



PRELIMINARY

QUICK START GUIDE

SYSTEM OVERVIEW



the RAM Variable Speed Solution for your Compressor Application

Contents

Safety	1
System Function	2
System Overview	2
Handling and Storage	3
Site Preparation Mechanical Installation	3
Installation	4
Programming	4
Wiring, Power	5
Wiring, Control	6
VFD Startup Checklist	7
Programming, Graphic Display Terminal	8
Troubleshooting	13
Harmonic Filter Installation	14
Extended Warranty Registration	15

Safety



Warning!

- The ENH₃ANCER II adjustable speed drive should ONLY be installed by a qualified electrician.
- Even when the motor is stopped, dangerous voltage is present at the power circuit terminals R/L1, S/L2, T/L3, and U/T1, V/T2, W/T3, and, where present, PO.1, PA/+, PO.2, PB, PC/-.
- Dangerous voltage is present when input power is connected. After disconnecting the supply, wait at least 5 minutes (to let the intermediate circuit capacitors discharge) before removing the cover.
- Even when the power is removed from the input terminals of the ENH₃ANCER II VFD, there may be dangerous voltage (from external sources) on the terminals of the relay outputs R1...R2.



Warning!

- The ENH₃ANCER II VFD is not a field repairable unit. Never attempt to repair a malfunctioning unit; contact the factory or your local Authorized Service Center for repair or replacement.
- The ENH₃ANCER II VFD will start up automatically after an input voltage interruption if the external run command is on.



Danger!

Hazardous Voltage

- Read and understand this manual before installing or operating the ENH₃ANCER II drive. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical standards in force concerning protective grounding of all equipment.
- Many parts of this variable speed drive, including the printed circuit boards, operate at the line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA and PC or across the DC bus capacitors.
- Install and close all the covers before applying power or starting and stopping the drive.
- Before servicing the variable speed drive:
 - Disconnect all power.
 - Place a "DO NOT TURN ON" label on the variable speed drive disconnect.
 - Lock the disconnect in the open position.
- Disconnect all power including external control power that may be present before servicing the drive. Wait for the charging LED to go off, then follow the DC bus voltage measurement procedure to verify that the DC voltage is less than 45V. The drive LEDs are not accurate indicators of the absence of DC bus voltage.

Electric shock will result in death or serious injury.

Caution!

Improper Drive Operation

If the drive is not turned on for a long period, the performance of its electrolytic capacitors will be reduced.

If it is stopped for a prolonged period, turn the drive on every two years for at least 5 hours to restore the performance of the capacitors, then check its operation. It is recommended that the drive is not connected directly to the line voltage. The voltage should be increased gradually using an adjustable AC source.

Failure to follow this instruction can result in equipment damage.



NOTE: For additional technical information, contact the factory or your local sales.

System Function

The ENH₃ANCER II VFD package has been specifically designed to interface with the OEM microprocessor compressor control system to provide a range of adjustable speed motor control on a compressor application.

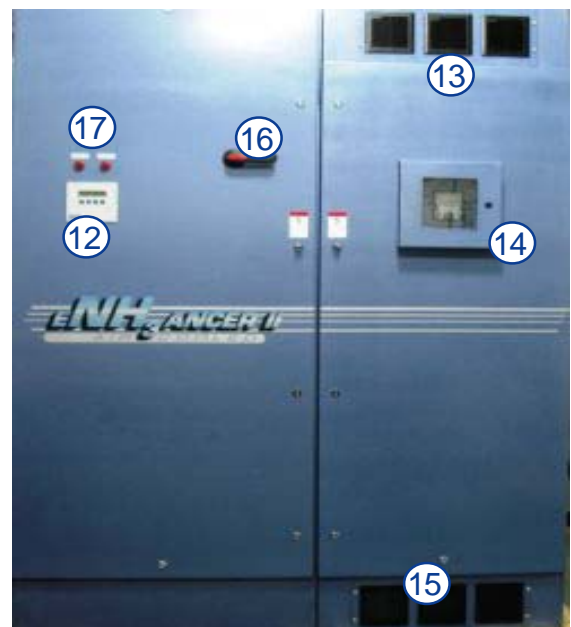
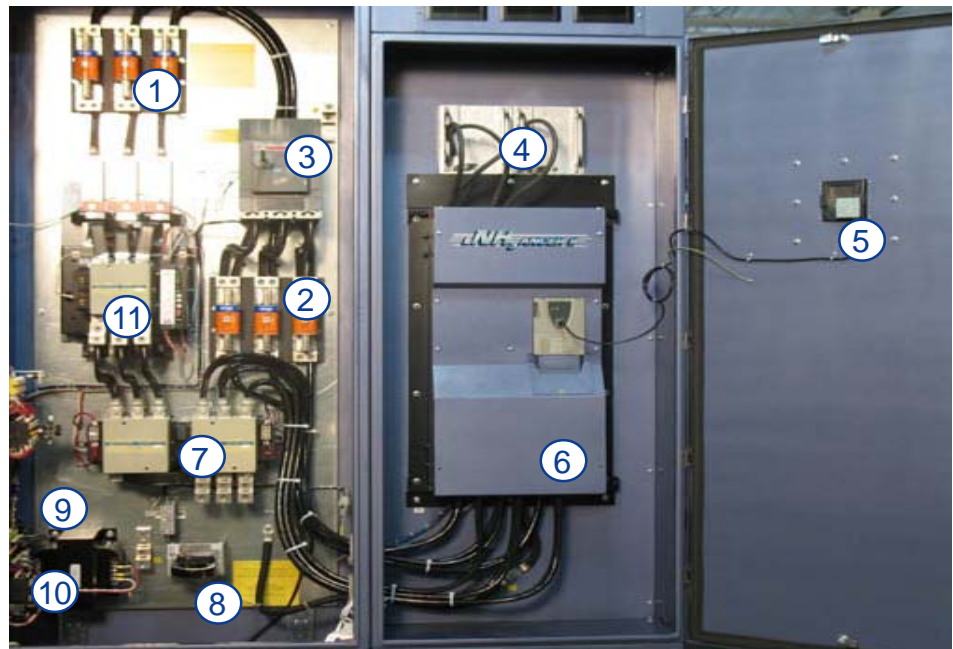
The ENH₃ANCER II VFD package will work in conjunction with the commands from the OEM microprocessor to optimize the control of the compressor motor. The range of speed available is set by the parameters in the VFD and the OEM microprocessor. Typically the speed range of the motor is 2:1 or 5:1 depending on the type of motor. Motor speed range is indicated on the RAM motor nameplate. Some HP and speed range require that the motor be supplied with blowers in order to provide adequate cooling inside the motor during reduced speed.

The ENH₃ANCER II VFD is available with solid state bypass to ensure reliable compressor operation in the unlikely event of a VFD failure or malfunction. The ENH₃ANCER II VFD package has been designed to include the necessary compressor application auxiliary control devices to provide system compatibility.

The ENH₃ANCER II VFD package has been designed and engineered by RAM Industries, LLC based on the Altivar 61 VFD component. Software manuals included with the package reference the Altivar 61 model drive.

System Overview

- 1 RAM DBS FUSING
- 2 VFD FUSING
- 3 MAIN DISCONNECT SWITCH
- 4 DC LINK CHOKES
- 5 DOOR MOUNTED VFD KEYPAD
- 6 BASE VFD
- 7 ISOLATION CONTACTORS
- 8 4-20 mA TRANSDUCER WITH 24VDC SUPPLY
- 9 3 KVA CONTROL TRANSFORMER
- 10 OIL PUMP CONTROL RELAYS BLOWER MOTOR STARTERS
- 11 RAM DBS SOLID STATE BYPASS
- 12 DBS KEYPAD
- 13 AIRFLOW OUTLET
- 14 VFD KEYPAD
- 15 AIRFLOW INLET
- 16 DISCONNECT HANDLE
- 17 INDICATING LIGHTS



Handling and Storage

To protect the drive prior to installation, handle and store the device in its packaging. Ensure that the ambient conditions are acceptable.

Warning! Damaged Packaging

If the packaging appears to be damaged, it can be dangerous to open it or handle it. Take precautions against all risks when performing this operation.
Failure to follow this instruction can result in death or serious injury.

Warning! Damaged Equipment

Do not operate or install any drive that appears damaged.
Failure to follow this instruction can result in death or serious injury.

Warning! Remove the Screws

Remove the screws holding the drive on the pallet and lift off the drive by means of a hoist. It is fitted with handling lugs for this purpose.
Failure to follow this instruction can result in death or serious injury, as well as equipment damage

Warning! Risk of Toppling

Never stand the drive upright without keeping hold of it or it will topple over.
Failure to follow this instruction can result in death or serious injury, as well as equipment damage

Site Preparation

Mechanical Installation

To ensure a proper installation of the ENH₃ANCER II VFD package, please follow these basic guidelines.

- ENH₃ANCER II VFD package should be mounted in a cool, clean mechanical or electrical room with adequate ambient temperature to provide operation of the VFD within its specified temperature range.
- Do not store the VFD near piping.
- Do not store the VFD near construction debris.
- Do not obstruct VFD air intake and outlet plenums.
- Properly cover and protect the VFD prior to installation.
- Properly clean and inspect the internal cabinet prior to energizing.
- Use removable factory conduit drill plates for all cabinet penetrations to prevent metal shavings and debris from getting into the VFD package.

Steps for settings up the drive

Installation

Steps 1-4 must be performed with the power off.

1. Take delivery of the drive

- Check that the catalog number printed on the label is the same as that on the purchase order
- Remove the ENH₃ANCER II VFD from its packaging and check that it has not been damaged in transit

2. Check the line voltage

- Check that the line voltage is compatible with the voltage range of the drive

3. Mount the drive

- Mount the drive in accordance with the instructions in the Installation Guide
- Install any internal and external options

4. Wire the drive

- Connect the motor ensuring that its connections correspond to the voltage
- Connect the line supply after making sure that it is turned off
- Connect the control
- Connect the speed reference

Programming

- Please refer to the programming manuals available online at www.ramusa.com**

RAM DBS Inline Operator's Guide

ENH₃ANCER II / ATV 61 Programming Manual

ENH₃ANCER II / ATV 61 1-7HP Installation

ENH₃ANCER II / ATV 61 125-900HP Installation

ENH₃ANCER II / ATV 61 Quick Reference Guide

ENH₃ANCER II / ATV 61 Engineering Guide



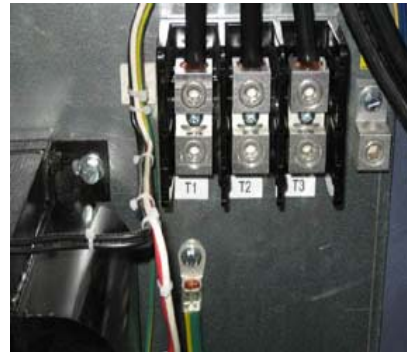
Power Wiring

1. □ **Remove conduit drill plates**
Located at top/bottom of enclosure



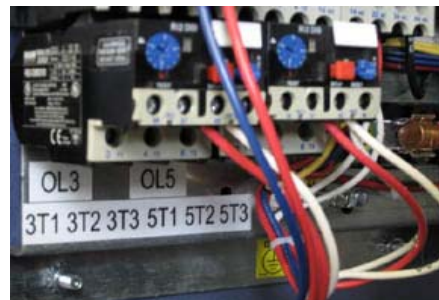
2. □ **Input power**
Terminate incoming power supply to L1-L2-L3 lugs on disconnect device

3. □ **Motor Wire Power Wires**
Terminate motor leads to T1-T2-T3 block



4. □ **Ground**
Properly ground all connections

5. □ **Auxiliary starters**
Wire oil pump and blower motor starters when supplied as specified on drawings

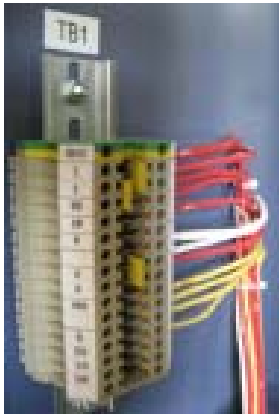


 **NOTE:** All power wiring needs to be in separate metal conduit. Conduit shall be bonded to cabinet.

Control Wiring


1. □ **Signal wiring**

Wire analog, signal wires in shielded cable to reduce noise and improve signal integrity to TB2 as specified



2. □ **Control wiring**

Wire control wires to terminal TB1 as specified

 **NOTE:** Signal and control wiring needs to be in separate metal conduit. Conduit shall be bonded to cabinet to ensure proper grounding is maintained.



VFD Start-up Checklist

A. Reference Material

1. Installation and Operation Manual
2. Wiring schematic located inside panel door
3. Certified start-up should be performed by a certified Representative to maintain the 2-year warranty

B. Pre-Installation Checks

1. Verify drive model number and nameplate data to what was ordered
2. Verify voltage being applied is the same for:
 - a. Drive Package
 - b. Power Line
 - c. Motor being operated by the drive
3. Are line and load reactors installed properly
4. Verify the drive output current FLA is equal to or greater than the motor(s) being driven by it
5. Check Motor Wiring.
 - a. A disconnect (if supplied by others) between the drive and motor should be interlocked to the drives safety interlock to prevent nuisance tripping
 - b. Do not apply power factor correction capacitors between the drive output and the motor
 - c. Verify that motor is connected according to nameplate for the correct connection and voltage.
 - d. Verify all motor lead connections are tight and wire insulation is not nicked or cut. Loose connections or cut wire insulation can cause overcurrent or ground fault trips in the drive
 - e. We don't recommend use of set screw type termination devices on motor leads.
6. Remove motor leads in panel and "megger" motor and leads in reference to ground

C. Installation Checks

1. Branch circuit protection must be provided for the drive. Drive package that comes with an integral main disconnect with fusing is sized to protect the drive package
2. Environmental Concerns
 - a. Clean: Keep construction debris out of drive and/or cabinet
 - b. Dry: maximum 95% relative humidity noncondensing
 - c. Cool: 32°F - 122°F Ambient temperature. -10-50°C Confirm air flow into cabinet
 - d. Elevation: 3300 feet above sea level w/o derate
 - e. Warm: If the drive is to operate below 32°F, install enclosure ambient space heater
3. Mounting
 - a. NEMA 1 drives are floor mounted top or bottom cable entrance. Do not obstruct airflow inlet/outlet on front door of drive
4. Wiring
 - a. Separate grounded metal conduits must be provided for **input power, output power, and control wiring**. Failure to provide separate conduits could result in disruption of other electrical devices due to harmonics and RFI/EMI generated by the drive
 - b. Conduit should be bonded to drive cabinet
 - c. On drives with bypasses, the interlock and remote run commands are at 120VAC potential. See wiring diagram in drive enclosure for connection detail
 - d. Use conduit plates provided. Avoid metal shavings in the drive enclosure. Clean out all debris
 - e. Protect signal wires from noise. Be sure to use shielded and properly grounded signal wires. Noisy input signal wires can cause erratic drive operation

- f. Ground each drive package individually
- g. Double check input and output wiring for correct termination
- h. Double check all electrical connections. Loose wiring can cause nuisance tripping, over current trips, single phase trips, and component failure
- i. Safeties and remote run command must be wired as indicated on wiring diagrams
- j. On drive only applications, all connections must be dry contact connections on the drive logic board
- k. A 0-10VDC or 4-20mA remote speed signal must be wired on drive logic board (polarity must be correct) Consult drawings
5. Programming

Record Motor Data

 - a. Voltage: 208, 230, 380, 460, 575
 - b. Frequency: 50 Hz, 60 Hz
 - c. Motor full-load current: _____ FLA
 - d. Motor full-load speed: _____ RPM
 - e. Motor power (HP x .746) _____ kW or HP

Apply power to drive

 - a. Drives are programmed for basic defaults. Some field programming is required
 - b. Using the soft keys of the Keypad, verify or change as required the parameters.
 - c. Configure speed signal using software parameters
6. Operational Test

Before proceeding, confirm system is safe to run at full speed with motor disconnected from load.

 - a. Perform motor ID run as described in manual

For Drive Only Systems.

Place drive in LOCAL mode, manually increase speed to. Verify rotation of motor. If motor is running backwards, power down drive by opening disconnect and change two phases at drive output motor leads (see drawings)

For Drive and Bypass Systems.

In the bypass mode, check for proper phase rotation (with DBS Bypass). The DBS display will indicate a phase reversal trip if incorrect. Reverse any two input phases to correct fault.

For Drive and Bypass Systems.

Check motor rotation in bypass mode by "bumping" motor using contact closure on the start input. If motor is running backwards in bypass mode, remove power from drive by opening disconnect and change any two motor leads

 - b. Once rotation has been verified in both VFD mode and Bypass mode, place the drive in VFD mode and verify operation in "LOCAL and REMOTE" mode using the keypad. The drive will follow an external speed reference when placed in REMOTE mode and will follow speed commands from the keypad while in LOCAL mode. Use the LOCAL mode to ramp up the motor to full speed. During ramp up, check for system vibration or resonant points
 - c. At full speed and load, measure drive input voltage and output voltage between phases, a voltage balance of less than 5V per phase is desired. Measure drive input and output current between phases, a current balance of less than 5% per phase is desired
 - d. After the above steps are performed, the drive can be placed in REMOTE mode for normal remote operation
 - e. Recommend locking keypad for remote operation only

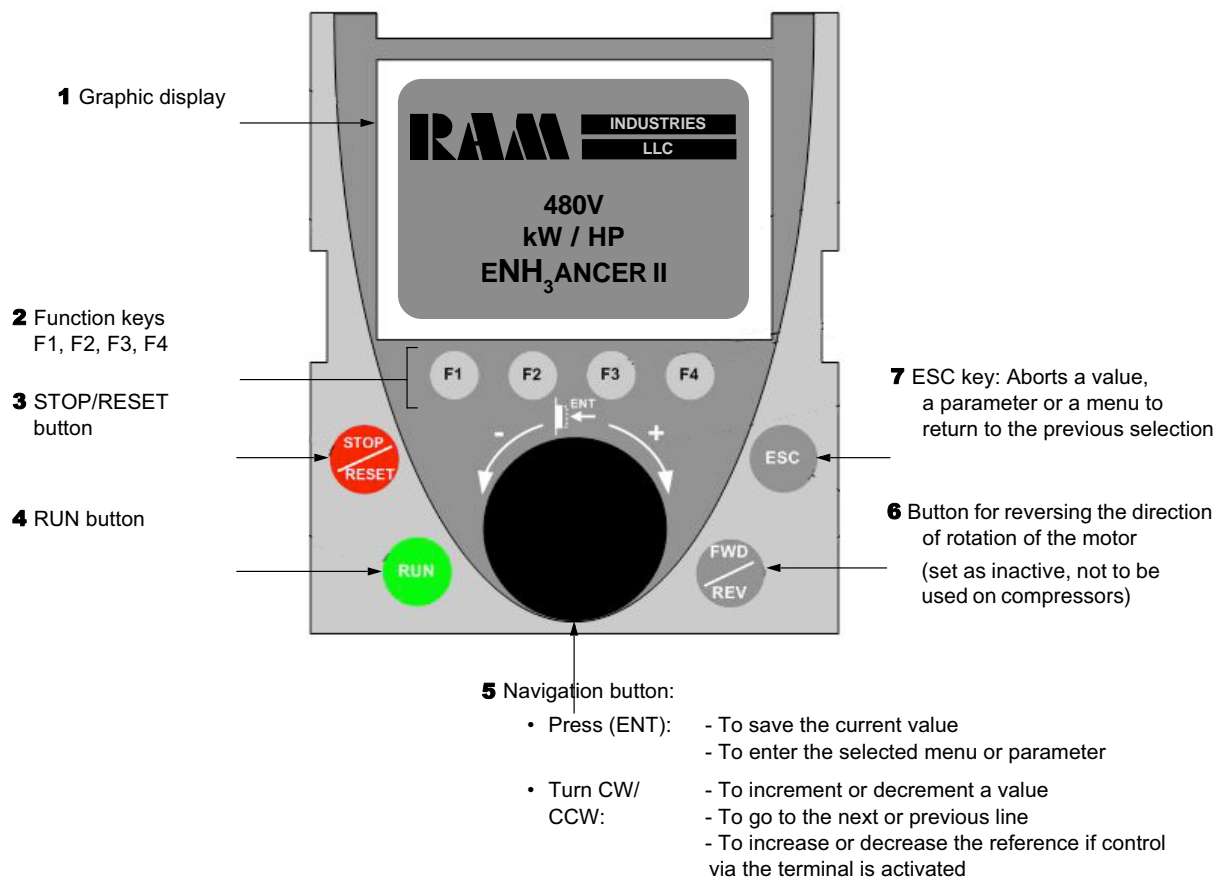
Programming

All programming of the ENH₃ANCER II VFD is performed via the graphic display terminal. The following pages will explain how to access and modify parameters.

Graphic display terminal

The graphic display terminal can be disconnected and connected remotely (on the door of an enclosure for example) using the cables and accessories available as options.

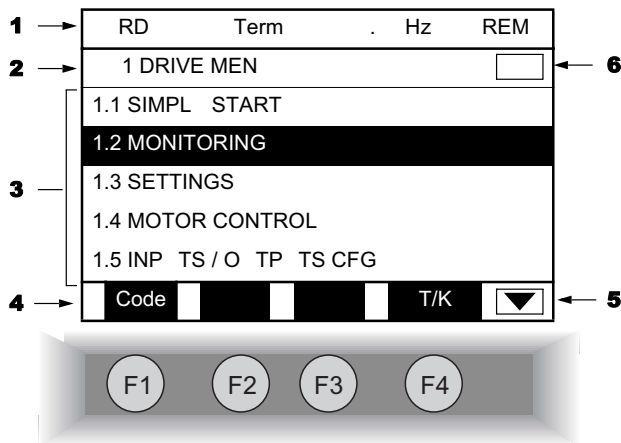
Description of the terminal



Note: Buttons 3, 4, 5 and 6 can be used to control the drive directly, if control via the terminal is activated.

Graphic display terminal

Description of the graphic screen



1. Display line. Its content can be configured; the factory settings show:
 - The drive state
 - The active control channel:
 - Term: Terminals
 - HMI: Graphic display terminal
 - MDB: Integrated Modbus
 - CAN: Integrated CANopen
 - NET: Communication card
 - APP: Controller Inside card
 - Frequency reference
 - LOC/REM: "LOC" appears if the command and reference are set via the graphic display terminal; otherwise, "REM" appears. This corresponds to the state selected by the **[T/K]** function key.
2. Menu line. Indicates the name of the current menu or submenu.
3. Menus, submenus, parameters, values, bar charts, etc., are displayed in drop-down window format on a maximum of 5 lines. The line or value selected by the navigation button is displayed in reverse video.
4. Section displaying the functions assigned to the keys F1 to F4 and aligned with them, for example:
 - Code **F1** : Displays the code of the selected parameter, i.e., the code corresponding to the 7-segment display.
 - HELP **F1** : Contextual help.
 - << **F2** : Navigate horizontally to the left, or go to previous menu/submenu or, for a value, go to the next digit up, displayed in reverse video.
 - >> **F3** : Navigate horizontally to the right or go to next menu/submenu (going to the [2 ACCESS LEVEL] menu in this example) or, for a value, go to the next digit down, displayed in reverse video.
 - T/K **F4** : Command and reference via the terminal.

The function keys are dynamic and contextual.

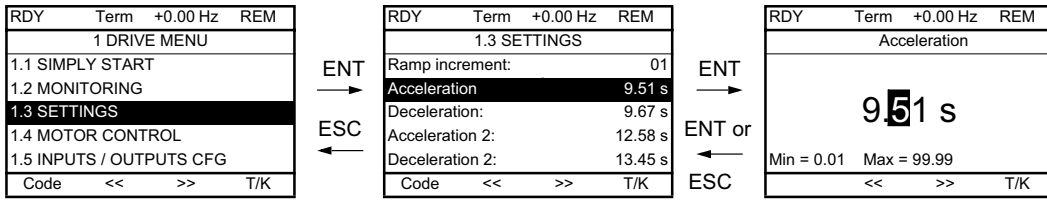
Other functions (application functions) can be assigned to these keys via the [1.6 COMMAND] menu.

5. Indicates that there are no more levels below this display window.
 Indicates that there are more levels below this display window.
6. Indicates that there are no more levels above this display window.
 Indicates that there are more levels above this display window.

Graphic display terminal

Programming: Example of accessing a parameter

Accessing the acceleration ramp



Note:

- To select a parameter:
 - Turn the navigation button to scroll vertically.
- To modify a parameter:
 - Use the << and >> keys (F2 and F3) to scroll horizontally and select the digit to be modified (the selected digit changes to white on a black background).
 - Turn the navigation button to modify the digit.
- To cancel the modification:
 - Press ESC.
- To save the modification:
 - Press the navigation button (ENT).

Graphic display terminal

Quick navigation

In order to access this function you must first reassign the F4 key, which is assigned by default to control via the terminal (T/K). If the "Quick" function is displayed above the F4 key, you can gain quick access to a parameter from any screen.

Example:

RDY	Term	+0.00 Hz	REM
1.4 MOTOR CONTROL			
Standard mot. freq:		5 0 Hz IEC	
Rated motor power:		0.37 kW (0.5 HP)	
Rated motor volt.:		206 V	
Rated mot. current:		1.0 A	
Rated motor freq.:		50.0 Hz	
Code	<<	>>	Quick

Press F4 to access the Quick screen, which contains 4 selection options.

RDY	Term	+0.00 Hz	REM
QUICK NAVIGATION			
RETURN TO MAIN MENU			
DIRECT ACCESS TO...			
10 LAST MODIFICATIONS			
GOTO MULTIPOINT SCREEN			
Code			

See Programming Gd

- [HOME]: Return to [MAIN MENU].

RDY	Term	+0.00 Hz	REM
MAIN MENU			
1 DRIVE MENU			
2 ACCESS LEVEL			
3 OPEN / SAVE AS			
4 PASSWORD			
5 LANGUAGE			
Code			Quick

- [DIRECT ACCESS TO...]: Opens the direct access window, which will contain the text "1". The function keys << and >> (F2 and F3) can be used to select each of the numbers and the navigation button to increment or decrement the numbers: 1.3 in the example below.

RDY	Term	+0.00 Hz	REM
DIRECT ACCESS TO...			
1.3			
	<<		>>

RDY	Term	+0.00 Hz	REM
1.3 SETTINGS			
Ramp increment:			01
Acceleration			9.51 s
Deceleration:			9.67 s
Acceleration 2:			12.58 s
Deceleration 2:			13.45 s
Code	<<	>>	Quick

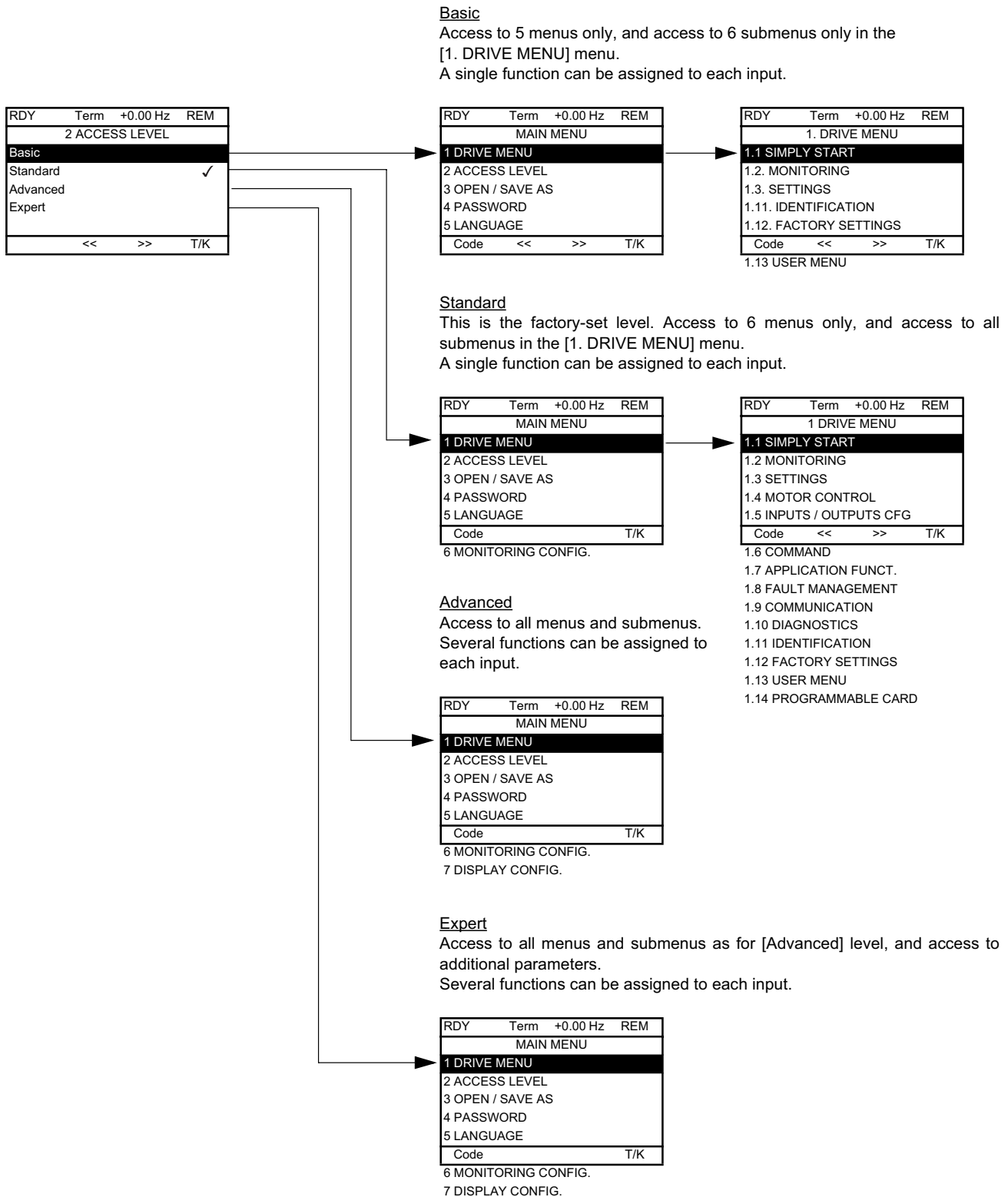
- [10 LAST MODIFICATIONS]: Opens a window in which the last 10 parameters modified can be accessed directly.

RDY	Term	+0.00 Hz	REM
10 LAST MODIFICATIONS			
Acceleration:			10 s
Speed prop. gain:			25%
Rated mot. current:			15 A
Preset speed 4:			20 Hz
Preset speed 5:			30 Hz
Code			

RDY	Term	+0.00 Hz	REM
Rated mot. current			
15.0 A			
	<<		>>

[2. ACCESS LEVEL] (LAC-)

With graphic display terminal



Programming

RAM ENH₃ANCER II Quick Menu contains most parameters that may need editing during commissioning and start up. Complete software parameters are available in the programming guide. To access the RAM ENH₃ANCER II menu, follow the sequence below:

MONITORING MENU

1.12 DRIVE MENU

 **NOTE:** While in Quick Mode, follow navigation instructions to edit/change parameters.

RAM ENH₃ANCER II

Rated motor power
Rated motor voltage
Rated motor current
Rated motor freq
Rated motor speed
Motor thermal current
Accel
Decel
Low speed
High speed
Motor control type
Skip Frequency
Skip Frequency 2
3rd Skip Frequency

The Graphic Display Terminal has been factory configured to show parameters.

TOP BAR

Motor voltage
Drive thermal state

DISPLAY

Frequency ref
Output frequency
Motor current
Motor speed
Run time

Troubleshooting

Under construction.

Harmonic Filter Installation

Under construction.



ENH3ANCER II Certified Start-up Extended Warranty Registration

This form is to be used by factory authorized personnel only for RAM Drive Warranty Registration. This form must be completed in its entirety and submitted to RAM within 30 days from start-up to receive warranty extension. Mail to RAM Industries LLC, PO Box 629, Leesport, PA 19533 or fax to 610-916-0157.

Job Site Information			
Company Name _____	Contact Name _____		
Street Address _____	Contact Phone _____		
City _____	State _____	Zip/Postal Code _____	

Drive Information			
Drive Model _____	Drive Serial# _____		
RAM Job# _____	RAM Assembly# _____		

Motor Information			
Motor HP _____	Voltage _____	RPM _____	Model # _____
FLA _____	Frequency _____	Serial # _____	

A. Installation Checks
<input type="checkbox"/> 1. Verify voltage being driven supplied is correct for.:
<input type="checkbox"/> a. Drive package.
<input type="checkbox"/> b. Motor being operated by the drive.
<input type="checkbox"/> 2. Are line and load reactors installed properly.
<input type="checkbox"/> 3. Verify the drive maximum output current is equal to or greater than the motor full load amps.

B. Motor Wiring
<input type="checkbox"/> 1. Verify that motor is connected according to nameplate for the correct connection and voltage. Note: The use of set screw connectors on RAM Motors will void the warranty!
<input type="checkbox"/> 2. Do not apply power factor correction capacitors between the drive output and the motor.
<input type="checkbox"/> 3. Verify the motor connection in the VFD panel are tight.

C. Environmental Concerns
<input type="checkbox"/> 1. Clean: Keep construction debris out of drive and / or cabinet.
<input type="checkbox"/> 2. Ambient temperature between 32 degrees F-122 degrees F.
<input type="checkbox"/> 3. Warm: If the drive is to operate below 32 degrees F, install enclosure ambient space heater.
<input type="checkbox"/> 4. Adequate spacing around drive for proper cooling.

Continued

D. Wiring

- 1. Separate grounded metal conduits must be provided for input power, output power, and control wiring. Failure to provide separate conduits could result in disruption of other electrical devices due to harmonic and RFI/EMI generated by the drive.
- 2. Conduit should be bonded to drive cabinet.
- 3. Use conduit knockouts. Avoid metal shavings in drive enclosure. Clean out debris.
- 4. Be sure to use shielded and properly grounded signal wires.
- 5. Check for proper grounding of motor and control panel. (Ground wire connected to frame of motor.)
- 6. Double check the control wiring connections. Loose wiring can cause nuisance tripping, over-current trips, single-phase trips, and component failure.

E. Electrical Test Megger Cable / Motor

- 1. Disconnect motor leads (on drive only packages) at the drive cabinet. Take meg ohm readings to ground on the leads going to the motor.
 T1-Gnd _____ T2-Gnd _____ T3-Gnd _____
Megger test voltage _____

F. Operational Test

- 1. Before proceeding, confirm system is safe to run at full speed with motor disconnected from load.
- 2. Apply power to drive.
 Drives are programmed for basic defaults. Some field programming is required, see RAM Data Sheet and Drive Manual.
 - a. For Drive Only Systems.
 Using the drive keypad, start the motor and check for proper rotation. If the rotation is incorrect, remove power and reverse any two motor leads.
 - b. For Drives with Bypass System
 In the bypass mode, check for proper phase rotation (with DBS Bypass). The DBS display will indicate a phase reversal trip if incorrect. Reverse any two inputs phases to correct fault.
 - c. For Drives with Bypass System
 Check motor rotation in bypass mode by "bumping" motor using contact closure on start input. If motor is running the wrong direction in bypass mode, remove power and change any two motor leads.
- 3. Once rotation has been verified in both VFD mode and bypass mode, place the drive in VFD mode and verify operation in "local and remote" mode using the keypad.

- 4. Couple motor to load and run under a loaded condition. Take the following readings:

Input Voltage @ Base Speed

L1-L2 = _____

L2-L3 = _____

L3-L1 = _____

Input Current @ Base Speed

L1 = _____

L2 = _____

L3 = _____

Output Current @ Base Speed

T1 = _____

T2 = _____

T3 = _____

Comments _____

Performed by _____

Registration # _____