically overwrite the earliest one when >32)

FAULT TYPE: fault type ; T_OCR / T_OCGR → CO/LCO time delay ◦

I_OCR / I_OCGR → CO/LCO instantaneous ◦

{PHASE} = A: display the fault phase and the fault current value ◦

Op_Time: trip(delay) time in micro second ◦

<YY.MM...>: fault date ; year.month.day.hour.minute.second ◦

2. Clear fault records

(press ENTER at 「2. CLEAR FAULT MEM」)

```
[ FAULT CLEAR ]  
  
CLEAR FAULT REC? [N]
```

use ▲、▼ key to select N or Y

N: do not delet ; **Y:** delet **ALL** fault records ◦

• SECURITY SET

(press ENTER at 「5. SECURITY SET」 of the main menu)

```
[ SECURITY PASSWORD ]  
  
PASSWORD [****]  
set "0000" to disable
```

use ▲、▼、◀、▶ key to set up password

If do not use password ◦ set 「0000」 ◦

To use password ◦ set any four-digit number between 0001 ~ 9999 ◦

If password is set ◦ password dialogue box will appear when pressing MODE key ◦

If password forgotton ◦ set 「1183」 ◦ and then the password will be reset to 「0000」 ◦ that is, not using password ◦

- **TIME SET** (press ENTER at 「6. TIME SET」 of the main menu)

```

[ TIME SET ]
yy-mm-dd-hh-mm-ss
XX-XX-XX-XX-XX-XX

```

use ▲、▼、◀、▶ key to change setting values
sequence: 「year-month-day-hour-minute-second」

- **SELF TEST** (press ENTER at 「7. SELF TEST」 of the main menu)

```

[ SELF TEST ]
1. TEST LAMPTUP
2. TEST RELAY
3. TEST SWITCH

```

use ▲、▼、◀、▶ key to select items

- 1. **Lamp test** (press ENTER at 「1. TEST LAMP」)

```

[ LAMP TEST ]
[ENTER] to ALL LAMP
[ESC] to QUIT TEST

```

press ENTER · all LED lights up (check if any lamp malfunction) ◦
press ESC · quit testing and return to previous page ◦

- 2. **Relay test** (press ENTER at 「2. TEST RELAY」)

```

[ RELAY TEST ]
[LEFT] to OC Alarm
[RIGHT] to EF Alarm
[ESC] to QUIT TEST

```

press ◀ key · OC alarm contact Oa-Oc is ON ◦
press ▶ key · EF alarm contact Ea-Ec is ON ◦
press ESC · quit testing and return to previous page ◦

(special: press ▲ key · trip contact Ta-Tc is ON) **Caution ! This test will trip the breaker. Be careful !!**

- 3. **Key test** (press ENTER at 「3. TEST SWITCH」)

```

[ SWITCH TEST ]
[      ] ← Key Input
Press & check switch
[ESC] to QUIT TEST

```

except CPU RESET and MODE key · pressing any key will display following message in []:

▲ → [UP]

▼ → [DOWN]

◀ → [LEFT]

▶ → [RIGHT]

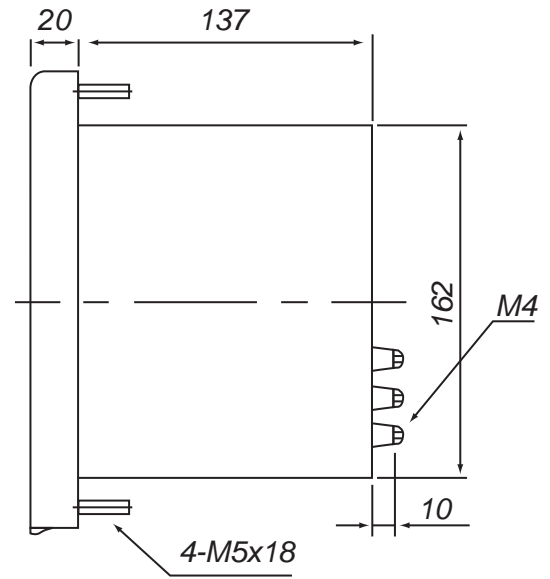
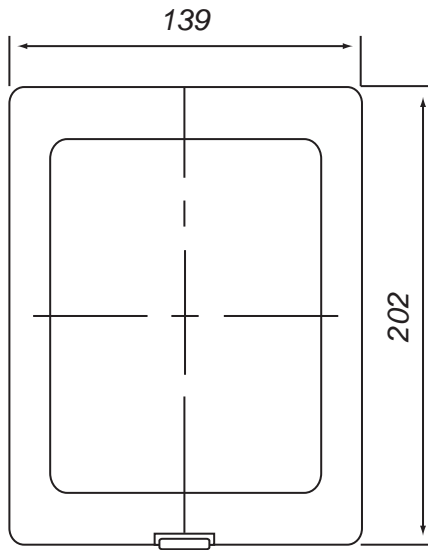
TRIP RESET → [CLEAR]

ENTER → [ENTER]

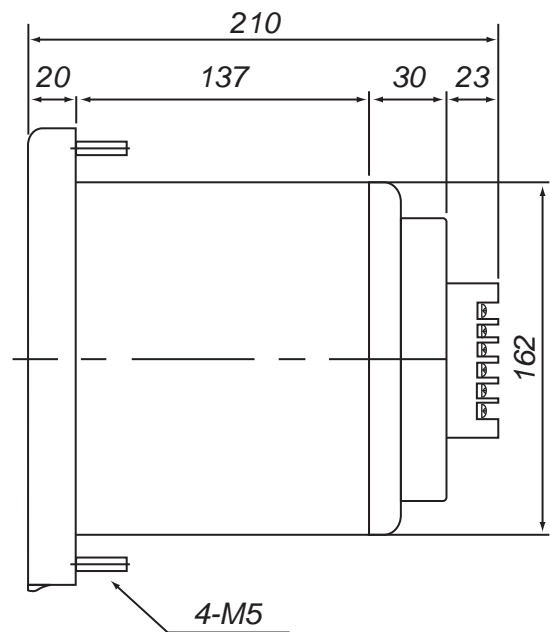
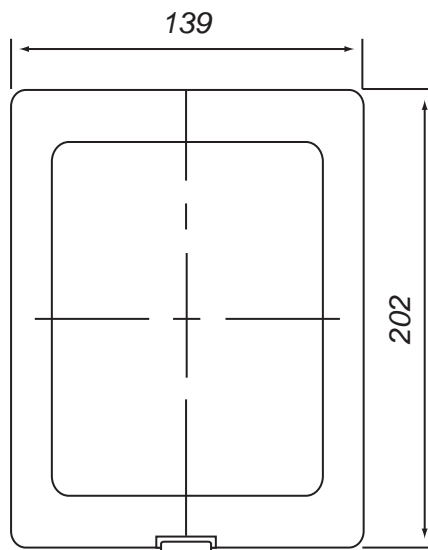
press ESC · quit testing and return to previous page ◦

5. Dimension & Panel Cut

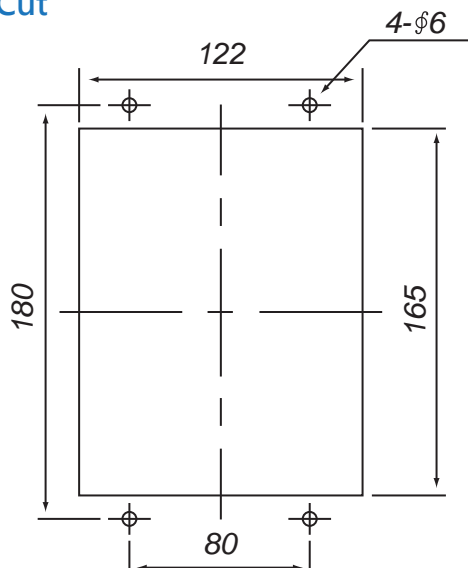
Fixed Type TDOG - 31



Draw-out Type TDOG - 31D



Panel Cut

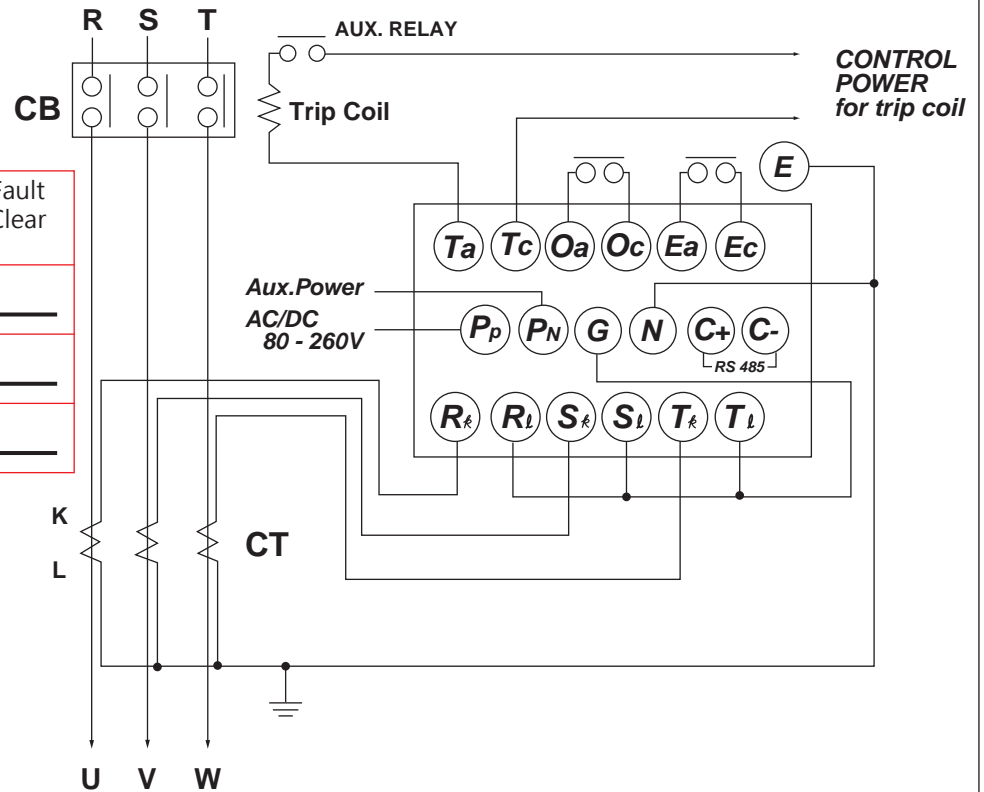


6. Wiring Diagram

Fixed Type TDOG - 31

Contact Operation:

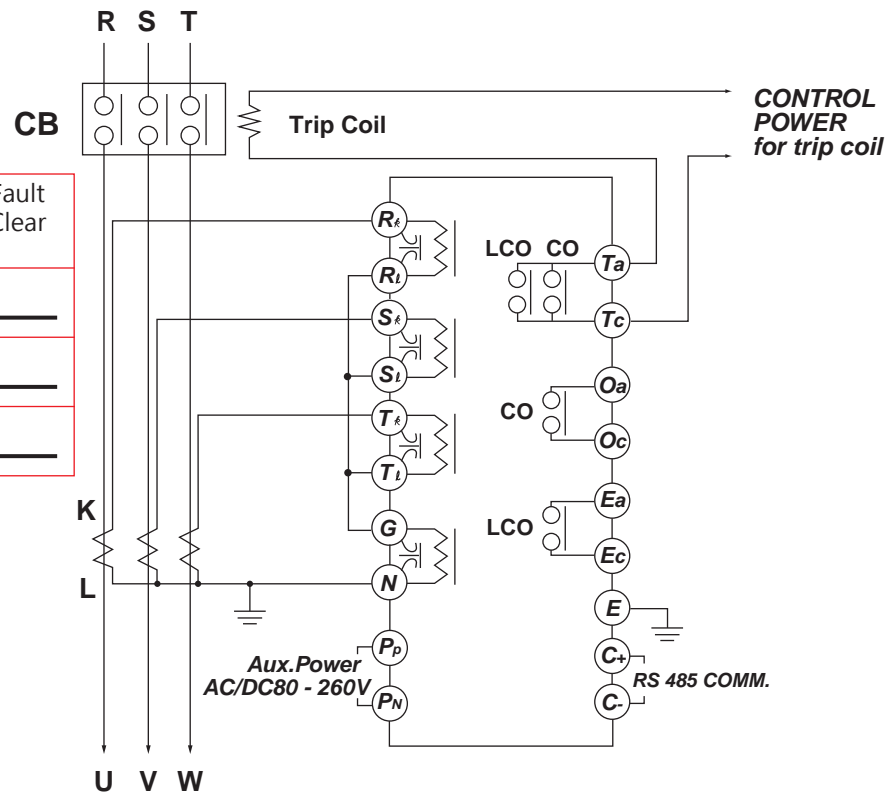
		Fault Occur (cont.)	Fault Clear
Ta-Tc			
Oa-Oc			
Ea-Ec			



Draw-out Type TDOG - 31D

Contact Operation:

		Fault Occur (cont.)	Fault Clear
Ta-Tc			
Oa-Oc			
Ea-Ec			



7. Specification

Rating

Rated Current	AC 5A
Rated Frequency	50/60Hz±5%
Auxiliary Power	AC/DC 80~260V
Ambient Temperature	-10C~60°C (without icing)

Current Setting

CO	CO Time-delay	0.2~25A (0.1A step)
	CO Instantaneous	5~120A (1A step)
LCO	LCO Time-delay	0.2~20A (0.1A step)
	LCO Instantaneous	1~80A (1A step)

Time Setting & Curve

IEC 60255-3

Lever (t>)	0.1~40 (0.1 step)	
Inst. Trip Time	less than 40ms	
Normal Inverse	$NI = \frac{0.14}{I^{0.02} - 1} \times \frac{tp}{10}$	I = If/Is If = fault current Is = set current (I> x CT ratio) tp = Lever (t>)
Very Inverse	$VI = \frac{13.5}{I - 1} \times \frac{tp}{10}$	
Extremely Inverse	$EI = \frac{80}{I^2 - 1} \times \frac{tp}{10}$	
Definite Time	$D = tp$	
Reset Value	>95%	
Reset Time	<100ms	

Indicator

RUN (green)	CPU operating normally
COMM (yellow)	RS485 communicating
PICKUP (red)	Lights up when fault (CO/LCO) occurs
R.S.T.N / INST (red)	Trip (phase fault/instantaneous) indicators

Memory

32 trip records

RS485 Communication

Protocol	Modbus
Baud Rate	9600 / 19200 bps
Parity	None

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