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APPLICATION NOTE

Drive Applications Support Library

Application Note	**AN-P2-063**
Title	**High Frequency Firmware**
Related Products	**P2 Series AC Drives**
Level: **3**	1 - Fundamental - No previous experience necessary. 2 - Basic - Some basic drives knowledge recommended. 3 - Advanced - Some basic drives knowledge required. 4 - Expert - Good experience in topic of subject matter recommended.

Overview:

An optional High Frequency' firmware is available for all P2 models, intended to allow operation with special high speed motors, which require frequencies above the standard limit of 500Hz. The special firmware may be requested by Bardac Sales Partners, who must complete the request form included with this application note.

The sale of any high frequency drive is subject to strict legislation and export controls from the British Government, hence each software request must be individually approved prior to release. The request form enables this process to be completed quickly and efficiently to ensure the firmware can be supplied.

Each High Frequency Firmware file is supplied with a special encryption, and can only be loaded into the drive for which the serial number specified on the form at the time of application. This prevents other drives from having high frequency output function enabled, as required by government regulations.

High Frequency Operation:

The following rules apply when operating at high frequencies

- Maximum Operating Frequency Limit (P1-01) is limited to the lower of the following values
  - P1-09 (Motor Rated Frequency) * 5
  - P2-24 (Effective Switching Frequency) / 16

Ensure these parameters are set to suitable values before attempting to operate the drive. Only motors suitable for high frequency operation should be used, and the motor parameters should be correctly entered into the drive before attempting to operate the machine.

High Frequency Firmware Differences:

The optional High Frequency Firmware is identical to the standard firmware, except for allowing operation above 500Hz. The maximum permissible output frequency depends on the drive power rating, and is shown in the tables below. Note that when using higher switching frequencies, the derating information shown in the P2 Advanced User Guide should be observed for continuous operation.

230 Volt, 1 Phase Models							
Frame Size	**kW**	**HP**	**Default**	**Minimum**	**Maximum**	**Max Frequency**	**Output Current***
2	0.75	1	16 kHz	4 kHz	32 kHz	2000 Hz	4.3 A
2	1.5	2	16 kHz	4 kHz	32 kHz	2000 Hz	7 A
2	2.2	3	16 kHz	4 kHz	32 kHz	2000 Hz	8 A

230 Volt, 3 Phase Models							
Frame Size	**kW**	**HP**	**Default**	**Minimum**	**Maximum**	**Max Frequency**	**Output Current***
2	0.75	1	16 kHz	4 kHz	32 kHz	2000 Hz	4.3 A
2	1.5	2	16 kHz	4 kHz	32 kHz	2000 Hz	7 A
2	2.2	3	16 kHz	4 kHz	32 kHz	2000 Hz	8 A
3	4	5	16 kHz	4 kHz	32 kHz	2000 Hz	18 A
3	5.5	7.5	16 kHz	4 kHz	16 kHz	1000 Hz	19 A
4	5.5	7.5	8 kHz	3 kHz	24 kHz	1500 Hz	24 A
4	7.5	10	8 kHz	4 kHz	24 kHz	1500 Hz	30 A
4	11	15	8 kHz	4 kHz	24 kHz	1500 Hz	44 A
5	15	20	8 kHz	4 kHz	24 kHz	1500 Hz	61 A
5	18.5	25	8 kHz	4 kHz	24 kHz	1500 Hz	72 A

230 Volt, 3 Phase Models							
6	22	30	8 kHz	4 kHz	16 kHz	1000 Hz	90 A
6	30	40	4 kHz	4 kHz	16 kHz	1000 Hz	110 A
6	37	50	4 kHz	4 kHz	12 kHz	750 Hz	150 A
6	45	60	4 kHz	4 kHz	8 kHz	500 Hz	180 A
7	55	75	4 kHz	4 kHz	8 kHz	500 Hz	210 A
7	75	100	4 kHz	4 kHz	8 kHz	500 Hz	246 A
400 Volt, 3 Phase Models							
Frame Size	**kW**	**HP**	**Default**	**Minimum**	**Maximum**	**Max Frequency**	**Output Current***
2	0.75	1	8 kHz	4 kHz	32 kHz	2000 Hz	2.2 A
2	1.5	2	8 kHz	4 kHz	32 kHz	2000 Hz	4.1 A
2	2.2	3	8 kHz	4 kHz	32 kHz	2000 Hz	5.8 A
2	4	5	8 kHz	4 kHz	32 kHz	2000 Hz	5.8 A
3	5.5	7.5	8 kHz	4 kHz	24 kHz	1500 Hz	14 A
3	5.5	7.5	8 kHz	3 kHz	24 kHz	1500 Hz	18 A
3	7.5	10	8 kHz	4 kHz	16 kHz	1000 Hz	19 A
4	11	15	8 kHz	4 kHz	24 kHz	1500 Hz	24 A
4	15	20	8 kHz	4 kHz	24 kHz	1500 Hz	30 A
4	18.5	25	8 kHz	4 kHz	24 kHz	1500 Hz	39 A
4	22	30	8 kHz	4 kHz	24 kHz	1500 Hz	44 A
5	30	40	8 kHz	4 kHz	24 kHz	1500 Hz	61 A
5	37	50	8 kHz	4 kHz	24 kHz	1500 Hz	72 A
6	45	60	4 kHz	4 kHz	16 kHz	1000 Hz	90 A
6	55	75	4 kHz	4 kHz	16 kHz	1000 Hz	110 A
6	75	120	4 kHz	4 kHz	12 kHz	750 Hz	150 A
6	90	150	4 kHz	4 kHz	8 kHz	500 Hz	180 A
7	110	175	4 kHz	4 kHz	8 kHz	500 Hz	210 A
7	132	200	4 kHz	4 kHz	8 kHz	500 Hz	246 A
7	160	250	4 kHz	4 kHz	8 kHz	500 Hz	302 A
8	200	300	4 kHz	4 kHz	4 kHz	250 Hz	380 A
8	250	350	4 kHz	4 kHz	4 kHz	250 Hz	450 A

*Maximum output current shown is a typical figure for guidance, based on continuous operation at maximum switching frequency in 30°C ambient temperature with thermal management disabled (P6-xx = 0) for IP20 or IP55 drives only.

Firmware Upgrade Requirements

In order to install the High Frequency Firmware into the selected drive, you will require

- A suitable PC or lap top with Windows XP or later operating system installed
- Optitools Studio Software Package Version 1.5.0.0 or later installed on your PC (available to download from the Invertek website) here.
- A PC connection Kit (part number OD-485AD-IN)
- A High Frequency Firmware File coded with the correct serial number of the chosen drive. This requires the request form to be fully completed.

This parameter must be set to the motor continuous rated phase current in amps, often referred to as the motor nominal current (IN). This parameter is used to protect the motor and prevent damage through excessive current.

Loading the Firmware into the Drive

The following procedure details how to load the firmware to the drive

- Ensure that you have Optitools Studio software installed and operating on your PC
    - The software can be freely downloaded from the Invertek Website.
- Ensure that the connection method in Optitools Studio is set for RS485 method
    - Click on Tools > Select Communication Method > RS485
- Ensure that the correct communication port (COMxx)is selected in the Optitools Studio Software to suit the port being used by the PC connection kit
    - Click on Tools > Select COM Port > COM xx (where xx is the correct port number)
- Test the communication between the drive and PC
    - Ensure that the USB PC Connection Kit is connected to the PC
    - The USB interface itself has 4 DIP switches. These should be 1 & 2 OFF, 3 & 4 ON
    - Connect the DB9 – RJ45 (8 way) cable from the USB interface 9 Way D-Type connector to the drive communication port
    - In the Optitools Studio software, click on the ‘Read From Drive’ button on the toolbar
    - Ensure the parameters are loaded from the drive to the PC
    - If required, the parameter file can be saved by clicking the ‘Save’ button on the toolbar
- Prepare the drive for firmware update
    - In order to update the drive firmware, the drive must be in the “1 nh ibt” state
    - This can be easily achieved by disconnecting the 13 way terminal connector from the drive
- Upgrade the drive firmware

    - In the Optitools Studio software, select
        - Tools > Upgrade Drive Firmware > Manual
    - In the Optitools Studio software, select
- Each drive contains two separate processors. Both processor firmware files must be upgraded

It is essential that the firmware in both processors is upgraded at the same time, and that the version numbers of the firmware are the same. Operating a drive with mismatched firmware could cause damage to the drive, any connected machinery, and can result in unpredictable drive behaviour.

- Providing that communications with the drive can be established, a window will open allowing selection of the IO firmware file
    - This file will have been sent to you in an archive folder, which must be unpacked before upgrading the drive
    - The filename will have the following format
        - IO_SPINDLE_(Frame Sizes) v(Version Number) (Checksum) [Serial Number].upghs
    - Each file is individually coded to the drive, and the serial number must match that of the intended drive, otherwise upgrade will not be possible
    - Select the upgrade file to suit the connected drive and click “Open”
- You will now be prompted to select the Power firmware file
    - This file will be included in the archive folder and must again be extracted before use
    - The filename will have the following format
        - Sa_bbbV(cPh)_dddkW_Ve.ee_3GV-S (Checksum) [Serial Number].upgss
    - Where
        - a = Frame Size
        - b = Supply Voltage
        - c = Incoming Supply Phase
        - d = kW
        - e = Version Number
    - This data, and the serial number must all match the connected drive
    - Select the file to match the connected drive
- The drive will now enter upgrade mode
    - The drive display will show “Pro9- 1”
    - The IO Firmware is updated first. The process takes around 3 minutes
    - Communication with the drive must not be interrupted during this phase
    - Optitools Studio shows a progress bar in the bottom right hand corner of the screen showing the progress of the update
    - When the IO firmware upgrade is complete, the Power firmware upgrade will commence automatically
    - The drive display will show “Pro9- 2”
- When the upgrade is complete, the drive will return automatically to the “1 nh ibt” state

Using Optitools Studio with High Frequency Spindle Drives

Following the update, the drive will appear in Optitools Studio as a Spindle Drive, and can be commissioned in the normal way.

Appendix:

Revision History			
Version	**Comments**	**Author**	**Date**
3	Updated for V2.00 Firmware	KB	17/11/15
2	Updated to reflect functionality of Optitools studio V1.5.0.0	KB	15/1/13
1	First Release	KB	21/12/12