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# Tube Transmitter Blower Motor Inverter Installation Application Guide

597-2022  
Revision D  
June 28, 2016





## SAFETY PRECAUTIONS

### PLEASE READ AND OBSERVE ALL SAFETY PRECAUTIONS

ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES, POWER TRANSISTORS, OR EQUIPMENT THAT UTILIZES SUCH DEVICES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. EXERCISE EXTREME CARE AROUND SUCH PRODUCTS. UNINFORMED OR CARELESS OPERATION OF THESE DEVICES CAN RESULT IN POOR PERFORMANCE, DAMAGE TO THE DEVICE OR PROPERTY, SERIOUS BODILY INJURY, AND POSSIBLY DEATH!!



### DANGEROUS HAZARDS EXIST IN THE OPERATION OF POWER TUBES AND POWER TRANSISTORS

The operation of power tubes and power transistors involves one or more of the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

- A. HIGH VOLTAGE** - Normal operating voltages can be deadly. Additional information follows.
- B. RF RADIATION** - Exposure to RF radiation may cause serious bodily injury possibly resulting in Blindness or death. Cardiac pacemakers may be affected. Additional information follows.
- C. HOT SURFACES** - Surfaces of air-cooled radiators and other parts of tubes can reach temperatures of several hundred degrees centigrade and cause serious burns if touched. Additional information follows.
- D. RF BURNS** - Circuit boards with RF power transistors contain high RF potentials. Do not operate an RF power module with the cover removed.

### HIGH VOLTAGE

Many power circuits operate at voltages high enough to kill through electrocution. Personnel should always break the primary AC Power when accessing the inside of the transmitter.



## RADIO FREQUENCY RADIATION

Exposure of personnel to RF radiation should be minimized, personnel should not be permitted in the vicinity of open energized RF generating circuits, or RF transmission systems (waveguides, cables, connectors, etc.), or energized antennas. It is generally accepted that exposure to "high levels" of radiation can result in severe bodily injury including blindness. Cardiac pacemakers may be affected.

The effect of prolonged exposure to "low level" RF radiation continues to be a subject of investigation and controversy. It is generally agreed that prolonged exposure of personnel to RF radiation should be limited to an absolute minimum. It is also generally agreed that exposure should be reduced in working areas where personnel heat load is above normal. A 10 mW/cm<sup>2</sup> per one tenth hour average level has been adopted by several U.S. Government agencies including the Occupational Safety and Health Administration (OSHA) as the standard protection guide for employee work environments. An even stricter standard is recommended by the American National Standards Institute which recommends a 1.0 mW/cm<sup>2</sup> per one tenth hour average level exposure between 30 Hz and 300 MHz as the standard employee protection guide (ANSI C95.1-1982).

RF energy must be contained properly by shielding and transmission lines. All input and output RF connections, such as cables, flanges and gaskets must be RF leak proof. Never operate a power tube without a properly matched RF energy absorbing load attached. Never look into or expose any part of the body to an antenna or open RF generating tube or circuit or RF transmission system while energized. Monitor the tube and RF system for RF radiation leakage at regular intervals and after servicing.

## HOT SURFACES

The power components in the transmitter are cooled by forced-air and natural convection. When handling any components of the transmitter after it has been in operation, caution must always be taken to ensure that the component is cool enough to handle without injury.

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## MODIFICATIONS

Broadcast Electronics, reserves the right to modify the design and specifications of the equipment in this manual without notice. Any modifications shall not adversely affect performance of the equipment so modified.



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# 1 Prepare to Install the Blower Motor Inverter

## 1.1 Overview

This Kit is for Models: FM-30T, FM-35T, FM-40T, FMi 21T, and FMi 25T

The AC Frequency Inverter Kit is installed to increase Blower Motor Speed for improved cooling in HD conversions and operating at lower PA efficiencies.

Note: The original inverter has now been replaced with two inverter part numbers for different AC line voltages and frequencies:

- BE Kit Part Number: 979-2022-003 196 – 252 VAC, 60 Hz
- BE Kit Part Number: 979-4022-003 339 – 427 VAC, 50 Hz

Please read and review all information on both inverters for a complete overview of installation of these kits or the replacement of an existing inverter already installed in the transmitter.

### 1.1.1 Inverter Location

- The area where the Inverter will be positioned is at the base of the cabinet near the Screen Power Supply Transformer.



Figure 1 – Inverter Location

## 1.2 Tools / Items Needed

### 1.2.1 Supplied By Customer:

- 700°F Soldering Iron
- SN 63PB37 Solder or Equivalent
- Wire Cutting & Stripping Tools
- 9/16" Nut driver or Wrench
- 1/4" Nut driver or Wrench
- No. 2 Phillips Screwdriver
- Drill and 1/4-20 Tap Set Required on some transmitters. (Refer to Section 2.5.1.)

### 1.2.2 Supplied in B.E. Kit: 979-2022-003

#### **Inverter Kit, for transmitters operating on: 240V, 60Hz**

- 341-2022-100 AC Frequency Inverter 240V (Qty 1)
- 471-5710-100 Inverter Mounting Plate (Qty 1)
- 421-6008 Kepnut, 6-32 (Qty 2)
- 423-1002 Splitlock, 1/4 (Qty 1)
- 420-1517 Screw, 1/4-20 (Qty 1)
- 949-0167-200 Cable Harness (Qty 1)
- 423-5002 Flat Washer, 3/8 (Qty 1)
- 423-5006 Splitlock, 3/8 (Qty 1)
- 420-5007 Screw, 3/8-16 X 1/2 Long (Qty 1)
- 402-0000 Tywrap, 6" (Qty 12)
- 611-2500 Heatshrink, 1/4" (Qty 6")
- 611-3750 Heatshrink, 3/8" (Qty 6")



### 1.2.3 Supplied in B.E. Kit 979-4022-003

#### **Inverter Kit, for transmitters operating on: 380V/415V, 50Hz**

- 341-4022 AC Frequency Inverter, 380/415V (Qty 1)
- 471-7212 Inverter Mounting Plate (Qty 1)
- 441-8452 Standoff, 8-32 Hex, 2.5 X 1/4 (Qty 4)
- 520-1336 Screw, 1/4 - 20 X .625
- 523-8001 Flat Washer, #8 (Qty 2)
- 523-8002 Splitlock, #8 (QTY 4)
- 949-0167-200 Cable Harness (Qty 1)
- 423-5002 Flat Washer, 3/8 (Qty 1)
- 423-5006 Splitlock, 3/8 (Qty 1)
- 420-5007 Screw, 3/8-16 X 1/2 Long (Qty 1)
- 402-0000 Tywrap, 6" (Qty 12)
- 611-2500 Heatshrink, 1/4" (Qty 6")
- 611-3750 Heatshrink, 3/8" (Qty 6")

### 1.3 Estimated Time for Replacement

- With items listed above and a full review of the installation information in this document, it will take approximately, 40 – 60 minutes to install the Inverter for the Blower Motor.



## 2 Inverter Installation

### 2.1 Turn the Transmitter OFF (from the Transmitter's Front Panel)

- Depress **BOTH** the **Filament** and **High Voltage OFF** buttons on the front panel of the transmitter. The blowers will run until the tube has been cooled. Once the blowers stop, proceed with turning the Primary AC Breaker at the Service Entrance to OFF.

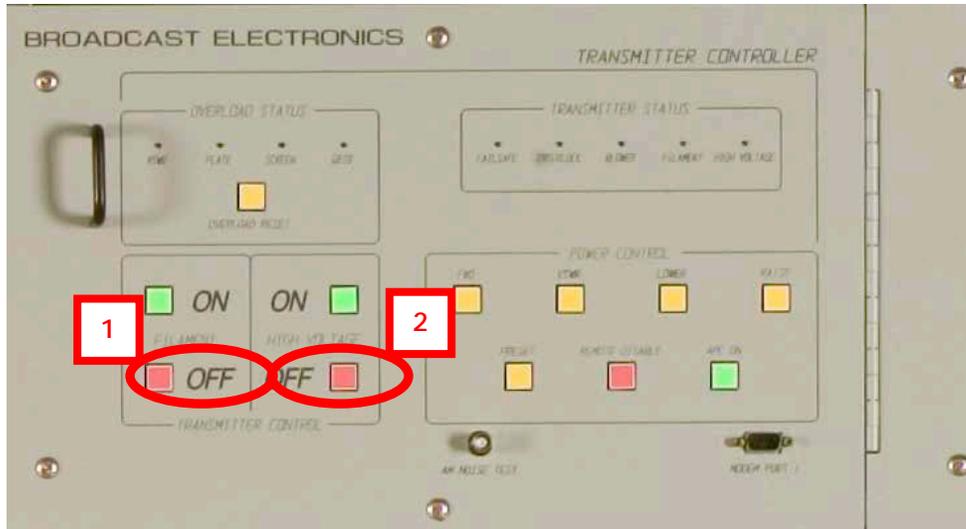


Figure 2 – Transmitter Controller

### 2.2 Disconnect AC Power from Transmitter



Before opening any doors or access panels, remove all AC power to transmitter. Turn breakers or disconnect switches to OFF and lock out before proceeding with any work inside transmitter

### 2.3 Remove Labels and Tags



Figure 3 – Remove Vent Cover Label from Inverter

- Remove information tags, if present, on outside and inside hinged cover to access configuration terminal strips.



Figure 4 – Open Cover and Remove Outer Tag

## 2.4 Install Jumpers

- The jumper configuration between the 60 Hz / 240V systems and the 50 Hz / 380-415V systems are different

### 2.4.1 60 Hz Jumper Configuration

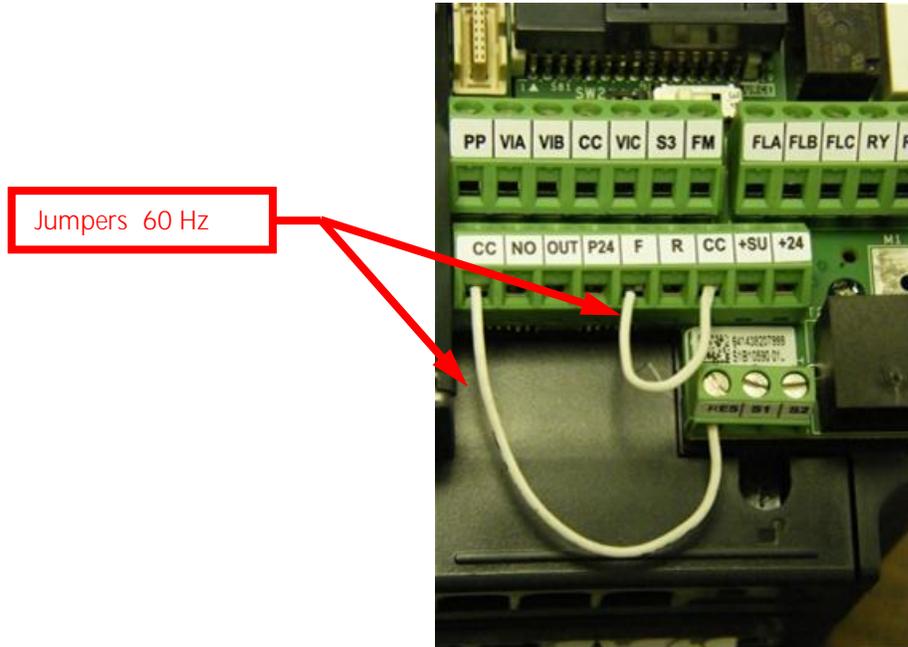


Figure 5 –Jumpers for 60 Hz / 341-2022-100

### 2.4.2 50 Hz Jumper Configuration

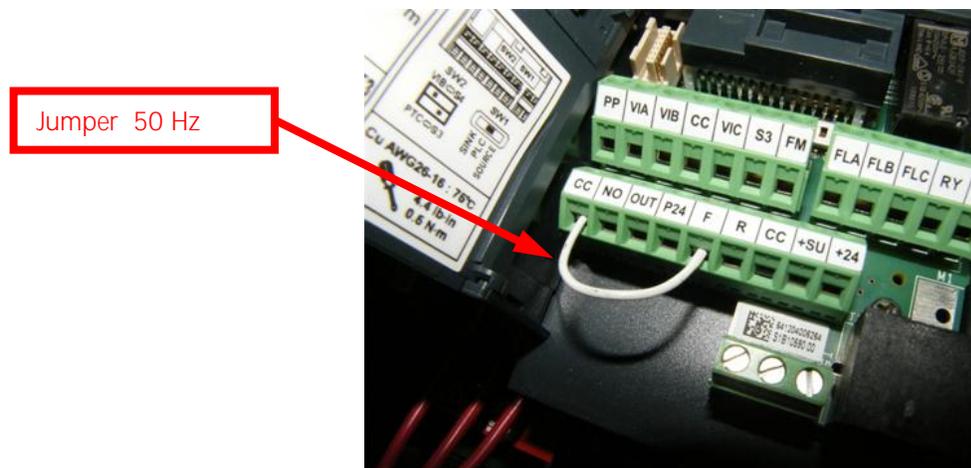


Figure 6 – Jumper for 50 Hz / 341-4022

## 2.5 Install Mounting Plates

### 2.5.1 Overview - Mounting Plates

- The Inverter for 50 Hz operation is larger than the Inverter used at 60Hz and therefore the Mounting Plates are different. Review both versions for complete information on mounting information.
- Both versions of the mounting plates use two bolt /screw locations in the base of the transmitter cabinet to secure the plate.. One location is a 3/8–16 pressed in nut near the Screen Supply Transformer. The second is a 1/4-20 pressed in nut located about 7 inches away.
- Some older transmitters may not have the 1/4-20 pressed in nut and it will have to be drilled and tapped. Use the Mounting Plate as a template for this requirement.
- To allow better access to the wiring entrance of the inverter for wiring into the existing harness of the transmitter do install the final hardware fastening of the inverter to the mounting plate after the wiring of the 3 phase AC power for the blower has been completed.

### 2.5.2 60 Hz Inverter & Mounting Plate

- Mount plate 471-5710-100 with the two Kep Nuts supplied to the opposite corners of the Inverter, 341-2022-100.
- Note the position of the wiring entrance end of the Inverter in relation to the 3/8" clearance hole for mounting in transmitter.



Figure 7 – 60 Hz Mounting Plate



### 2.5.3 50 Hz Inverter & Mounting Plate

- The 50Hz with it's larger foot print will cover the  $\frac{1}{4}$  - Clearance Hole. The 471-5712 Mounting Plate is positioned and then fastened first. The Inverter is fastened later with (4) threaded stand offs supplied in the kit.

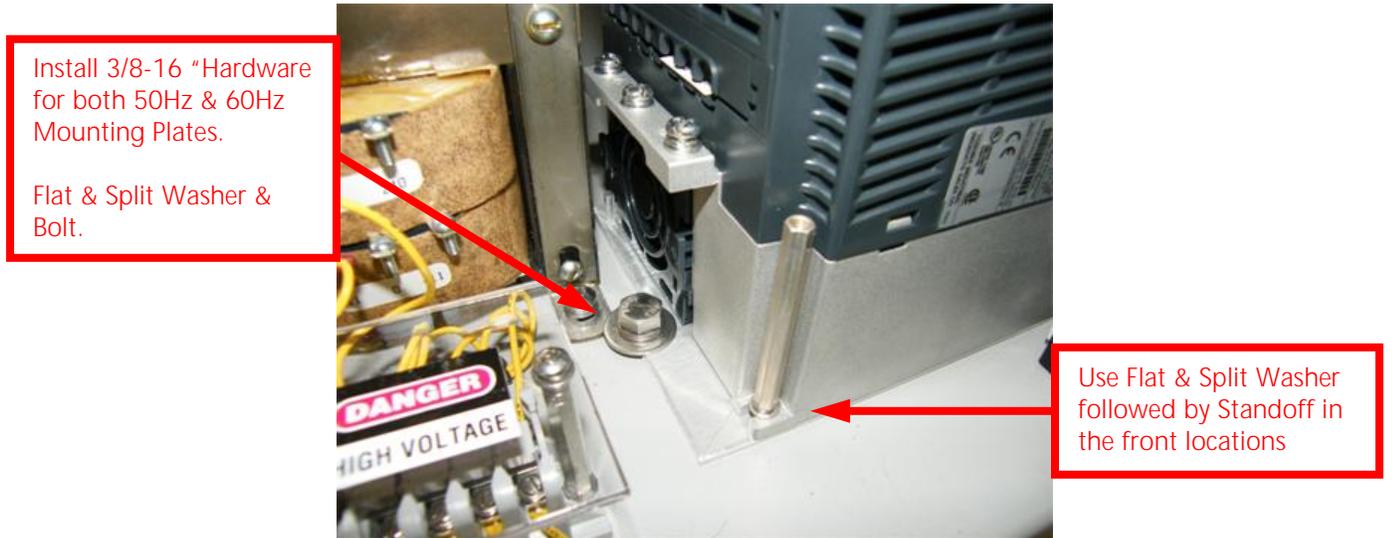


Figure 8 – 50 Hz Inverter Mounting Front View

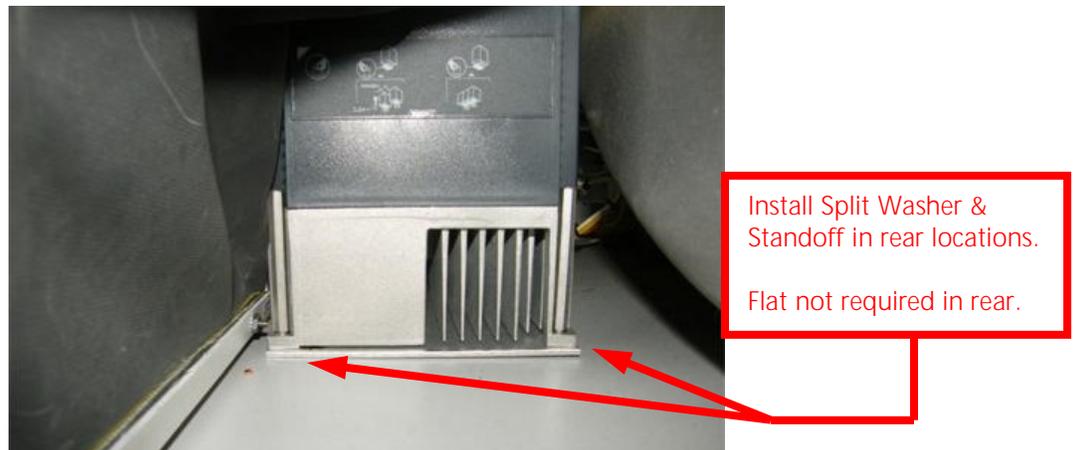


Figure 9 – 50 Hz Inverter Mounting Rear View

2.6 Disconnect Existing Wire Harness From Blower Motor



Figure 10 – Disconnect Harness from Blower Motor

2.7 Route Existing Harness to Rear of Cabinet

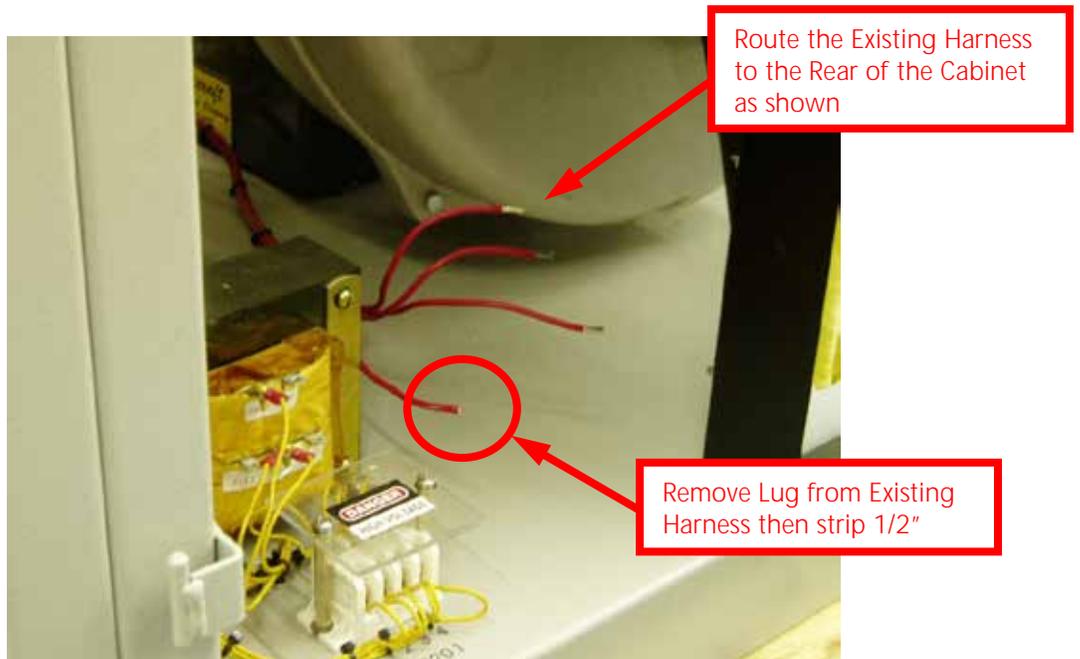


Figure 11 – Route Existing Harness to Rear of Cabinet

## 2.8 Remove AC Terminal Covers and Labels

- Below the hinged access cover are two removable covers for the AC Supply/Line, Motor/Load and DC Terminal Strips.



Figure 12 – Remove Upper Cover

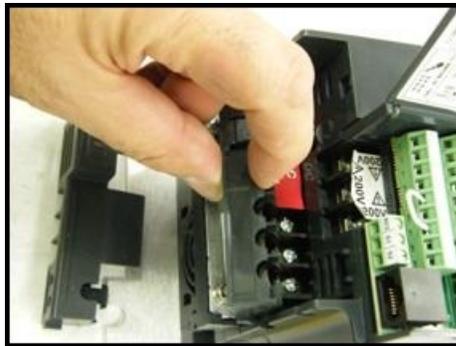


Figure 13 – Remove Lower Cover

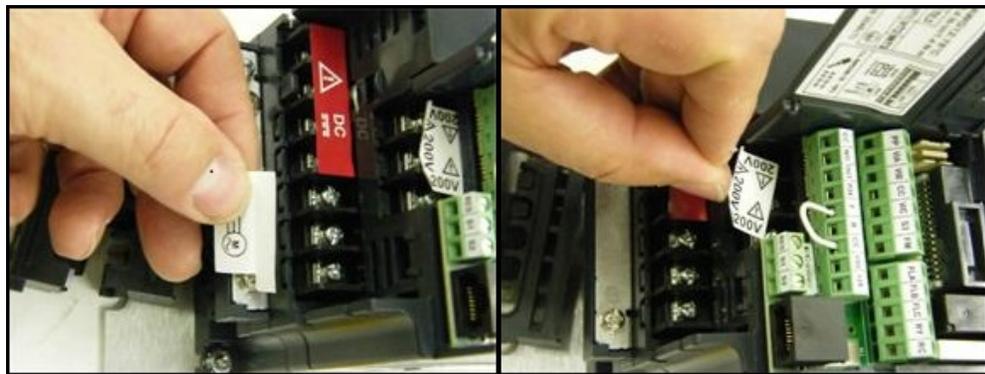


Figure 14 – Remove Labels, (DC Label can remain.)

## 2.9 Connect the Supplied Harness to Inverter

- Supplied in both versions of the kit is wire harness, BE part number 949-0167-200.

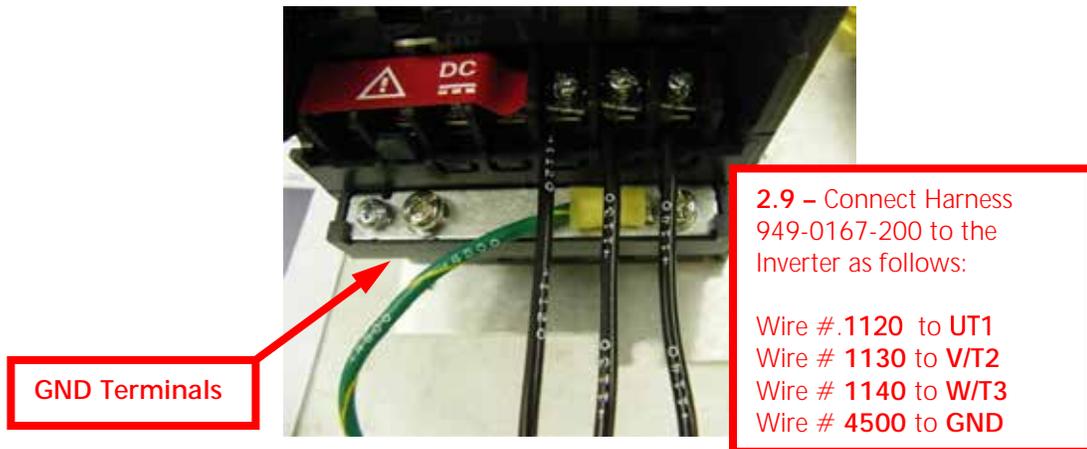


Figure 15 – Connect new Harness 949-0167-200 to Inverter

## 2.10 Connect Existing Wires to Inverter

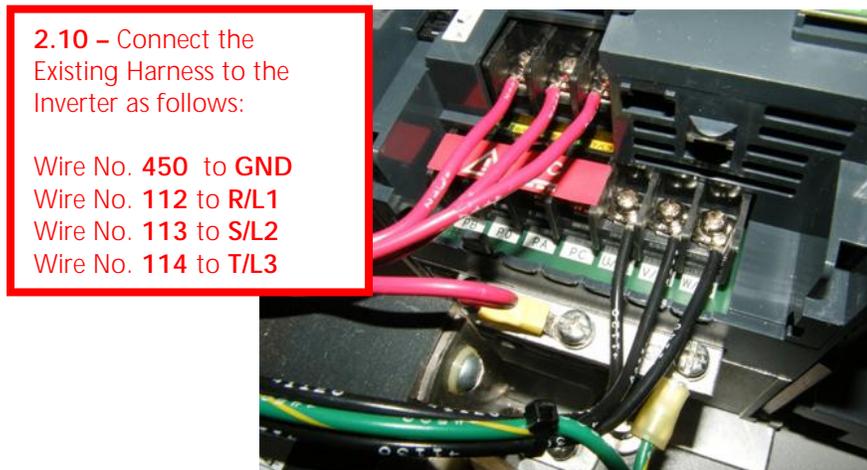


Figure 16 – Connect Existing Wires

## 2.11 Replace All Covers

- Replace the Motor Terminal Cover and AC Supply/Line Cover removed in Step 2.8
- Fasten remaining Inverter & Mounting Plate hardware if not already in place from Step 2.5

## 2.12 Connect the Supplied Harness to the Blower Motor

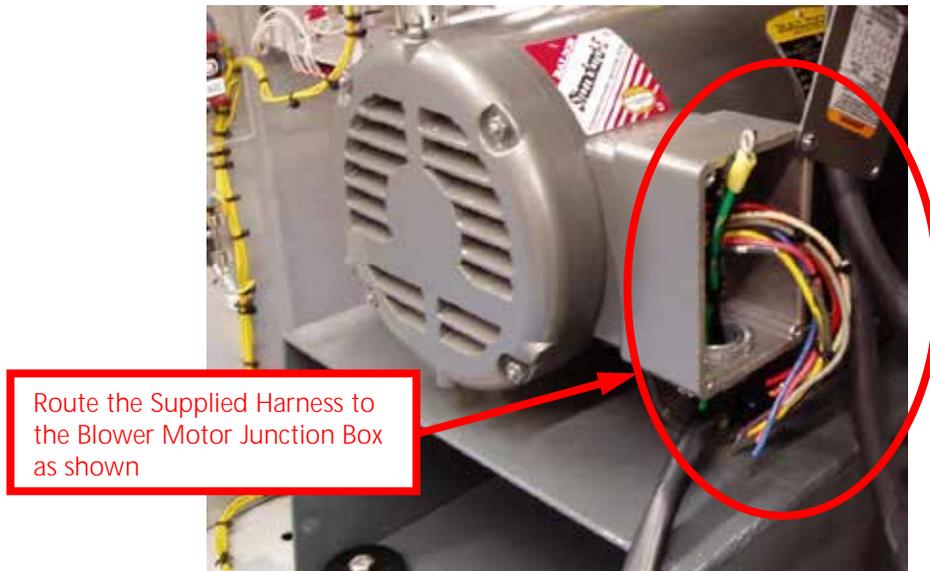


Figure 17 - Blower Motor Junction Box

Connect and Solder the Supplied Harness to the Motor Wires as follows:

Harness 949-0167-200	Motor Harness
Wire # 1120 (BLK)	to Wire # 1 (Blue) and 7 (Pink)
Wire # 1130 (BLK)	to Wire # 2 (White) and 8 (Red)
Wire # 1140 (BLK)	to Wire # 3 (Orange) and 9 (Grey)
Wire # 4500 (GRN/YEL)	to Ground Lug Inside of Box

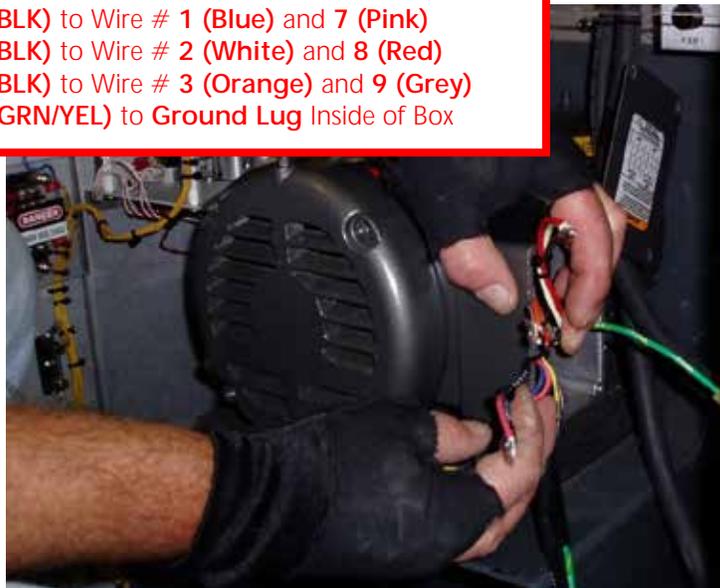


Figure 18 – Supplied Harness & Motor Wiring Connections

### 2.13 Apply Heatshrink

- Cover the soldered wire ends with the 1/4" heatshrink tubing. Shrink with heat gun and add second layer with 1/2" heatshrink



Figure 19 – Apply Heatshrink

### 2.14 Install Junction Box Cover Plate

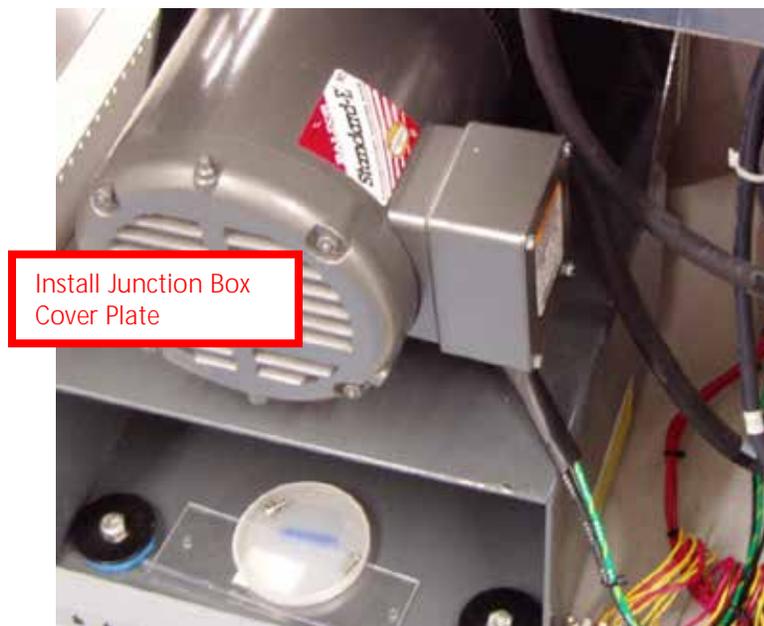


Figure 20 – Install Junction Box Cover Plate

### 3 TOSHIBA TOSVERT VF-S15 Information

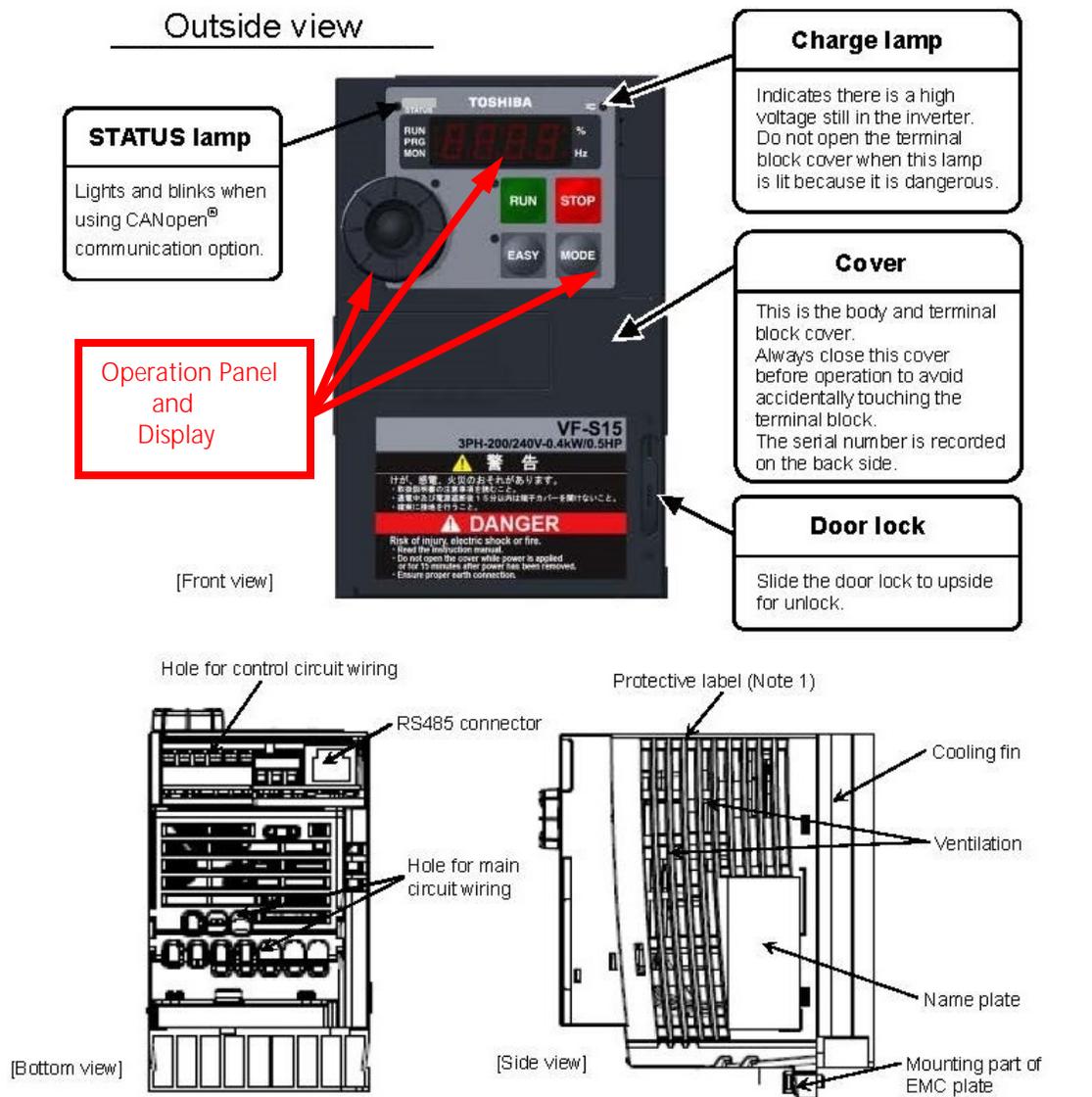
The Toshiba Inverters are delivered to Broadcast Electronics Pre-Programmed and should NOT need to be programmed. If for some reason the device should need to be re-programmed or serviced, this section was created for a quick overview of the VF-S15 Inverter. If additional information is needed on the VF-S15, refer to the PDF file of the Toshiba Instruction Manual located on the CD ROM disk included with the inverter.

#### 3.1 Outside Views and Names & Functions

**TOSHIBA**

E6581611

#### Names and functions



1

Figure 21 – VF-S15 Outside Views Names & Functions.

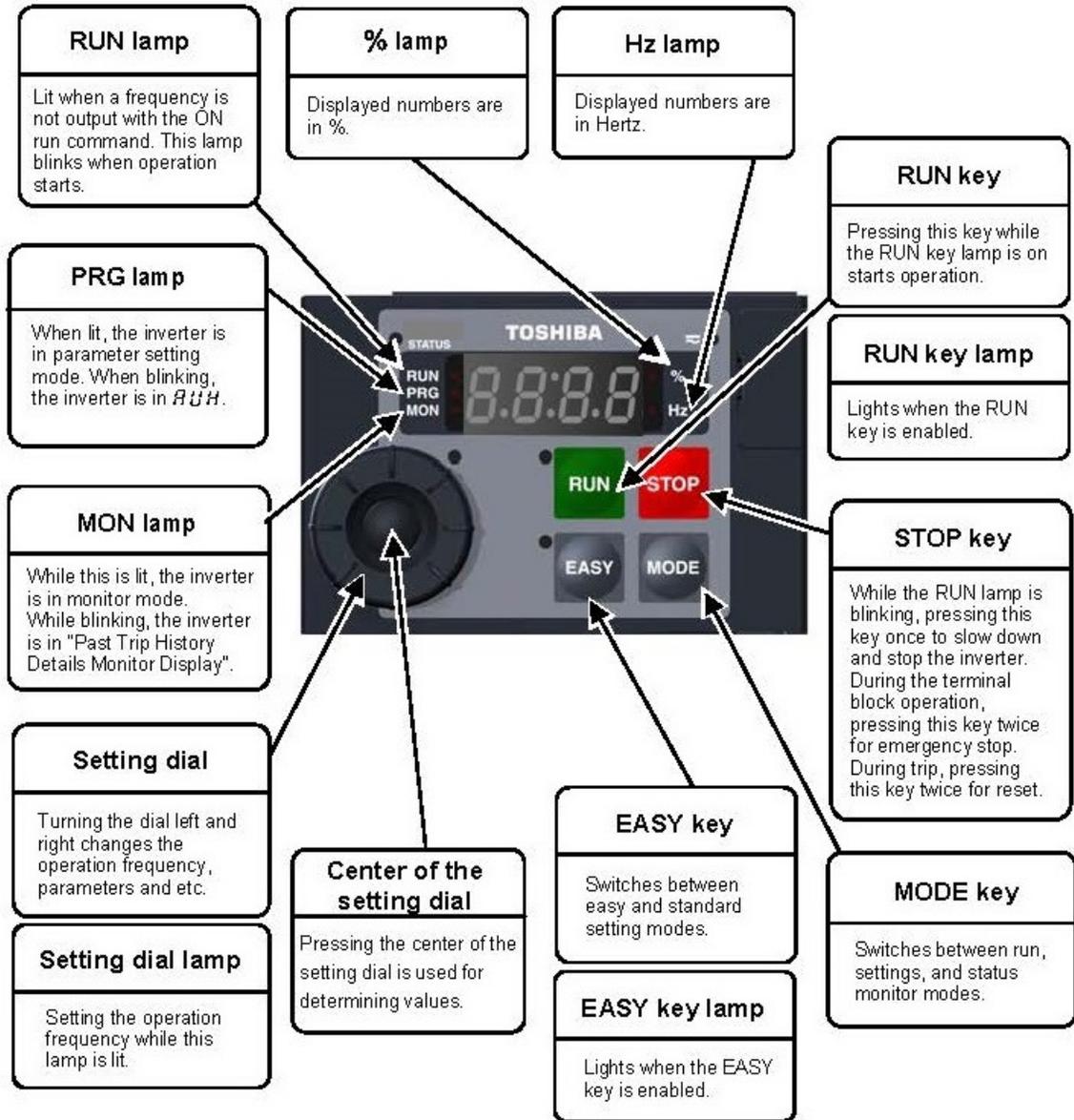


### 3.2 Operation Panel; Displays & Controls

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[Operation panel]



1

Figure 22 – VF-S15 Operation Panel. Displays & Controls



### 3.3 Inverter Presets

The Pre-Programmed Settings are listed in Table 1

Inverter (341-2022-100) is pre-programmed for an AC Input Frequency of 60Hz and an AC Input Voltage of 240 V, which sets the input voltage range from 196 VAC to 252 VAC.

Inverter (341-4022) is pre-programmed for an AC Input Frequency of 50 Hz and an AC Input Voltage of 380 V. which sets the input voltage range from 339 VAC to 437 VAC.

Both versions are programmed for an AC Output Frequency Range of 70Hz to 80Hz controlled by the Dial on the Inverter. For best cooling of the tube and PA, adjust the Inverter for 80 Hz output frequency.

BE Part Number		341-2202-100	341-4022
TITLE	FUNCTION / DESCRIPTION	SETTING	SETTING
TYP	Default Setting	2	1
CMOD	Command Mode Selection	0	0
FH	Maximum Frequency	80HZ	80HZ
UL	Upper Limit Frequency	80HZ	80HZ
LL	Lower Limit Frequency	70HZ	70HZ
THR	Motor Electronic Thermal Protection	92%	92%
F110	Always Active Function	0	
F113	Input Terminal Selection 3	6	
F170	Base Frequency	60	60
F171	Base Frequency Voltage	240	380
F204	VIA Input Point 2 Frequency	80	80
F300	PWM Carrier Frequency	4	4
F301	Auto Restart Control Selection	3	3
F302	Regenerative Pwr Ride-Through Control	1	1
F303	Retry Selection (number of times)	5	5
F417	Motor Rated Speed	1765	1765

Table 1 – Inverter Settings

The 7-Segment LED display on the operation panel uses the following symbols shown in Table 2. Settings such as TYP, CMOD, & THR will display as:

*TYP, CMOD, THR*

LED display (numbers)

0	1	2	3	4	5	6	7	8	9	-
0	1	2	3	4	5	6	7	8	9	-

LED display (letters)

Aa	Bb	C	c	Dd	Ee	Ff	Gg	H	h	I	i	Jj	Kk	Ll
A	b	C	c	d	E	F	G	H	h	I	i	J	K	L
Mm	Nn	O	o	Pp	Qq	Rr	Ss	Tt	Uu	Vv	Ww	Xx	Yy	Zz
M	n	O	o	P	q	r	S	t	U	v	W	X	Y	Z

Table 2 – Alpha /Numeric Chart for 7-Segment LED Display



### 3.4 Setting Parameters - Overview

The two Function Keys, "EASY" and "MODE" are used when displaying inverter parameters and settings. However, the EASY Key only displays the ten most frequently used parameters. The BE application of Blower Speed Control requires settings of Extended Parameters with the Suffix letter F from Table 1, Therefore the Standard Mode is used in this application.

**TOSHIBA**

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## Setting and Display Modes

This inverter has the following three display modes.

**Standard monitor mode** The standard inverter mode. This mode is enabled when inverter power goes on.

**Setting monitor mode** The mode for setting inverter parameters.  
⇒ How to set parameters, refer to section 4.2.

There are two parameter read modes. Refer to section 4.2 for details about selection and switching of modes.

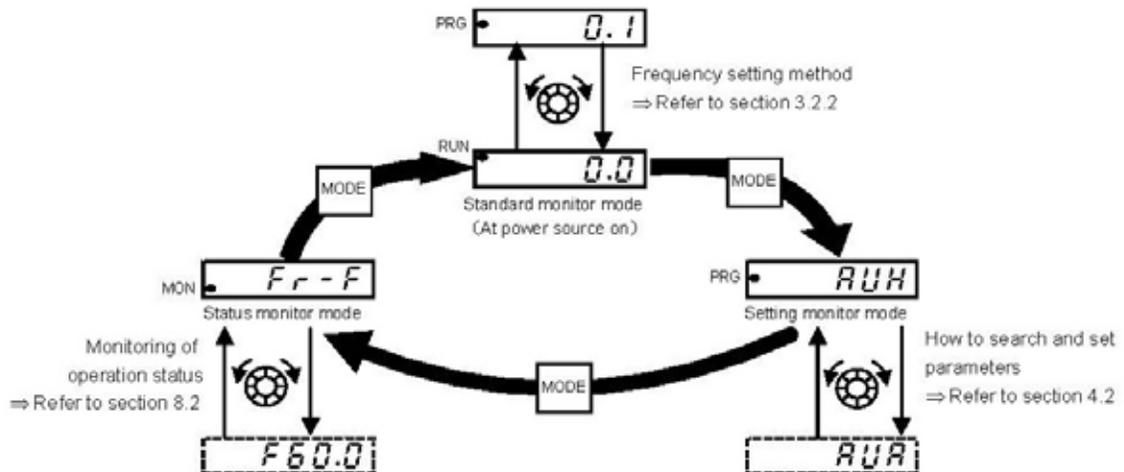
**Easy setting mode** : Only the ten most frequently used parameters are displayed.  
Parameters can be registered as necessary.  
(max. 32 parameters)

**Standard setting mode** : Both basic and extended all parameters are displayed.

- Each press of the EASY key switches between the Easy setting mode and the Standard setting mode.

**Status monitor mode** The mode for monitoring all inverter status.  
Allows monitoring of frequency command value, output current/voltage and terminal information.  
⇒ Refer to chapter 8.

The inverter can be moved through each of the modes by pressing the MODE key.



## How to set parameters

There are two types of setting monitor modes: Easy mode and Standard setting mode. The mode active when power is turned on can be selected at **PSEL** (EASY key mode selection), and the mode can be switched by the EASY key. Note, however, that the switching method differs when only the Easy mode is selected. Refer to section 4.5 for details.

Setting dial and panel key operations are as follows:



Turning the setting dial  
Used to select items and changing setting values. (Note)



Pressing the center of the setting dial  
Used for executing operations and determining setting values. (Note)



Used to select the mode and return to the previous menu



Used to switch between the Easy and Standard setting modes.

### Easy setting mode

The mode changes to the Easy setting mode when the EASY key is pressed at the standard monitor mode and "EASY" is displayed. In the Easy setting mode, the EASY lamp lights.

Only the most frequently used 10 basic parameters are displayed at default setting.

Easy setting mode

Title	Function
<b>CMD</b>	Command mode selection
<b>FND</b>	Frequency setting mode selection 1
<b>ACC</b>	Acceleration time 1
<b>DEC</b>	Deceleration time 1
<b>UL</b>	Upper limit frequency
<b>LL</b>	Lower limit frequency
<b>ELC</b>	Motor electronic-thermal protection level 1
<b>FA</b>	Meter adjustment gain
<b>FUI</b>	Current/voltage unit selection
<b>PSEL</b>	EASY key mode selection

- If the EASY key is pressed while the setting dial is being turned, values continue to be incremented or decremented even if you release your finger from the setting dial. This feature is handy when setting large values.

Note) Of the available parameters, number value parameters (**ACC** etc.) are reflected in actual operation when the setting dial is turned. Note, however, that the center of the setting dial must be pressed to save values even when the power is turned off.

Note, also, that item selection parameters (**FND** etc.) are not reflected in actual operation by just turning the setting dial. To reflect these parameters, press the center of the setting dial.

### Standard setting mode

The mode changes to the Standard setting mode when the EASY key is pressed and "Std" is displayed. Both basic and extended all parameters are displayed.

#### Basic parameters

This parameter is a basic parameter for the operation of the inverter.

⇒ Refer to chapter 5 for details.

⇒ Refer to section 1.2 for parameter tables.

#### Extended parameters

The parameters for detailed and special setting.

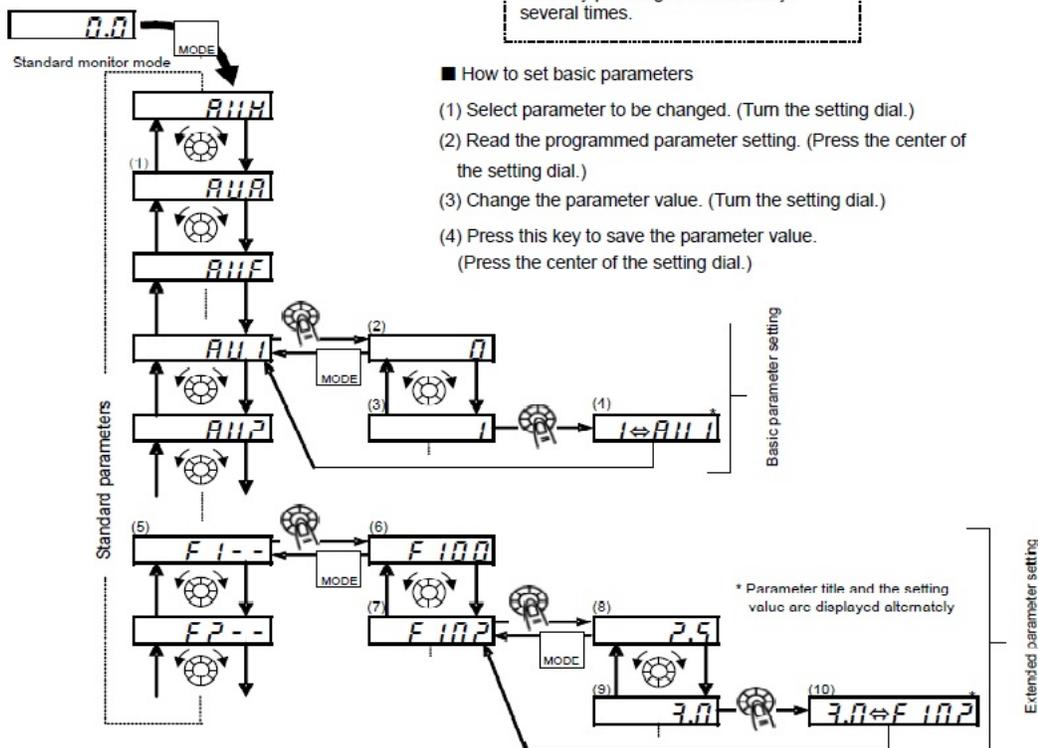
⇒ Refer to chapter 6 for details.

⇒ Refer to section 1.3 for parameter tables.

## Settings in the Standard setting mode

The inverter enters this mode by pressing the MODE key when the Standard setting mode is selected.

When you are unsure of something during operation:  
You can return to the Standard monitor mode by pressing the MODE key several times.



■ Adjustment range and display of parameter setting value

**H I**: An attempt has been made to assign a value that is higher than the programmable range.

**L O**: An attempt has been made to assign a value that is lower than the programmable range.

If the above alarm is flashing on and off, values that exceed **H I** or are equal or lower than **L O** cannot be set.

\* A setting value of the presently-selected parameter might exceed the upper limit or the lower limit by changing other parameters.

- NOTE: The above information on Setting Parameters has been extracted and abridged from the Toshiba VF-S15 Instruction Manual, sections 4.1 & 4.2.
- For other details on the inverter, refer to the Toshiba Instruction Manual.

