SAFTRONICS

IINSTRUCTION MANUAL

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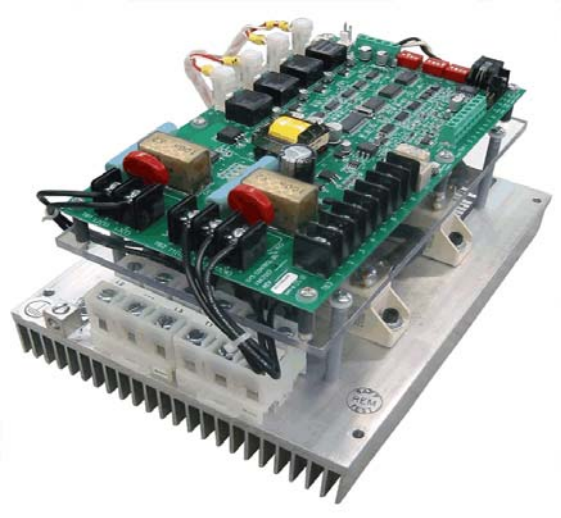
DY5
Solid State
Brake Manual



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CAUTION ! Loss or interruption of line voltage during braking will result in damage to the brake

1.0 DESCRIPTION

1.1 Overview

The **Saftronics *DY5*** 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 ***Saftronics Solid State Starter**. It may also be used with other reduced voltage starters, subject to compatibility of interlocks. The ***DY5*** also has the capability to be programmed by the user allowing most functions to be tuned to a particular application. This is covered in detail in the **Appendix : *DY5 Configuration Software*** section.

1.2 Standard Features

Universal Source Matching (USM™)

The ***DY5*** Brake can operate with any **AC** supply of **200 to 600 VAC**, **45 to 65 Hz**, irrespective of phase rotation.

Current Controlled

The ***DY5*** Brake is designed with current feedback. This provides the proper current, and hence consistent braking torque, every time dynamic braking is applied, regardless of motor temperature.

Fully Automated Operation

When the motor **"STOP"** push-button is pressed, the motor contactor opens. The ***DY5*** senses this event and applies controlled **DC current**. When the motor reaches zero speed, the ***DY5*** senses this condition and removes the **DC** supply. The unit has a built-in **"backup timer"** to the auto zero speed operation. This backup 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 **SCRs'** connected as a full-wave rectifier with free-wheeling effect. This configuration provides the maximum **DC** braking current with a minimum **AC** supply current.

Dual Connection

The ***DY5*** 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 the ***Saftronics Solid State Starter**.

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 an adjustable time regardless of motor speed.

*** Softstart must be fully controlled 6 SCR type. If a 2 leg controller is used (CSX/CSX) , it must have a properly sequenced isolation contactor.**

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

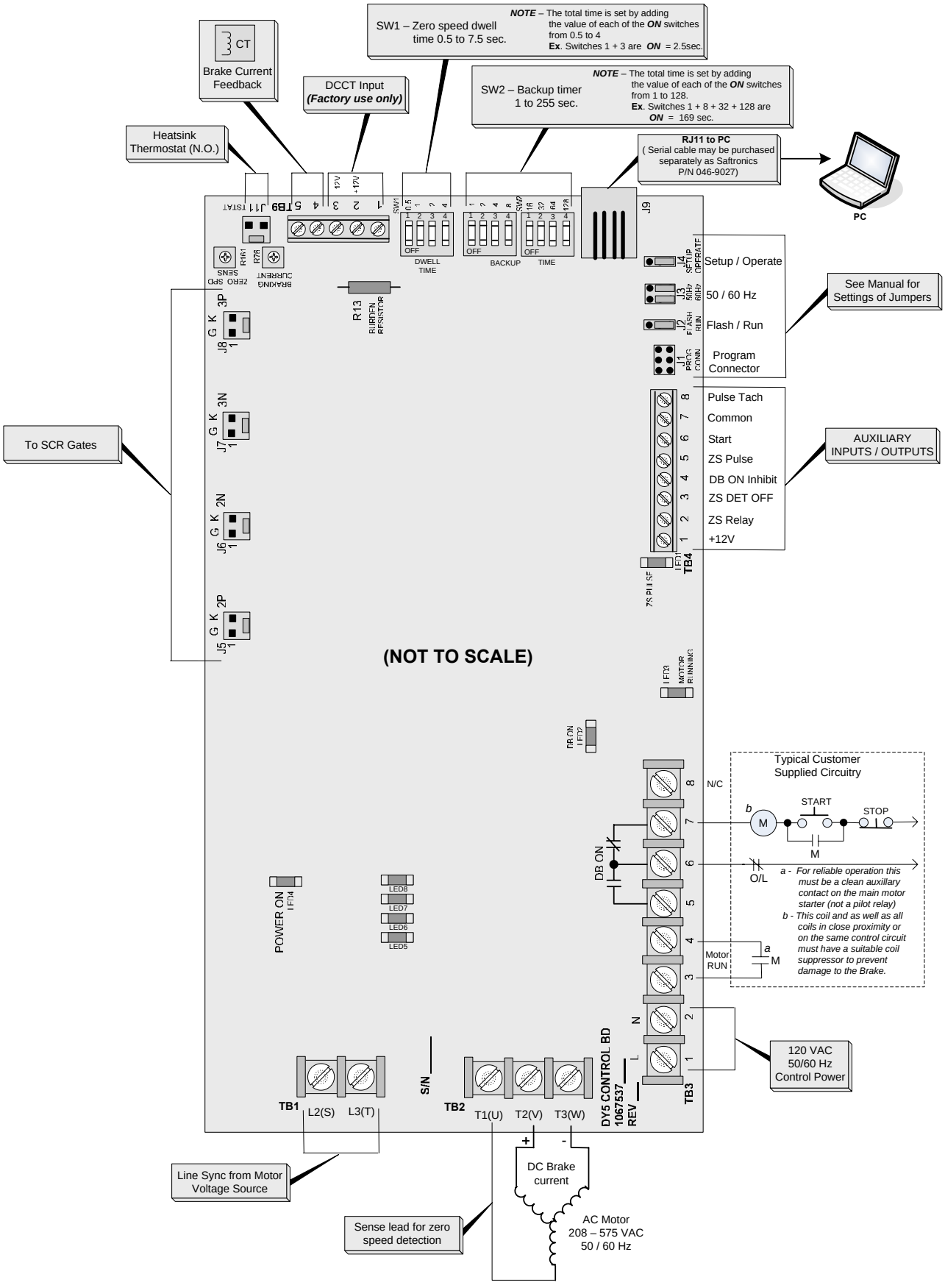


Fig. 1 DY5 CONTROL BOARD (P/N 1067538)

2.0 SPECIFICATIONS (Refer to Fig. 1)

2.1 Electrical

Power

Single phase, 200 to **600 Volts, 45** to **65 Hz** ***(for a three phase supply, use L2 and L3 or S and T).***

Control

120 VAC, 45 to **65 HZ, 20 VA**

Duty Cycle

One 30 second stop every **15 minutes** ***at maximum current***. Consult factory for suitability of other duty cycles.

Operator Devices

No direct operator devices are required.

Input Contacts

(1) normally open auxiliary from the motor starter. This must be a ***clean standard auxiliary*** contact on the main motor starter. ***Use of pilot relays or dirty auxiliary contacts may result in improper operation, and damage to the brake or other equipment.***

Output Contacts

Brake On – **(1) NO/NC contact** rated at **5 AMPS, 250 VAC.**

Auxiliary Inputs/Outputs (TB4)

TB4 – 2 Zero speed relay

TB4 - 3 Zero speed detect inhibit input for timer operated braking.

TB4 - 4 DB inhibit input to interrupt or preclude the braking cycle.

TB4 – 5 Zero speed open collector, **24 VDC, 50 mA pulse output**.

TB4 – 6 Auxiliary start input to manually initiate the braking cycle.

TB4 – 8 Pulse Tach input for zero speed detect, software selectable. (See **Appendix :** ***DY5 Configuration Software*** section)

Table 1

Model DY5	Recommended Maximum HP Rating					Current Amps		Option AC Line Fuse Rating Amps
	208V	230V	380 / 415V	460V	575V	MIN	MAX	
15	3	5	7.5	10	15	6	30	30
40	10	15	25	30	40	16	80	60
75	20	25	50	50	75	30	150	100
125	40	50	75	100	125	50	250	200
180	60	75	125	150	200	75	360	250
780	150	200	350	400	500	200	960	600
720	250	300	500	600	700	300	1440	1000

NOTE: **Table 1 indicates *Maximum* recommended HP for general purpose use. Brakes may be re-rated for operation of larger or smaller motors, depending on application and duty cycle. Brakes may be de-rated for higher HP in specific applications by consulting factory.**

CAUTION: The DY5 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.

2.0 SPECIFICATIONS (con't)

2.2 Electrical Protection

Wiring Diagrams

Refer to **Fig.2** for a typical wiring diagram.

Motor Overload

The ***DY5*** 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 semiconductor **AC** line fusing may enhance protection of the brake and starter.

2.3 Mechanical

This section intentionally left blank.

2.4 Adjustments

R76 - Braking 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 **240A**.

R161 - Zero Speed Sensing

This adjustment determines the point at which the braking current is turned off (zero speed detection).

SW1 - Zero Speed Dwell Time - Dip Switches

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

SW2 - Backup Timer - Dip Switches

When zero speed is disabled, the ***DY5*** Brake will apply **DC current** to the motor for the time set by **SW2**. The time can be set between **1 sec**. and **255 sec**. in **1 sec**. increments.

When in the automatic zero speed sensing mode, the **DB** time setting is a backup 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 backup **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 starter is stopped). If the **M auxiliary** fails to open, braking is not applied.

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.

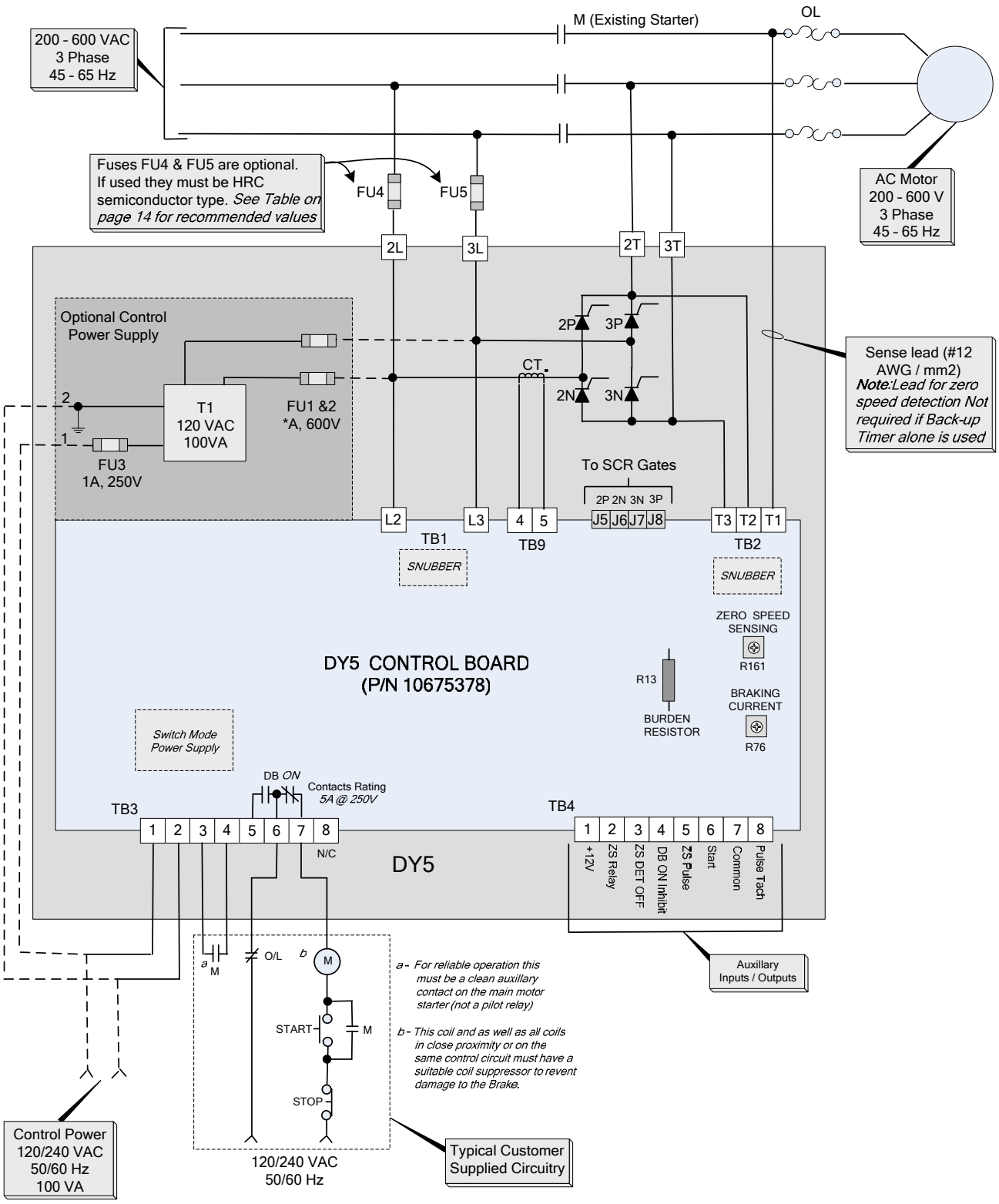


Fig. 2 DY5 Typical Wiring Diagram

3.0 RECEIVING AND INSTALLATION

3.1 Installation

The cabinet containing the ***DY5*** 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* 0°C (32°F) @ 95% R.H. non-condensing.**

***Altitude above sea level is* 3300 feet (1000 m)** or less.

Ambient air is reasonable 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 (30 cm)** is required around the air inlet and outlet, on ventilated units.

The *DY5* Brake has been designed for 50°C maximum inside the enclosure.

3.2 De- rating Data

When the unit is installed in poor environmental conditions, it ***must be de-rated*** as follows:

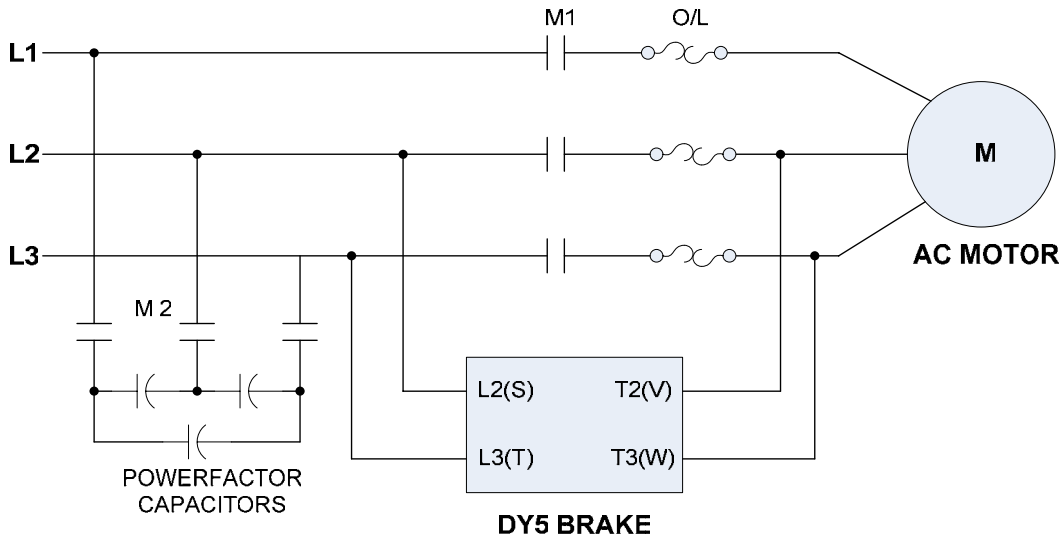
1.5% per **°C** above **40°C,** or **0.75%** per **°F** above **104°F.**

1% for every **100 m** above **1000 m**, or for every **300 feet** above **3300 feet.**

3.3 Wiring

The ***DY5*** Brake is to be connected according to the **NEC** and any other applicable **Electrical Codes** in the customer's area. ***The chassis must be grounded to earth ground.***

Power Factor Capacitor Connection



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

Suppression of Inductive AC Loads

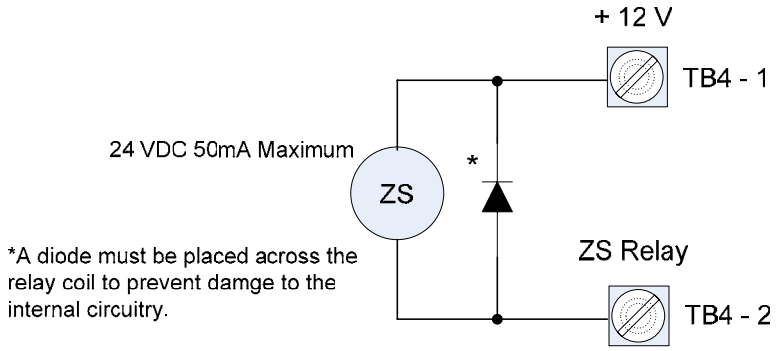
All Inductive **AC** Loads (contactors, relay or solenoid coils) in close proximity, or on the same **120V** source must utilize **R-C Snubbers** to suppress inductive voltage spikes caused by de-energizing these loads. ***Failure to suppress these spikes may cause improper operation to damage the brake or other components.***

3.0 RECEIVING AND INSTALLATION (con't)

3.4 Auxiliary Connections

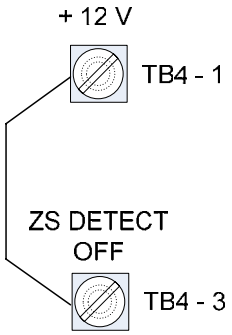
External Zero Speed Relay

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 **M** on terminals **TB3-3** and **TB3-4** is closed again.



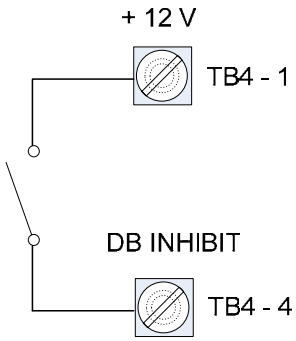
Zero Speed Detection Inhibit

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



DB Inhibit

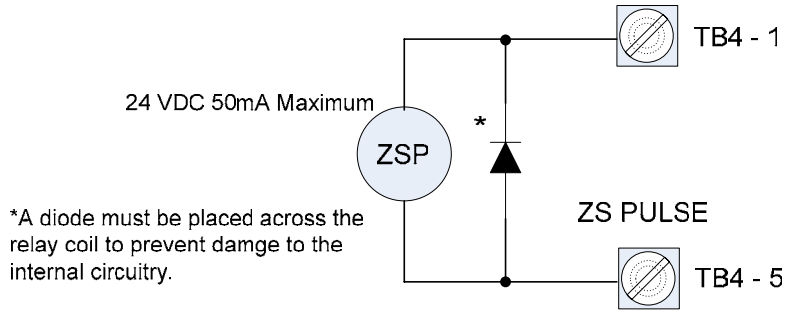
Braking current can be immediately interrupted by closing a normally open switch or contact connected as shown. The switch could, for example, be the **N.O.** contact of a thermal overload relay connected in the **DC** leg of the output **T2**. If the switch is opened before the backup timer expires,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



3.0 RECEIVING AND INSTALLATION (con't)

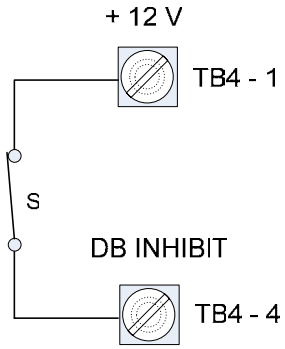
Zero Speed Pulse

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 1 (ZS pulse** is also illuminated for this period of time. The length of the **ZS** pulse is determined by the setting of **SW1** (see Page 6).



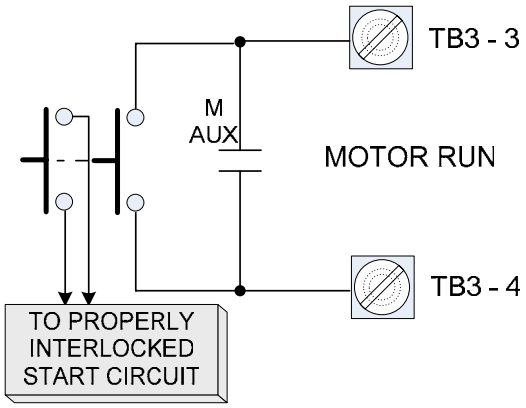
Auxiliary Start

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 push-button connected as shown can be used to interrupt the braking current and restart the motor before zero speed has been reached. If the push-button is pressed and held for **2 seconds** during the braking cycle, the **DC current** will be interrupted and the motor restarted.



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 braking cycle. Damage to the SCR's could result.

4.0 START-UP

4.1 General

Ensure that the brake has been installed according to the previous guidelines. Also, ensure that the unit has been wired in accordance with all applicable codes and diagrams. Check that all connections are secure, and that the motor can rotate freely.

One of the main settings in the initial set-up is zero speed detection tuning, which can be implemented in one of two ways. A pulse tach feedback which may be selected in software (**Appendix B : *DY5 Configuration Software***) or more commonly, a zero speed adjustment potentiometer, which is the default setting. The following procedure is based on the latter.

Before power-up, the following initial settings and connections should be made:

4.2 Pre-Start Settings

R76 - Braking Current

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

R161 - Zero Speed Sensing

Fully counter-clockwise (CCW). Minimum level.

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 **255 seconds**. (Set **SW1-1,2,3,4,5,6,7& 8** to **ON)**

Use a **DC clamp-on ammeter** around the wire connected to motor terminal **T2(V).** An **AC meter** will not read properly. Temporarily connect a single pole toggle switch between terminals **TB4-1** and **TB4-4** to inhibit braking current in case of emergency. Set the switch to the **open** position.

Connect a voltmeter between terminals **TB4-1** (positive) and **TB4-2** (negative) set to a scale suitable for measuring **24VDC**. A **24V** lamp can be used in place of the voltmeter.

Connector & Jumpers J1, J2, J3 & J4

J1 - *Programming Connector* is for factory use only.

J2 – *Flash / Run* jumper is used in conjunction with **J1** to load firmware at the factory. This jumper must be in the **RUN** position for proper operation.

J3 - *50 / 60 Hz* must be set to the correct value. ***Failure to do so will result in incorrect timing values*** with the ***DY5***.

J4 - ***Setup / Operate*** must be in the **OPERATE** position for the ***DY5*** to operate as a brake. For further information on **J4** refer to:

Appendix B : *DY5 Configuration Software* section of this manual.

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, **POWER ON LED 4** must be illuminated. If it is not, see troubleshooting Page 13.

Starting

Press the **START** push-button and check that the motor accelerates to full speed. **MOTOR RUNNING LED 3** will illuminate. If not, see troubleshooting Page 13.

Zero Speed Detection Tuning

After the confirming the motor is operational, initiate a braking cycle. Press the **STOP** push-button. **MOTOR RUNNING LED 3** will go off and **DB ON LED 2** will illuminate. The voltmeter connected to **TB4** should read approximately **0** volts. As the braking cycle begins, **DC** current will start to flow in the motor. As the motor is braking, adjust **R78 (BRAKING CURRENT)**, to obtain a **DC current** of approximately ***twice*** the motor **FLA** using the DC clamp-on ammeter. The motor will decelerate towards stop (if it does not appear to be stopping fast enough, increase the braking current by turning the **R76 Braking Current** pot clockwise). When the motor shaft reaches zero speed, slowly rotate the **Zero Speed Sensing** pot **R161** clockwise until the voltmeter shows a transition value close to **24V** (the lamp, if used, will illuminate).

Test the zero speed detection by restarting the motor and initiating another braking cycle. When the motor gets near zero speed the voltmeter should indicate **24V** (the lamp, if used, will illuminate). In most instances it may be desirable have the ***DY5*** detect zero speed while the motor shaft is still rotating at a slow speed. This will help to insure the ***DY5*** will positively detect zero speed, thereby turning the brake current off. Any remaining motion can be brought to a complete stop using ***dwell*** which is a time based function.

Once the zero speed detection feature of the ***DY5*** has been set, be sure to set the backup time to an appropriate value for the application The **"Backup Timer"** adjustment **SW2** must be set to match the actual stopping time plus **5** to **10 seconds.** If the backup 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 **TB4-1** and **TB4-3** (see Pg.9) and set **SW2** time to just slightly greater than the actual stopping time.

Once proper braking action has been achieved, record the **DC current**, **DB time setting** and **actual stopping time** on the inside of the panel door. Remove the **DC ammeter, DC voltmeter** and **DB inhibit switch**. The brake is now ready for operation.

5.0 TROUBLESHOOTING

5.1 Diagnostics

The ***DY5*** has several **LED indicators** for quick and simple diagnosis of the **Brake** status. In all cases an illuminated **LED** indicates that the labeled function is present or active.

Power On LED 4

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 **TB3**. If it is present, then ***replace*** the ***DY5*** **Control Board (P/N 1067538).**

Motor Running LED 3

This **LED** indicates the status of the starter auxiliary contact connected across terminals **3** and **4** of **TB3**. The **LED** will be ***ON*** when the contact is closed, indicating that the starter is energized, and will remain ***ON*** until the starter is de-energized. 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*** **Control Board (P/N 1067537)**. If the voltage is **2 volts** or above, ***check the auxiliary contact and wiring***.

DB On LED 2

This **LED** indicates the presence of the **DC** output of the brake. This **LED** should turn ***ON*** shortly after the starter is deactivated and the **"Motor Running" LED 3** goes ***OUT***. It should stay ***ON*** during the braking cycle and go ***OUT*** only after zero speed has been sensed or the backup timer has elapsed. If this **LED** fails to illuminate after the **"Motor Running" LED 3** goes ***OUT***, check to ensure that the backup timer **SW2** is not set too short. Otherwise ***replace*** the ***DY5*** **Control Board (P/N 1067538).**

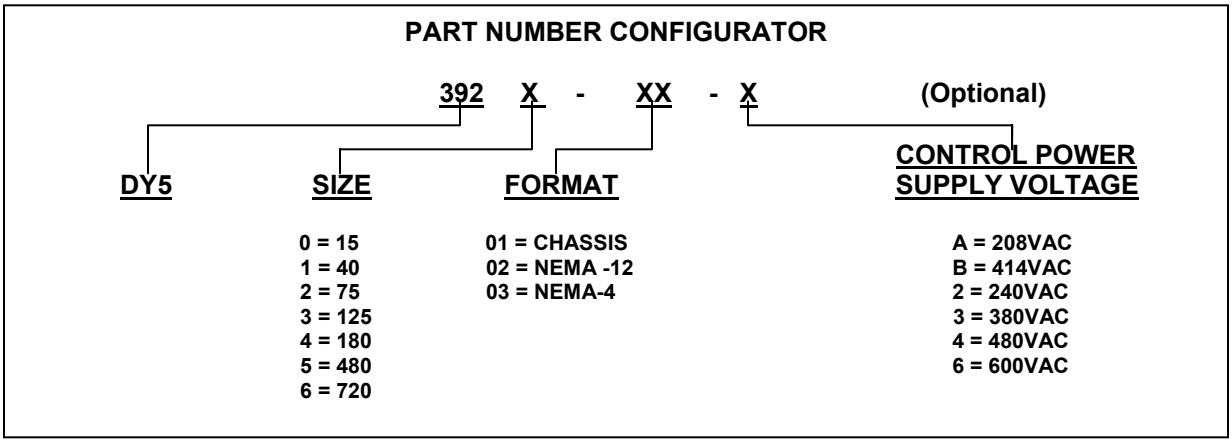
ZS Pulse LED 1

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 1** ***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** lead ***(zero speed sensing)*** from the motor for continuity and proper connection. If this fails, ***consult the factory.***

LEDs' 5 ***thru*** **8**

These **LEDs'** are used for internal troubleshooting and are for ***factory service only.***

6.0 PART NUMBER CONFIGURATOR & PART NUMBERS



7.0

DY5 STAND ALONE BRAKE								
CT RATIO *	R13 Ω	PART NUMBER			DY5 SIZE	SCR TYPE	QTY	FU4 & FU5
		N4	N12	CHASSIS				
1500 : 1 (x2 Turns)	200	3920-03	3920-02	3920-01	15	N10SP03	2	30A
1500 : 1	150	3921-03	3921-02	3921-01	40	N10SP06S	2	60A
1500 : 1	82	3922-03	3922-02	3922-01	75	N10SP06S	2	100A
2500 : 1	82	3923-03	3923-02	3923-01	125	N20SP10S	2	200A
2500 : 1	56	3924-03	3924-02	3924-01	180	N20SP08S	2	250A
5000 : 1	47	3925-03	3925-02	3925-01	480	N716452	4	600A
8500 : 1	47	3926-03	3926-02	3926-01	720	N719122	4	1000A

DIMENSIONS AND WEIGHTS

SIZE	DIMENSIONS	CHASSIS	NEMA12
15 & 40	H x W x D in.	9.5 x 6.25 x 5.25	16 x 14 x 10
	H x W x D mm	241 x 159 x 133	406 x 356 x 254
	Lbs. Kg.	7 Lbs. 2.3 Kg.	27 Lbs. 12.2 Kg.
75	H x W x D in.	10 x 7.5 x 6	16 x 14 x 10
	H x W x D mm	254 x 190x 152	406 x 356 x 254
	Lbs. Kg.	8 Lbs. 3.6 Kg.	28 Lbs. 12.7 Kg.
125 & 180	H x W x D in.	13 x 7.5 x 7	24 x 20 x 12
	H x W x D mm	330 x 190 x 178	609 x 508 x 304
	Lbs. Kg.	17 Lbs. 7.7 Kg.	72 Lbs. 32.7 Kg.
480	H x W x D in.	15.25 x 14 x 10	30 x 24 x 16
	H x W x D mm	387 x 356 x 254	762 x 609 x 406
	Lbs. Kg.	35 Lbs. 15.9 Kg.	115 Lbs. 52.2 Kg.
720	H x W x D in.	20 x 17 x 12.5	36 x 30 x 16
	H x W x D mm	508 x 432 x 317	914 x 762 x 406
	Lbs. Kg.	54 Lbs. 24.5 Kg.	175 Lbs. 80 Kg.

8.0 SPARE PARTS

SIZE	PART NUMBER	DESCRIPTION	QUANTITY USED	QUANTITY SUGGESTED
15	1067538 (1)	DY5 Control Board	1	1
	N10SP03	SCR Module	2	1
	T5004-01	Current Trans. 1500:1	1	1
40	1067538 (1)	DY5 Control Board	1	1
	N10SP06S	SCR Module	2	1
	T5004-01	Current Trans. 1500:1	1	1
75	1067538 (1)	DY5 Control Board	1	1
	N10SP06S	SCR Module	2	1
	T5004-01	Current Trans. 1500:1	1	1
125	1067538 (1)	DY5 Control Board	1	1
	N20SP10S	SCR Module	2	1
	T5003-02	Current Trans. 2500:1	1	1
180	1067538 (1)	DY5 Control Board	1	1
	N20SP08S	SCR Module	2	1
	T5003-02	Current Trans. 2500:1	1	1
480	1067538 (1)	DY5 Control Board	1	1
	N716452	SCR Module	4	2
	T5003-03	Current Trans. 5000:1	1	1
720	1067538 (1)	DY5 Control Board	1	1
	N719122	SCR Module	4	2
	T5003-04	Current Trans. 8500:1	1	1

(1) The original burden resistor ***(R13)*** must be reused on the replacement **Control Board.**
(2) Prices and specifications subject to change without notice.

Appendix: DY5 Configuration Software

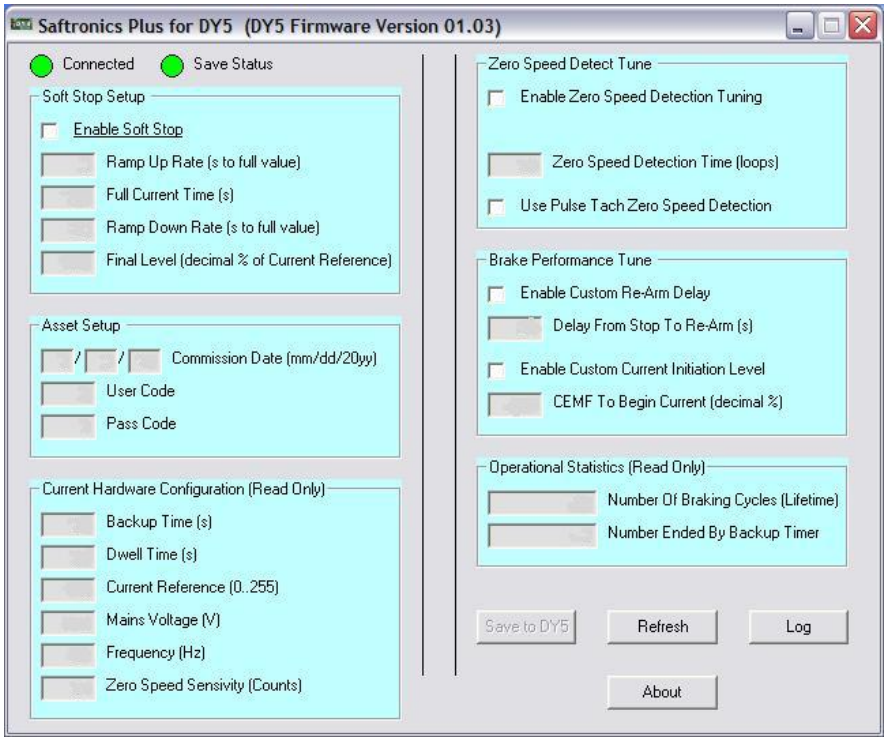
A. Overview and Initial setup

Saftronics *DY5 Configuration Software* for the ***DY5*** Brake is a configuration tool designed to enhance the ***DY5*** **DC braking module** by allowing the user to tune most functions to a particular application. It is a ***32 bit Windows*** application which will run on nearly all platforms using ***Windows 98 or higher***. The only significant requirement is that the computer must have an unused serial port configured as **COM1**.

The ***DY5 Configuration Software*** file may be downloaded from the internet by going to **www.saftronics.com > Soft Starter > DY5 Brake**. After the file has been successfully downloaded execute the program **Startup** which will guide you through the setup process. In most instances you will not have to change any of the setup defaults.

Once the software has been installed, connect a ***serial cable***, the **DB9M** connector to the computer's serial port **COM1** and the **RJ45** connector to the ***DY5*** control board at terminal **J9**. (The serial cable can be user supplied or it may be purchased from Saftronics as **P/N 046 – 9027**). To enable communications with the ***DY5***, place the jumper labeled **setup/operate J4** in the **SETUP** position (shorting the two pins furthest from the edge of the board).

Once the cable and jumper have been installed, you can start the program. If you installed the program using the setup defaults, you will find it on the **"Start"** menu under **"Programs" > "Saftronics Applications" > "DY5".** Launching the program will bring up the main screen as shown below.



After the program has started, apply ***120V*** power to **TB3-1** and **TB3-2** of the ***DY5*** control board. The data fields will remain "grayed" until the ***DY5*** begins to communicate with the computer. This may take up to 3 seconds. There is no need to set the ***baud rate or communications parameters***, as the software is dedicated to the ***DY5***.

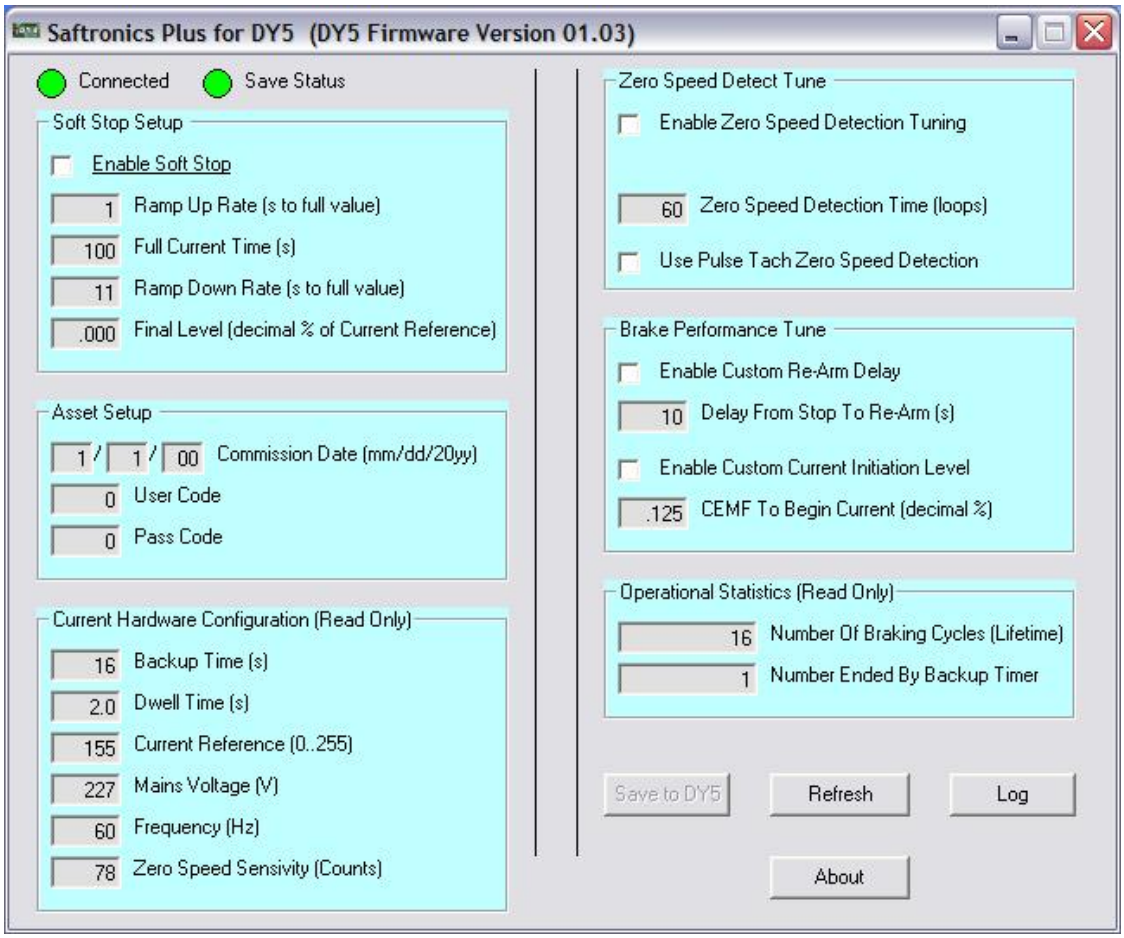
If communication is not established after a few seconds, take the following troubleshooting steps. First, confirm the blue "**power on" LED 1** is illuminated on the ***DY5*** control board. If it's not, the board is not powered.
Next, confirm the integrity of the serial cable ensuring that the pin-outs are correct and that both ends are firmly connected. Finally, confirm that your computer's communications port is unused and configured as **COM1**.

This can be done using the **Windows "control panel"**. Open "**control panel"** and double click the **"system"** icon. Next, select either the **"device manager"** tab ***Windows 98*** or the **"hardware"** tab then the **"device manager"** button in ***Windows 2000/XP***. Finally, locate the item called **"Ports (COM & LPT)"**. Click the **"+"** to the right of the icon to expand the list of available ports. If you see a port labeled **"Communications Port (COM1)"** your computer is properly configured. If you don't see any **COM** ports listed, or the number is something other than **COM1**, refer to your computer documentation for instructions on adding or configuring **COM** ports.

It's important to note that the ***DY5*** has two different operating modes controlled by the position of the **setup / operate jumper J4**. In **setup** mode, the ***DY5*** can communicate with a computer and send and store information. It ***cannot*** operate as a brake while in **setup** mode. In **operate** mode, the ***DY5*** operates as a **DC** braking module, but ***cannot*** communicate with a computer (even if the cable is connected, and the computer is running the software). Changing the position of the **setup / operate** jumper while the ***DY5*** is powered, while safe, ***will not*** cause the unit to change modes. The ***DY5*** must be powered down, and then restarted to effect a mode change. The ***DY5*** will assume whatever mode is requested by the **setup / operate** jumper at the time power is applied to the unit.

B. Running the *DY5* Configuration Software

Once Communications is established the screen will look like this (your screen may differ slightly due to software versions and parameter settings):



The program arranges the data received from the ***DY5*** into logical groups on the screen. The following is a brief overview of the ***DY5 Configuration Software*** capabilities, a detailed description of each section will follow.

The main window title is modified to display the firmware version of the particular ***DY5*** the computer is connected to. The green **"connected"** indicator in the upper left corner indicates that the computer is connected and communicating with the ***DY5***. It will turn red should communications be lost. The green **"save status"** indicator is informing the operator that the data displayed on the screen matches the data in the ***DY5***, and that saving to the ***DY5*** is not required. Should the **"save status"** indicator turn red, saving the displayed values to the ***DY5*** is recommended.

The **"Soft Stop Setup"** frame allows the user to configure the soft stop feature of the ***DY5***. This powerful capability can be used to control how braking current is applied and removed from the motor. It can also be used to configure the brake for exceptionally long braking times.

"Asset Setup" allows the user to access the permanent memory of the ***DY5*** to store information related to his particular application.

"Current Hardware Configuration" functions as an effective troubleshooting and diagnostic tool, by showing the operator the values the ***DY5*** control logic is using for a number of critical functions. These values are **"read only"** and cannot be set from the program.

The **"Zero Speed Detect Tune"** pane allows the user near total control over the ***DY5's*** motor voltage based zero speed detection logic. When properly tuned, the ***DY5*** offers unparalleled zero speed detection over a wide range of motor types and sizes. In addition to voltage based detection, the user can enable pulse tachometer zero speed detection for the most demanding applications.

"Brake Performance Tune" supports the adjustment of several critical braking current related features of the ***DY5***. The ***"Restart Delay"*** function can be used to restrict the duty cycle of the brake, where motor damage resulting from heat may be a problem. The ***"Custom Current Initiation Level"*** adjustment is used to set the level of motor terminal voltage the ***DY5*** will use to determine when to apply braking current. This allows for optimal braking time performance on a wide range of motors.

The read-only ***"Operational Statistics"*** data is designed to help the operator troubleshoot applications by recording the total number (lifetime) of braking cycles a particular ***DY5*** has encountered, and the number (lifetime) that were terminated by using the backup timer.

Four buttons in the lower right corner of the window control the main functions of the program. **"Save to DY5"** causes the displayed values to be written to the ***DY5***. It will be "grayed" when the save function is not needed or allowed. The **"Refresh"** button causes a re-read and display all of the data located in the **DY5. "Log"** allows all the displayed data to be written to file on the computer for later use. The **"About"** button provides information about the version of the ***DY5 Configuration Software*** currently running. Like the **"Save to DY5"** button, the other buttons are grayed when not allowed.

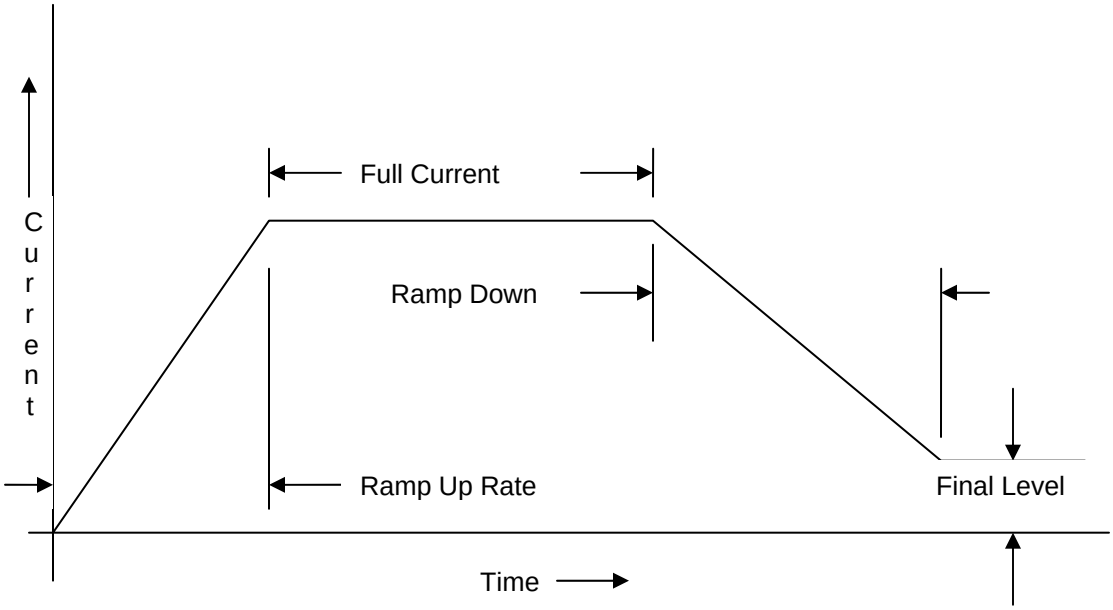
C. Using the DY5 Configuration Software

The software works just like most other Windows applications. When connected ***(the "connected" indicator is green)*** any non-read-only field can be selected by using the mouse to **"click"** on it. It will automatically select any value present, so all you need to do is type the new number. It will not let you enter characters that are not allowed, like letters when numbers are required. It also supports the typical editing keys like backspace, delete, home, end, etc. When entering data, the program ***will*** however, let you enter values that exceed the allowable range for that field. It will correct this issue whenever the focus is changed to a different input field, or the **"Save to DY5"** button is pressed. At that time, excessive values are set to the maximum or minimum, and parameters that must have discrete values are set to the closest value allowed. You ***cannot*** save out of range or invalid values in the ***DY5***.

Soft Stop Operation

There are certain applications where a fixed level of braking is undesirable due the increase in braking torque achieved as the motor speed decreases. Soft Stop gives the operator control over the output current profile to achieve optimal braking without risking over-torque conditions.

The figure below shows the fundamental components of the soft stop profile.



Ramp Up Rate – Controls the ***rate*** at which current is built up to the level set by the **"Braking Current"** potentiometer **R76**. The units for this value are **"seconds"**. The ***DY5*** interprets this value as the time it will take to go from a current reference of ***zero***, to the maximum value allowed irrespective of the setting of the braking current pot. Therefore, if the pot is set at half rotation, the actual ramp up ***time*** will be half of what the program indicates. For this reason, it is referred to as a ***rate*** and not a ***time***. Acceptable values for **"ramp up rate"** range from ***0 to 255 s*** (0 to 4.25 minutes).

Full Current Time – This adjustment controls the time at which current will be held at the level set by the **"Braking Current"** potentiometer **R76**. The units for this value are **"seconds"**. Acceptable values for **"full current time"** range from ***0 to 1200 s*** (0 to 20 minutes).

Ramp Down Rate – Controls the ***rate*** at which current is reduced to the level set by the **"final level"** setting. The units for this value are **"seconds"**. Acceptable values for **"ramp down rate"** range from ***0 to 255 s*** (0 to 4.25 minutes).

Final Level – Sets a percentage of the current reference (as set by **R76**) to use as a minimum current level until the termination of braking. This is set in decimal percent (i.e. numbers between ***0 and 1***, 1 being 100%).

Enabling Soft Stop - Checking the **"enable soft stop"** check box will instruct the ***DY5*** to use the soft stop braking profile with the user values supplied, once the settings are transferred to the ***DY5***. Should, at any time, the operator un-check the enable soft stop box, and execute a save to the ***DY5***, soft stop mode will be disabled. There is no need to return the soft stop parameters to their original or default values, as they will now be ignored.

Operating In Soft Stop Mode – Braking is initiated in soft stop mode the same way it is done in **"normal"** mode. Other than the current profile, there is one other significant difference between the default braking mode and soft stop. This is the way the backup time adjustment is used by soft stop.

To enable very long braking times using the soft stop feature, the backup time cannot be limited to the **255 seconds** that can be set by switch **SW2**, so it is not used in the conventional sense. In soft stop mode, the backup timer begins timing (using the value set by **SW2**) when the final level current value is reached. This means that the backup timer is setting the time at which the ***DY5*** will output the final level (back porch) current. This does not mean there is no backup time protection in soft stop mode. Since each element of the soft stop profile has a defined (and accurately measured) time, the **"backup time"** for soft stop mode becomes the sum of the times of the individual components of the profile. Braking will always stop when the total time has expired.

As with normal mode, zero speed detection is active (unless defeated by the **ZS CCT** Inhibit input) during soft stop operation. Either voltage sensing or the pulse tach method can be used to establish zero speed. Once zero speed is detected, the ***DY5*** will execute any programmed dwell time and then stop braking.

It's important to note that zero speed detection will terminate braking at ***any*** point in the soft stop profile. Therefore the programmed times need to be developed with knowledge of the actual stopping performance of the machine. For most applications this will require some experimentation for optimal performance.

Asset Setup

Asset setup allows the user to access the permanent storage ability of the ***DY5*** to save certain information useful for maintenance and troubleshooting.

Commission Date - fields are intended for entering the date the ***DY5*** was placed into service. the program will limit the numbers to valid values for each of the fields, however it will not check for valid dates. For example, it will not except **32** for a day number, but it will allow **2/31/04 or February 31st**, which is an invalid date. Since the ***DY5*** does not use the commission date information for ***any*** purpose, the user may enter any values that may have special meaning into the date fields without risk of affecting ***DY5*** operation. The default value for the date is **1/1/2000.**

User Code - is a field accepting any value between **0** and **65535**, and has no defined meaning. It may be used to identify the installer, the job, the machine function, etc. Like the commission date, it is not used by the ***DY5*** or the program and can have any meaning. The default value for the user code is **0**.

Pass Code - allows the user to **"password protect"** communication with the ***DY5***. Password protection does not change the operation of the ***DY5***, but it prevents the program from reading or writing any ***DY5*** information unless the password has been entered. The default value for the pass code parameter is **0**, which is interpreted as **"protection off"**. As long as the program is communicating with a ***DY5*** that supplies a pass code of **0**, it will not request the user to enter a password. Programming the pass code parameter to any other value in the range of **1** to **65535** will cause the program to ask for the matching password to communicate with the ***DY5***. If you use the pass code feature, make sure to record the value, as you will not be able to recover it from the ***DY5*** without entering the password.

Current Hardware Configuration

The group of parameters listed in the **Current Hardware Configuration** pane are read only values. That is, they cannot be set via the program. The microprocessor on the ***DY5*** reads these values from the analog and digital I/O ports on the board and reports them. This is a valuable troubleshooting tool, as well as a method, using the **Log** function, of completely documenting an installation.

*Note that none of these read-only values are automatically updated when a change is made on the board. Use the Refresh button to instruct the program to re-read the parameters from the **DY5** if changes are made.*
Backup Time - This is the current value for backup time as set by **SW2** converted into **seconds**.

Dwell Time - As with **Backup Time**, this displays the current setting of the **Dwell Time** switch **SW1** converted into **seconds.**

Current Reference - is the value the ***DY5*** is reading from the **Braking Current** potentiometer **R76**. The value is displayed in **"counts"** and ranges between **0** (no braking current) and **255** (maximum braking current).

Mains Voltage - is the value of line voltage the ***DY5*** recorded the last time it was in operate mode and the **"motor running"** input was asserted. **DY5s'** that have never been run will report zero**. Mains Voltage** is supplied for reference purposes. It is not intended to be used as a **VOM**, or to troubleshoot power quality problems.

Frequency **-** displays the line frequency as set by the **50/60 Hz** jumper **J3**. Configuring the ***DY5*** to the correct line frequency is a manual operation done at startup. The displayed value is not measured by the unit, and will not be accurate if the ***DY5*** is improperly configured.

Zero Speed Detect Tune

Zero speed detect tune is one of the most powerful features enabled by the ***DY5 Configuration Software***. It provides complete control over the motor voltage zero speed detection capability of the ***DY5***, by allowing the user to choose the detection level and the time at which the voltage must be below that level to detect zero speed.

Enable Zero Speed Detection Tuning – As with the other features enabled by the program, the custom tuning values are ignored by the ***DY5*** until the **Enable Zero Speed Detection** check box is checked and the data sent to the ***DY5***. Un-checking the enable box will return the ***DY5*** to its default values irrespective of the settings remaining in **Threshold** and **Time**.

Threshold Voltage – This adjustment, set by **R161** is displayed in counts and determines the point at which the ***DY5*** will interpret the motor terminal voltage to be **"zero",** or stopped. The higher the value, the higher the **"zero"** voltage will be. The lower the value, the lower the voltage must be to be interpreted as **"zero".**

The threshold voltage is typically set to achieve optimal zero speed detection over a wide variety of motors. For example, a low horsepower motor (1 HP) will have considerable impedance. The very action of sending braking current through the windings of such a motor may create a terminal voltage sufficiently high as to cause the zero speed detection logic to fail. In this case, elevating the threshold will allow the ***DY5*** to ignore its own contribution to the motor's terminal voltage and properly detect zero speed.

In the case of large motors (>100 HP), the default threshold value used by ***DY5*** may cause the zero speed detection logic to operate **"early"**, ending current with the motor still spinning. This can be eliminated by adjusting the threshold down to sense **"zero"** at a lower value.

Zero Speed Detection Time – This parameter, displayed in **"loops"** is the number of sample times in a row the ***DY5*** must see the motor terminal voltage be below the threshold value. This is effectively a **"filter"** making sure the ***DY5*** does not act on a single errant value. Each **"loop"** has a time value of **1/(2*f),** where **f** is the line frequency. For a 60Hz system, **60** loops is ½ seconds. If **60** loops are commanded, the ***DY5*** must read a motor voltage value less than the threshold **60** times in a row. Valid settings are **0** to **255** with a default of **60** loops

Use Pulse Tach Zero Speed Detection - In certain applications it is desirable to use a pulse tachometer for absolute zero speed detection. The ***DY5*** has provisions for interfacing a pulse tach and to use it to determine zero speed. This feature is enabled by checking the **Use Pulse Tach Zero Speed Detection** check box and saving the parameters to the ***DY5***. Note that voltage zero speed detection is not disabled when using the tach input. If the ***DY5*** terminates braking using the voltage detection feature, and if this is a problem, voltage detection can be disabled by asserting the **ZS CCT OFF** input. Every other aspect of the braking cycle remains the same when the tach is used for zero speed detection, this includes dwell, backup time, etc. The tach may also be used with the soft stop feature.

Brake Performance Tune

The **Brake Performance Tune** pane includes parameters to control the allowable duty cycle, and how quickly braking current will be applied to the motor once braking is commanded.

Enable Custom Re-Arm Delay - The custom re-arm delay is made active by checking the check box and saving the parameters to the ***DY5***.

Delay From Stop To Re-Arm – This value, set in **seconds**, controls the time it will take the ***DY5*** to re-arm itself following the termination of the braking cycle. It can be set in the range of **0** to **65535.** This feature effectively determines the brake duty cycle which can be used to protect the motor.

Enable custom Current Initiation Level - The custom **CEMF** setting is enabled by checking the check box, and storing the data in the ***DY5***

CEMF To Begin Current – This parameter allows the operator to customize the point at which braking current is developed in the spinning motor. Once power is removed from a rotating induction motor, it continues to produce a significant terminal voltage for a considerable period of time. If the brake attempts to make current while the motor voltage is too high, excessive current will result. This can be eliminated by adjusting the voltage at which the ***DY5*** will begin braking.

This adjustment is primarily useful for tuning the ***DY5*** to motors of different sizes. For instance, with small motors braking can be initiated at a higher voltage level due to the higher impedance of the motor. Larger motors may need to start current a lower voltage value to avoid excessive currents.

The **CEMF To Begin Current** setting is set in percent of the **Mains Voltage**. Acceptable values are **0** to **1** in increments of **.06.** You may enter any value, but the program will convert it to the nearest **.06** increment before it is sent to the **DY5.**

Operational Statistics

Number Of Braking Cycles - is the total ***number of braking cycles*** this particular ***DY5*** has completed in its lifetime.

Number Ended By Backup Timer - is the number of braking cycles that were terminated by using the backup timer. This is useful to assess the effectiveness of the zero speed detection feature, if it's enabled.

*Note that these values are incremented on completion of the braking cycle. If power is removed from the **DY5** as a method of terminating braking, that cycle will not be counted.*

Buttons

Save to DY5 – When enabled, clicking this button will save all of the displayed values (except read-only data) to the permanent memory of the ***DY5***. The button is enabled only when saving is required, and is grayed once the save operation is complete.

Refresh – Clicking this button causes the program to re-read all the displayed data from the ***DY5***. This is done automatically when the ***DY5 Configuration Software*** first establishes communication, and when **Save To DY5** is clicked (for confirmation purposes). Any other time it must be done manually.

Log – Clicking the **Log** button allows the operator to save a file on the computer's disk containing the currently displayed ***DY5*** data. the program will open a standard Windows **"save"** dialog to prompt the user for a file name. After picking a name and location for the file, it will save the data to the disk. The format used by the ***DY5 Configuration Software*** is **CSV** or **"comma separated values".** This is a text file, and can be opened in most ***Windows*** applications, including ***Wordpad, Word,*** or ***Notepad***. This format is most effective with ***Excel*** however, where the labels and data will be imported into adjacent cells. With a minimal amount of formatting the **CSV** file can me made into a printable report.

About – Clicking the **About** button opens the about dialog which displays the version of the ***DY5 Configuration Software*** you are using as well as other information about the program.

WARRANTY

Saftronics warrants to buyer that products, and any services furnished hereunder will be free from defects in material, workmanship and title, and will be of the kind and quality specified in the quotation. The foregoing shall apply only to failures to meet said warranties (excluding any defects in title) which appear within one year from the date of shipment hereunder, provided, however, that if buyer, in the course of its regular and usual business, transfers title to or leases such products (including equipment incorporating such products) to a third party, such period shall run until one year from such transfer or lease or eighteen months from shipment by Saftronics whichever occurs first. The warranties and remedies set forth herein are conditioned upon (a) proper storage, installation, used and maintenance, and conformance with any applicable recommendations of Saftronics and, (b) buyer promptly notifying Saftronics of any defects and, if required, promptly making the product available for correction.

If any products or services fails to meet the foregoing warranties (except title), Saftronics shall thereupon correct any such failure either, at its option, (i) by repairing any defective or damaged part or parts of the products, or (ii) by making available FOB Saftronics plant or other point of shipment, any necessary repaired or replacement parts. The preceding paragraph sets forth the exclusive remedies for claims (except as to title) based on defect in or failure of products or services, whether claim in contract or tort (including negligence) and however instituted. Upon expiration of the warranty period, all such liability shall terminate. The foregoing warranties are exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. No implied statutory warranty of merchantability or fitness for particular purpose shall apply and Saftronics will not be liable for any consequential damage arising from any product defect or failure to deliver on time. Saftronics does not warrant any products or services of others which buyer has designated.