



System Directions Ltd.

DY4 PLUS

SOLID STATE BRAKE



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DY4 PLUS
SOLID STATE BRAKE
Instruction Manual
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1.0 DESCRIPTION

1.1 Overview

System Directions' DY4 Plus Series Electronic Motor Brakes provide a continuously controlled DC current to an AC induction motor to achieve rapid and smooth stopping. The unit has been designed as a stand-alone brake package to be used with across-the-line starters, or as an option to the electronic "soft starters". It may also be used with other reduced voltage starters, subject to compatibility of interlocks.

1.2 Standard Features

Universal Source Matching (USM™)

The DY4 Plus Brake can operate with any AC supply of 200 to 600 VAC, 45 to 65Hz, irrespective of phase rotation.

Current Controlled

The DY4 Plus Brake is designed with current feedback. This provides the same current and hence consistent braking torque, every time dynamic braking is applied, regardless of motor temperature.

Fully Automated Operation

When the motor "Stop" pushbutton is pressed, the motor contactor opens. The DY4 Plus senses this event and applies controlled DC current. When the motor reaches zero speed, the DY4 Plus senses this condition and removes the DC supply. The unit has a built-in "back-up timer" to the auto zero speed operation. This back-up timer adjustment can be used with the auto zero-speed sensing feature switched off to provide timed braking.

Full-Wave Half-Controlled Rectifier

The power unit consists of 4 conservatively rated SCR's connected as a full-wave rectifier with free-wheeling effect. This configuration provides the maximum DC braking current with a minimum of AC supply current.

Dual Connection

The DY4 Plus Brake can be used as a stand-alone brake when used with an electromechanical starter, or can be used as an add-on option to Solid State Starters.

Dual Stopping Mode

Auto Zero-Speed Stop

Auto Zero-Speed Stop is the standard mode of operation and automatically removes braking current as soon as zero speed is reached.

Timed Only Stop

Timed Only stop mode is provided for special applications. The DC injection brake is on for the adjustable time regardless of motor speed.

IMPORTANT: When ordered as an integrated option on solid state starter, all interlocking is automatic. When used as a "Stand Alone" add-on to other solid-state starters, extra interlocking may be required to prevent false trips.

2.0 SPECIFICATIONS

2.1 Electrical

Power

Single Phase, 200 to 600 volts, 45 to 65 Hertz (for a three phase supply), use L2 and L3.

Control

110 to 240 volts, 45 to 65 Hertz, 20 VA

Duty Cycle

One stop every 15 minutes at maximum current. Consult SDL for suitability of other duty cycles.

Operator Devices

No direct operator devices are required. (Ask about options)

Input Contacts

1 normally open auxiliary from the motor starter.

Output Contacts

Brake on - 1 NO/NC contact rated at 5 amps, 220 vac.

Auxiliary Inputs/Outputs

Zero speed detect inhibit input for timer operated braking. DB inhibit input to interrupt or preclude the braking cycle. Auxiliary start input to manually initiate the braking cycle.

Zero speed open collector, 24 vdc, 50 ma output.

Zero speed open collector, 24 vdc, 50 ms pulse output.

CAUTION: The DY4 Plus Brake unit is not designed as a holding brake. In case of any power interruption, loss of braking will occur immediately.

CAUTION: The zero speed outputs are not to be used as an indication that the motor is at rest.

Model	Recommend Maximum HP Rating					CURRENT Amps		Optional AC Line fuse rating Amps
	208V	230V	380/415	460V	575V	MIN	MAX	
DY4+15	3	5	7.5	10	15	6	30	30
DY4+40	10	15	25	30	40	16	80	60
DY4+75	20	25	50	50	75	30	150	100
DY4+125	40	50	75	100	125	50	250	200
DY4+180	60	75	125	150	200	75	360	250
DY4+250	75	100	150	200	250	100	500	350
DY4+350	100	150	250	300	350	150	700	400
DY4+480	150	200	350	400	500	200	960	600
DY4+720	250	300	500	600	700	300	1440	1000

NOTE: The table indicates Maximum recommended HP for general purposes use. Brakes may be re-rated for operation of larger or smaller motors, depending on application and duty cycle. Brakes may be derated for higher HP in specific applications by consulting factory.

2.2 Electrical Protection

Wiring Diagram

Refer to section 6.0 for wiring diagrams

Motor Overload

The DY4 Plus Brake does not provide motor overload protection, however, this can be provided as an option.

Short Circuit Protection

The NEC requires fusing of all motor branch circuits, however optional semi-conductor AC line fusing may enhance protection of the brake and starter.

2.3 Mechanical

This section intentionally left blank.

2.4 Adjustments

RV2 Current

This adjustment sets amount of DB current, over a 6:1 range. The braking torque is proportional to the square of the DC current. Typically, the DC current is set to 200% of the AC current rating of the motor. For example, for a motor rated at 120A, the DC current is set to 240ADC.

SW1-Zero Speed Dwell Time-Dip Switches

This setting, variable between 0.5 sec. and 7.5 sec. in 0.5 sec. increments, determines how long DB current continues to be applied after zero speed has been detected.

SW2 Back-up Timer Dip Switches

DB Time-Adjustable between 1 sec. and 255 sec. in 1 sec. increments. When zero speed is disabled, the DY4 Plus Brake will apply DC current to the motor for the time set by this adjustment.

When in the automatic zero speed sensing mode, DB time setting is a back-up only. DC current will be removed once the time set by this adjustment expires, regardless of the zero speed detector. Thus, it is important that the Back-up DB time setting be set at 5-10 seconds longer than the stopping time of the motor under DB conditions.

The timing starts when the M contactor opens (or soft starter is stopped). If the M auxiliary fails to open, braking is not applied.

P1 240V/480V Link

This link adjusts the response of the brake circuit to the decay of the residual motor voltage after AC power has been removed.

CAUTION: Excessive starts and stops will result in motor overheating. Customer must ensure that the duty imposed on the motor during starting and stopping is within the motor's thermal capability. (Ask about "watchdog" option).

3.0 RECEIVING & INSTALLATION

3.1 Installation

The cabinet containing the DY4 Plus Brake must be installed in an area where the following conditions exist:

- Ambient temperature does not exceed 40°C (104°F).
- Ambient temperature is not less than 10°C (50°F).
- Altitude above sea level is 3300 feet (1000m) or less.
- Ambient air is reasonably clean, dry and free of flammable or combustible vapors, steam or corrosive gases.

The cabinet must be installed away from any heat source and a minimum of 1 foot (30cm) is required around the air inlet and outlet, on ventilated units.

The DY4 Plus Brake has been designed for 50°C maximum inside the enclosure.

3.2 Derating Data

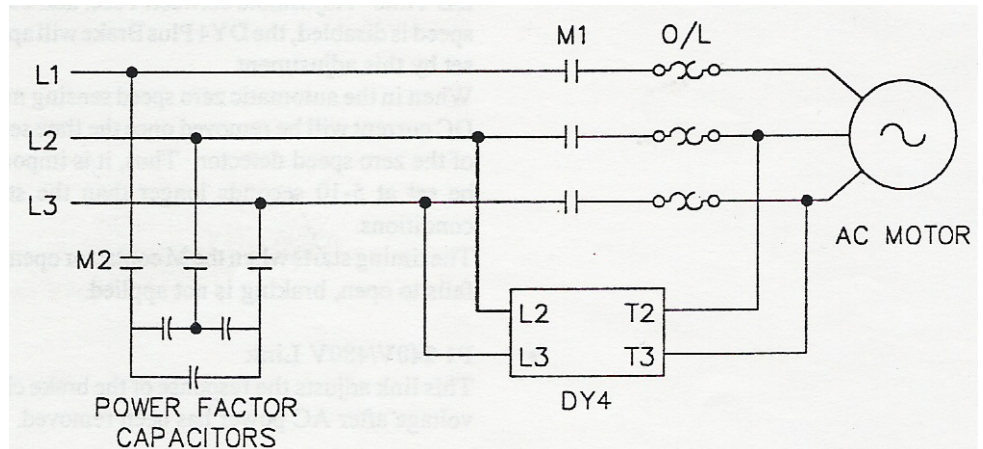
When the unit is installed in poor environmental conditions, it must be derated as follows:

- 1.5% per °C above 40°C, or 0.75% per °F above 104°F.
- 1% for every 100m above 1000m, or for every 300 feet above 3300 feet.

3.3 Wiring

The DY4 Plus Brake is to be connected according to applicable Electrical Codes in the customer's area. The chassis must be grounded to earth ground.

Power Factor Capacitor Connection

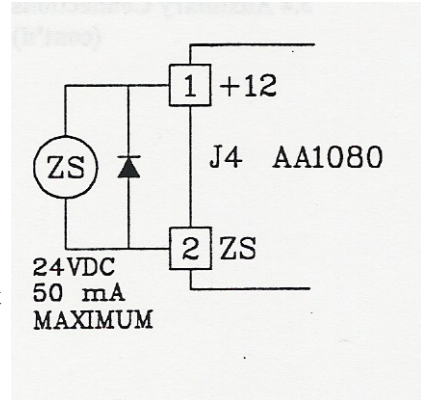


CAUTION: Power factors capacitors, when utilized, must be connected to the line side of the brake and never to the load side.

3.4 Auxiliary Connections

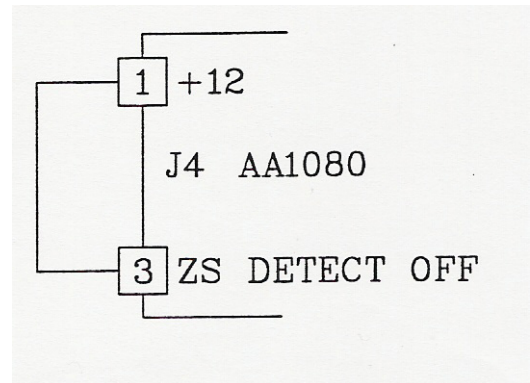
External Zero Speed Relay

A relay with a 24 volt DC coil connected as shown will be energized when zero speed is detected and will remain in that state until the starter auxiliary contact on terminals 5 and 6 (J3) are closed again.



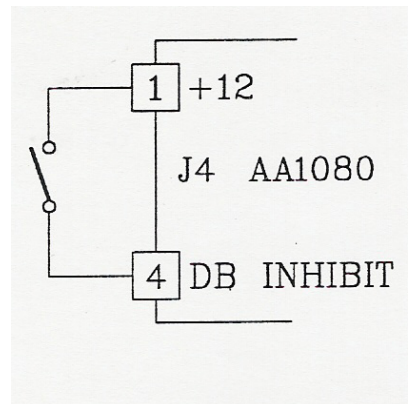
Zero Speed Detection Inhibit

To prevent the Zero Speed Detection circuit from operating, connect a wire jumper as shown. In this mode, braking timer is set by backup time switch S2.



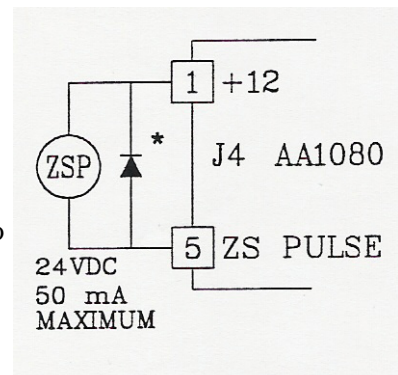
DB Inhibit

Braking current can be immediately interrupted by closing a normally open switch or contact connected as shown. The switch could, for example, be the N.O. contact of a thermal overload relay connected in the DC leg of the output T2. If the switch is opened before the backup timer expires, DB will reinitiate.



Zero Speed Pulse

A relay with a 24 volt DC coil connected as shown will be energized when zero speed is detected and will remain in that state until the braking current ceases. LED DS4 is also illuminated for this period of time. The length of the ZS pulse is determined by the setting of SW1 (see P6).

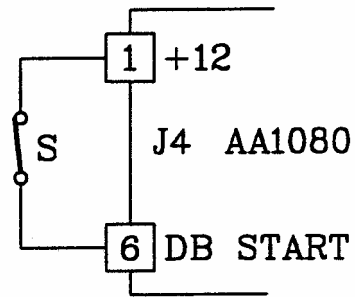


* A diode must be installed across the relay coil to

3.4 Auxiliary Connections (cont'd)

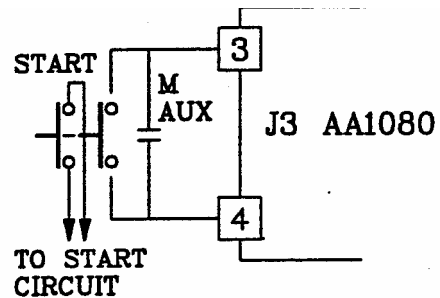
Auxiliary Start

When a normally closed switch connected as shown is opened and there is no voltage on terminals T2 and T3 (V and W) of the motor, the DB cycle starts.



Re-starting during the DB cycle

A two pole pushbutton connected as shown can be used to interrupt the braking current and restart the motor before zero speed has been reached. If the pushbutton is pressed and held for 2 seconds during the braking cycle, the DC current will be interrupted and the motor re-started.



4.0 START-UP**4.1 Inspection**

Insure that the brake has been installed according to the previous guidelines. Also, ensure that the unit has been wired according to the schematics. Check that all connections are tight. Check that the motor can rotate freely.

4.2 Pre-Start adjustments

Before power is applied to the brake, the following settings should be made:

P1 Setting

AC Supply Voltage	P1 Setting
200 - 370 VAC	240V
380 - 600 VAC	480V

RV2 Current

Fully counter-clockwise (CCW). Minimum braking current.

SW1 Dwell time

Set to 0.5 seconds. Set SW1-1 to ON and SW1-2,3,4 to OFF.

SW2 Backup time

Set to 32 seconds. Set SW2-1,2,3,4,5,7,8 to OFF and SW2-6 to ON.

Use a DC clamp-on ammeter around the wire connected to motor terminal T2. An AC meter in the output circuit will not read properly and if used on either L1 or L2 will only indicate approximately 50% of the DC current.

Temporarily connect a single pole toggle switch between terminals J4-1 and J4-4 to inhibit braking current in case of emergency. Set the switch to the open position.

4.3 Starting**Power-up**

Once the brake has been checked and set up, it is ready for power. Check that all personnel are clear of the brake and motor, then apply power. +12VLED DS3 must be illuminated. If it is not see p.11.

Starting

Press the Start pushbutton and check that the motor accelerates to full speed. MOTOR RUNNING LED DS1 will illuminate. If not see troubleshooting p11.

Stopping

Press the Stop pushbutton. MOTOR RUNNING LED DS1 will go off and DB ON LED DS2 will illuminate.

CAUTION: There is a shock hazard present even when the motor brake/starter is Off.
CAUTION: Do not interrupt the AC supply to the brake during the brake cycle.
DAMAGE TO THE SCR'S COULD RESULT.

4.3 Starting (cont'd)

When the motor reaches full stop, the DC supply will be removed immediately by the DY4 Plus zero speed sensing circuit. This is indicated by a zero speed pulse on LED DS4 "ZS Pulse". If the unit fails to sense zero speed, momentarily close the "DB Inhibit" switch to turn-off the brake unit.

If the current setting is not completed on the first attempt, open the inhibit switch and repeat the above two steps after waiting for a suitable time as determined by the duty cycle rating (see Duty cycle. P4).

The "Back-up timer" adjustment (SW2) must be set to match the actual stopping time plus 5 to 10 seconds. If the Back-up timer adjustment is set too low, the braking action will be removed before the motor reaches zero speed. For example, if the actual stopping time is 15 seconds, set SW2 between 20 and 25 seconds.

With some motors, the unit may not reliably detect zero speed. In such cases the brake will have to be operated in the Timed Only mode. To defeat the zero speed detector, connect a wire jumper between terminals J4-1 and J4-3 and set SW2 time to just slightly greater than the actual stopping time.

5.0 TROUBLE SHOOTING

5.1 Diagnostics

The DY4 Plus has several LED indicated for quick and simple diagnosis of the Brake status. In all cases an illuminated LED indicates that the labeled function is present or active.

+12 LED

This LED indicates the status of the internal +12 volt power supply. It is on when 120 VAC control voltage is present. All other LED's will be off if this LED is off. If this LED is off, check the 120 VAC supply across 1 and 2 on the control card terminal block. If it is ok, check the fuse on the control card. If both are ok, then change the DY4 Plus Control Module (P/N AA01-10).

Motor Running LED

This LED indicates the status of the starter auxiliary contact connected across terminals 3 and 4. The LED will be ON when the contact is closed. Indicating that the starter is energized and will remain on until the starter is deenergized. If this LED does not light when the starter has been activated, check the operation of the contact by measuring the DC voltage across terminals 3 and 4. If the voltage is below 2 volts, replace the cards. If the voltage is 2 volts or above, check the auxiliary contact and wiring.

DB on LED

This LED indicates the presence of the DC output of the Brake. This LED should turn on shortly after the starter is deactivated the “Motor Running” LED goes out. It should stay on during the braking cycle and go out only after zero speed has been sensed and/or the backup timer has elapsed. If this LED fails to illuminate after the “Motor Running” LED goes out, check to ensure that the backup timer (SW2) is not set too short. Otherwise replace the cards.

ZS pulse LED

This LED indicates that the brake has sensed zero speed. This LED should turn on shortly after the motor stops rotating and will remain on for the “Zero Speed Dwell Time” set by SW1. If the Brake does not sense zero speed this LED will not illuminate, however braking action will still be terminated by the backup timer. If this LED fails to illuminate at zero speed, check the T1 (zero speed sensing) lead from the motor for continuity. If this fails, consult the factory.

**7.0 DIMENSIONS &
WEIGHTS**

SIZE	DIMENSIONS	CHASSIS
15 & 40	H x W x D inches	9.5 x 6.25 x 5.25
	H x W x D mm	24.1 x 159 x 133
	Lbs* / Kg.*	7 lbs. 3.2 Kg
75	H x W x D inches	10 x 7.5 x 6
	H x W x D mm	254 x 190 x 152
	Lbs* / Kg.*	8 lbs 3.6 Kg
125	H x W x D inches	13 x 7.5 x 7
	H x W x D mm	330 x 190 x 178
	Lbs* / Kg.*	17 lbs 7.7 Kg
180	H x W x D inches	13 x 7.5 x 8.25
	H x W x D mm	330 x 190 x 210
	Lbs* / Kg.*	19 lbs 8.6 Kg
250	H x W x D inches	13 x 7.5 x 7
	H x W x D mm	330 x 190 x 178
	Lbs* / Kg.*	20 lbs 9.1 Kg
350	H x W x D inches	12 x 13 x 11
	H x W x D mm	305 x 330 x 279
	Lbs* / Kg.*	33 lbs 15 Kg
480	H x W x D inches	12 x 13 x 11
	H x W x D mm	305 x 330 x 279
	Lbs* / Kg.*	35 lbs 15.9 Kg
720	H x W x D inches	20 x 17 x 12.5
	H x W x D mm	508 x 432 x 317
	Lbs* / Kg.*	54 lbs 24.5 Kg

8.0 SPARE PARTS

SIZE	PART NUMBER	DESCRIPTION	QTY USED	QTY SUGG	PRICE
15	AA01-10 ⁽¹⁾	DY4 Plus Control Module	1	1	Contact System Directions for Current Pricing
	100-0034-01	Snubber/Surge Absorber	1	1	
	N10SP03A	SCR Module	2	1	
	T5004-01	Current Transformer 1500:1	1	1	
40	AA01-10 ⁽¹⁾	DY4 Plus Control Module	1	1	
	100-0034-01	Snubber/Surge Absorber	1	1	
	N10SP03A	SCR Module	2	1	
	T5004-01	Current Transformer 1500:1	1	1	
75	AA01-10 ⁽¹⁾	DY4 Plus Control Module	1	1	
	100-0034-01	Snubber/Surge Absorber	1	1	
	N10SP06A	SCR Module	2	1	
	T5004-01	Current Transformer 1500:1	1	1	
125	AA01-10 ⁽¹⁾	DY4 Plus Control Module	1	1	
	100-0034-01	Snubber/Surge Absorber	1	1	
	N20SP10	SCR Module	2	1	
	T5003-02	Current Transformer 5000:1	1	1	
180	AA01-10 ⁽¹⁾	DY4 Plus Control Module	1	1	
	100-0034-01	Snubber/Surge Absorber	1	1	
	N20SP08	SCR Module	2	1	
	T5003-02	Current Transformer 5000:1	1	1	
250	AA01-10 ⁽¹⁾	DY4 Plus Control Module	1	1	
	100-0034-01	Snubber/Surge Absorber	1	1	
	N20SP08	SCR Module	3	1	
	T5003-02	Current Transformer 2500:1	1	1	
350	AA01-10 ⁽¹⁾	DY4 Plus Control Module	1	1	
	100-0034-01	Snubber/Surge Absorber	1	1	
	N20SP08	SCR Module	4	2	
	T5003-03	Current Transformer 5000:1	1	1	

SYSTEM DIRECTIONS

SIZE	PART NUMBER	DESCRIPTION	QTY USED	QTY SUGG	PRICE
480	AA01-10 ⁽¹⁾	DY4 Plus Control Module	1	1	Contact System Directions for Current Pricing
	100-0034-01	Snubber/Surge Absorber	1	1	
	N716452	SCR Module	4	2	
	T5003-04	Current Transformer 8500:1	1	1	
720	AA01-10 ⁽¹⁾	DY4 Plus Control Module	1	1	
	100-0034-01	Snubber/Surge Absorber	1	1	
	N719122	SCR Module	4	2	
	T5003-04	Current Transformer 8500:1	1	1	

(1) Original burden resistor (R13) must be reused on the replacement control card.

(2) Prices and Specifications subject to change.

DY4 PLUS STAND ALONE BRAKE					
CT Ratio*	R13	DY4 Plus Size	SCR Type	Qty	FU4 & FU5
1500:1	200	15	N10SP03A	2	30A
1500:1	150	40	N10SP03A	2	60A
1500:1	82	75	N10SP06A	2	100A
2500:1	82	125	N20SP10	2	200A
2500:1	56	180	N20SP08	2	250A
2500:1	56	250	SKKT330/18E	2	400A
5000:1	47	350	N28452	4	600A
5000:1	47	480	N716452	4	800A
8500:1	47	720	N719122	4	1400A

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