8.2 Control of Drive with Keypad and Display

All the operating parameters for standard applications of the INVERTRON BMI/GMI units are factory-set.

Following successful completion of the self-diagnostics, which is activated each time the line voltage is switched on (see section: 'Start-Up'), the unit is ready for operation.

The 'Local Control' mode must be selected to be able to control the drive from the keyboard. This is indicated by the relevant red LED lighting up. If the 'Remote Control' mode is selected, the setting of parameter 0 must be changed (see section: 'Programming').

Use the 'AUTO/MAN' switchgear key to decide whether the speed set point is to be selected externally or internally.

- 'AUTO' selection : the set point is supplied externally.
- 'MAN' selection : the set point is selected from the keyboard using the 'SPEED/DATA' keys.

The 'AUTO' selection using the switch key on the keyboard can be locked by altering the appropriate parameter (see section: 'Description of Parameters'). The actual selection is indicated by the relevant red LED lighting up and can be varied as desired by pressing the 'AUTO/MAN' key.

Notes: When the drive is started, it will accelerate automatically to the preset 'minimum speed' even if 'zero' is selected as set point.

The desired output frequency to which the drive should accelerate after the start command, can be set with the 'SPEED/DATA' keys. If one of these two keys is pressed, the 'PGM No./MONITOR' display goes out. The preset output frequency now appears in the four-digit display panel.
This value can be varied as desired within the factory-set limits using the 'SPEED/DATA' keys. Pressing the keys briefly results in a slight change in the value while pressing and holding the key produces a rapid change. A value set in this manner can be transferred to the memory by pressing the key 'set'.

The desired direction of rotation of the motor can be specified with the 'FWD/REV' switch key. The actual selection is indicated by the relevant red LED lighting up and can be varied as desired by pressing this key.
The 'REV' selection using the switch key on the keyboard can be locked by altering the appropriate parameter (see section: 'Description of Parameters').
The change in direction of rotation is produced by electronically reversing the phase rotation at the unit output. In the 'FWD' (forward) position, the direction of rotation of the phases is clockwise, in the 'REV' (reverse) position it is counter-clockwise.

Locking-in of the Start command can be pre-selected with the 'RUN/JOG' switch key. The actual selection is indicated by the relevant red LED lighting up and can be varied as desired by pressing this key.
In the 'RUN' selection, the Start command remains stored until the 'STOP/RESET' key is operated or the unit switches off as a result of a malfunction. The 'JOG' selection is selected for the Jogging mode. The drive is activated only as long as the 'START' key is pressed.
The speed set point for the Jogging mode can be set separately within the programmable limits.

Once all the settings have been made in accordance with the desired application, the drive can be started by pressing the 'START' key (see section: 'Start-Up'). The green LED 'RUN' indicates in this case that the unit output is activated. At the same time, the value for the actual output frequency appears in the four-digit display. As this display is able to indicate three different output variables, a related symbol of the measured variable displayed appears in the two-digit 'PGM No./MONITOR' display. In line with this assignment, the following characters appear

in two-digit display:		in the four-digit display:
H	->	output frequency in Hz.
U	->	output voltage in V.
PA	->	output current as percentage of unit rated current.
RPM	->	motorspeed (see parameter 46, 47 und 48 for calibration)

The switching between the various measured variables is performed by pressing the 'MON' key while the unit output is activated.
The output frequency can be varied within the programmed limits with the 'SPEED/DATA' keys. The preset output frequency is varied in the same way as already described above.

A reversal of the direction of rotation can also be performed during system operation. In this case, the drive brakes at the variable deceleration ramp, electronically reverses the phase rotation at the output frequency zero and then accelerates at the variable acceleration ramp to the preset speed.
Both the 'AUTO/MAN' set point switch as well as the 'RUN/JOG' switch can be performed during system operation.
If the drive is stopped by pressing the 'STOP/RESET' key, the last set speed set point is automatically stored as the speed selection for the subsequent start. This corresponds to operation of the external set point potentiometer.

The values of the programmed parameters can also be displayed during system operation with the 'PGM' key. In this case, the parameter number is shown in the two-digit display and the related value appears in the four-digit display. The parameters values can only be displayed in the 'Run' operating state, but not varied. The 'MON' key should be pressed to return to the operating data display.

If the unit is in the 'Remote Control' mode, the following keys are inoperative:

- START
- RUN / JOG
- FWD / REV
- AUTO / MAN
- SET
- SPEED / DATA

8.3 Programming with Keypad and Display

A total of 99 parameters can be set in order to adapt the unit to application-specific tasks. As unintentional or unwitting modification of a number of parameters may well result in restricting operational safety and thus also represent a hazard for persons, several 'safety levels' are implemented in the equipment.

- No modification of parameters possible.
- Enlargement to second menu only possible with decimal code number.
- Change of parameters which are linked directly to operational safety only possible by means of further, decimal code number.

The unit may be programmed to prevent any modification of the parameters. This is achieved by inserting a plug-in jumper on the controller card. Access to the controller card is gained after removing the front cover. It is located in the centre of the unit. A plug-in jumper is located on the top edge of the card, directly below the sealed keyboard. In position 'J6', no change of the parameters is possible. In position 'J5', the parameters may be modified.
The position of the plug-in jumper may only be altered when the unit is completely 'dead' (observed discharge time of capacitors of 2 minutes). In this case, the electronic components on the card must not be touched with your hands (components may be damaged beyond repair as a result of static charges).

After the line voltage has again been connected, the parameters of the first menu can now be altered. When performing this step, the unit may be either in the 'Local Control' operating state or in the 'Remote Control' state.
When the 'PGM' key is pressed, the parameter number appears in the two-digit display. The parameter no. 0 is always displayed first. The parameters can be retrieved in ascending order by briefly pressing the 'PGM' key. If the 'PGM' key is pressed and held, it is possible to 'leaf through' the menu very rapidly. In this case, the relevant parameter values are displayed in the four-digit operating data display.

If the inverter is in the 'stopped' state, the red LED 'PROGRAM ENABLE' lights up after the 'PGM' key is pressed. In this state, the parameter values can be modified according to the application with the 'SPEED/DATA' keys. Once the desired value for the respective parameter has been set, this parameter can be stored by pressing the 'SET' key..

The parameters of the first menu can be varied only within the factory-set security ranges. Should it be necessary to enlarge these ranges, or if it is desired to set other parameters, access to the second menu must be obtained by entering a code value for parameter No. 6. In this case, the following procedure should be adopted:

- In the 'PROGRAMMING' mode (red LED 'PROGRAM ENABLE' lights up), operate the 'PGM' key until parameter no. 6 appears in the two-digit display.
- As soon as parameter no. 6 has been pre-selected, the red LED 'PROGRAM ENABLE' goes out.
- Now press the 'SET' key for approx. 3 seconds until the operating data display flashes.
- Set the code number '**0306**' by means of the 'SPEED/DATA' keys.
- Press the 'SET' key in order to transfer this code number to the memory.
- Once the entered code number has been accepted, the red LED 'PROGRAM ENABLE' now lights up.
- The value of parameter no. 6 appears in the four-digit display with '0000'.
- Alter this value with the 'SPEED/DATA' keys to '0001'.
- Now press the 'SET' key in order to transfer this value to memory.
- All the parameters can now be displayed by pressing the 'PGM' key.

The complete menu is accessible up to the moment where the value for parameter no. 6 is again altered to 0000. In this case, the procedure described above should be performed by analogy. Should it be necessary to alter the value of the parameter which is directly related to operational safety, it is then necessary to enter a decimal code number. The following procedure should then be observed:

- In the 'PROGRAMMING' mode (red LED 'PROGRAM ENABLE' lights up), press the 'PGM' key until the desired parameter appears in the two-digit display.
- If altering this parameter requires entering a code number, the LED 'PROGRAM ENABLE' goes out.
- Now press the 'SET' key for approx. 3 seconds until the operating data display flashes.
- Set the code number '**1123**' by means of the 'SPEED/DATA' keys.
- Press 'SET' key in order to transfer this code number to the memory.
- Once the entered code number has been accepted, the red LED 'PROGRAM ENABLE' now lights up.
- The value of the corresponding parameter is indicated in the four-digit display.
- Change this value with the 'SPEED/DATA' keys according to your requirements.
- Now press the 'SET' key in order to transfer this value to the memory.
- Any further modification of this parameter must be performed by adopting the same sequence.

Once all the parameters have been set, the 'PROGRAMMING' mode can be terminated by pressing the 'MON' key. When this is done, the LED 'PROGRAM ENABLE' goes out and the unit is again in the 'Stop' operating state.

Note: Pressing the 'MON' key twice results in a switch to the 'Error Code Display' operating state.

If the unit is in the 'PROGRAMMING' state, the following keys are inoperative:

- START
- STOP/RESET
- RUN / JOG
- FWD / REV
- AUTO / MAN

After completion of start-up, all the parameter values should be recorded in writing, access to the second menu disabled (parameter no. 6) and the plug-in jumper set on the controller board to position 'J6'.

8.4 Error Code Display

The last three malfunctions which have occurred are stored in the unit and can be retrieved as an error code in the four-digit display.
If the unit is in the 'stopped' state, the error code display is activated by pressing the 'MON' key. In this case, the last fault which has occurred (IET tripping) is displayed as a code in the operating data display (see error code table in section: 'Rectifying Faults').
If the top 'SPEED/DATA' key is pressed once, the second last malfunction is retrieved as an error code and, if this key is again pressed, the third last fault can also be displayed.
If the bottom 'SPEED/DATA' key is pressed, the stored faults can be displayed in the reverse order.
If the 'STOP/RESET' key is pressed, the unit can be switched back from the 'Error Code Display' operating state to the 'Stop' mode.
If a malfunction occurs in the 'RUN' operating state (green LED 'RUN' light on), this results in an IET trip. The unit is than automatically in the 'Error Code Display' operating state. In this case, the actual fault message appears in the four-digit display. The fault can be reset by pressing the 'STOP/RESET' key.

If the unit is in the 'Error Code Display' mode, the following keys are inoperative:

- START
- RUN / JOG
- FWD / REV
- AUTO / MAN
- MON
- SET

The contents of the fault memory can be erased by pressing the 'STOP/RESET' key in the 'Error Code Display' mode for 3 seconds. When '0000' appears in the four-digit operating data display, this confirms that the fault memory has been erased.

9.0 DESCRIPTION OF PARAMETERS

9.1 Description of first menu functions

Parameter No. 0 **Local/remote Operation Control**

Parameter Selection:
'0' - Local Control (Keypad).
'1' - Remote Control (Terminal Strip).
'2' - Remote Control (RS-232C-requires optional Serial Communications port card)
'3' - Remote Control (Reliance I/O Port-requires optional Serial Communications Port Card).

Initial Setting: '0'

Description: When 0 is selected, operational control is through the keypad and the LOCAL LED is lit. When 1, 2 or 3 is selected, the controller is operated remotely and the REMOTE LED is lit. In the REMOTE MODE following keys are de-activated

RUN/JOG
FWD/REV
AUTO/MAN
START
SET
SPEED/DATA

Note: The STOP key remains functional. The controller will not allow selection of 2 or 3 unless the optional Serial Communications Card is installed and wired in the controller.

Parameter No. 1 **Acceleration Time**

Adjustment Range : 5.0s - 360.0s

Initial Setting: 20.0s

Description: Acceleration time is the normal time in which the motor reaches maximum Hz after starting. The acceleration rate (hertz/second) depends on the maximum Hz setting. If an acceleration time faster than 5 seconds is required see Function 44. If the motor load inertia is high and/or the current limit (Function 5) setting is too low, acceleration time will be longer than the preset time.

Note: With very fast acceleration times, the motor may draw excessive current resulting in an overcurrent (OC-A) IET. To avoid this condition, set the acceleration time for a longer period.

Parameter No. 2 **Deceleration Time**

Adjustment Range: 5.0s - 360.0s

Initial Setting: 20.0s

Description: Deceleration time is the normal time in which the motor decreases from maximum Hz to zero Hz. Therefore, the deceleration rate (hertz/second) depends on the maximum Hz setting. If a deceleration time faster than 5 seconds is required, see Function 45.

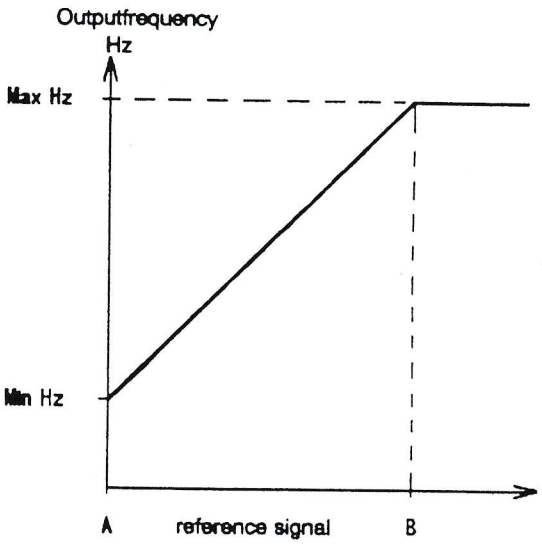
Note: Motor Load inertia and input line conditions can extend the deceleration time to a value greater than the preset time. With very fast deceleration times, regenerative motor voltage may charge up the DC- bus voltage causing a high bus voltage (HU) IET. To avoid an IET condition, reset the deceleration time for a longer period. If a deceleration time faster than the acceptable range is required, install an optional Dynamic Braking Kit.

Parameter No. 3 **Minimum Hz**

Adjustment Range: 5.0Hz - 60.0Hz

Initial Setting: 5.0Hz

Description: 'Minimum Hz' is the minimum output frequency value that can be reached with down key. Minimum Hz should always be lower than maximum Hz (Function 4), and the speed setting value must always be within minimum and maximum Hz. When the AUTO key is selected to control speed by an external process control signal, the gain (output frequency/speed reference) can be adjusted with the minimum Hz setting and/or the maximum Hz setting. If a minimum Hz lower than 5 Hz is required, allows the second password to access Function 43, Extended Minimum Hz Range.



Reference-signal	A	B
Voltage	0 VDC	10 VDC
Current	4 mA	20 mA
Current	0 mA	20 mA
Frequency	0 Hz	97.6 kHz

Fig.9.a: Influence of Min Hz

Parameter No. 4 **Maximum Hz**

Adjustment Range: 15.0Hz - Overfrequency limit (parameter 38)

Initial Setting: 50.0Hz

Description: Maximum frequency is the maximum output frequency value that can be reached with the up key, or when AUTO is selected the is output frequency at the nominal input of the external speed reference of 10VDC, 20 mA, or 97,656 kHz into the controller.

Note: Maximum Hz can be programmed between 15Hz and 90 Hz in the first menu. If a maximum Hz higher than 90Hz is required, the second password allows access to Function 38, Overfrequency Limit.
Maximum Hz should be bigger than the setting of Minimum Hz.

Parameter No. 5 **Current Limit**

Adjustment Range: 50% - 150% rated current for S-Type
50% - 115% rated current for P-Type

Initial Setting: 150% rated current for S-Type
115% rated current for P-Type

Description: This feature provides the means to limit motor output torque. When output current attempts to exceed the preset current limit level, motor speed is decreased by the rate which is programmed in parameter 55. This feature automatically provides an adjustable torque limit for the driven equipment.

Parameter No. 6 **Expand to Second Menu**

Parameter Selection: '0' - Basic (First Menu Only)
'1' - Expanded to Second Menu

Initial Setting: '0' - only first Menu

Description: Most simple applications will require only the adjustable functions found in the first menu. When you scroll trough the functions list with the PGM key, at Function 6 the list will complete its cycle and return to Function 0. Note that the Program Enable LED goes off when you reach Function 6. This indicates that you cannot modify this function without a password. (See chapter 'Operation and PROGRAMMING').

9.2 Description of second menu functions

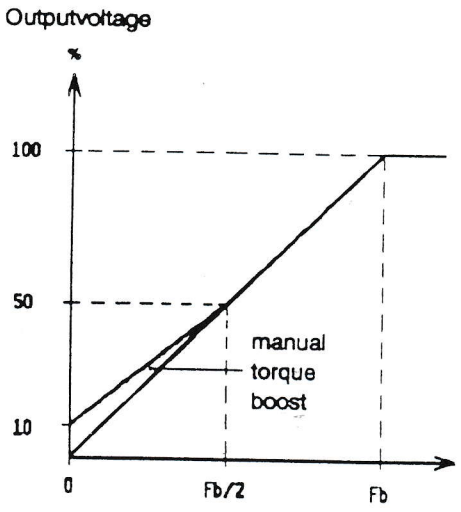
Parameter No. 7 **Manual Torque Boost**

Adjustment Range: 0% - 10% of nominal voltage voltage

Initial setting: 2% voltage

Description: Torque boost is required to offset the voltage drop of the A-C motor at low speeds to produce a constant torque capability. For friction loads and large inertia loads, a high starting torque level may be needed. Manual torque boost is effective only at speeds lower than half of base frequency.

Note: If the torque boost setting is too high or the acceleration ramp is too fast, the motor may draw excessive starting current. This could cause an overcurrent (OC-A or OC) IET. Also, too much torque boost may cause excessive motor heat and motor noise.



Fb = Base - frequency

Fig.9b Torque Boost

Parameter No. 8 **Jog Frequency**

Adjustment Range: 0.0Hz - 60.0Hz

Initial Setting: 5.0Hz

Description: Jogging can be accomplished in either Local Control or Remote Control. Jog frequency can be set from 0.0 to 60.0 Hz and is independent from any other set speed. The actual output frequency for jog is automatically limited between minimum and maximum Hz.
The only way to change Jog speed is to program another value for parameter No. 8.

Parameter No. 9 **Stop Mode Selection**

Parameter Selection: '0' - Coast-to-rest
'1' - Ramp-to-rest

Initial Setting: '0' - Coast-to-rest

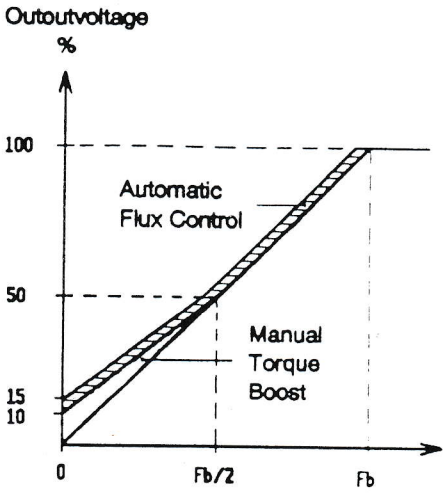
Description: With parameter "0" selected, pressing the STOP key or giving an external Stop command causes the motor to coast to a rest. With parameter "1" selected, pressing the STOP key or giving an external Stop command causes the motor to ramp to a rest within a time equal to or greater (high inertia of the load) than the preset deceleration time (parameter 2).

Parameter No. 10 **Automatic Flux Control**

Adjustment: 0% - 5% rated voltage

Initial Setting: 0% rated voltage

Description: Automatic flux control optimises the motor magnetic flux and, thus, the motor output torque. It senses the output current and adjusts the corresponding voltage to provide the ideal flux and torque conditions of the motor. This compensated voltage is adjustable from 0 to 5% rated voltage at 100% full load current of the controller.



Fb = Base Frequency

Fig.9c: Auto Flux Control

Parameter No. 11 **Base - Frequency (V/Hz)**

Adjustment Range: 30.0Hz - 400.0Hz

Initial Setting: 50.0Hz

Description: The base frequency selection is used to adjust the controller output volts/hertz ratio. Base frequency is the set frequency between 30-400Hz at which the output voltage reaches Maximum voltage (parameter 50). Below base frequency, output voltage varies with output frequency according to the V/Hz adjustment(referred to as the constant torque range). Above base frequency, output voltage is held constant as frequency increases (referred to as the constant horsepower range). The V/Hz ratio is affected by the settings of automatic flux control (Function 10) and manual torque boost (Function 7).
In normal constant torque applications, base frequency should be equal maximum Hz.

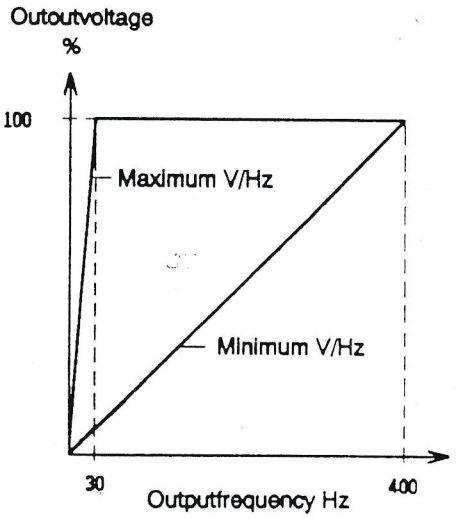


Fig.9d: V/Hz - ratio

Parameter No. 12 **Electronic Thermal Overload Selection**

Parameter Selection: '0' - Standard motor
'1' - Forced Cooled Motor

Initial Setting: '0' - Standard motor

Description: The function of an electronic thermal overload is similar to a motor overload relay because it limits output current to the motor.
Function 12 allows selection of an output current profile best suited for the type of motor to be run. Function 13 allows adjustment of the output current value.

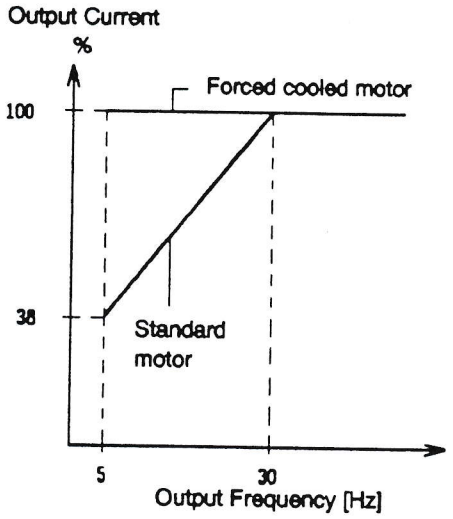


Fig. 9e: Overload profile at 100% Output Current

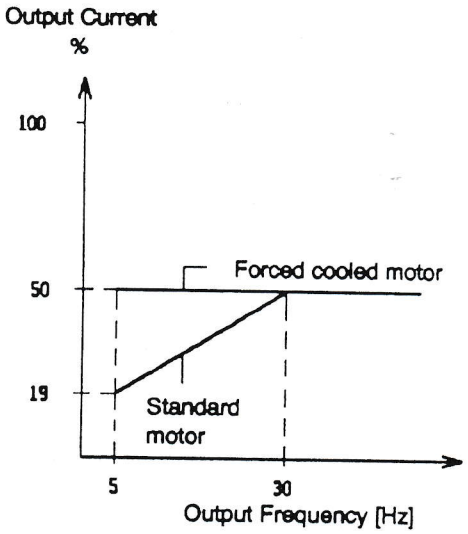


Fig. 9f: Overload profile at 50% Output Current

Note: While the electronic thermal overload functions is similar to a motor overload relay, it is not accurate below 5Hz and does not measure actual motor temperature. A temperature measuring device is the best way to thermally protect a motor under all conditions.

Parameter No. 13 **Electronic Thermal Overload Level**

Adjustment Range: 20% - 100% rated current

Initial Setting: 100% rated current

Description: The adjustment of this function is useful if the motor KW rating is less than controller KW size. Using the formula below, calculate the setting level as a percentage of maximum continuous current:

Note: If motors are wired in parallel on the output of the controller, do not use the electronic thermal overload function. Use separate motor overload relays on each individual motor.

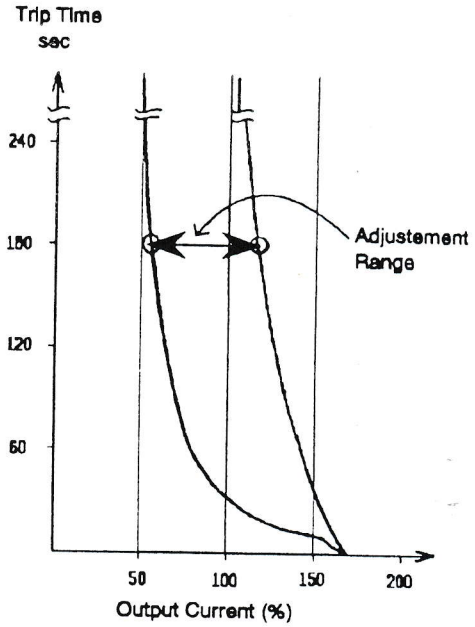


Fig. 9g: Electronic Thermal Overload Curves

$$\text{Setting Level } (\%) = \frac{\text{Motor Full Load Current}}{\text{Controller Output Rated Current}} * 100$$

Parameter Nr. 14 **'S' - Curve Function for Acceleration**
Parameter Nr. 15 **'S' - Curve Function for Deceleration**

Adjustement Range: '0' - Linear Acceleration
'1' - 'S' - Curve Acceleration

Initial Setting: '0' - Linear Acceleration

Description: When S-Curve acceleration or deceleration is preselected, acceleration or deceleration will begin and end slowly. The acceleration time set at parameter1 and 2 remain the same.

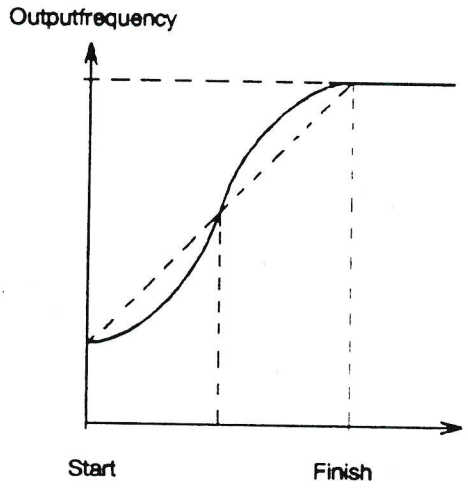


Fig.:9h S-Curve for Acceleration

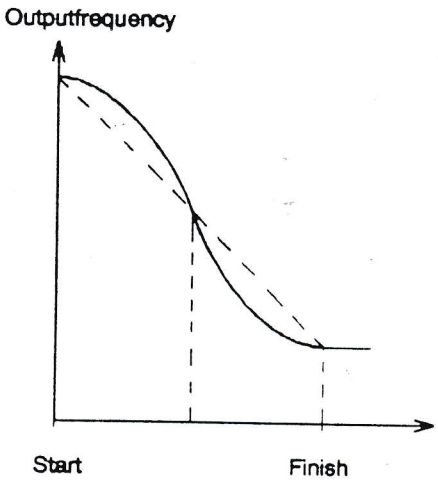


Fig.: 9l S-curve for Deceleration

Parameter No. 16 **Multi-Speed Preset 1**
Parameter No. 17 **Multi-Speed Preset 2**
Parameter No. 18 **Multi-Speed Preset 3**

Adjustment Range: 0.0Hz - 400.0Hz

Initial Setting: 5.0Hz

Description: When the controller is controlled remotely (Parameter 0, Value 1,2 or 3), the controller can be configured to run at three different preset speeds. The frequency of each preset speed is limited between minimum and maximum Hz. When the circuit is closed, the Multi-Speed Preset function overrides the external speed reference, causing the output frequency to accelerate or decelerate to the selected preset level. When the circuit is open, control is returned to the external speed reference signal.
Closing both circuits at the same time will activate in the selection of Multi-Speed Preset 3.

Note: If the internal MOP function (parameter 57) is preselected, the multispeed mode is not functional anymore.

Parameter No. 19 **Avoidance Frequency 1**
Parameter No. 20 **Avoidance Frequency 2**
Parameter No. 21 **Avoidance Frequency 3**

Adjustment Range: 0.0Hz - 400.0Hz

Initial Setting: 0.0Hz

Description: Operating a motor continuously at a particular frequency may cause vibrational resonance within the machine. Three independent avoidance frequencies can be programmed to prevent motor vibration at these critical frequencies. The actual output frequency is limited between minimum and maximum Hz.
This function (19,20 or 21) is used with Function 22, Avoidance Frequency Band.
The avoidance frequency function is effective in both local and remote control.
Normal acceleration and deceleration is unaffected by this function.

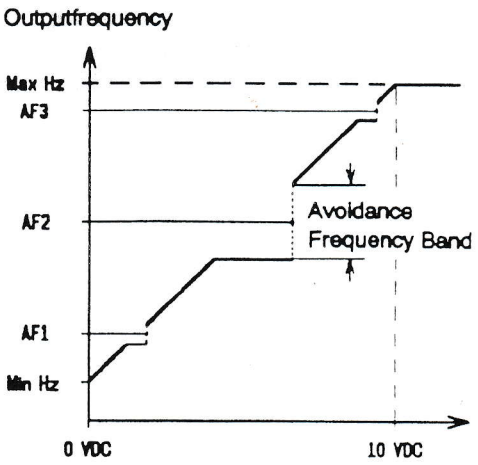


Fig.: 9j Avoidance Frequency Band

Parameter No. 22 **Avoidance Frequency Band**

Adjustment Range: 0.2Hz - 10.0Hz

Initial Setting: 0.2Hz

Description: This function is applicable with Functions 19, 20 and 21. (Avoidance Frequency). The avoidance frequency band selection will apply to each of the three avoidance frequencies set in Function 19,20 and 21. The actual range of avoidance frequency is calculated by the following formula:

AF - (AFB/2) < FR < AF + (AFB/2)

AF - Avoidance Frequency (1,2 supply 3)
AFB - Avoidance Frequency Band
FR - Avoidance Range

Parameter No. 23 **Variable Torque Volts/Hz Curve Selection**

Parameter Selection: '0' - Constant Torque Curve
'1' - Variable Torque Curve

Initial Setting: '0' - for S Type drives
'1' - for P-Type drives

Description: The constant torque curve is used for constant torque loads; the variable torque curve is used for variable torque loads (pump & fans). If the variable torque curve is selected, the base frequency selection (Function 11) must be equal to or less than 120Hz.

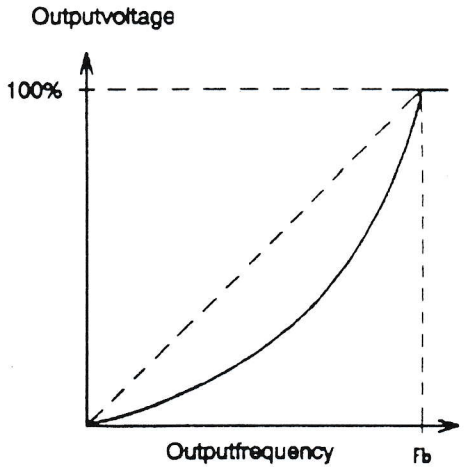


Fig. 9k: Variable Torque Curve

Parameter No. 24 **DC Braking - Operation Time**
Parameter No. 25 **DC Braking - Voltage**
Parameter No. 26 **DC Braking - Frequency**

Adjustment Range: 0.0sec - 10.0sec for Parameter No. 24
0% - 20% of rated Voltage for Parameter Nr. 25
0.5Hz - 10.0Hz for Parameter Nr. 26

Initial Setting: 0.0Hz for Parameter Nr. 24
0% of rated Voltage for Parameter Nr. 25
1.0Hz for Parameter Nr. 26

Description: DC braking is used to provide additional motor braking at speeds of 10Hz or lower. If DC braking is required, all three DC braking functions (24,25 and 26) must be adjusted. When the motor decelerates to the preset start frequency (Function 26), the preset constant DC voltage (Function 25) is momentarily applied to the motor for the preset time (Function 24).

Note: This function will not provide the holding torque of a mechanical brake.
DC-braking is only operative when parameter 9 (Stop Mode Selection is set to 1 (Ramp to rest).

Parameter No. 27 **Line-Dip-Ride-Through**

Adjustment Range: 15ms - 500ms

Initial Setting: 15ms

Description: During a line voltage dip, the standard controller has enough energy storage to keep the regulator active for up to 500ms. The actual ride-through time depends upon the setting of this function and the characteristics of the load. For example, if the load deceleration is slow (high inertia, low frictional loss), the controller may be able to maintain enough DC bus voltage to ride through a line dip of up to 500ms. If the load deceleration is fast (low inertia, high frictional loss), the controller may only be able to keep the regulator active for 15ms. If a voltage line dip occurs that exceeds the capability or line dip voltage setting of the controller, an IET will occur. If the line-dip-ride-through time is set at greater than 15 ms, the IET will cause the 4-digit display to show LdIP but only for as long as the bus voltage can maintain enough voltage for the LED display (approximately 500ms to 8 s).

Parameter No. 28 **Relays 1 (RMI - Card)**
Parameter No. 29 **Relays 2 (RMI - Card)**

Parameter Selection:
'0' - Not Used
'1' - Zero Speed Detect
'2' - Input Contactor
'3' - Output Contactor
'4' - Frequency Level Detection 1
'5' - Frequency Level Detection 2
'6' - Current Level Detection
'7' - Reverse Rotation
'8' - DC Braking Operation
'9' - Reserved

Initial Setting: '0' - Not Used

Description: These functions require the Remote Meter Interface Card (option), which includes two relays. Each relay operates according to the parameter (0-9) selected. Function 28 configures output relay 1 and Function 29 configures output relay 2. Output relay 1 provides a form C contact (1NO and 1NC), and output relay 2 provides a form A contact (1NO). The response time of each relay is typically 8 ms. The ten parameters are described as follows:

'0' - The relay does not operate.
'1' - The relay is energized while output frequency is equal to or higher than 0.5Hz.
'2' - This provides the control signal for an input contactor. The relay energizes when the controller is put into the RUN mode.
'3' - This provides the control signal for an output contactor. The relay energizes when the controller is put into the RUN mode.
'4' - The relay energizes when the output frequency is equal to or higher than the frequency level set in Function 33.
'5' - The relay energizes when the output frequency level is equal to or higher than the frequency set in Function 34.
'6' - The relay energizes when the output current level is equal to or higher than the current set in Function 35.
'7' - The relay energizes when the phase sequence of the output frequency is in reverse rotation.
'8' - The relay energizes when the DC braking voltage is applied to the motor. This relay is not required for DC braking to be operational.
'9' - Reserved

Parameter No. 30 **Slip Compensation**

Adjustment Range: 0.0Hz - 5.0Hz

Initial Setting: 0.0Hz

Description: Actual motor shaft speed is determined by two factors: the applied Hz and the slip of the motor. The controller keypad regulates the applied Hz to an accuracy of 0.01% of base frequency. The slip of the motor, however, is fully determined by the type of induction motor and varies with the driven load. Slip compensation senses motor slip and adjusts the applied Hz automatically. Because of changes in the load, the actual speed regulation of the motor is greatly improved with this function properly adjusted.

Note: Only accessible when in parameter 39 '0' is selected.

Parameter No. 31 **Inverse Reference**

Parameter Selection: '0' - Normal
'1' - Inverse

Initial Setting: '0' - Normal

Password: Second Password

Description: This signal will invert the signal of all external speed references.

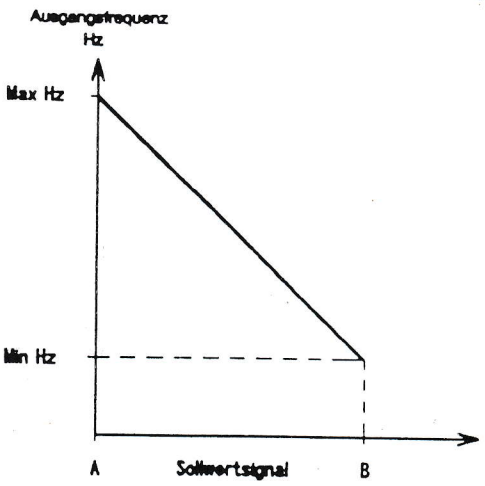


Fig. 9n: Inverse Reference

Reference-Signal	A	B
voltage	0VDC	10VDC
Current	4mA	20mA
Current	0mA	20mA
Frequency	0 Hz	97.6 kHz

Parameter No. 32 **Function Loss Selection**

Parameter Selection: '0' - IET at 'Function Loss'
'1' - Coast-to-rest without an IET output at Function Loss

Initial Setting: '0' - IET at 'Function Loss'

Password: Second Password

Description: If parameter '0' is selected, a function loss signal causes the controller to stop, resulting in the following:

- The motor will coast to rest.
- The 4-digit display will show 'FL'(function loss).
- The internal speed reference will be reset to zero.
- The IET relay will be latched on.
- The IET can be reset with the Stop key after the cause of the function loss is removed.
- The controller will restart with the Start key after the IET is reset.

If parameter '1' is selected, a function loss signal causes the controller to Stop, resulting in the following:

- The motor will coast to rest.
- The 4-digit display will indicate 'CS' (coast stop).
- The internal speed reference will be reset to zero.
- The controller will restart with the Start key after the cause of function loss is removed.

Parameter No. 33 **Frequency Level Detection 1**
Parameter No. 34 **Frequency Level Detection 2**

Adjustment Range: 0.5Hz - 405.0Hz

Initial Setting: 0.5Hz

Description: This function is effective and displayed only when parameter 4 or 5 is selected at function 28 or 29. When the output frequency is equal to or higher than the set detection level, the selected output relay located on the optional Remote Meter Interface Card will energize.

Parameter No. 35 **Current Level Detection**

Adjustment Range: 30% - 150% Rated Current

Initial Setting: 100% Rated Current

Description: This function is effective and displayed only when parameter 6 is selected at Function 28 or 29. When the output current is equal to or higher than the set detection level, the selected output relay located on the Remote Meter Interface Card will energize.

Parameter No. 36 **Reverse Disable**

Parameter Selection: '0' - Forward / Reverse Enable
'1' - Reverse Disable on Keypad

Initial Setting: '0' - Forward / Reverse Enable

Description: This function is effective only when the controller is controlled locally (Function 0, Parameter 0). If parameter 1 is selected, the FWD/REV key is locked in the FWD position, preventing the motor from rotating in the reverse direction.

Parameter No. 37 **Automatic Disable on Local Control**

Parameter Selection: '0' - Auto/Man key Enable
'1' - AUTO Disable on Keypad

Initial Setting: '0' - AUTO/MAN key Enable

Description: This function is effective only when the controller is controlled locally (Function 0, Parameter 0). If parameter 1 is selected, the AUTO/MAN key is locked in the manual position, preventing the motor from responding to any external speed command.

Parameter No. 38 **Over frequency Limit**

Adjustment Range: 50.0Hz - 405.0Hz

Initial Setting: 90.0Hz

Password: Second Password

Description: The Over frequency limit is factory set at 90Hz. The maximum Hz setting (Function 4) is limited by the setting of this function.

Parameter No. 39 **DC Offset Enable (used for Synchronous motor)**

Adjustment Range: '0' - Offset Disable
'1' - Offset Enable

Initial Setting: '0' - Offset Disable

Password: Second Password

Description: When parameter 0 is selected, DC Offset is disabled for normal operation of an induction motor. When this function is enabled (selection 1), the DC Offset function allows some DC voltage to be output to the motor terminals at 0Hz. The magnitude of this voltage is equal to the manual torque boost setting at Function 7. This may be required to synchronize the rotor of a permanent magnet synchronous motor to avoid high starting currents.

Note: when this function is enabled, slip compensation (parameter 30) is no longer operational.

Function No. 40 **Auto - reset**

Parameter Selection: '0' - Auto-reset Disable
'1' - Auto-reset Enable

Initial Setting: '0' - Auto-reset Disable

Password: Second Password

Description: Select Auto-reset enable to automatically restart the controller when one of following IET's occur:

- Overcurrent (OC, OC - A, OC - d, OC - g)
- High bus voltage
- Low bus voltage
- Line dip

If a line-dip-ride-through time longer than 15 milliseconds was selected at Function 27 and a line power supply interruption is long enough that bus voltage cannot maintain enough voltage for the LED display (approximately 500 milliseconds to 8 seconds), the controller will not restart automatically.

Note: The drive may restart automatically with the auto-restart enabled. Attach a warning tag of the appropriate driven equipment. Before working on this equipment, be sure that power is removed and locked out from the drive. Failure to observe this precaution may result in severe bodily injury or loss of life.

Function No. 41 **Number of automatic fault reset**
Function No. 42 **Interval time between fault reset**

Adjustment Range: 0 - 10 times fault reset (No. 41)
1s - 60s interval time (No. 42)

Initial Setting: 0 for fault resets (Function No. 41)
1 for interval time (Function No. 42)

Description: The auto-reset operation can be repeated the number of times set in Function 41 (0-10 times) within the time interval set in Function 42 (1-60 seconds).
The repeat number is returned to zero when the controller restarts successfully.

Note: These parameter are only activ when in parameter 40 a 1 is programmed.

Parameter No. 43 **Extended 'Minimum Hz' Range**

Parameter Selection: '0' - Disable (5 - 50Hz)
'1' - Enable (0 - 50Hz)

Initial Setting: '0' - Disable (5 - 50Hz)

Password: Second Password

Description: If minimum Hz lower than 5Hz is required, select parameter 1. Return to Function 3 and set the desired minimum Hz.

Note: The drive is intended to operate at a predetermined minimum speed unless disconnected from the power source. If the application requires zero speed without such disconnection, the user is responsible for assuring safe conditions.

Parameter No. 44 **Extended Acceleration Time**

Adjustment Range: '0' - Disable (5.0 - 360.0 s)
'1' - Enable (0.1 - 360.0 s)

Initial Setting: '0' - Disable (5.0 - 360.0 s)

Description: When an acceleration time shorter than 5 seconds is required, select parameter 1. Return to Function 1 and set the desired acceleration time.

Note: With very fast acceleration and/or high manual torque boost settings, the motor may draw excessive current resulting in an IET.

Parameter No. 45 **Extended Deceleration Time**

Adjustment Range: '0' - Disable (5.0 - 360.0 s)
'1' - Enable (0.1 - 360.0 s)

Initial Setting: '0' - Disable (5.0 - 360.0 s)

Description: When a deceleration time shorter than 5 seconds is required, select parameter 1. Return to Function 2 and set the desired deceleration time.

Note: With very fast deceleration, the regenerative motor voltage may charge up the DC bus voltage causing an IET. To avoid such an IET, increase the deceleration time or install a Dynamic Braking Kit (Option).

Parameter No. 46 **RPM Monitor enable**
Parameter No. 47 **RPM Monitor Range Selection**
Parameter No. 48 **RPM Monitor Base Frequency Selection**

Adjustment Range:
Parameter 46
'0' = Disable
'1' = Enable
Parameter 47
'0' = 150 - 9999 RPM
'1' = 0 - 9999 RPM
Parameter 48
150 - 9999 RPM

Initial Setting:
Parameter 46 = '0'
Parameter 47 = '1'
Parameter 48 = '1450'

Password:
second Password for parameter 47

Description:
When parameter 46 is programmed to 1, you can monitor actual speed in addition to the output frequency, output voltage and output current. The display can be scrolled through by pressing the MON key. The 2 digit display shows "SP" at the RPM monitor.
Parameter 47 and 48 can also be used to scale the 4 digit display readout in a different number than motor rpm. This can be done by entering a value for "Base frequency" selection /parameter 11), that is different than actual motor speed but represents some other speed of the application. When Base Frequency selection of parameter 48 is programmed, use the following formula:

$$\text{Base Frequency Selection (parameter 48)} = \frac{\text{Motor rated RPM}_1}{\text{Motor rated Hz}_2} * \text{Base Frequency in Hz}_3$$

Note:
1) "Motor rated RPM" equals the RPM of the motor under full load and motor rated frequencies conditions. This value for RPM can be found on the motor nameplate.

2) "Motor rated Hz" equals the base frequency of the motor. This value can be found on the motor nameplate.

3) "Base Frequency" equals the setting of parameter 11.

Example:

Outputfrequency BMI/GMI [Hz]	actual motorspeed rpm	param 11 Input	param48 Input	4 digit display
50	1450	50	1450	1450
50	1450	50	725	725

Parameter No. 49 **Output Voltage Regulation Mode Selection**

Parameter Selection: '0' - Proportional to Input
'1' - Fixed to Maximum Voltage

Initial Setting: '0' - Proportional to Input

Password: Second Password

Description: When a '0' is selected in this parameter, the maximum output voltage will be proportional to the input voltage. When a '1' is selected, the maximum output voltage will be equal to the setting value of parameter 50. The output voltage or the V/Hz ratio will be fixed, even if the input voltage varies.

Parameter No. 50 **Maximum Voltage**

Parameter Selection: 190 - 230 V for BMI-types
380 - 460 V for GMI-types

Initial Setting: 220 V for BMI-types
440 V for GMI-types

Description: When the output frequency reaches the Base frequency of parameter 11 the output voltage will be equal to the Maximum Voltage of parameter 50.

Parameter No. 51 **Jog Acceleration Value**

Parameter Selection: 0.1 - 360.0 s

Initial Setting: 20.0

Description: When parameter 53 is a '0' then Jog Acceleration Time can be set by scaling up the jog Hz to the maximum Hz and use the following formula:

$$\text{Param51} = \frac{\text{Jog Acceleration Time (s)} * \text{Max Hz (param4)}}{\text{Jog Hz (param 8)}}$$

When parameter 53 is a '1' then use the following formula:

$$\text{Param51} = \sqrt{\frac{\text{Maximum Hz}}{\text{Jog Hz}}} * \text{Jog Acceleration Time (s)}$$