ENGLISH

MOTOR BRAKE MANAGEMENT
MANUAL

Enclosures to Service Manual of:

- ► Mack Indy
- ► Mack Nano
- ► Mack UniNano

Version 1, release 04/'21

Release	Notes
ver.1 rev.09/'17	Preliminary first edition.
ver.1 rev.04/'21	Output Specification. Software Interface Update.

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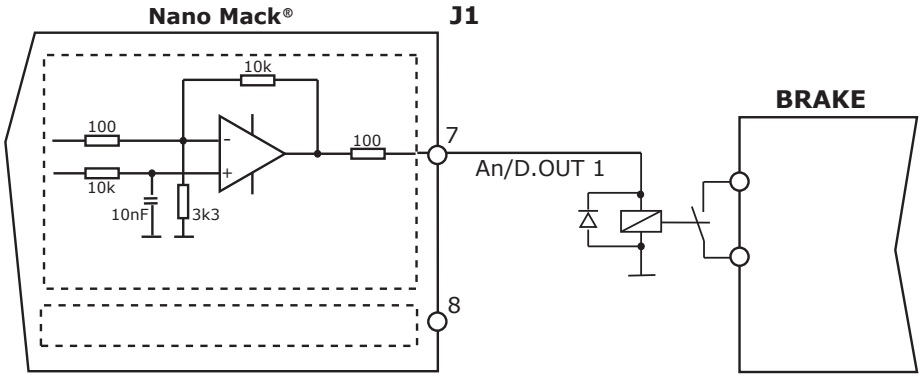
THIS MANUAL IS EXCLUSIVELY ADDRESSED TO TECHNICAL PERSONNEL WITH AN APPROPRIATE TECHNICAL KNOWLEDGE ON SERVODRIVE.
BEFORE USING THIS MANUAL READ DRIVE'S SERVICE MANUAL.

Some Axor digital servodrives (**Mack Indy, Nano, Uninano**) have a output which allows the control of the **electromechanical brake integrated** in the motor with external relay. It is a ***Stationary Brake***, so it can be used with motor not running, for blocking the motor's axis.

It cannot be used for dynamic braking.

Example



PRODUCT	ANLOG/DIGITAL OUTPUT "An/OUT 1"	DIGITAL OUTPUT "OUT 3"	REQUESTED FUNCTION
MACK NANO	Digital output = 12Vdc; Max 20mA		19:Out Brake
MACK UNINANO	Digital output = Vbackup (12Vdc ; 24 Vdc) Max 20mA		19:Out Brake
MACK INDY		Opto-Isolated Digital output = 24 Vdc; Max 20mA	SETTED BY DEFAULT AND CANNOT BE CHANGED

The user has the following possibilities:

a- **Not manage the brake by drive.**

b- MANUAL brake management:

- **The Drive provide a signal to controll an external relay to unblock the brake.**

- **The user has to manage:** the blocking time and the unblocking time of the brake, the enabling, the emergency ramp, the blocking time of the brake during alarms or when the motor is turning.

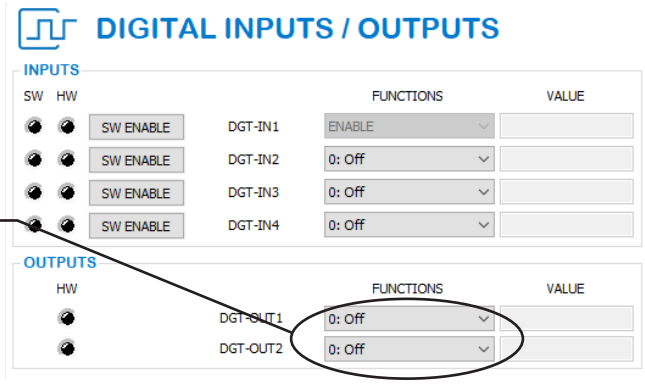
c- AUTOMATIC brake management:

- **The Drive provide a signal to controll an external relay to unblock the brake.**

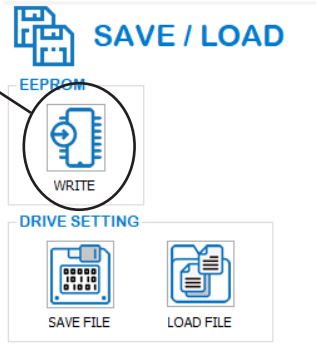
- **The drive has to manage:** the blocking time and the unblocking time of the brake, the enabling, the emergency ramp, the opening time of the brake during alarms or when the motor is turning.

a- NOT managing the brake by drive

1) Deselect ***"19: Out Brake"*** on all Digital Outputs in the **Digital I/O** window.



2) Click on the "**Save Data To Eeprom**" icon in the main window of the interface, in order to save all settings and make them operative at the next start up.

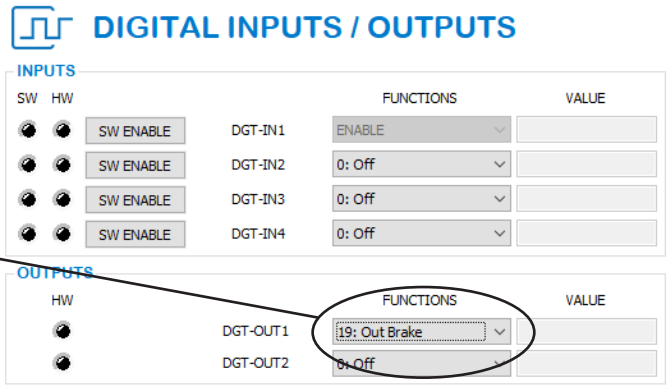


During alarms the functioning of the system is interrupted, the motor remains free and will eventually stop due to the friction and inertia of the axis; at this point there are two possibilities:

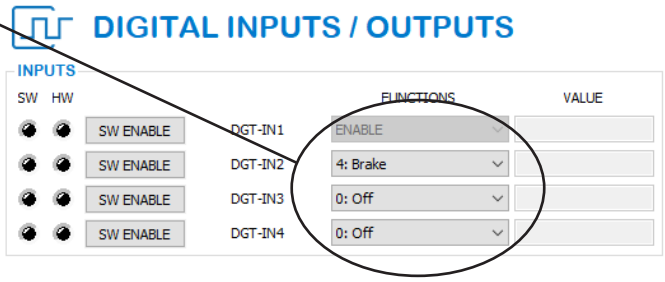
- **if the motor has no brake, the axis remains free;**
- **if the motor has an electromechanical brake, the user can manage the axis block, for example using an external relè.**

b- MANUAL brake management: the brake can be **manually** controlled via **software,** or via **hardware**.

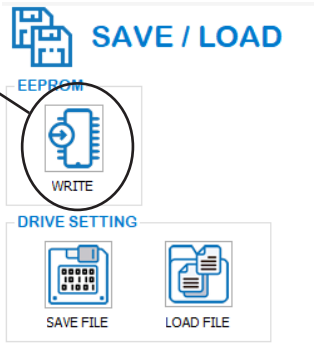
1) Select ***"19: Out Brake"*** on a Digital Output in the **Digital I/O** window.



2) Select ***Brake*** in a digital programmable input (DGT-IN2...DGT-IN5).



3) Click on the "**Save Data To Eeprom**" icon in the main window of the interface, in order to save all settings and make them operative at the next startup.



Follow this ***insertion procedure***:

1) Stop the motor by applying a zero speed reference.

2) Then block the motor brake by applying **0V** on the digital input set with the **"Brake"** function.

3) After **100ms** it is possible to disable the drive applying **0V** on the **DGT-IN1(ENABLE)** input.
At this point the motor will remain mechanically blocked.

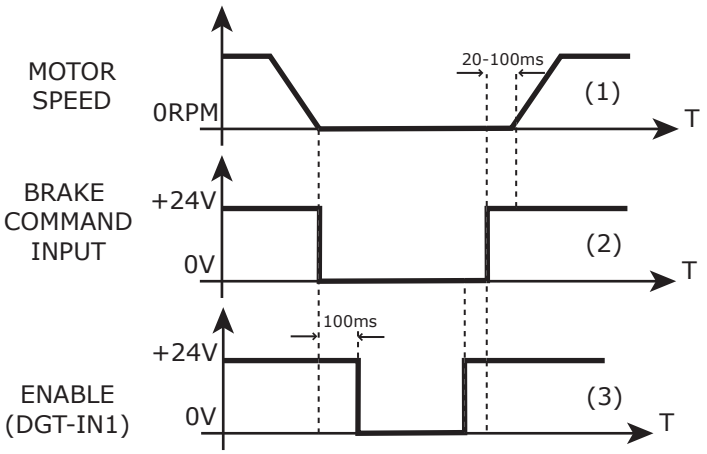
Follow this ***dis-insertion procedure***:

1) Apply **+24V** to the **DGT-IN1** (**ENABLE**) input.

2) Apply **+24V** to the digital input set with the **"Brake"** function.

3) After **20÷100ms** (reference to brake), it will be possible to setup the desired speed reference.

***Insertion* and *dis-insertion procedure* of the motor brake:**



Attention: it is possible to drive the **DGT-IN1** and **Brake** digital inputs:
- ✓ **via software**: in the **Digital I/O** window, by using the dedicated buttons;
- ✓ **via hardware**: applying the appropriate voltage (0V/+24V) on pin corresponding to the digital input set with Brake function. It is necessary to connect the pin **DGT-IN RTN** to CN, too.

Note: You can found more information about the *behaviour of the system in presence of alarms* on paragraph "7 Stop Functions".

c- AUTOMATIC brake management:

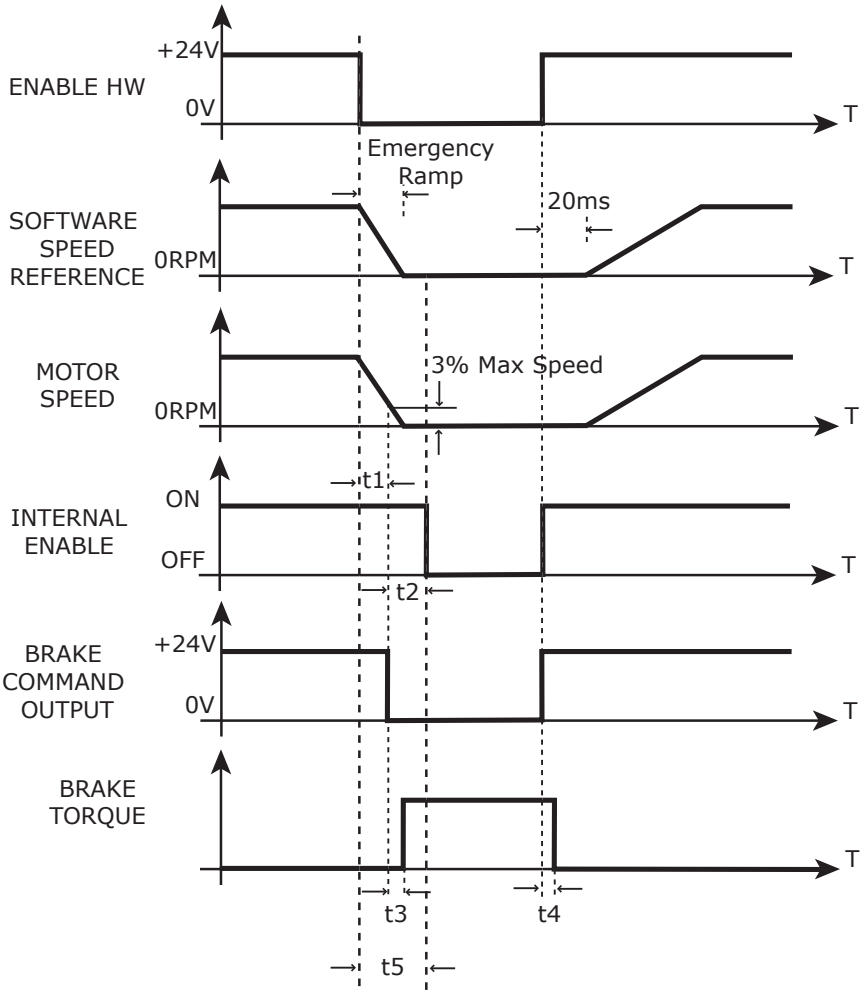
It works with these operative modes: "0: Analog Speed", "1: Digital Speed", "4: Position Mode", "7: Can Open", "10: Square Wave".

Execute these ***settings***:

1) Select "***19: Out Brake"*** on a Digital Output in the **Digital I/O** window.
2) **Do not** select the "**Brake**" function in a programmable digital input.

The ***behaviour of the system*** is the following:

After the hardware disabling the speed reference becomes zero by using the emergency ramp set in the Speed window. When 3% of the max. speed is reached, or after a time equal to 1,5xEmer. Ramp, the brake output is disabled (so the brake is blocked).
During the dis-insertion phase of the brake, the internal speed reference can be supplied after about 20ms from the disabling of the brake output.



t1 = max. deceleration time (1.5x Emergency Ramp).
t2 = internal software delay after the brake block (100ms)
t3, t4 = opening and closing times of the brake (they depend from the brake).
t5 = **into this time the functioning of the system is controlled only by the drive, all external commands are ignored.**

Note: You can found more information about the behaviour of the system in presence of alarms on paragraph "Stop Functions".

In the following pages we illustrate the behaviour of the system in reference to these settings:

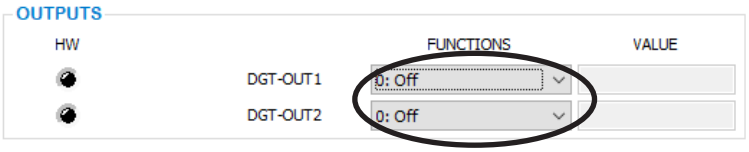
- automatic or manual management of the *stationary brake*;
- *emergency stop*.

We remember that:

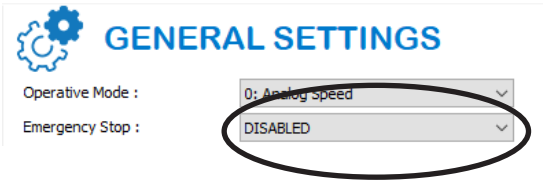
• For the ***manual management*** of the brake it is necessary to set the "***19: Out Brake"*** on a Digital Output in the **Digital I/O** window, then it is necessary to select the "**Brake**" function on one of the programmable digital inputs.

• For the ***automatic management*** of the brake it is only necessary to set the "***19: Out Brake"*** on a Digital Output in the **Digital I/O** window (Attention: Do Not select the "**Brake**" function on one of the programmable digital inputs).

• For the ***no management*** of the brake it is necessary to deselect ***"19: Out Brake"*** on all Digital Outputs in the **Digital I/O** window.



• For the ***emergency stop function*** it is necessary to set the dedicated flag in the "**General Set**" window, and to set the "**Emer. Ramp**" parameter [in ms] in the "**Speed**" window.
ATTENTION: In the "7: CAN open" operative mode the "Emer. Ramp" parameter is set via CanBus.



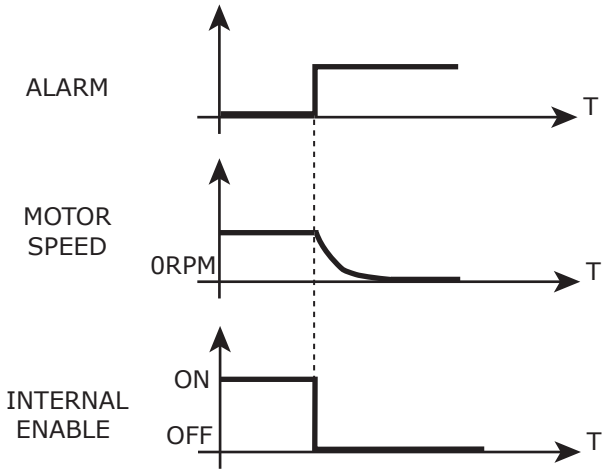
The ***dangerous alarms***, which cause the immediately insertion of the brake, are the followings:
- AI2: Over Current;
- AI4: Hall;
- AI5: Encoder;
- AI9: Max/Min Voltage;
- AI12: Resolver;
- AI14: Following Error;
- AI17: Over Current Brake.

All others alarms stop the system by using the emergency ramp before the brake's insertion.

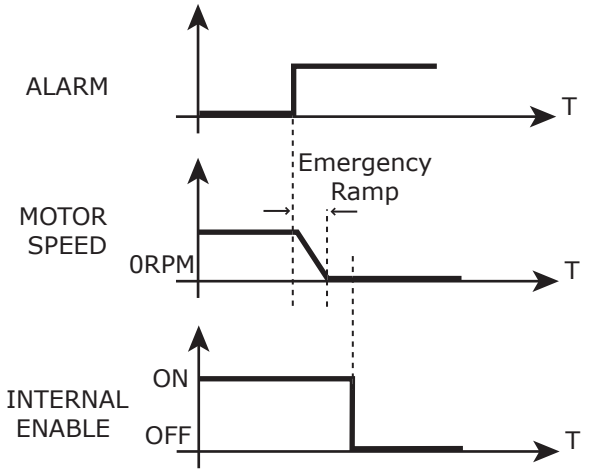
This table illustrates all possible cases:

CASES	BRAKE MANAGEMENT	EMERGENCY STOP FUNCTION	BEHAVIOUR	
			DISABLING OR NOT DANGEROUS ALARM	DANGEROUS ALARM
1°	No brake management	Disable	The internal enable immediately disables, the motor remains free and will eventually stop due to the friction and inertia of the axis.	
2°	No brake management	Enable	The motor stops following an emergency ramp equal to the "**Emer. Ramp**" parameter set in the "Speed" window.	The internal enable immediately disables, the motor remains free and will eventually stop due to the friction and inertia of the axis.
3°	Automatic brake management	Enable or Disable	The motor stops following an emergency ramp equal to the "**Emer. Ramp**" parameter; when 3% of the max speed is reached the brake output is disabled, then after the motor stops, the internal enable disables.	The brake is immediately activated.
4°	Manual brake management	Disable	The internal enable disables, the motor remains free and will eventually stop due to the friction and inertia of the axis; after the motor stops it is possible to block the axis enabling the brake command. In particular conditions (for example: having a vertical axis), it is possible to immediately enable the brake without waiting the axis' stop ⇨ the motor will stop due to the friction. ATTENTION: THE TIME FOR BRAKE ENABLE IS DECIDED BY THE USER.	
5°	Manual brake management	Enable	The motor stops following the emergency ramp; after the motor stops it is possible to block the axis enabling the brake command.	The motor remains free and will eventually stop due to the friction and inertia of the axis; after the motor stops it is possible to block the axis enabling the brake command. In particular conditions (for example: having a vertical axis), it is possible to immediately enable the brake without waiting the axis' stop ⇨ the motor will stop due to the friction. ATTENTION: THE TIME FOR BRAKE ENABLE IS DECIDED BY THE USER.

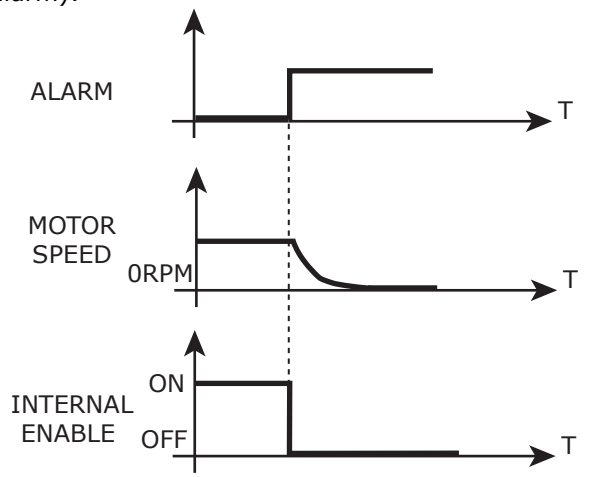
Case 1° (disable or alarm):



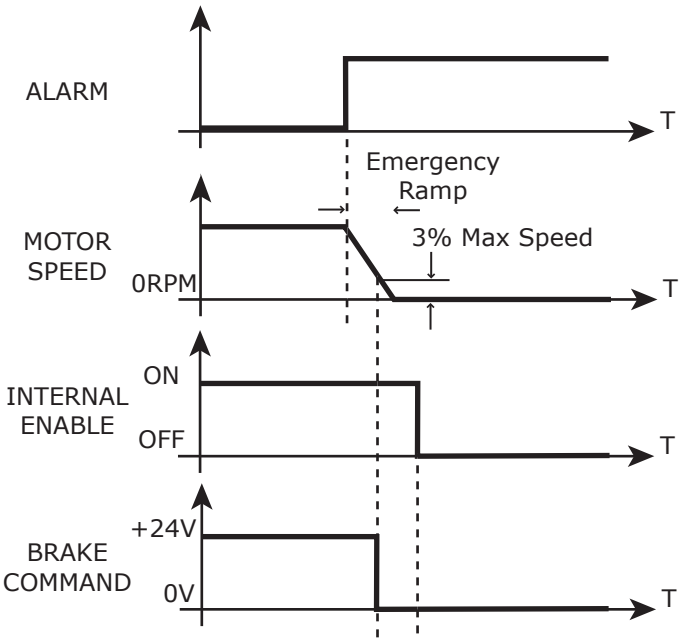
Case 2° (disable or not dangerous alarm):



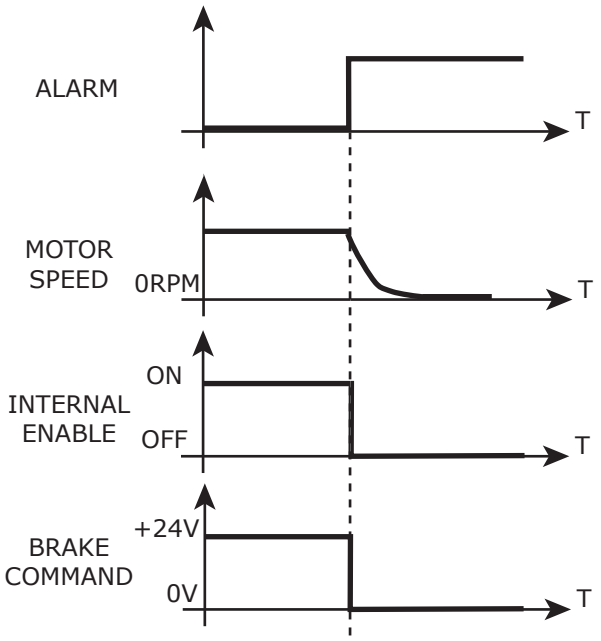
Case 2° (dangerous alarm):



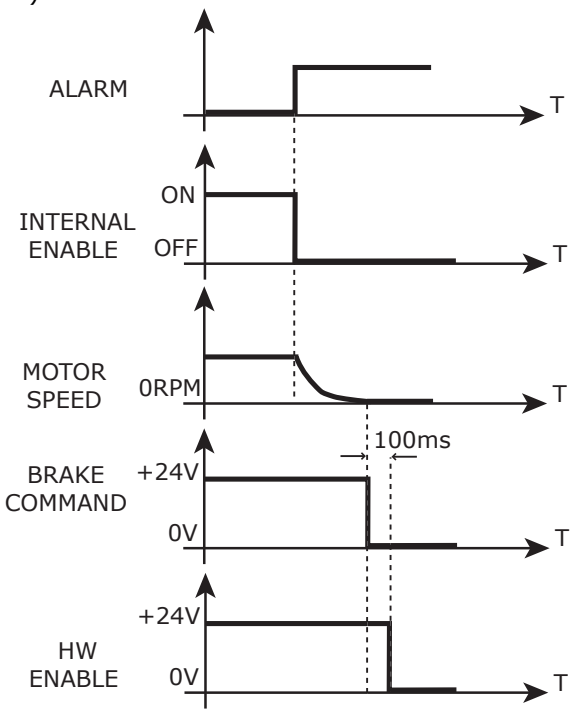
Case 3° (disable or not dangerous alarm):



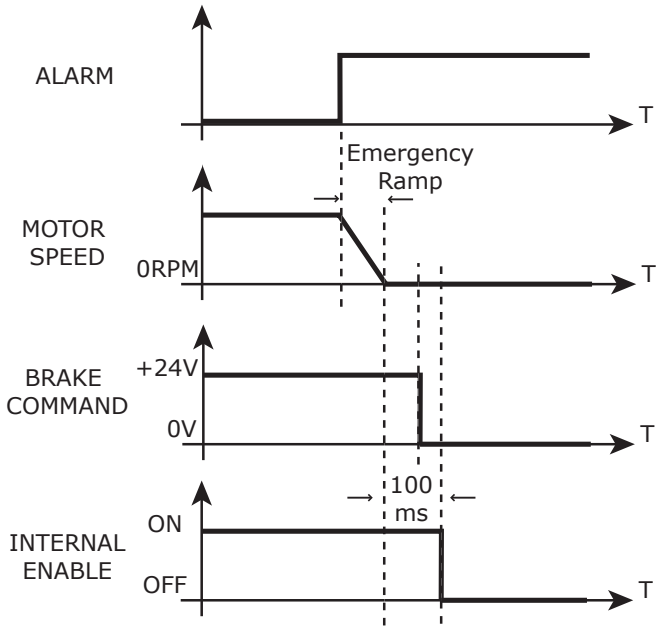
Case 3° (dangerous alarm):



Case 4° (disable or alarm):



Case 5° (disable or not dangerous alarm):



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