

Micro5000

Display Adjustment Options
77NK1, 77NK2, 77NK4

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INTRODUCTION

This instruction bulletin covers installation and operation of the three Display/Adjustment options available for use with the Micro5000 family of drive controllers:

- 77NK1: Display/Adjustment Option
- 77NK2: Display/Adjustment/Local Control Option
- 77NK4: Remote Mounting Kit

It also describes the various parameters and fault codes accessible with the options. Each option is described in the following sections.

77NK1

Option 77NK1 mounts on the front of the drive controller. It includes three seven-segment displays, one program LED, and four push buttons for programming the controller. Its features are illustrated in Figure 1.

For a summary of the parameters accessible with this and the other two display options, see Figure 5 on page 6. The codes displayed in the event of a fault are listed in Table 5 on Page 24.

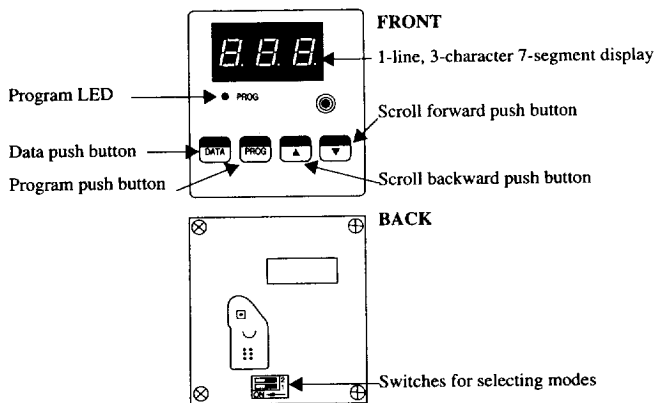


Figure 1 Display/Adjustment Option 77NK1

77NK2

Option 77NK2 also mounts on the front of the drive controller. It provides the same features as option 77NK1, but adds the ability to start and stop the drive controller from the option if a direction command (F/W/RV) and a reference signal are present, and the ability to reset the drive controller from the option. LEDs indicate when the drive is in local control and whether the motor is rotating in forward or reverse. Option 77NK2 is illustrated in Figure 2.

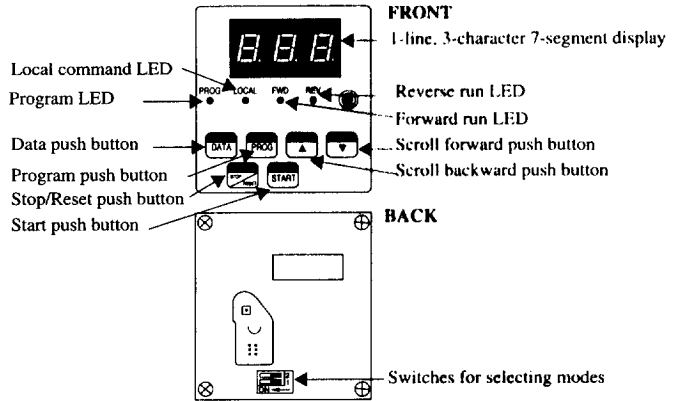


Figure 2 Display/Adjustment/Local Control Option 77NK2


77NK4

Option 77NK4 is a kit for remote mounting of option 77NK1 or 77NK2 to a NEMA Type 1, 4 or 12 enclosure. The kit consists of an interface box which mounts on the front of the drive controller, a 3-meter connection cable and a plastic keypad cover.

MOUNTING
Local

Options 77NK1 and 77NK2 can be connected while the drive controller is powered up. To mount either option (refer to Figure 3):

1. Using a screwdriver, remove programming cover plate from front of drive controller as shown. Do not remove any other cover.

 **WARNING**

HAZARDOUS VOLTAGE.
Do not remove any other cover besides programming cover plate when installing the option.
Failure to observe this precaution can cause shock or burn, resulting in severe personal injury or death!

2. Plug option into drive controller. Use screwdriver to secure option.

NOTE

Removal of option 77NK2 when it is set to local mode (Switch 1 set to On, see page 7) and the drive controller is powered up (with or without the motor running) will cause the drive controller to fault.

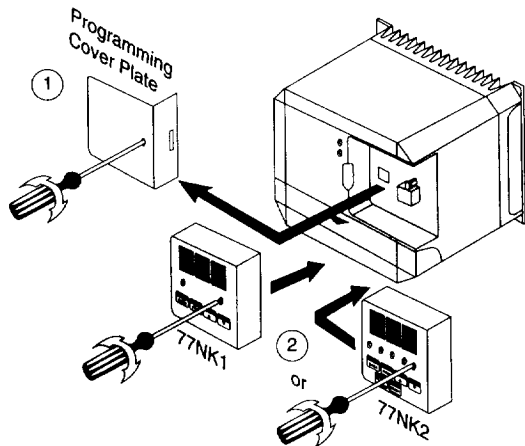


Figure 3 Mounting Option 77NK1 or 77NK2

Remote

When mounted with kit 77NK4 on a NEMA Type 1, 4 or 12 enclosure, options 77NK1 and 77NK2 have a protection rating of IP65. To remotely mount the options (refer to Figure 4):

1. Using a screwdriver, remove programming cover plate from front of drive controller. Do not remove other covers.

! WARNING

HAZARDOUS VOLTAGE.
Do not remove any other cover besides programming cover plate when installing the option.
Failure to observe this precaution can cause shock or burn, resulting in severe personal injury or death!

2. Plug interface box provided with kit into front of drive controller. Use screwdriver to secure interface box.
3. Connect display unit (77NK1 or 77NK2) to interface box with cable provided in kit.
4. Mount display unit on front of enclosure. Information concerning cut-out size is found in the instruction guide which accompanies option 77NK4.

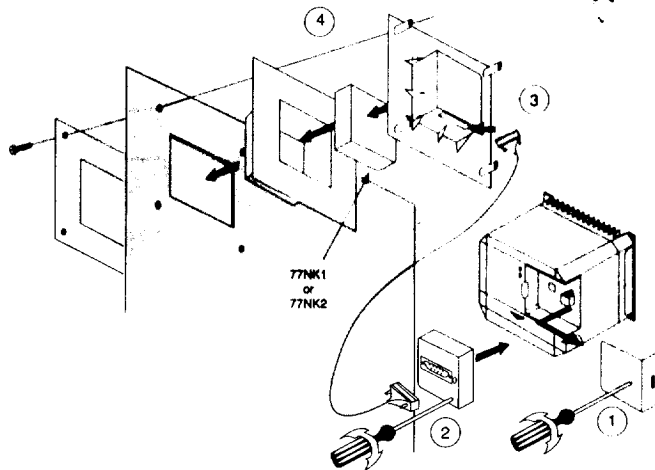


Figure 4 Remote Mounting with Kit 77NK4

PARAMETER SUMMARY

Three types of parameters are accessible through the Display/Adjustment options:

- Display parameters (electrical quantities)
- Adjustment parameters
- Configuration parameters

Figure 5 lists the parameters in each group along with their valid ranges.

To adjust -
Hold "program" key while scrolling up or down

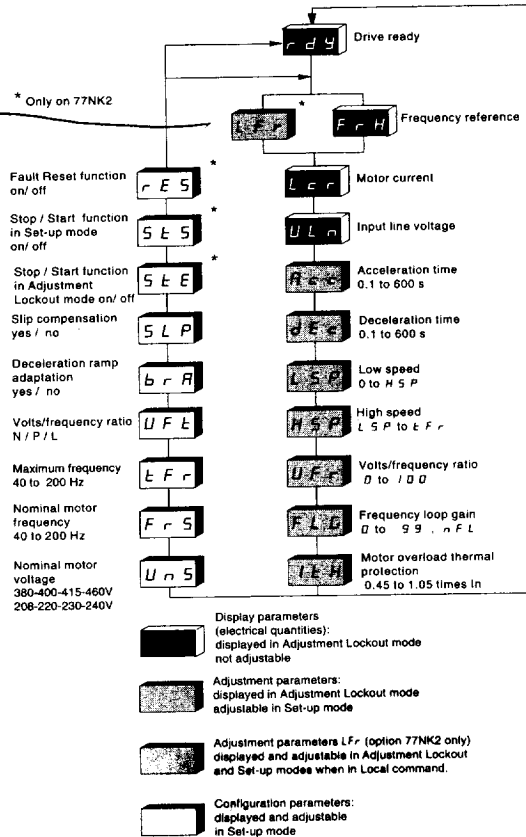


Figure 5 Parameter Summary

NOTE
Value of input line voltage, UL_n , is valid only when the drive controller is in ready mode (rdy). In addition, the value displayed may be incorrect if the input line voltage is subject to waveform distortion.

SWITCH SETTINGS

Use the switches on back of the Display/Adjustment options as described in the following sections. Refer to Tables 1 and 2 for a summary of switch settings. For location of the switches on option 77NK1, see Figure 1 on page 2. For location of the switches on option 77NK2, see Figure 2 on page 3. Note: Drive Ready indicates that power is applied to the controller, but no Run command is present.

Switch 1 77NK2 Only

Switch 1, used on option 77NK2 **only**, selects local control. When Switch 1 is set to On, the drive is in Local mode. With the presence of a direction command (FW/RV) and reference signal, the controller may be started, stopped and reset from the Display/Adjustment option, depending on settings of the $rE5$, $St5$ and StE parameters (see page 11). When Switch 1 is set to Off, the controller is run only with the presence of a direction command (FW/RV) and reference signal.

Switch 2 77NK1 and 77NK2

Switch 2 is used on both options to determine the mode of the Display/Adjustment option. When Switch 2 is set to On, the option is in **Set-up mode**. Set-up mode permits modification of parameters when the drive controller is ready or the motor is running. See Table 1 for further explanation. When Switch 2 is set to Off, the option is in **Adjustment Lockout mode**. No modification of parameters is possible in this mode. See Table 2 for further explanation.

Table 1 Set-Up Mode

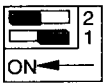
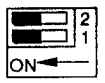
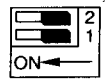
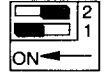
Switch Position	Option	Drive Ready	Motor Running
	77NK1 and 77NK2	<ul style="list-style-type: none"> •Drive controller can be started and stopped with presence of direction command (FW/RV) and reference signal •Display of display parameters •Display and modification of adjustment parameters •Display and modification of configuration parameters •Display of fault codes •Prog LED lit 	<ul style="list-style-type: none"> •Display of display parameters •Display and modification of adjustment parameters •Display of configuration parameters; no modification of configuration parameters
	77NK2 only	<ul style="list-style-type: none"> •Same as above •Enables local command push buttons: Reset if $rE5$ is set to On. Start/Stop if $St5$ is set to On and with presence of a direction command (FW/RV) and reference signal. •Local LED lit (flashes if $rE5$, $St5$ and StE are set to Off). 	<ul style="list-style-type: none"> •Same as above •Enables local command push buttons: Reset if $rE5$ is set to On. Start/Stop if $St5$ is set to On and with presence of a direction command (FW/RV) and reference signal. •Local LED lit





Table 2 Adjustment Lockout Mode

Switch Position	Option	Drive Ready or Motor Running
	77NK1 and 77NK2	<ul style="list-style-type: none"> •Drive controller can be started and stopped with presence of direction command (FW/RV) and a reference signal •Display of display parameters •Display of adjustment parameters •Display of fault codes •Configuration parameters not displayed •No modifications possible
	77NK2 only	<ul style="list-style-type: none"> •Same as above •Enables local command push buttons: Reset if $rE5$ was set to On in Set-up mode. Start/Stop if StE was set to On in Set-up mode and with presence of a direction command (FW/RV) and a reference signal. •Local LED lit (flashes if $rE5$, $St5$ and StE are set to Off).

OPERATION OF THE PUSH

Figures 6 and 7 illustrate operation of the Display/Adjustment option push buttons. Refer to Table 3 for key operation. For key operation with the LFr parameter, refer to page 14

Table 3 Key Operation

Key	Operation	
	When parameter name is displayed	When parameter value is displayed
	Steps forward through list of parameters	Increases parameter value
	Steps back through list of parameters	Decreases parameter value
	Displays parameter value	Displays parameter name or cancels change to parameter value
		Saves change to parameter value

Set-up Mode

Figure 6 illustrates how to change and save adjustment and configuration parameter values in Set-up mode (Switch 2 set to On).

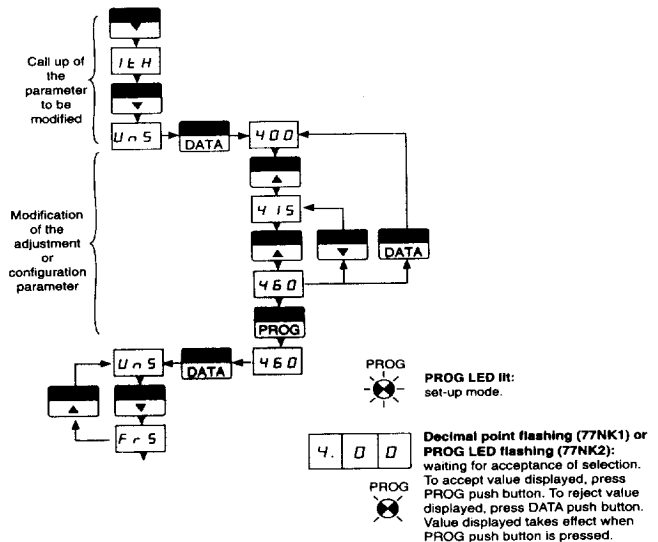
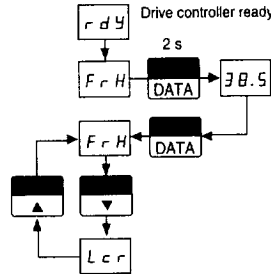


Figure 6 Set-up Mode

Adjustment Lockout Mode

Figure 7 illustrates how to scroll through the available parameters and display their values in Adjustment Lockout mode.



2 seconds after the parameter name appears, the parameter value is displayed. The parameter value can also be displayed by pressing the DATA push button.

Figure 7 Adjustment Lockout Mode

CONFIGURATION PARAMETERS

The following sections describe the configuration parameters available on options 77NK1 and 77NK2.

**Un5:
 Nominal Motor Voltage**

Nominal motor voltage is based on the motor nameplate. Refer to Table 4 for appropriate settings.

Table 4 Nominal Motor Voltage Settings

Choice of Nominal Voltage at 50 or 60 Hz:	Factory Setting:
77N→221: 208, 220, 230, 240 V	230 V
77N→421: 380, 400, 415, 480 V	400 or 480 V depending on position of Switch 1 on drive controller

**Fr5:
 Nominal Motor Frequency**

Nominal motor frequency can range from 40 to 200 Hz. Selection of nominal motor frequency is based on nominal motor voltage and is indicated on the motor nameplate. Setting this parameter from the display overrides selection of the volts/frequency ratio switch on the controller. Factory setting is 60 Hz, and can be selected 1313

to 50 Hz by changing the position of Switch 1 on the drive controller. Note that with the variable torque option card 77NG2 installed, the range of Fr5 is 40 to 70/80 Hz. With the high speed option card 77NG3 installed, the range of Fr5 is 40 to 400 Hz.

LFr:
Maximum Drive Output Frequency

Maximum drive output frequency can range from 40 to 200 Hz. Factory setting is 60 Hz, $F_r S=60$. Overspeed operation at constant power above nominal motor frequency follows the characteristics shown in Figure 8. Note that with the variable torque option card 77NG2 installed, the range of LFr is 40 to 70/80 Hz. With the high speed option card 77NG3 installed, the range of LFr is 40 to 400 Hz.

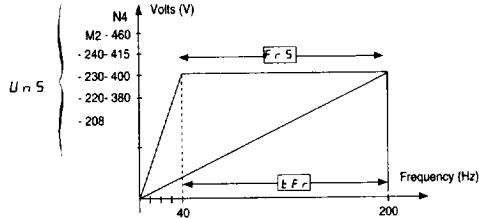


Figure 8 Voltage/Frequency Operation

UFt:
**Type of Volts/
 Frequency Ratio**

UFt is used along with UFR to give voltage boost. Refer to Figure 14 on page 13 for the V/f curves. Possible settings are n, L or P.

- n:** Volts/frequency ratio adjusted for constant torque applications (machines with average loads) not requiring high voltage boost.
- L:** Volts/frequency ratio adjusted for constant torque applications for special motors (tapered rotor motors, pole change motors, high torque motors) used in fast cycle applications.
- P:** Volts/frequency ratio adjusted for quadratic torque applications such as fans or centrifugal pumps.

brA:
Deceleration Ramp Adaptation

Possible settings are Yes and No.

- Yes:** Deceleration ramp time (dEc) is automatically adjusted to compensate for load inertia and to avoid overbraking fault (ObF).
- No:** Deceleration ramp time is not automatically adjusted. Maximum braking performance is obtained with this setting. If the motor is unable to follow the deceleration ramp, the drive will trip on overbraking fault (ObF).

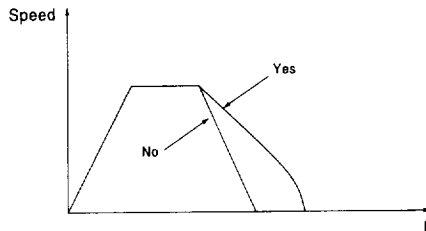
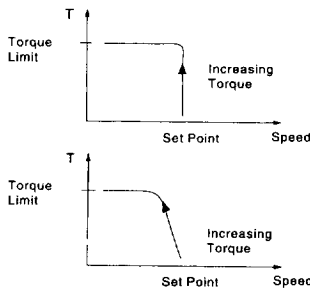


Figure 9 Deceleration Ramp Adaptation

SLP:
Automatic Slip Compensation

Possible settings are Yes and No.



Yes: Automatic slip compensation enabled. Use this setting for running at constant speed as the load changes.

No: Automatic slip compensation disabled. Use this setting for applications with high inertia, variable torque or external speed regulation.

Figure 10 Automatic Slip Compensation

Three additional configuration parameters are available with option 77NK2. These are used to start, stop and reset the drive controller from the display option when in Local mode (Switch 1 set to On) and when a direction command (FW/RV) and reference frequency set with **LFr** are present. When not in Local mode (Switch 1 set to Off), these parameters are not used and the drive controller is run with the presence of a direction command and reference signal at AIV or AIC.

StE
Start/Stop in Adjustment Lockout Mode

When **StE** is set to On and the display is in Adjustment Lockout mode, with the presence of a direction command (FW/RV) and a reference frequency set with **LFr**, the controller is started and stopped from the display option. When a direction command is present, the FWD or REV LED will flash to indicate that the controller can be started from the display option. When started, the FWD or REV LED will be lit. If the direction command is removed while the controller is running, the controller will stop. If a direction command (FW or RV) is restored, the controller will restart. When **StE** is set to Off and the display is in Adjustment Lockout mode, the controller cannot be started even if a direction command and reference frequency are present.

StS
Start/Stop in Set-up Mode

When **StS** is set to On and the display is in Set-up mode, with the presence of a direction command (FW/RV) and reference frequency set with **LFr**, the controller is started and stopped from the display option. When a direction command is present, the FWD or REV LED will flash to indicate that the drive controller can be started from the display option. When started, the FWD or REV LED will be lit. If the direction command is removed while the controller is running, the controller will stop. If a direction command (FW or RV) is restored, the controller will restart. When **StS** is set to Off and the display is in Set-up mode, the controller cannot be started, even if a direction command and reference frequency are present.

rES
Reset Fault

The reset fault function is not dependent on whether the display option is in Adjustment Lockout or Set-up mode. When **rES** is set to On, the drive controller can be reset after the **DSF**, **OLF**, **DBF**, **DBF**, **SPF**, **SPF**, and **SLF** faults (see pages 23 and 24) by pressing the Stop/Reset push button if the cause of the fault has been corrected. When **rES** is set to Off, after these faults the drive controller must be reset by removing power. If the cause of the **PhF**, **USF** and **OPt** faults is corrected, the controller automatically resets.

ADJUSTMENT PARAMETERS

The following sections describe the adjustment parameters available on both options 77NK1 and 77NK2.

R_{cc} Acceleration Ramp Time

Acceleration ramp time can range from 0.1 to 600 s. The factory setting is 3 s. Acceleration ramp time is automatically extended when the maximum transient output current of the controller is reached.

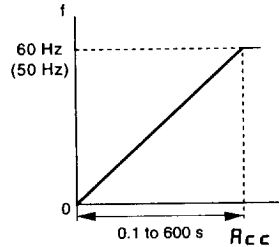


Figure 11 Acceleration Ramp

dE_c Deceleration Ramp Time

Deceleration ramp time can range from 0.1 to 600 s. The factory setting is 3 s. If deceleration ramp adaptation (**brA**) is set to Yes, the deceleration time is automatically extended to avoid overbraking fault (**ObF**).

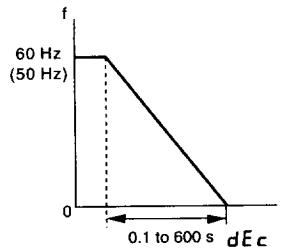


Figure 12 Deceleration Ramp

LSP: Low Speed
HSP: High Speed

The factory settings for low speed (**LSP**) and high speed (**HSP**) are 0 Hz and 60 Hz respectively. When **LSP** is 0, the drive stays ready as long as reference speed is less than 0.1 Hz. **HSP** is limited by the value of maximum drive output frequency (**EFr**).

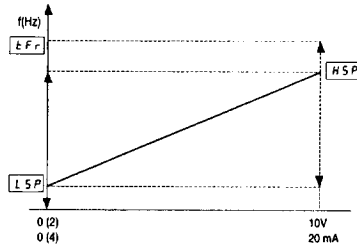


Figure 13 Low Speed/High Speed

UFR:
Volts/Frequency Ratio

UFR is factory set to **n20**, **L20** or **P20**, depending on the setting of **UFt** (i.e. n, P or L). The factory settings are suitable for most applications; however, if the torque is insufficient, increase the setting gradually from **00** to **100**.

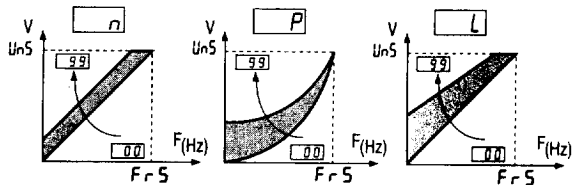


Figure 14 Volts/Frequency Ratio

FLG:
Frequency Loop Gain

Frequency loop gain can range from **00** to **99** or **nFL**. The factory setting is **33**. For machines with high resistant torque or high inertia, reduce the gain gradually to a value between **33** and **00**. For machines with fast cycles, low resistant torque or low inertia, increase the gain gradually from **33** to **99**. Note that too much gain can cause instability. A value of **nFL** suppresses frequency loop gain. This can cause the motor to stall if the required torque is too high.



CAUTION

MOTOR MAY STALL.

Inhibiting this function can cause motor to stall if required torque is too high.

Failure to observe this precaution can result in equipment damage.

lth:
Motor Thermal Protection

Motor thermal protection can range from 0.45 to 1.05 times the nominal drive current (In). Factory setting is 0.9 times the nominal drive current. Adjust **lth** to the current value shown on the motor nameplate. To suppress motor thermal protection, increase the value of **lth** to the maximum and provide external thermal protection.



CAUTION

LOSS OF MOTOR OVERLOAD PROTECTION.

When using external overload relays connected to the drive controller output, the overload relay must be capable of operation over the expected range of controller output frequencies (including direct current).

When DC injection braking is used:

- **The overload relay must be suitable for operation with direct current flowing in the motor.**
- **Do not use overload relays equipped with current transformers for sensing the motor current.**

Failure to observe this precaution can result in equipment damage.



CAUTION

MOTOR OVERHEATING.

This drive controller does not provide direct thermal protection for the motor. Use of a thermal sensor in the motor may be required for protection at all speeds and loading conditions. Consult motor manufacturer for thermal capability of motor when operated over desired speed range.

Failure to observe this precaution can result in equipment damage or personal injury.

When the display/adjustment keypad is in local command mode (Switch 1 On), this parameter appears in place of **Frh** and is used to adjust the reference frequency. In Set-up mode, **SE** must be set to On and in Adjustment Lockout mode, **SE** must be set to On for this parameter to take effect. To change the value of **LFr**, press the Program and Up or Down keys simultaneously. If the motor is running, the change is immediately taken into account.

DISPLAY PARAMETERS

The values of the Display parameters, available on both option 77NK1 and 77NK2, are obtained by pressing the DATA push button.

- rdy**: Drive ready (no run command)
- Frh**: Reference frequency in Hz. If the displayed value flashes, it is because the drive is adjusting its acceleration or deceleration ramp, or because the drive is at current limit.
- Lcr**: Motor current in Amps
- ULn**: Input line voltage in volts

ADDITIONAL PARAMETERS

Additional parameters appear on the display with the option cards. These are described in the following sections.

77NG1 Option Card Set for General Use

Adjustable parameter:

- Jog**: Jog operation. The LI3 input on the 77NG1 option card is factory set for Jog operation when the option card is configured for general use. With LI3 at state 1 and a direction command (FW/RV) present, the drive controller will jog at the frequency set by the Jog parameter. Factory set for 5 Hz, it can be adjusted between 0.1 and 10 Hz. When jogging, the acceleration and deceleration ramp rates are 0.1 s.

Configurable parameters:

- Rtr**: Automatic restart. Enables the drive controller to automatically restart following an overvoltage (**OSF**), overload (**OLF**) or overbraking (**ObF**) fault. For the **OSF** and **ObF** faults, the drive controller remains disabled for 1 minute after the fault appears causing the fault relay of the drive controller to engage, then it restarts automatically if the fault has disappeared. If the fault is present at the end of 1 minute, the drive controller faults and must be reset. If there are 5 faults within 6 minutes of the first fault, the drive controller faults and must be reset. For the **OLF** fault, the restart is effective as soon as the thermal state drops below 100% without any delay. Factory set to **OFF**, can be configured to **On**.



WARNING

UNINTENDED EQUIPMENT ACTION.

- Automatic restart and catching a spinning load can only be used for machine or installations that present no danger in the event of automatic restarting, either for personnel or equipment.
- Equipment operation must conform with national and local safety regulations.

Failure to observe these precautions can result in equipment damage or severe personal injury.

- FLr**: Catching a spinning load. Allows smooth restarting of motor after a brief input line undervoltage. If the reference signal and a direction command are maintained, the motor accelerates back up to speed without starting at zero. Factory set to **No**, can be configured to **Yes**.

77NG1
Option Card Set for
Material Handling

Adjustable functions:

Preset speeds: Preset Speed 1 is Low Speed (**LSP**) or the value of the reference signal. Preset Speed 2 is High Speed (**HSP**). The display allows adjustment of Preset Speeds 3 and 4.

- **3SP**: Preset Speed 3. Input LI2 is factory set for Preset Speed 3. The drive controller will run at Preset Speed 3 when LI2 is at state 1 and a direction command is present (FWD or REV). Factory set to 5 Hz, Preset Speed 3 can be adjusted between **LSP** and **HSP**.
- **4SP**: Preset Speed 4. Input LI3 is factory set for Preset Speed 4. The drive controller will run at Preset Speed 4 when LI3 is at state 1 and a direction command (FWD or REV) is present. Factory set to 25 Hz, Preset Speed 4 can be adjusted to a value between **LSP** and **HSP**.

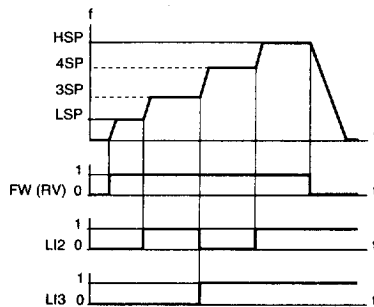


Figure 15 Preset Speeds

Brake control: The S2A-S2B relay on the 77NG1 option card is set for brake control. The release and engaging of the mechanical brake follows the graph below. When the brake release frequency threshold and the brake release current threshold (lbr) are reached, the S2A-S2B relay closes. During a time delay of $t1$, the acceleration ramp is inhibited. This allows the motor to develop sufficient torque to release the brake.

For the brake to engage, when the deceleration ramp reaches the brake engage frequency threshold, the S2A-S2B relay opens and the brake engages.

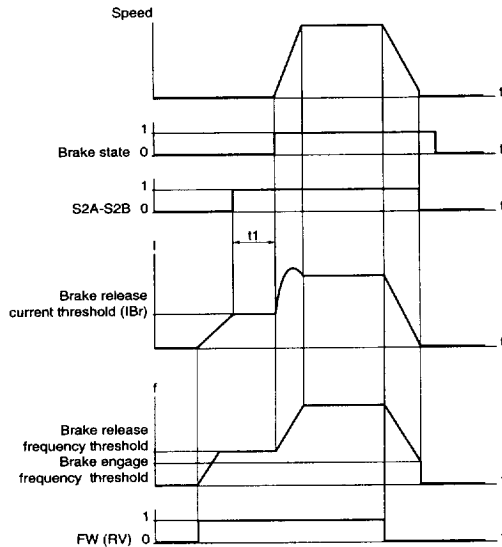


Figure 16 Brake Control Logic

Factory settings:

Brake release frequency threshold = Low speed setting (**LSP**)

Brake release current threshold (lbr) = 0. See lbr below.

Brake release time delay = 0 s

Brake engage frequency threshold = Low speed setting (**LSP**)

- lbr : Brake release current threshold. Current threshold initiates closing of S2A-S2B brake control relay activating the brake release. Factory set to 0, brake release current threshold can be adjusted from 0 to 1.05 In.

Configurable function:

- STP**: Controlled stop on loss of input power. Factory set to **Off**, can be configured to **On**. When set to **On**, deceleration follows a self-adjusting ramp which is a function of the regenerated energy. When set to **Off**, motor coasts to a stop at loss of input power.

77NG2

Variable Torque Option
Card

Adjustable functions:

- JF1**: Jump frequency 1 with bandwidth of 2 Hz. Factory set at 0 Hz (not used); can be adjusted to a value between **LSP** and **HSP**.
- JF2**: Jump frequency 2 with bandwidth of 2 Hz. Factory set at 0 Hz (not used), can be adjusted to a value between **LSP** and **HSP**.

Configurable functions:

- ARr**: Automatic restart. Enables the drive controller to automatically restart following an overvoltage (**OSF**), overload (**OLF**) or overbraking (**ObF**) fault. For the **OSF** and **ObF** faults, the drive controller remains disabled for 1 minute after the fault appears, causing the fault relay of the drive controller to engage, then it restarts automatically if the cause of the fault has disappeared. If the cause of the fault has not disappeared at the end of 1 minute, the drive controller must be manually reset. The drive controller will attempt 5 automatic restarts (one every minute) before it must be manually reset. For the **OLF** fault, the restart is effective as soon as the thermal state drops below 100%, usually about 7 minutes after the fault occurs. Factory set to **Off**, can be configured to **On**.



WARNING

UNINTENDED EQUIPMENT ACTION.

•Automatic restart and catching a spinning load can only be used for machine or installations that present no danger in the event of automatic restarting, either for personnel or equipment.

•Equipment operation must conform with national and local safety regulations.

Failure to observe these precautions can result in equipment damage or severe personal injury.

- FLr**: Catching a spinning load. Allows smooth restarting of the motor after a brief input line undervoltage. If the reference signal and a direction command are maintained, the motor accelerates back up to speed without starting at zero. Factory set to **Off**, can be configured to **On**.
- StP**: Controlled stop on loss of input power. Factory set to **Off**, can be configured to **On**. When set to Yes, deceleration follows a self-adjusting ramp which is a function of the regenerated energy. When set to No, motor coasts to a stop at loss of input power.

77NG3

High Speed Motor Option Card

Adjustable functions:

- Acc2**: Acceleration ramp 2. LI2 is factory set as Switch to Ramp 2. When this input is at state 1, drive controller will accelerate according to **Acc2**. Factory set to 12 s, can be adjusted between 0.1 and 600 s.
- dDec2**: Deceleration ramp 2. LI2 is factory set as Switch to Ramp 2. When this input is at state 1, drive controller will decelerate according to **dDec2**. Factory set to 12 s, can be adjusted between 0.1 and 600 s.
- Idc**: DC current level. DC injection occurs when frequency drops to a value less than 0.1 Hz. Factory set to 0.7 Ith, can be adjusted between 0.5 and 1.5 Ith.
- tDc**: DC current time. Amount of time for which DC is injected when frequency drops to a value less than 0.1 Hz. Factory set at 0.5 s, can be adjusted from 0 to 5 s or to be permanently injected (setting is **dcb**).



WARNING

NO HOLDING TORQUE.

- **DC injection braking does not provide holding torque at zero speed.**
 - **DC injection braking does not function during loss of power or controller fault.**
- When required, use separate brake function for holding torque.**

Failure to observe this precaution can result in equipment damage, severe personal injury or death!



CAUTION

MOTOR OVERHEATING.

Application of DC injection braking for long periods of time can cause motor overheating and damage. Protect motor from extended periods of DC injection braking.

Failure to observe this precaution can result in equipment damage or personal injury.

- FLr**: Catching a spinning load. Allows smooth restarting of the motor after a brief input line undervoltage. If the reference signal and a direction command are maintained, the motor accelerates back up to speed without starting at zero. Factory set to **Off**, can be configured to **On**.

OPERATION ASSISTANCE

Table 5 lists the fault codes accessible on the Display/Adjustment options, the probable causes of the faults and associated corrective action. When taking corrective action, follow the two procedures outlined on pages 22 and 23.

DANGER

HAZARDOUS VOLTAGE.

- **Read and understand these procedures before servicing AC drive controllers. Installation, adjustment, repair and maintenance of these controllers must be performed by qualified personnel.**
- **Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools while making adjustments.**

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death!

The following procedures are intended for use by qualified electrical maintenance personnel and should not be viewed as sufficient instruction for those who are not otherwise qualified to operate, service or maintain the equipment discussed.

**Procedure 1:
Checking Supply
Voltage**

Before checking supply voltage, disconnect all power and measure DC bus capacitor voltage by following the procedure below.

DC bus capacitor voltage is measured between the J9+ and J8- terminals of the drive controller. The DC bus capacitors are discharged when input power is removed from the controller. To ensure the capacitors are fully discharged, always disconnect all power, wait 1 minute, then test with a DC voltmeter (1000 VDC scale) before wiring, troubleshooting or working inside the drive controller. If no reading is shown on the voltmeter, reduce scale and test again.

⚠ DANGER

HAZARDOUS VOLTAGE.

- **Read and understand Bus Voltage Measurement Procedure before performing procedure. Measurement of bus capacitor voltage must be performed by qualified personnel.**
- **DO NOT short across capacitors or touch unshielded components or terminal strip screw connections with voltage present.**
- **Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools.**

Failure to observe these precautions will cause shock or burn, resulting in severe personal injury or death.

The J9+ and J8- terminals are located on the power board, in the general area shown in Figure 17. To measure the bus capacitor voltage, follow the Bus Voltage Measurement Procedure below.

**Bus Voltage Measurement
Procedure**

1. Disconnect all power from controller.
2. Wait 1 minute to allow the DC bus to discharge.
3. Remove all covers.
4. Set the voltmeter to the 1000 VDC scale. Measure the bus capacitor voltage between the J9+ and J8- terminals to verify the DC voltage is zero. **Do not short across capacitor terminals with voltage present!**
5. If the bus capacitors are not fully discharged, contact your local Square D/Telemecanique representative – **do not operate the controller.**
6. Replace all covers.

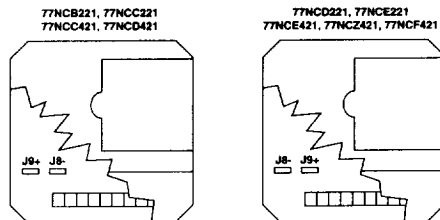


Figure 17 Measuring Bus Capacitor Voltage

After measuring DC bus capacitor voltage, check supply voltage by following the procedure below:

1. Attach meter leads to L1 and L2. Set voltmeter to the 600V AC scale.
2. Reapply power. Voltage should be as follows:
77N**221 187.2 VAC < V < 264 VAC
77N**421 340.0 VAC < V < 529 VAC
3. Remove power and repeat procedure for L2 and L3, and L1 and L3 if wired for three phase.
4. When all phases have been measured, remove power. Remove leads, re-install covers.

Procedure 2: Checking Peripheral Equipment

The following equipment may need to be checked. Follow the manufacturers' procedures when checking this equipment.

1. A protective device such as fuses or circuit breaker may have tripped.
2. A switching device such as a contactor may not be closing at the correct time.
3. Conductors may require repair or replacement.
4. Connection cables to the motor or high resistance connections to ground may need to be checked. Follow NEMA standard procedure WC-53.
5. Motor insulation may need to be checked. Follow NEMA standard procedure MG-1. Do not apply high voltage to U, V or W. Do not connect the high potential dielectric test equipment or insulation resistance tester to the drive controller since the test voltages utilized may damage the controller. Always disconnect the drive controller from the conductors or motor while performing such tests.



CAUTION

EQUIPMENT DAMAGE HAZARD.

- Do not perform high potential dielectric tests on circuits while the circuits are connected to the drive controller.
- Any circuit requiring high potential dielectric tests must be disconnected from the drive controller prior to performing the test.

Failure to observe this precaution can result in equipment damage.

Fault Codes

Table 5 Fault Codes

Fault	Probable Causes	Corrective Actions
Display Off or Partial Display	<ul style="list-style-type: none"> •No voltage •Voltage too low 	Check: <ul style="list-style-type: none"> • Supply Voltage (Procedure 1 on page 22) • Supply fuses or circuit breaker (Procedure 2 on page 23)
PhF	Phase failure <ul style="list-style-type: none"> •No supply to terminals L1, L2, (L3) •Power fuses blown •Brief input line failure ($t \geq 200$ ms) 	Check: <ul style="list-style-type: none"> • Supply Voltage (Procedure 1 on page 22) • Supply fuses or circuit breaker (Procedure 2 on page 23)
USF	Undervoltage <ul style="list-style-type: none"> •Supply voltage too low •For 77N**221, $U \leq 187$ V •For 77N**421, $U \leq 340$ V •Temporary voltage drop ($t \geq 200$ ms) 	Check: <ul style="list-style-type: none"> •Supply voltage (Procedure 1 on page 22) •Connections
OSF	Overvoltage <ul style="list-style-type: none"> •Supply voltage too high •For 77N**221, $V \geq 264$ V •For 77N**421, $V \geq 529$ V 	Check: <ul style="list-style-type: none"> •Supply voltage (Procedure 1 on page 22)
OLF	Overload Thermal trip due to prolonged motor overload	Check: <ul style="list-style-type: none"> • It setting and compare with motor In •Load base speed and power rating and compare with operating speed and controller/motor power rating •Motor connections (possibility of single phase operation) Wait approximately 7 minutes before resetting.
ObF	Overbraking due to overvoltage or	Increase deceleration time, optimize gain by decreasing value of FLG , and optimize Ufr . Add braking option if necessary. Refer to Instruction Bulletin 77-HVFD3.
ObF.	overcurrent due to excessive braking or an overhauling load, even with braking option.	
drF	Transient overcurrent <ul style="list-style-type: none"> •Short circuit or phase to ground on the output of the drive controller •Overheating of drive controller •Supply voltage transient variations •Current too high during transient duty •Internal short circuit 	Switch drive off. Disconnect drive from motor at U, V and W. Check connection cables and motor insulation (Procedure 2 on page 23).
crF	Capacitor charge relay fault Failure of command for capacitor charge relay to close	Replace controller.
InF	Internal connection fault Drive does not recognize rating	Disconnect power and wait one minute for capacitors to discharge. Check internal connections in the drive. If fault persists, replace controller.
EEF.	EEPROM memory fault	Replace controller.
SLF.	Communication fault Communication loss between options	Check display option connection. Reset controller.
OPt	Option Card Fault. Switch 2 on option card was moved to On in order to reconfigure the I/O.	Reconfigure the I/O with the PC connection option (refer to Instruction Bulletin 77-IMVFD3) or return Switch 2 to Off.

Table 5 Fault Codes (Continued)

Fault	Probable Causes	Corrective Actions
SPF	Option card fault (77NG1 only) Speed feedback fault Incorrect adjustment of tachogenerator feedback, or machine overload.	Check: •Feedback signal •Load base speed and power rating and compare with operating speed and controller/motor power rating •Tachogenerator connection
SPF.	No tachogenerator signal.	

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