# User Guide

# DP-53

### Digital Motor Protection Relay

## features

**True RMS Measurement** with SPARC[1] and DCOI[2] Algorithm

**Auto / Manual Scroll**
for Real Time Display of Phase Current and Earth Fault in (%)

**Protection-**
Thermal Overload / Undercurrent / Phase Unbalance / Phase Loss /
Phase Sequence / Stalled Current (Locked Rotor)

**Indication-**
Fault, Undercurrent, Overload, Phase Unbalance, Phase Loss,
Phase Sequence, Locked Rotor, Earth Fault

**Trip Event Memory**
(non-volatile 7 previous records for 3 phases + earth)

**Motor Hour Run (Accumulative)**

**Selectable Frequency** (50 / 60 Hz)

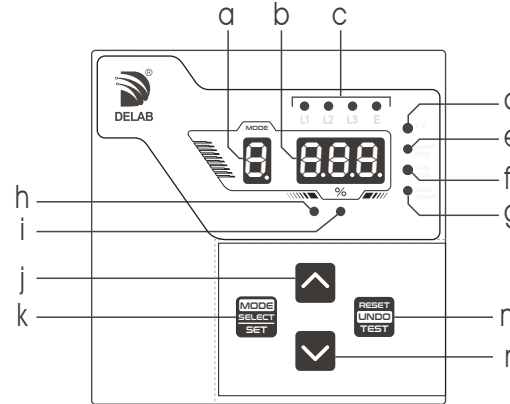**Programmable Relay Output Contact** for K2

**Selectable Auto/ Manual Reset Function**

**Software Lock** to Prevent Unauthorized Setting

**External Plug-in Module**
for A-01s / A-01sp (RS-485 MODBUS RTU) isolated type

Complies with: IEC-60255-26/27 ; BS EN 50121-5 Standards     ANSI Code: 37, 46, 49, 51P, 51G

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## Panel Overview



a. Single digit mode LED display
b. 3 digit data LED display
c. Individual phase indication
d. x10 indication
e. Locked rotor indication
f. Overload indication
g. Under current indication
h. Fault indication
i. Trip indication
j. Up button - Increment
k. Mode / Select / Set button
m. Reset / Undo / Test button
n. Down button - Increment

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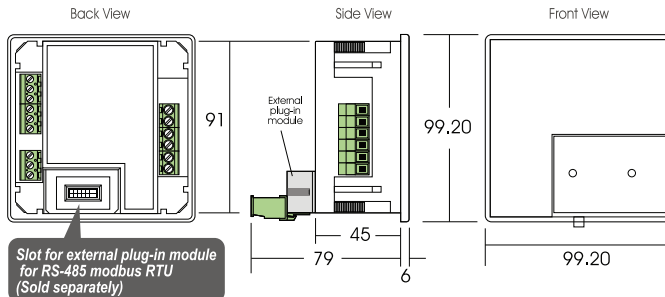## Technical Data

| | | |
|---|---|---|
| Aux Power | : | 65 ~ 275 Vac (45~65 Hz); 90 ~ 300 Vdc (model 220a) |
| | : | 18 ~ 72 Vdc (model 024d) |
| Fund. Frequency | : | 50 or 60 Hz (software selectable) |
| Current Input (In) | : | ../5A or ../1A (depending on model) |
| Burden | : | < 0.3 VA @ In |
| Output Relay Rating | : | SPDT 5A, 250 VAC / VDC |
| Consumption | : | < 15 VA |
| Accuracy | : | Current protection threshold ($\pm$5%), Time delayed (+5% or 50 ms) |
| Display | : | 7-segment LED (3+1 digit) |
| Indication (LEDs) | : | phase, x10, locked rotor, overload, undercurrent, fault, trip |
| Operating Temp. | : | 0ºC ~ +55ºC |
| Humidity | : | 56 days at 93%RH, 40ºC non-condensing |
| IP Rating | : | IP54 (front panel) |
| Weight | : | 260 g |

## Parameter Setting Range

**1** : Full Load Current, $I_\theta$ (%)
10%~200% (step of 1%)

**2** : Thermal Overload Time Constant, $t_{\theta x}$ (sec)
0.1s~10s (step of 0.1s)
10s~60s (step of 1s)

**u1**: Undercurrent, $I<$ (%)
OFF or
10%~100% of $I_\theta$ (step of 1%)

**u2** : Undercurrent Trip Time Delay, $t<$ (sec)
0.1s~10s (step of 0.1s)
10s~60s (step of 1s)

**3** : Unbalance, $\Delta I>$ (%)
OFF, 5%~50% (step of 1%)

**4** : Unbalance Trip Time Delay, $t_\Delta>$ (sec)
0.1s~10s (step of 0.1s)
10s~60s (step of 1s)

**5** : Stalled Current, $I_{stall}>$ (%)
OFF or
1.0~12.0 x $I_\theta$ (step of 0.1 x $I_\theta$)

**6** : Stalled Current Trip Time Delay, $t_{stall}>$ (sec)
0.1s~10s (step of 0.1s)
10s~60s (step of 1s)

**PL** : Phase Loss
ON or OFF
(Trip time delay fixed @ 100ms)

**PS** : Phase Sequence
ON or OFF
(Trip time delay fixed @ 100ms)

**E1** : Earth Fault, $I_0>$ (%)
OFF or
5%~100% (step of 1%)

**E2** : Earth Fault Trip Time Delay, $t_0>$ (sec)
0.1s~10s (step of 0.1s)
10s~60s (step of 1s)

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## Casing

Back View          Side View          Front View



External plug-in module

Slot for external plug-in module for RS-485 modbus RTU (Sold separately)

91     99.20     99.20
45
79
6
92
92

### Panel Cut-out
### 92 x 92
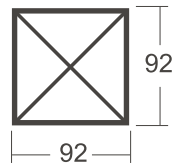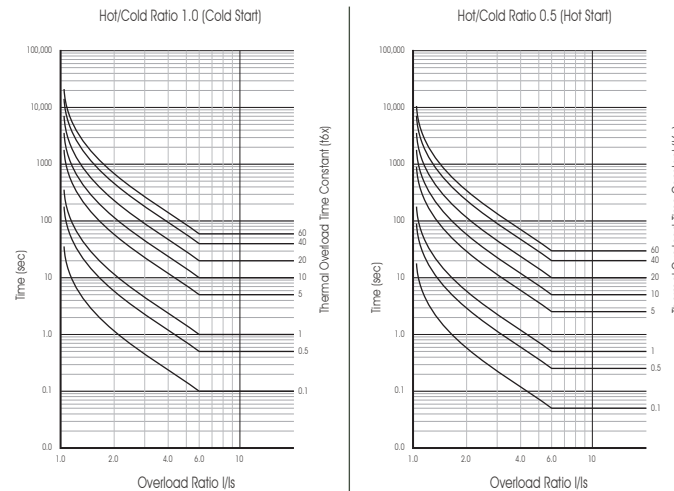
*Note: All measurement in mm.*

Note: Specification subject to change without prior notification (please visit www.delab.com.my for latest specification)
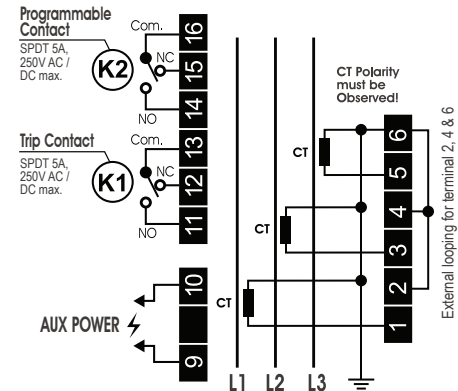
**You Tube** : Delab Scientific Sdn. Bhd.

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## Thermal Tripping Curve

Hot/Cold Ratio 1.0 (Cold Start)



Time (sec)
Thermal Overload Time Constant (tθx)
Overload Ratio I/Is

Hot/Cold Ratio 0.5 (Hot Start)



Time (sec)
Thermal Overload Time Constant (tθx)
Overload Ratio I/Is

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## Wiring

### 3P3W : CT x 3

**Programmable Contact**
SPDT 5A, 250V AC / DC max.
K2    Com.  16
NC   15
NO   14
13

**Trip Contact**
SPDT 5A, 250V AC / DC max.
K1    Com.  12
NC   11
NO

**AUX POWER**   10
9

CT Polarity must be Observed!
CT
External looping for terminal 2, 4 & 6
6 5 4 3 2 1

L1  L2  L3

### 1P2W : CT x 1

External looping for terminal 2 to 3 & 4 to 5
6 5 4 3 2 1
CT
L  N

**Earth Fault and Phase Sequence detection :**
Set to **'OFF'**

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### Digital Motor Protection Relay DP-53

# ☰ Modes

### PARAMETER SETTING

| | | Factory Setting | | | | Factory Setting |
|---|---|---|---|---|---|---|
| 80 | $I_\theta$ (%) | Full Load Current | 3.0 | $I_{stall}>$ (%) | Stalled Current | |
| 2.0 | $t_{6x}$ (sec) | Thermal Overload Time Constant | 0.5 | $t_{stall}>$ (sec) | Stalled Current Trip Time Delay | |
| 50 | $I<$ (%) | Undercurrent | On | Phase Loss | ON or OFF (Trip time delay fixed @ 100ms) | |
| 2.0 | $t<$ (sec) | Undercurrent Trip Time Delay | On | Phase Seq. | ON or OFF (Trip time delay fixed @ 100ms) | |
| 20 | $\Delta I>$ (%) | Unbalance | 10 | $I_o>$ (%) | Earth Fault | |
| 2.0 | $t_\Delta>$ (sec) | Unbalance Trip Time Delay | 0.3 | $t_o>$ (sec) | Earth Fault Trip Time Delay | |

### VIEWING INFO

| | | |
|---|---|---|
| b, c1 to c6 | Trip memory | 7 tripped records for 3 phases + earth (non-volatile) |
| d | Motor hour run | Value x1000 hours (accumulative) |
| FUEr | Version | Firmware version |
| FoPh | Info | Device operated in hours (x1000) |

### SPECIAL SETTING MODE

| | | | Factory Setting | | | | Factory Setting |
|---|---|---|---|---|---|---|---|
| OFF | L | Software lock | OFF / ON (Keypad lock) | On | - | Standby Option | OFF / ON |
| OFF | Ar | Auto Reset | OFF / ON | non | PC | Selection of Plug-in Module | non / A01 |
| Lc | r1 | Trip Relay K1 Response Type | (Lc) Latching / (nLc) Non latching | 1 | Ad | Modbus Address | 1 ~ 247 |
| trP | r2 | Output Relay K2 Function | Programmable relay output | 96 | br | Baud rate Setting | 3, 6, 12, 24, 48, 96, 192, 288 |
| Lc | r2 | Trip Relay K2 Response Type | (Lc) Latching / (nLc) Non latching | non | Pr | Parity Setting | non / Odd / Eun |
| 50 | Fr | Electrical Network System Frequency | Selectable as - 50 / 60 Hz | | End | End Setting | Save changes and exit setting mode |

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# ⬤⬤⬤ Trip Event Memory Display

| LED | | | | | | | Flashing | |
|---|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | E | Locked Rotor | Overload | Undercurrent | 3 Digit Data | Description |
| On | Off | Off | Off | Off | On | Off | tripping current | L1 Phase Thermal Overload Tripping |
| Off | On | Off | Off | Off | On | Off | tripping current | L2 Phase Thermal Overload Tripping |
| Off | Off | On | Off | Off | On | Off | tripping current | L3 Phase Thermal Overload Tripping |
| On | Off | Off | Off | Off | Off | On | tripping current | L1 Phase Undercurrent Tripping |
| Off | On | Off | Off | Off | Off | On | tripping current | L2 Phase Undercurrent Tripping |
| Off | Off | On | Off | Off | Off | On | tripping current | L3 Phase Undercurrent Tripping |
| On | Off | Off | Off | On | Off | Off | tripping current | L1 Phase Stalled current Tripping |
| Off | On | Off | Off | On | Off | Off | tripping current | L2 Phase Stalled current Tripping |
| Off | Off | On | Off | On | Off | Off | tripping current | L3 Phase Stalled current Tripping |
| Off | Off | Off | On | Off | Off | Off | tripping current | Earth Fault Tripping |
| | | | On | | | | trP | Manual Tripping |
| | On | | | | Off | | unb | Unbalance Tripping |
| | On | | | | Off | | rPh | Phase Sequence Error Tripping |
| On | Off | Off | | Off | | | PL | L1 Phase Loss Tripping |
| Off | On | Off | | Off | | | PL | L2 Phase Loss Tripping |
| Off | Off | On | | Off | | | PL | L3 Phase Loss Tripping |

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# ⚙ Parameters Setting

**Single digit mode display**

MODE

**Mode decimal** — Indicates seconds count

**Three digit data display**

%

**All modes exit automatically if left untouched for more than 20 secs.**

### STEP 1
Press [SELECT] button while in default mode (when mode display is blank)
To scroll thru modes, just press & release the SELECT button

MODE SELECT SET

### STEP 3
Press [SET] button to store new value & proceed to next mode

### STEP 2
Press [UP] or [DOWN] button to select desired value
For fast increment or decrement, press & hold the Up or Down button

### RESET/UNDO
Press button to undo changes or exit mode

RESET UNDO TEST

### TEST TRIP
Press & hold for 5 seconds to test trip device
5 flashes (mode decimal) = 5 sec.

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# ℹ Info Viewing

### b , c1 ~ c6
**Tripped values for last 7 events**

Press [SELECT] button until mode b or hold [SELECT] button for 1 sec in any mode 1~E2. Display will show the tripped value for the most recent tripped event.

Manual tripped event will display a flashing trP

--- Indicate no tripping has occured.

Press [SELECT] button again to scroll thru mode c1~c6. (Auto skip to mode d if memory is empty)

**Skip directly to mode d :**
Hold [SELECT] button for 1 sec

**Clear trip event memory:**
Hold [RESET] button for 3 sec in mode b
Press [UNDO] button to exit

### d Motor Hour Run
Press [SELECT] button until mode d.
Display will show the motor hour run value (x1000) in hour.
Hold [RESET] button for 3 sec in mode d to clear motor run hour memory.
Press [UNDO] button to exit

### FUEr Firmware version
Press [SELECT] button until mode FUEr
Display will show the firmware of the device.
Press [UNDO] button to exit

### FoPh Total Operation Hour
Press [SELECT] button until mode FoPh
Display will show a value (x1000 hr).
Press [UNDO] button to exit

e.g. 005 x1000 = 50 hours

### 8 Manual Scroll    MODE SELECT SET / ∧ ∨
When mode display is blank:
1) Press & hold [MODE] button for 3 sec to enter mode 8 or
2) Press [UP / DOWN] button
Display will show the individual phase value (L1, L2, L3, E) in real time.
Continue pressing the [MODE] or [UP / DOWN] button to scroll thru the next phase.
Press [UNDO] button to exit

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# ⚙ Special Setting Modes

**When no mode is selected** (mode display is blank)

Press 'SELECT & RESET' button simultaneously & hold for 5 seconds until mode L appears

∧ OR ∨    Press 'UP or Down' button to modify parameters

Press 'SET' button to confirm & proceed to next mode

MODE SELECT SET

MODE ▼    select ∧∨

| | | |
|---|---|---|
| L | Software Keypad Lock | OFF / On |
| Ar | Auto Reset Option | OFF / On |
| r1 | Trip Relay K1 Response Type — Can only be accessed when mode Ar is set to OFF | Lc / nLc |
| r2 | Output Relay K2 Function | ⟫⟫ |
| r2 | Trip Relay K2 Response Type — Can only be accessed when mode Ar is set to OFF | Lc / nLc |
| Fr | Electrical Network System Frequency (Hz) | 50 / 60 |

**- Standby Option** (Running LED bar)    OFF / On
If set to ON, after about 3 minutes of idle and no fault is detected, running LED bar will be displayed instead of the real time value. It automatically exits on fault detection or when any button is pressed. When device trips, standby mode is temporary de-activated until device is reset.
To toggle this setting, user can also press [SELECT] button when powering up the device.

**PC Selection of Plug-in Module**
non = none
A01 = A-01s / A-01sp

**Ad Modbus Address**
[ Selectable from 1 ~ 247 ]

**br Baud Rate Setting**
[ Selectable ]
Set the baud rate for modbus communication between host computer and the unit.
Selectable as:
( 3=300, 6=600, 12=1200, 24=2400, 48=4800, 96=9600, 192=19200 or 288=28800 ) bps

**Pr Parity Setting**
[ non (none) / Odd / Eun (Even)]    non / Odd / Eun
Set the parity for modbus communication between host computer and the unit.

**End End Setting**
Press [ SELECT ] button to exit and save the settings or [ UNDO ] button to go back.

### Output Relay Function K2

| | |
|---|---|
| **Tripping Output Function** | trP |
| **Locked-rotor Trip** (Activated only if locked-rotor trip) | Lrt |
| **Unbalance Trip** (Activated only if unbalance trip) | unb |
| **Phase Loss Trip** (Activated only if phase loss trip) | PLt |
| **Phase Sequence Trip** (Activated only if phase sequence trip) | PSt |
| **Earth Fault Trip** (Activated only if earth fault trip) | EFt |
| **Underload Trip** (Activated only if under current trip) | uLt |
| **Overload Trip** (Activated only if thermal overload trip) | oLt |