

TROUBLE SHOOTING MANUAL



FBR(A)9, 10, 13

FBR(A)10H, 13H

FBR(A)14, 15, 18

FBR(A)20, 25, 30

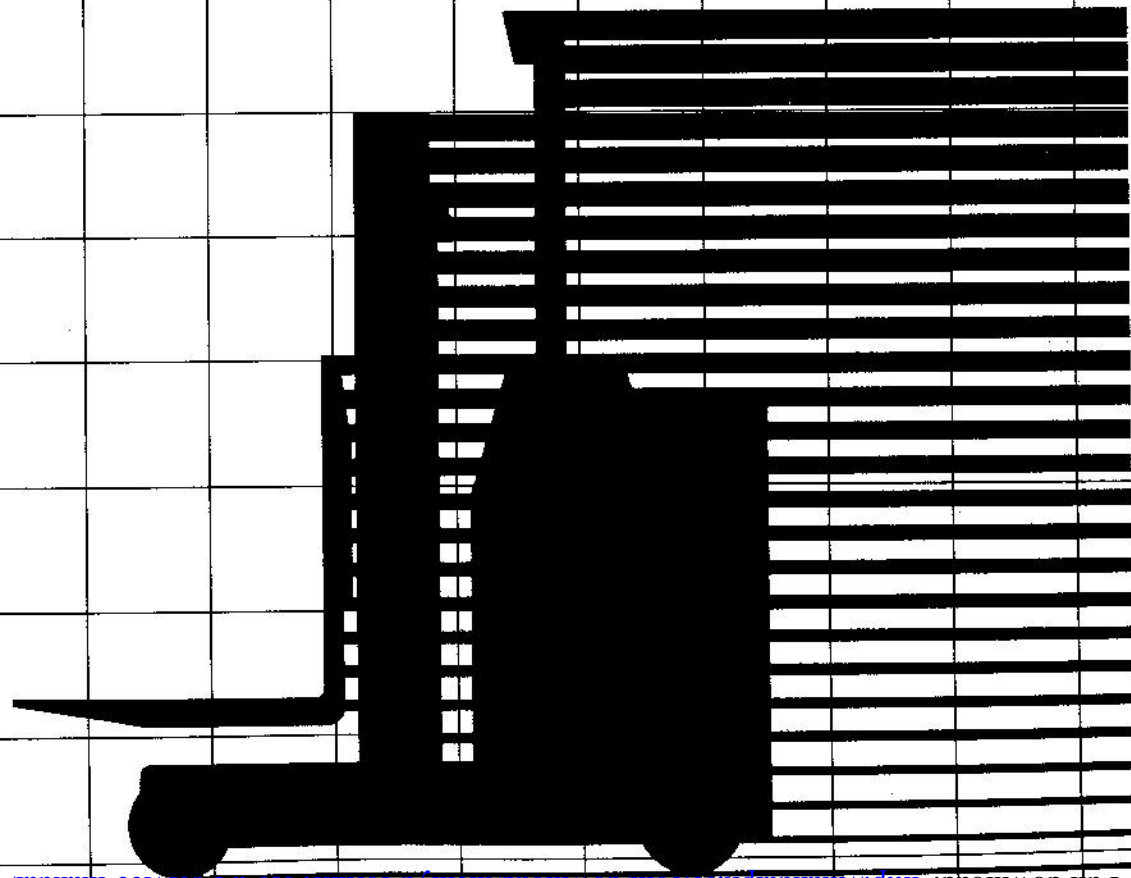
FBRF 10, 13

FBRF 14, 15, 18

FBRF 20, 25, 28

FER15D, 20D

FER15C, 20C



CONTENTS

1. NEW FEATURES OF SICOS 50	1
1-1 FET chopper (Travel, Hydraulic)	1
1-2 Contactor chopper	2
1-3 Regenerative brake	3
1-4 Automatic torque increase	6
1-5 Anti-rollback	6
2. FUNCTION OF SICOS 50	7
2-1 Safety monitor and self-diagnosis function by the LCD display	7
2-2 Table of safety monitor and self-diagnosis	9
2-3 Checking I/O	12
2-4 Checking Self-diagnosis history memory	19
2-5 Monitor selection	23
3. HANDLING NEW WIRING CONNECTORS (MIC MARK II)	24
3-1 Connecting and disconnecting connectors	24
3-2 Checking with V-ohm meter	24
3-3 Pulling out terminal	25
3-4 Crimping terminals	25
3-5 Fitting terminal to connector	26
4. HOW TO ADJUST SICOS 50	27
4-1 Adjustment by potentiometers	27
4-2 Adjustment of rotary switches	31
5. FAULT-FINDING PROCEDURE	36
5-1 Caution on fault-finding	36
FBR & FBRF Fault finding and trouble shooting	39
5-2 Fault finding and trouble shooting for FBR, FBRF	40
FBR Diagram and component	59
5-3 Diagram and component for FBR, FBRF	60
• FBR-50 Circuit diagram	60

● FBR-50 Body wiring	61
● FBR-50 Body harness	62
● FBR-50 Control unit wiring	63
● FBR-50 Control unit harness	64
● FBR-50 Wiring (Indicator panel accelerator)	65
● FBR-50 Devices	66
● FBR-50 Printed board	67
FBRF Diagram and component	68
● FBRF-50 Circuit diagram	69
● FBRF-50 Body wiring	70
● FBRF-50 Body harness	71
● FBRF-50 Control unit wiring	72
● FBRF-50 Control unit harness	73
● FBRF-50 Wiring (Indicator panel accelerator)	74
● FBRF-50 Devices	75
● FBRF-50 Printed board	76
FER Fault finding and trouble shooting	77
5-4 Fault finding and trouble shooting for FER	78
FER Diagram and component	97
5-5 Diagram and component for FER	98
● FER-50 CIRCUIT DIAGRAM	98
● FER-50 Body wiring	99
● FER-50 Body harness	100
● FER-50 Control unit wiring harness	101
● FER-50 Wiring (Contactor relay)	102
● FER-50 Wiring (Indicator panel accelerator)	103
● FER-50 Devices	104
● FER-50 Microswitch for hydraulic & power cylinder	105
● FER-50 Printed board	106

1. NEW FEATURES OF SICOS 50

1-1 FET chopper (Travel, Hydraulic)

SCR control system has been equipped on NYK FBR series. However, from new FBR-50 series FET chopper is adopted for travel control system as well as hydraulic chopper control.

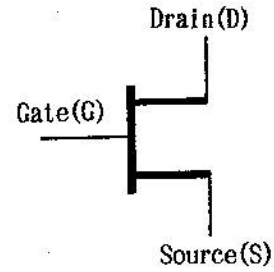


Fig. 1-1 Symbol of FET

FET is an abbreviation for Field Effect Transistor. As shown in Fig. 18, there are three electrodes: D (Drain), S (Source), and G (gate). The main feature of this element is that circuit between D-S can be turned on by applying just voltage, with almost no flow of gate current. (Fig. 19)

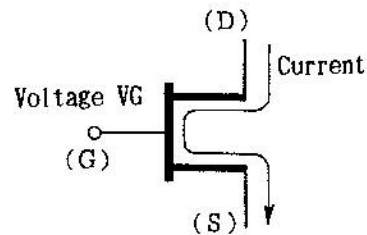
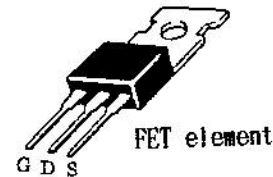


Fig. 1-2 Feature of FET

In other words, they are very effective for energy-saving. In addition to this, turn-off-circuit like an SCR chopper is unnecessary, therefore failing to turn off will not happen. Also, fine control can be made.



FET element is shown in Fig. 20. Actually, 7 or 10 or 14 FET's are connected in parallel and installed on a heat sink. (Fig. 20: FET comp.)

Another FET comp. are mounted for hydraulic control.

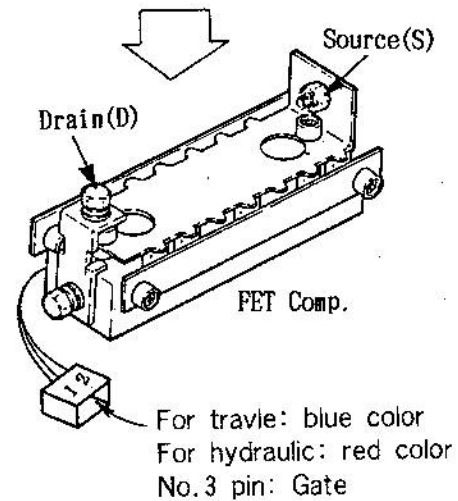


Fig. 1-3 FET element & FET Comp.

1-2 Contactor chopper

■ Except for FER

The contactors have become compact extremely. This is because full battery voltage is applied only when the contactor is closed (Fig.21), and then voltage is reduced through chopper control. (Fig.22) Therefore not only the contactors become compact, but also they consume less energy.

Chopping ratio is also automatically changed according to drop in battery voltage. This means the chopper activates at ideal duty. (Fig. 23)

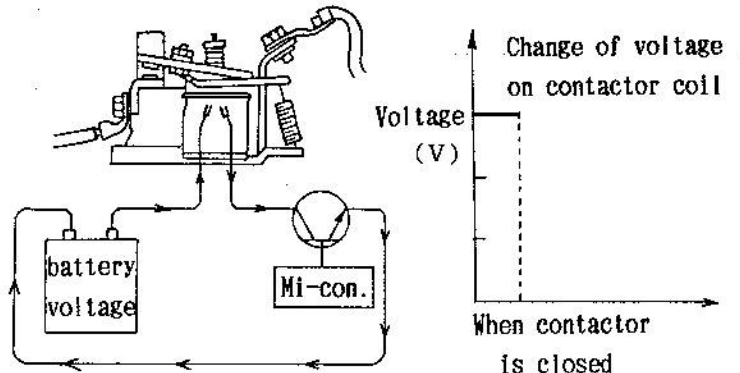


Fig.1-4 When contactor is closed

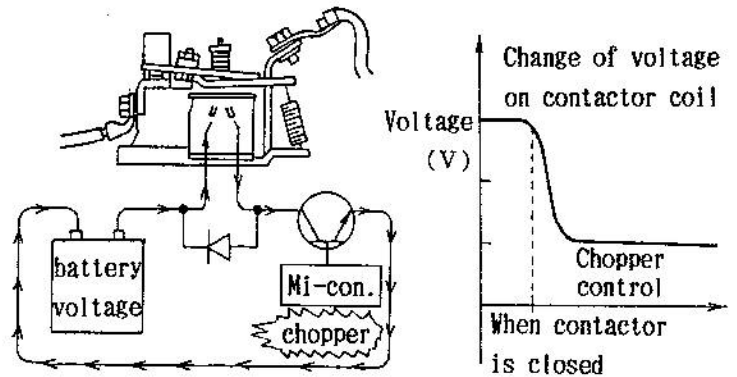


Fig.1-5 Contactor chopper

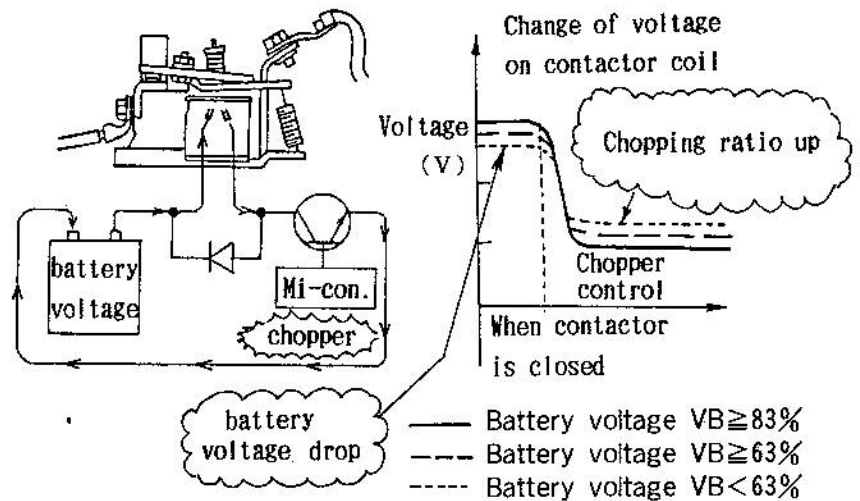


Fig.1-6 Automatic chopping ratio adjustment on battery voltage dropping

1-3 Regenerative brake

※ FER is option

Conventional electrical braking changes kinetic energy to heat energy by plugging operation. But the new electrical braking system enables the drive motor to be used as a generator by plugging operation. Kinetic energy charges the battery and also performs the electric brakes. This is called "regenerative brake."

The following figures (Fig.27-Fig.31) show current flow during regenerative braking. For instance, in this case, the truck drives from forward direction to reverse direction by plugging operation.

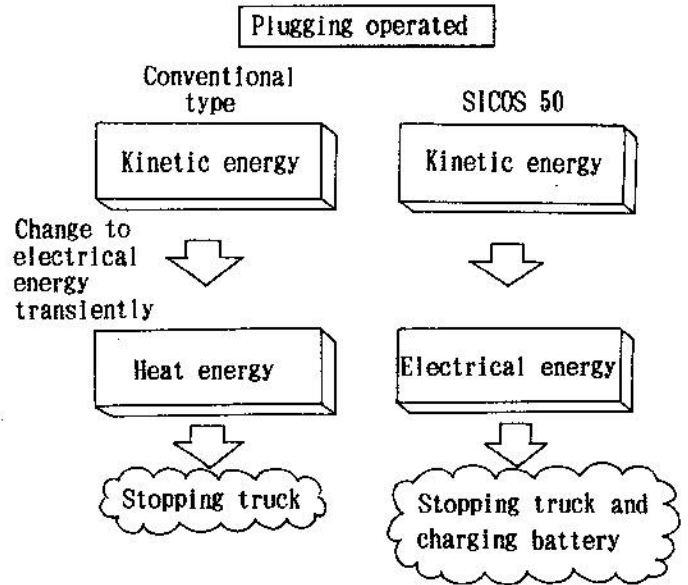


Fig.1-7 Change of energy on plugging operation

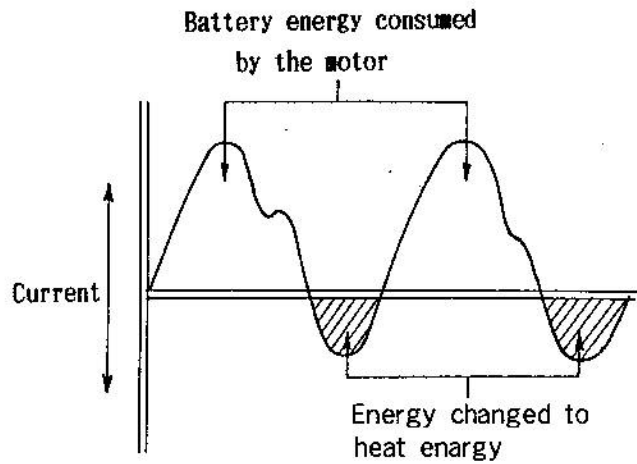


Fig.1-8 Electrical braking (conventional type)

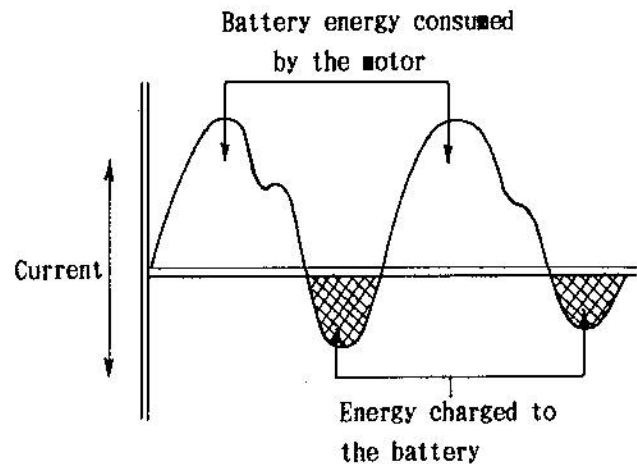


Fig.1-9 Regenerative brake (SICOS 50)

① Traveling in forward direction

Forward contactor M1→ON
Regenerative brake contactor M4→ON

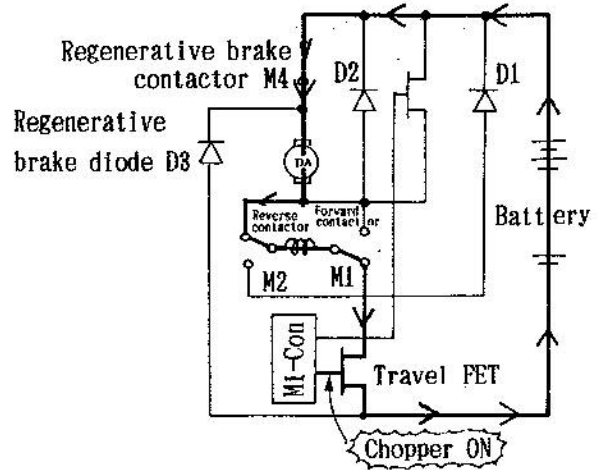
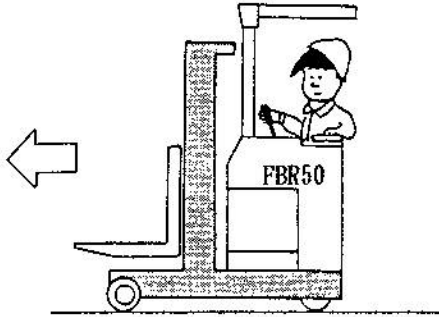
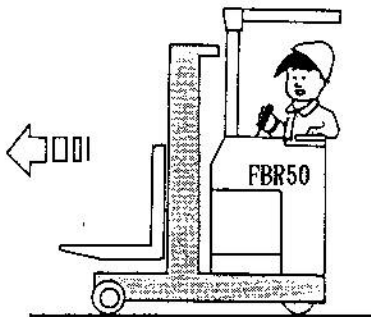


Fig.1-10 Current flow during traveling in forward direction

② Plugging operated

- 1) Forward contactor M1→OFF
Reverse contactor M2→ON
Regenerative brake contactor M4→OFF

2) Through pre-energizing circuit,



Travel speed reduced

current flows into the field coils for the drive motor to function as a generator.

※ Pre-energizing circuit is located in pre-energizing printed board

And regenerative current flows

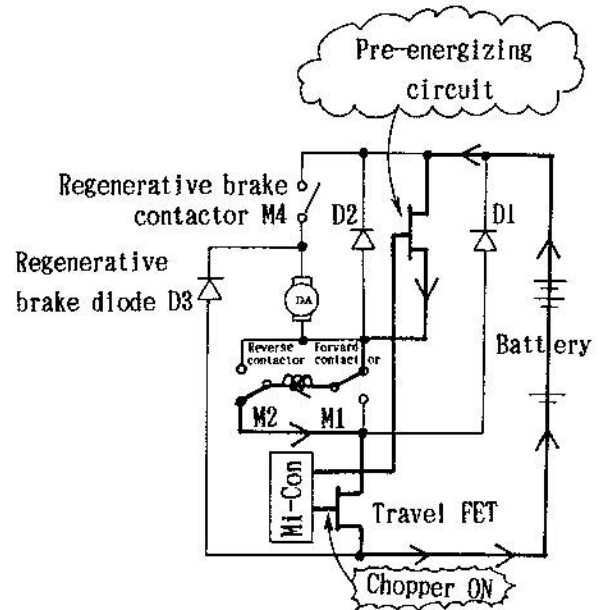


Fig.1-11 Current flow on plugging brake (1)

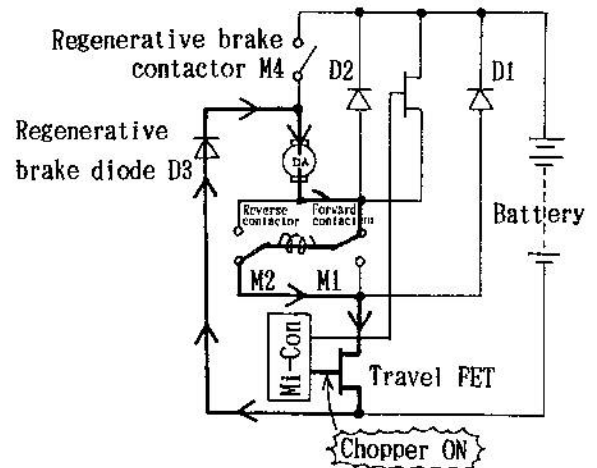


Fig.1-12 Current flow on plugging brake (2)

- 3) Then, travel FET is turned off, and regenerative current flows into the battery to enable to charge it. This is called "regenerative current."
 Actually travel FET's repeat turn-on (Fig. 29) and turn-off (Fig. 30)
 So, this is called "regenerative chopper."

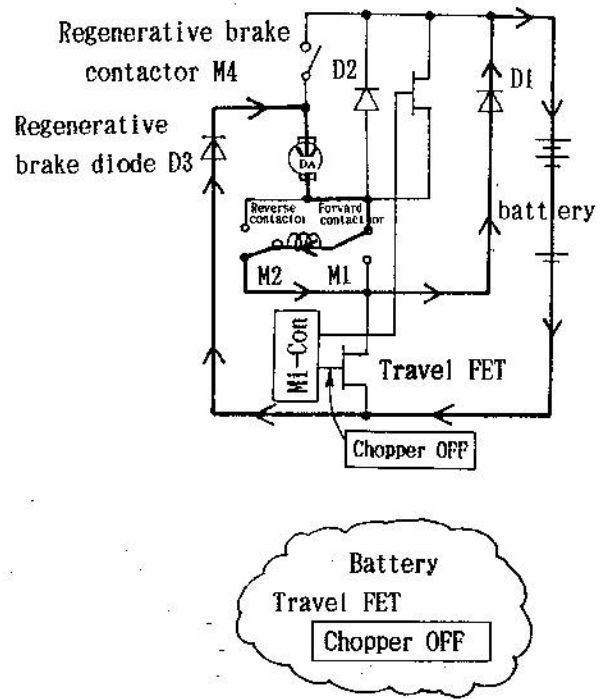


Fig.1-13 Current flow on plugging brake (3)

③ Traveling in reverse direction

After the truck stops
 Regenerative brake contactor M4 → ON
 The truck starts to travel in reverse direction.

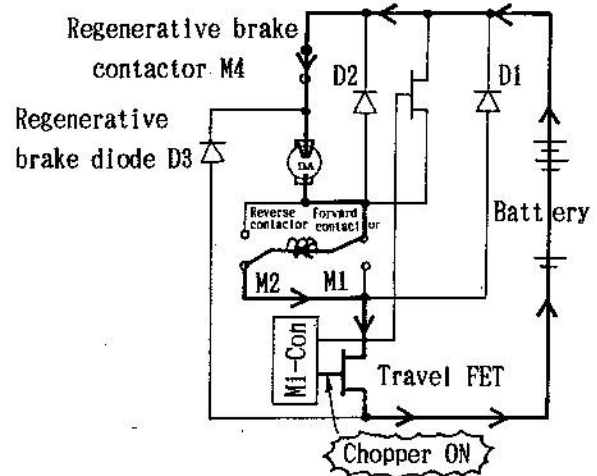
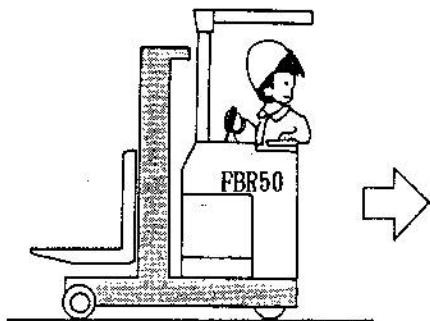


Fig.1-14 Current flow on traveling in reverse direction

1-4 Automatic torque increase

When the NYK forklift truck with a load starts on a ramp or gets out from a groove, sometimes the truck accelerates with a shock due to forcible bypass. This is because motor current is instantly increased from current limit to large current (approx. 1000A)

With SICOS 50, current limit is increased by 30% just before forcible bypass works.

This results in smooth acceleration at starting on a ramp and getting out from a groove.

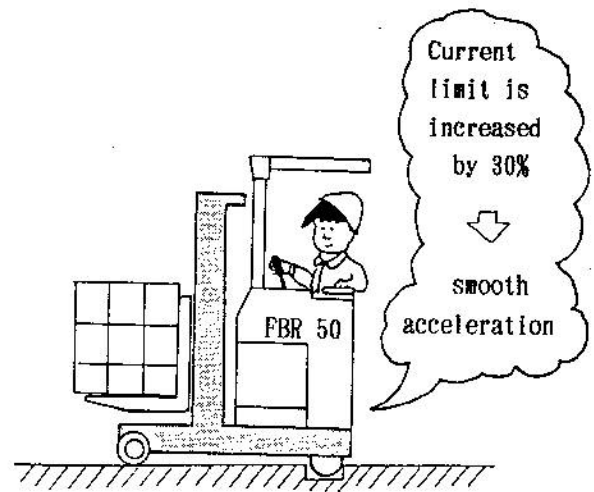


Fig.1-15 Automatic torque increase

1-5 Anti-rollback

NYK forklift truck with 'UNICON' control does not roll back a much when starting on a ramp (depressing the brake pedal with the accelerator lever fully operated.)

SICOS 50 is improved further to minimize rollback.

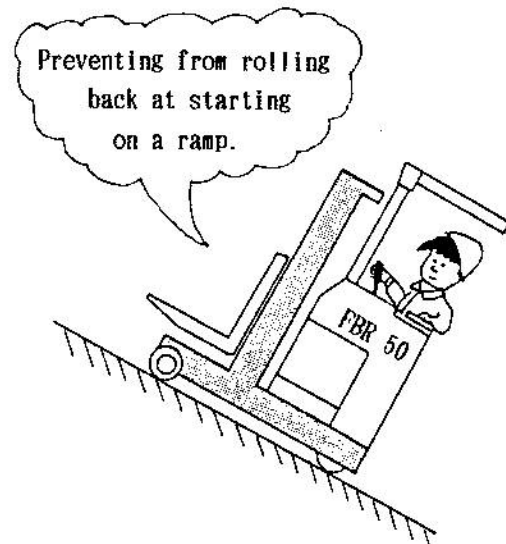


Fig.1-16 Anti-rollback


2. FUNCTION OF SICOS 50

2-1 Safety monitor and self-diagnosis function by the LCD display

This LCD display can display followings.

- Displaying possible defective parts (symbols and messages) by self-diagnosis function.
- Self-diagnosis history memory
- Checking I/O
- Hour meter
- Battery capacity indicator

When all circuits are normal, as soon as the key switch is turned on, followings are displayed.

- Symbols of self-diagnosis
(※When the parking brake is applied, BRAKE  flashes. ... ■ FBRF only)
- Battery capacity indicator
- Message 「MONITORING OK!」
(※This informs the system has checked monitored circuits.)



After several seconds, this message changes to,

- 「TOTAL ○.○ HR」
(※This hour meter counts the time during traveling or hydraulic operation, and the decimal point flashes while counting.)

1. How to start hour meter

■ FBR —————

Connect the wiring harness 「blue/yellow」 and 「black」 near the hydraulic motor. And hour meter starts to count.

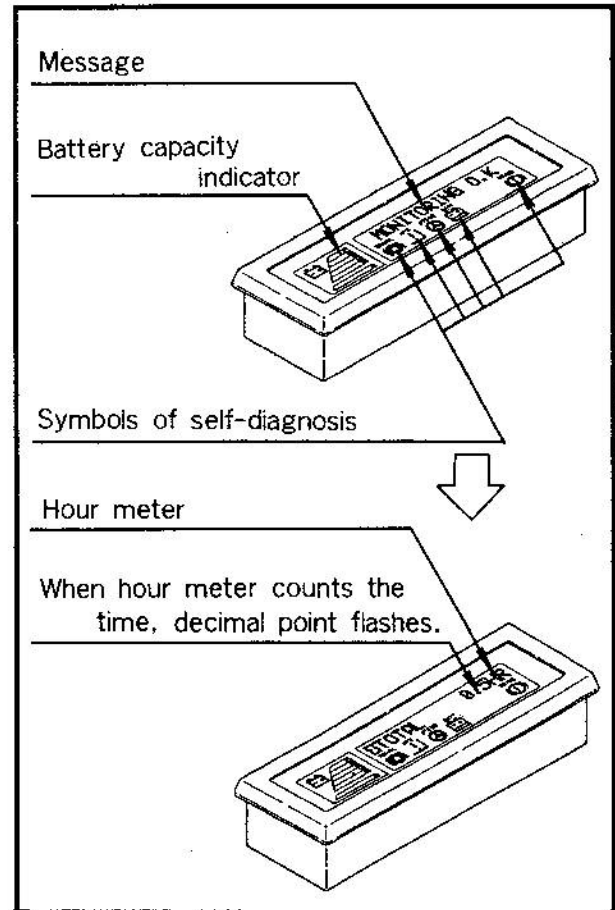
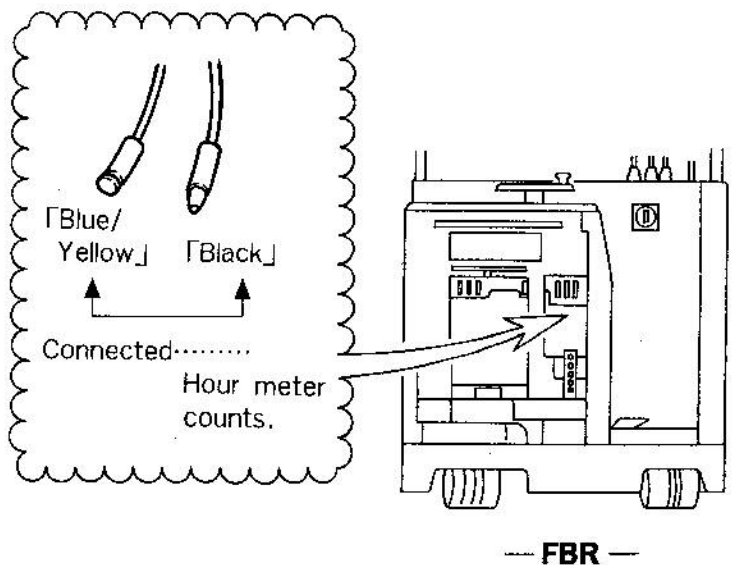


Fig.2-1 LCD display when key switch is turned on