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1

1 Overview

1.1.1 Software Version

VLT HVAC Drive
FC 102 Series
Software version: 3.4x
and VLT AQUA Drive FC 202 Series
Software version: 1.7x

This guide can be used with all VLT HVAC Drive frequency converters with software version 3.4x and VLT AQUA Drive frequency converters with software version 1.7x.
The actual software version number can be read from par. 15-43 *Software Version*.

1.1.2 Introduction

The frequency converter control board is program selectable for use with the Johnson Controls Metasys N2 protocol. Metasys N2 is a master/slave control network. The physical layer is RS-485 compatible, half duplex 9600 baud shielded twisted pair. The N2 software protocol is designed to be general in nature to accommodate the unique properties each device type may have. Every device connection to the N2 network can be thought of as a small data manager. Data points in the database are classified as analog I/O (floating point), binary I/O or integer data points - floats, integers or bytes. Each data type has its own unique structure defined in the Metasys N2 system Protocol Specification for Vendors.

The information in this manual is intended to provide you with comprehensive information on how to install and set up the frequency converter for communication over a Metasys network.

For specific information on operation of the drive, refer to the *VLT HVAC Drive Operating Instructions, MG.11.Ax.yy* or the *VLT AQUA Drive Operating Instructions, MG.20.Mx.yy*.

1.1.3 About this Manual

This manual is for both instructional and for reference purposes. This manual can also serve as a guideline when you specify and optimize your communication system.
It is highly recommended that you read this manual in its entirety before initiating any programming. It is assumed that the user has full knowledge of the capabilities and limitation of the controller node in addition to full knowledge of the frequency converter.

1.1.4 References

In addition to this manual, the following two manuals should be consulted: *VLT HVAC Drive Operating Instructions, MG. 11.Ax.yy, VLT AQUA Drive Operating Instructions, MG.20.Mx.yy* and *Johnson Controls METASYS N2 System Protocol Specification for Vendors, Johnson Controls number 04-3402-22, rev A*.

2 Instructions

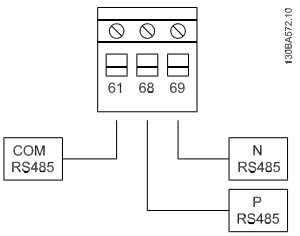
2.1.1 Abbreviations and Definitions

ACK	Acknowledge
ADF	Internal Floating Points
ADI	Internal Integers
AI	Analog Inputs
AO	Analog Outputs
BI	Binary Inputs
BO	Binary Outputs
COS	Change Of State
FC	Frequency Converter
HPFB	High Performance Field Bus
JCI	Johnson Controls Inc. developers of the METASYS N2 protocol
N2	METASYS N2
N2 master	A N2 master is either a PC with JCI software or a dedicated JCI controller
NAK	Not acknowledged
NPA	N2 Point Address (Each N2 Point Type has a address range from 0 to 255)
NPT	N2 Point Type
PAR	Parameter Number

2.1.2 Network Connection

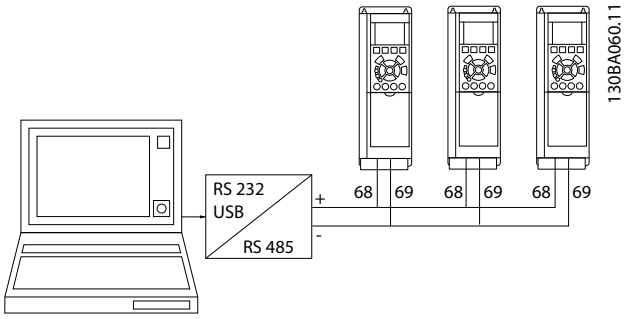
Connect signal wires to terminal 68 (N+) and terminal 69 (N-) on main control board of the drive. If shielded cabling is used, connect one end of the shield to terminal 61. This terminal is connected to ground via an internal RC link. It is highly recommended to use shielded twisted-pair cables to reduce the differential mode interference between the conductors. Danfoss do not take any responsibility for consequences, if unshielded or untwisted cables are used.

Torque Specifications:	4.5 in.lb. (0.5 Nm) if screw terminal is used
Control wire:	18 - 24 AWG, shielded, twisted pair



2.1.3 Hardware Set-up

RS-485 Bus Connection:
One or more frequency converters can be connected to a control (or master) using the RS-485 standardized interface. Terminal 68 is connected to the P signal (TX+, RX+), while terminal 69 is connected to the N signal (TX-,RX-). If more than one frequency converter is connected to a master, use parallel connections.



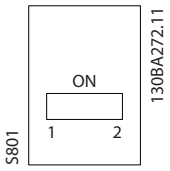


Illustration 2.1: Bus termination switch

NOTE
The factory setting for the dip switch is OFF.

In order to avoid potential equalizing currents in the screen, earth the cable screen via terminal 61, which is connected to the frame via an RC-link.
Bus termination: The RS-485 bus must be terminated by a resistor network at both ends. For this purpose, set switch S801 on the control card to "ON". For more information, see the paragraph: Switches S201, S202 and S801.

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2.1.4 Error Codes

Error Code 00	is issued after power up or after a time out where all overridden points were released, as long as no Identify yourself command has been issued by the master.
Error Code 01	is issued if the command is not supported or not known by the drive.
Error Code 02	is issued if the received telegram has a checksum error.
Error Code 03	is issued if the N2 telegram receive buffer exceeds 256 characters.
Error Code 05	is issued if the received N2 telegram is too long.
Error Code 10	is issued the data is out of expected range
Error Code 11	is issued when: 1. A point attributes or attribute bit is unused. 2. A point attributes or attribute bit is for JCI use only. 3. An internal data point attribute for current value can not be changed while running
Error Code 12	is issued when: 1. The N2 master tries to change attribute 2 bit 6 "Current State" on a BO and the drive is tripped. 2. The N2 master tries to change attribute 2 bit 6 "Current State" on a BO and the drive is trip locked except for BO 5 "reset"

2.1.5 VLT Parameters

The following parameters may need to be manually set for each drive in the Metasys N2 network. Refer to the *VLT HVAC Drive Design Guide*, MG.11.Bx.yy, or *VLT AQUA Drive Design Guide*, MG.20.Nx.yy, for the frequency converter for programming.

Parameter list

VLT Parameter	Description	Default	Desired Setting
8-01	Control Side	Digital & Ctrl. Word	
8-02	Control Source	FC Port	FC Port
8-03	Control Word Timeout	60 s	1-18000 s
8-30	Protocol	FC	Metasys N2
8-31	Address	1	1-255
8-32	Baud Rate	9600	Fixed to 9600
8-33	Parity	Even, 1stop	Fixed to No Parity, 1stop
8-37	Maximum Inter-char Delay		25 s for Metasys N2

2.1.6 General Commands (Acknowledged)

VLT Response	Command	Subcommand	NPA Object no.	Attribute Message Type	Error Code	Comments
ACK	0	4	-	Poll Message No Acknowledge	-	The slave is to respond with any data points, analog or binary I/O that have been flagged for COS
ACK	0	5	-	Poll message With Acknowledge	-	The slave is to respond with any data points, analog or binary I/O that have been flagged for COS
ACK	0	9	-	Status update Message	-	Slave device must respond with device manufacturing model number (Par. 6-21), days in service (Par. 6-00) and device status
ACK	F	-	-	Identify Device Type	-	Slave device responds with an identification number of 10H to indicate non JCI device
ACK	0	0	-	Synch Time	-	The internal clock is syncronized by this command
ACK, no action	8	0	-	Upload	-	Optional, no support in the frequency converter
ACK, no action	8	1	-	Upload	-	Optional, no support in the frequency converter
ACK, no action	8	3	-	Upload Record	-	Optional, no support in the frequency converter
ACK, no action	8	4	-	Upload Complete	-	Optional, no support in the frequency converter
ACK, no action	9	0	-	Download	-	Optional, no support in the frequency converter
ACK, no action	9	1	-	Download	-	Optional, no support in the frequency converter
ACK, no action	9	3	-	Download	-	Record optional, no support in the frequency converter
ACK, no action	9	4	-	Download Complete	-	Optional, no support in the frequency converter
NAK	0	1	-	Read Memory	01	Slave device memory read based on memory addresses
NAK	0	8	-	Warm Start	01	JCI use only

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2.1.7 Analog Input Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute No.	Attribute Message Type		Comments
ACK	1	-	1	0-23	1	Byte	Read Analog Input	Read Object Configuration attribute associated with each individual point
ACK	1	-	1	0-23	2	Byte	Read Analog Input	1) Read Object Status attribute associated with each individual point
ACK	1	-	1	0-23	3	Float	Read Analog Input	2) Read Analog Input Value attribute associated with each individual point
ACK	1	-	1	0-23	8	Float	Read Analog Input	Read Low Alarm attribute associated with each individual point
ACK	1	-	1	0-23	9	Float	Read Analog Input	Read Low Warning attribute associated with each individual point
ACK	1	-	1	0-23	10	Float	Read Analog Input	Read High Warning attribute associated with each individual point
ACK	1	-	1	0-23	11	Float	Read Analog Input	Read High Alarm attribute associated with each individual point
ACK	1	-	1	0-23	12	Float	Read Analog Input	Read Differential attribute associated with each individual point
ACK	2	-	1	0-23	1	Byte	Write Analog Input	Write to Object Configuration attribute associated with each individual point
ACK	2	-	1	0-23	8	Float	Write Analog Input	Write to Low Alarm Limit attribute associated with each individual point
ACK	2	-	1	0-23	9	Float	Write Analog Input	Write to Low Warning Limit attribute associated with each individual point
ACK	2	-	1	0-23	10	Float	Write Analog Input	Write to High Warning Limitattribute associated with each individual point
ACK	2	-	1	0-23	11	Float	Write Analog Input	Write to High Alarm Limit attribute associated with each individual point
ACK	2	-	1	0-23	12	Float	Write Analog Input	Write to Differential attribute associated with each individual point
ACK, no action	7	2	1	0-23	-	Float	Override Analog inputs	Analog inputs are "outputs" from the frequency converter and should not be written over by the network controller
ACK, no action	7	3	1	0-23	-	-	Override Analog Release	Analog inputs are "outputs" from the frequency converter and should not be written over by the network controller
ACK, no action	7	7	1	0-23	-	-	Write Analog Input Attributes	Optional command for slave devices. Only used for N2 commissioning purposes

2.1.8 Analog Input Commands (Not Acknowledged)

VLT Response	Comm and	Region	NPA Object no.	Attribute No.	Attribute Message Type		Error Code	Comments
NAK	1	1	0-23	4	Float	Read Analog Input	11[1)]	Read Linear Ranging Parameter 1 attribute associated with each individual point. (JCI use only)
NAK	1	1	0-23	5	Float	Read Analog Input	11[1)]	Read Linear Ranging Parameter 2 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	2	Byte	Write Analog Input	11[1)]	Object Status writeable
NAK	2	-	0-23	3	Float	Write Analog Input	11[1)]	Analog Input Value not writeable
NAK	2	-	0-23	4	Float	Write Analog Input	11[1)]	Write to Linear Ranging Parameter 1 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	5	Float	Write Analog Input	11[1)]	Write to Linear Ranging Parameter 2 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	6	Float	Write Analog Input	11[1)]	Write to Linear Ranging Parameter 3 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	7	Float	Write Analog Input	11[1)]	Write to Linear Ranging Parameter 4 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	13	Integer	Write Analog Input	11[1)]	Write to Filter Weight attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	14	Float	Write Analog Input	11[1)]	Write to AI Offset attribute associated with each individual point. (JCI use only)

[1)] Error code 11 is used because attributes are considered as fields/records in the point map database.

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2.1.9 Analog Output Commands (Acknowledged)

VLT Response	Command	Sub command	Region	NPA Object no.	Attribute No.	Attribute Message Type		Comments
ACK	1	-	3	0-2	1	Byte	Read Analog Output	Read Object Configuration attribute associated with each individual point
ACK	1	-	3	0-2	2	Byte	Read Analog Output	Read Object Status attribute associated with each individual point
ACK	0	9	-	-	-	-	Status update Message	Slave device must respond with device manufacturing model number (Par. 6-21), days in service (Par. 6-00) and device status
ACK	1	-	3	0-2	3	Float	Read Analog Output	Read Current Value attribute associated with each individual point
ACK	2	-	3	0-2	1	Byte	Write Analog Output	Write to Object Configuration attribute associated with each individual point
ACK	7	2	3	0-2	-	Float	Override Analog Output	Write to analog output current value (frequency setpoint)
ACK	7	2	3	0-2	-	Float	Override Analog Output	Write to analog output current value (frequency setpoint)
ACK	7	3	3	0-2	-	-	Override Release	Set the current value, the value that it was before the 1. Override Command was issued
ACK, no action	7	7	3	0-2	-	-	Write Analog Output	Optional command for slave devices. Only used for N2 Attributes commissioning purposes. Not to be implemented at this time
ACK, no action	7	8	3	0-2	-	-	Read Analog Output Attributes	Optional command for no action slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time

2.1.10 Analog Output Commands (Not Acknowledged)

VLT Response	Command	Region	NPA Object no.	Attribute No.	Attribute Message Type		Error Code	Comments
0-2	1	3	0-2	4	Float	Read Analog Output	11[1]	Read Low Linear Ranging Parameter attribute associated with each individual point. (JCI use only)
NAK	1	3	0-2	5	Float	Read Analog Output	11[1]	Read High Linear Ranging Parameter attribute associated with each individual point. (JCI use only)
NAK	2	3	0-2	2	Byte	Write Analog Output	11[1]	Object Status not writeable
NAK	2	3	0-2	3	Float	Write Analog Output	11[1]	Write to Current Value structure attributes associated with each individual point. (N2 does not support this, override function must be used)
NAK	2	3	0-2	4	Float	Write Analog Output	11[1]	Write Debouncing Value in msec attribute associated with each individual point.(JCI use only)
NAK	2	3	0-2	5	Float	Write Analog Output	11[1]	Write Accumulator value attribute associated with each individual point. (JCI use only)

[1)] Error code 11 is used because attributes are considered as fields/records in the point map database.

2

2.1.11 Binary Input (BI) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute No.	Attribute Message Type		Comments
ACK	1	-	2	0-135	1	Byte	Read Binary Input	Read Object Configuration attribute associated with each individual point
ACK	1	-	2	0-135	2	Byte	Read Binary Input	Read Object Status attribute associated with each individual point
ACK	2	-	2	0-135	1	Byte	Write Binary Input	Write to Object Configuration attribute associated with each individual point
ACK, no action	7	2	2	0-135	-	Byte(0/1)	Override Binary Input	Binary inputs are "outputs" from the frequency converter and should not be written over by the network controller. (Status word, Warnings, and Alarms)
ACK, no action	7	3	2	0-135	-	-	OverrideRelease	Binary inputs are "outputs" from the drive and should not be written over by the network controller. (Status word, Warnings and Alarms)
ACK, no action	7	7	2	0-135	-	-	Write Binary Input	Optional command for slave devices. Only Attributes used for N2 commissioning purposes. Not to be implemented at this time
ACK, no action	7	8	2	0-135	-	-	Read Binary Input	Optional command for Attributes slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time

2.1.12 Binary Input (BI) Commands (Not Acknowledged)

VLT Response	Command	Region	NPA Object no.	Attribute No.	Attribute Message Type		Error Code	Comments
NAK	2	2	0-135	2	Byte	Write Binary Input	11[1]	Object Status not writeable
NAK	2	2	0-135	3	Integer	Write Binary Input	11[1]	Write Debouncing Value in msec attribute associated with each individual point.(JCI use only)
NAK	2	2	0-135	4	Integer32	Write Binary Input	11[1]	Write Accumulator value attribute associated with each individual point (JCI use only)

2.1.13 Binary Output Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute No.	Attribute Message Type		Comments
ACK	1	-	4	0-10	1	Byte	Read Binary Output	Read structure attributes associated with each individual point
ACK	1	-	4	0-10	2	Byte	Read Binary Output	Read structure attributes associated with each individual point
ACK	2	-	4	0-10	1	Byte	Write Binary Output	Write to Object Configuration attribute associated with each individual point
ACK	7	2	4	0-10	-	Byte(0/1)	Override Binary Output	Write to binary output current state (VLT control word)
ACK	7	2	4	0-10	-	Byte(0/1)	Override Binary Output	Write to binary output current state (VLT control word)
ACK	7	3	4	0-10	-	-	Override Release	Set the current value, the value that it was before the 1. Override Command was issued
ACK, no action	1	-	4	0-10	3	Integer	Read Binary Output	Read Minimum On-time attribute associated with each individual point. Return value = 0
ACK, no action	1	-	4	0-10	4	Integer	Read Binary Output	Read Minimum Off-time attribute associated with each individual point. Return value = 0
ACK, no action	1	-	4	0-10	5	Integer	Read Binary Output	Read Maximum Cycles/ Hour attribute associated with each individual point. Return value = 0
ACK, no action	2	-	4	0-10	3	Integer	Write Binary Output	Write Minimum On-time attribute associated with each individual point
ACK, no action	2	-	4	0-10	4	Integer	Write Binary Output	Write Minimum Off-time attribute associated with each individual point
ACK, no action	2	-	4	0-10	5	Integer	Write Binary Output	Write Maximum Cycles/ Hour attribute associated with each individual point
ACK, no action	7	7	4	0-10	-	-	Write Binary Output	Optional command for slave devices. Only Attributes used for N2 commissioning purposes
ACK, no action	7	8	4	0-10	-	-	Read Binary Output	Optional command for slave devices. Only Attributes used for N2 commissioning purposes

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2.1.14 Binary Output (BO) Commands (Not Acknowledged)

VLT Response	Command	Region	NPA Object no.	Attribute No.	Attribute Message Type		Error Code	Comments
NAK	1	4	0-10	6	Integer	Read Binary Output	11[1)]	Read Interstage on delay attribute associated with each individual point. (JCI use only)
NAK	1	4	0-10	7	Integer	Read Binary Output	11[1)]	Read Interstage off delay attribute associated with each individual point. (JCI use only)
NAK	2	4	0-10	2	Byte	Write Binary Output	11[1)]	Object Status not writeable
NAK	2	4	0-10	6	Integer	Write Binary Output	11[1)]	Write Interstage on delay attribute associated with each individual point. (JCI use only)
NAK	2	4	0-10	7	Integer	Write Binary Output	11[1)]	Write Interstage off delay attribute associated with each individual point. (JCI use only)

[1)] Error code 11 is used because attributes are considered as fields/records in the point map database.

2.1.15 Internal Integers (ADI) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute No.	Attribute Message Type		Comments
ACK	1	-	6	0-254	1	Integer	Read Internal Parameter of object type integer (16 bit)	Read Object Status associated with each individual point
ACK	1	-	6	0-254	2	Integer	Read Internal Parameter of object type integer (16bit)	Read Current Value attribute associated with each individual point
ACK	2	-	6	0-254	-	Integer	Write Internal Parameter of object type integer (16bit)	Write to Current Value attribute associated with each individual point
ACK	7	2	6	0-254	-	Integer	Override Internal Parameter of object type Integer (16 bit)	Write to internal parameter current value (set-up parameters for VLT)
ACK	7	3	6	0-254	-	-	Override Release	Set the current value, the value that it was before the 1. Override Command was issued

2.1.16 Internal Floating Point Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute No.	Attribute Message Type		Comments
ACK	1	-	5	0-101	1	Byte	Read Internal Parameter of object type float	Read Object Status associated with each individual point
ACK	1	-	5	0-101	2	Float	Read Internal Parameter of object type float	Read Current Value attribute associated with each individual point
ACK	2	-	5	0-101	-	Float	Write Internal Parameter of object type float	Write to Current Value attribute associated with each individual point
ACK	2	-	5	0-101	-	Float	Write Internal Parameter of object type float	Write to Current Value attribute associated with each individual point
ACK	7	2	5	0-101	-	Float	Override Internal Parameter of object type float	Write to internal parameter current value (set-up parameters for VLT)
ACK	7	3	5	0-101	-	-	Override Release	Set the current value, the value that it was before the 1. Override Command was issued

2.2.1 Start-up of the Frequency Converter

2

Use the frequency converter keypad mounted either on the drive or remote. Use the Extended Menu key to access the 8-** group parameters (serial communication). The settings shown below are typical. Some settings may be changed to meet the application requirements. The settings below will serve as a good starting reference. Refer to the operating instruction manual for instructions on changing parameters and programming the drive.

Examples of typical settings. Program the following:

Parameter:	Setting:
Par. 8-30 *Protocol*	[3] Metasys N2
Par. 8-31 *Address*	1 (Default)
Par. 8-32 *Baud Rate*	[2] 9600 Baud (fixed at 9600 for N2 protocol)
Par. 8-50 *Coasting Select*	[3] Logic OR
Par. 8-52 *DC Brake Select*	[3] Logic OR
Par. 8-53 *Start Select*	[3] Logic OR
Par. 8-54 *Reversing Select*	[0] Digital input
Par. 8-55 *Set-up Select*	[3] Logic OR
Par. 8-56 *Preset Reference Select*	[3] Logic OR
Par. 8-94 *Bus Feedback 1*	0
Par. 8-95 *Bus Feedback 2*	0

NOTE

Send an F command to begin communications between the master and the drive

Example 1:

F command	Setting:
Device address	XX
Char1 command	F
Checksum	YY

Telegram code:
>XXFYY <CR>

Issue a run command through the master, to the device:

Example 2:

Bus start, BO override command:	Setting:
Device address	XX
Char1 command	7
Char1 subcommand	2
Char2 region	04
Char2 object number (NPA)	04 (Start)
Char2 override value	01 (Active)
Checksum	YY

Telegram code:
>XX72040401YY <CR>

Issue a frequency reference through the master, to the device:

Example 3:

Over-ride analog output, speed (50%) change command:	Setting:
Device address	XX
Char1 command	7
Char1 subcommand	2
Char2 region	03
Char2 object number (NPA)	00
Char8 override value *	4E 00 00 00 override value = 50% speed (IEEE floating point, format)
Checksum	YY

Telegram code:
>XX7203004E000000<CR>

To calculate override value for speed: refer to Scaling of Bus Reference and Bus Feedback. Issue an override release command through the master to the device:

Example 4:

Bus stop, BO over-ride release command:	Setting:
Device address	XX
Char1 command	7
Char1 subcommand	2
Char2 region	04
Char2 object number (NPA)	04 (Start)
Char8 override value *	00 (Not active)
Checksum	Y

Telegram code:
>XX72040400YY <CR>

If the preceding commands were issued, the drive should have accelerated to 50% after the speed reference was issued. After the override release, the drive should have stopped.

2.2.2 Scaling of Bus Reference and Feedback

Reference/ feedback	Scaling	Float	IEEX hex
20%	20 * 16384/100	3276.8	454C CCCD
50%	50 * 16384/100	8192	4600 0000
100%	100 * 16384/100	16384	4680 0000
200%	200 * 16384/100	32767	46FF FE00
-100%	-100 * 16384/100	-16384	C680 0000
-200%	-200 * 16384/100	-32768	C700 0000

Table 2.1: Reference/feedback values

The reference/feedback value is the percentage of the range of parameter 3-02 and 3-03. Values within the ranges 100% to 200% and -200% to -100% applies only to the reference. The Float representation of the value 200% must be limited to maximum 32767 and minimum -32768.

2.2.3 Status Update Request

A Status Update Request will cause the drive to report its current operating status. The status codes, descriptions and associated alarms are shown in the chart below.

The Device Status Code consists of two parts. The Least Significant Byte, (LSB) of the hex number is the Alarm Number. The Most Significant Byte (MSB) indicates if the alarm is a normal trip (01) that can be reset automatically or manually, or if the alarm is a trip lock (02) requiring cycling power to the drive.

Status codes with associated alarms and descriptions

Device Status Code1	Alarm No.	Description
0x0000	-	Device OK
0x0102	2	Live zero error
0x0204	4	Phase fault (Trip lock)
0x0107	7	Over voltage
0x0108	8	Under voltage
0x0109	9	Inverter overloaded
0x010A	10	Motor overloaded
0x010B	11	Motor thermistor
0x010C	12	Current limit
0x020D	13	Over current (Trip lock)
0x020E	14	Earth fault (Trip lock)
0x020F	15	Switch mode fault (Trip lock)
0x0210	16	Short circuit (Trip lock)
0x0111	17	Standard bus time out
0x0112	18	HPFB time out
0x0116	22	Auto optimization not OK
0x021D	29	Heat sink temperature to high (Trip lock)
0x011E	30	Motor phase U missing
0x011F	31	Motor phase V missing
0x0120	32	Motor phase W missing
0x0122	34	Profibus communication error
0x0225	37	Inverter fault (Trip lock)
0x013C	60	Safety interlock
0x0263	99	Unknown fault (Trip lock)

Read/write notes

A write command to an ADF (Internal Floating Point) or BD (Internal Byte) point type will be stored in the drive's EEPROM.

NOTE

If write command is issued to an overridden point, the new value will not be stored in the drive's EEPROM.

2

2.2.4 Override/Override Release Commands and Time Out, 8-04 (Setting [20], N2 Override release)

The way the overridden points are released is very important to the way the drive will behave during the override release time out or for release commands issued by the N2 master. This is due to the fact that the active setup can be changed to a different setup. If one would release the active setup before the values that have been overridden in that setup, the backup values would then be restored to the wrong setup, leaving the overridden values in the old setup unchanged.

The release after override time out:
During an override release time-out, all points which are overridden, will be released in the order, which they are specified in Appendix POINTMAP:

1. Release Analog Outputs from point address (NPA) 0 to 255.
2. Release Binary Outputs from point address (NPA) 0 to 255.
3. Release Internal Floating Points from point address (NPA) 0 to 255.
4. Release Internal Integer Points from point address (NPA) 0 to 255.
5. Release Internal Byte points from point address (NPA) 0 to 255.

2.2.5 Change of State (COS)/POLLING

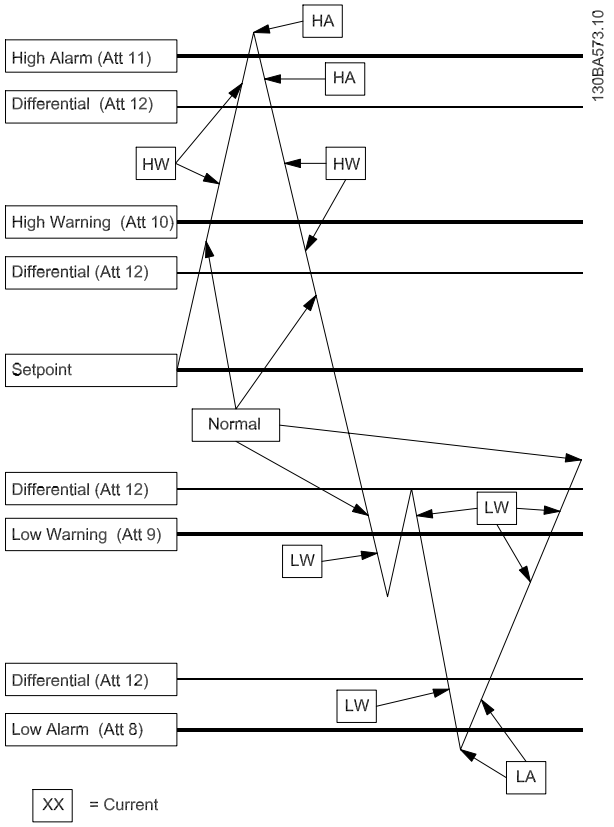
A change of state occurs when a new command has been issued for the drive. This command can be issued through the bus or through a drive related status change or command. The master can issue a series of poll commands to the network devices to get an update on any status changes from the time of the last polling. When polling a frequency converter for the first time after a network has been powered up after an F command has been issued, a 0/4 poll command must be issued.

2.2.6 Handling of Poll Message Commands

The Identity Command will cause the drive to report all AI, AO, BI and BO points, which are available when the next Poll (0/4) is received. The drive also supports COS for AI and BI point types. The drive is limited to responding with up to 200 ASCII characters, so multiple messages may need to be sent before all available points have been reported.

Upon receiving the Poll (0/4), the frequency converter will begin exporting the requested information. The frequency converter will continue to export new information upon receiving the 0/5 Poll until it has sent all requested information. Then it will respond to a new 0/5 Poll with an ACK response to indicate all information has been transmitted and complete the Poll sequence receiving a 0/4 Poll before sending the ACK response will cause the frequency converter to re-transmit its latest response.

The drawing below illustrates the AI COS handling.



For AI:
Alarm Enable or Warning Enable must be set in the Object Configuration Attribute (Attribute 1). Low/High Alarm limits (Attribute 8, 11) or Low/High Warning limits (Attribute 9, 10) must be programmed. Differential Value (Attribute 12) must also be programmed.

For BI:
Alarm Enable must be set in the Object Configuration Attribute (Attribute 1).

Normal state must be programmed in the Object Configuration Attribute (Attribute 1)

Att XX = Attribute number, HA = High alarm, LA = Low alarm, HW = High Warning, LW = Low Warning

The AI COS alarms will only be cleared when the point value goes below the high alarm/warning or above the low alarm/warning limit by more than the programmed differential value (Attribute 12).
The BI COS will set the Alarm (Object Status bit 4) if COS enabled (Object Configuration Bit 0) is set, Alarm Enabled (Object configuration bit 3) is set, and Current State (Object Status bit 6) is different from Normal State (Object Configuration bit 1).

3 Appendix

3.1.1 Analog Inputs (AI)

NPA	Unit	Description	Range	FC Par. Number
0	%	Reference [%]	-	16-02
1	-	Reference [Unit]	-	16-01
2	-	Feedback	-	16-52
3	Hz	Frequency	-	16-13
4	-	User defined readout	-	16-09
5	A	Current	-	16-14
6	kW	Power	-	16-10
7	hp	Power	-	16-11
8	V	Output Voltage	-	16-12
9	V	DC Voltage	-	16-30
10	%	Motor Thermal Protection	-	16-18
11	%	Inverter Thermal Protection	-	16-35
12	V	Terminal 53 analog	-	16-62
13	V	Terminal 54 analog	-	16-64
16	%	External reference	-	16-50
17	C	Heat sink temperature	-	16-34
18	Hour	Operating hours	-	15-00
19	Hour	Running hours	-	15-01
20	kWh	kWh counter	-	15-02
21	-	Power-ups	-	15-03
22	-	Over temps	-	15-04
23	-	Over voltages	-	15-05
24	-	Start Ups	-	15-08
25	-	Torque [%]	-	16-22
26	-	Speed [rpm]	-	16-17
27	-	Analog Input, GPIO X30/11	-	16-75
28	-	Analog Input, GPIO X30/12	-	16-76
29	-	Analog Input, IO option X42/1	-20.000 to +20.000	18-20
30	-	Analog Input, IO optionX42/3	-20.000 to +20.000	18-21
31	-	Analog Input, IO optionX42/5	-20.000 to +20.000	18-22
32	-	Analog Out X42/7	-	18-33
33	-	Analog Out X42/9	-	18-34
34	-	Analog Out X42/11	-	18-35
40	-	ECB: Bypass Running Hours	$0\text{-}2^{32}/10$	31-11
45	-	Feedback 1 [Unit]	-	16-54
46	-	Feedback 2 [Unit]	-	16-55
47	-	Feedback 3 [Unit]	-	16-56
48	-	Ext. 1 Feedback [Unit]	-	21-18
49	-	Ext. 2 Feedback [Unit]	-	21-38

The default values are shown in bold on the following pages. Any point not listed on the following pages is reserved for future use.

Some Metasys software uses an object number range from 0 to 255, other Metasys software uses the range 1 to 254. The latter software will interpret object number 0 as 1, and 1 as 2, etc. To access the proper point with this Metasys software, add 1 to the NPA number in the tables.

3.1.2 Binary Inputs (BI)

NPA	Unit	Description	Range	FC Par. Number
0	15	Timers Status	**0=OK**, 1=Limit	Par. 16-03 *Status Word*
1	14	Current Status	**0=OK**, 1=Limit	
2	13	Voltage Status	**0=OK**, 1=Limit	
3	12	Inverter Status	**0=OK**, 1 =Stall, Auto-start	
4	11	Running Status	**0=Not Running,** 1=Running	
5	10	Frequency Status	**0=Out of Range,** 1=In Range	
6	9	Control Status	**0=Local,** 1= Bus	
7	8	Reference Status	**0=Not on Ref., 1**=On Ref.	
8	7	Warning Status	**0=No Warning** , 1= Warning	
9	3	Tripped Status	**0=No Trip** , 1=Tripped	
10	2	Drive Enabled Status	**0=Not Enabled** , 1=Enabled	
11	1	Drive Ready Status	**0=Not Ready**, 1=Ready	
12	0	Drive Controller Status	**0=Not Ready**, 1=Ready	
16	31	Reserved		Par. 16-92 *Warning Word*
17	30	Reserved		
18	29	Unused		
19	28	Unused		
20	27	Voltage Limit	**0=OK**, 1=Warning	
21	26	Low Temperature	**0=OK**, 1=Warning	
22	25	Current Limit	**0=OK**, 1=Warning	
23	24	Mains Failure	**0=OK**, 1=Warning	
24	23	24V Supply Low	**0=OK**, 1=Warning	
25	22	Fieldbus Fault	**0=OK**, 1=Warning	
26	21	Speed Limit	**0=OK**, 1=Warning	
27	20	Brake IGBT	**0=OK**, 1=Warning	
28	19	Brake Resistor	**0=OK** , 1=Warning	
29	18	Brake Overload	**0=OK**, 1=Warning	
30	17	10V low	**0=OK**, 1=Warning	
31	16	Live Zero Error	**0=OK**, 1=Warning	
32	15	No Motor	**0=OK**, 1=Warning	
33	14	Mains Phase Loss	**0=OK**, 1=Warning	
34	13	DC Voltage High	**0=OK**, 1=Warning	
35	12	DC Voltage Low	**0=OK**, 1=Warning	
36	11	DC Overvoltage	**0=OK**, 1=Warning	
37	10	DC Undervoltage	**0=OK**, 1=Warning	
38	9	Inverter Overload	**0=OK**, 1=Warning	
39	8	Motor ETR Overload	**0=OK**, 1=Warning	
40	7	Motor Thermal Overload	**0=OK**, 1=Warning	
41	6	Torque Limit	**0=OK**, 1=Warning	
42	5	Over Current	**0=OK**, 1=Warning	
43	4	Ctrl. Word Timeout	**0=OK**, 1=Warning	
44	3	Ctrl. Card Temp.	**0=OK**, 1=Warning	
45	2	Earth Fault	**0=OK**, 1=Warning	
46	1	Pwr. Card Temp	**0=OK**,1=Warning	
47	0	Brake Check	**0=OK**1=Warning	

3

Binary Inputs (BI), continued..

NPA	Unit	Description	Range	FC Par. Number
48	31	Reserved		Par. 16-90 *Alarm Word*
49	30	Reserved		
50	29	Drive Initialized	**0=OK**, 1=Alarm	
51	28	Option Change	**0=OK**, 1=Alarm	
52	27	Brake IGBT	**0=OK**, 1=Alarm	
53	26	Brake Resistor	**0=OK**, 1=Alarm	
54	25	1.8V Supply Low	**0=OK**, 1=Alarm	
55	24	Mains Failure	**0=OK**, 1=Alarm	
56	23	24V Supply Low	**0=OK**, 1=Alarm	
57	22	Fieldbus Fault	**0=OK**, 1=Alarm	
58	21	W Phase Loss	**0=OK**, 1=Alarm	
59	20	V Phase Loss	**0=OK**, 1=Alarm	
60	19	U Phase Loss	**0=OK**, 1=Alarm	
61	18	Brake Overload	**0=OK**, 1=Alarm	
62	17	Internal Fault	**0=OK**, 1=Alarm	
63	16	Live Zero Error	**0=OK**, 1=Alarm	
64	15	AMA not ok	**0=OK**, 1=Alarm	
65	14	Mains Phase Loss	**0=OK**, 1=Alarm	
66	13	Inrush Fault	**0=OK**, 1=Alarm	
67	12	Short Circuit	**0=OK**, 1=Alarm	
68	11	DC Overvoltage	**0=OK**, 1=Alarm	
69	10	DC Undervoltage	**0=OK**, 1=Alarm	
70	9	Inverter Overload	**0=OK**, 1=Alarm	
71	8	Motor ETR Overload	**0=Trip,** 1=Trip lock	
72	7	Motor Thermal Overload	**0=OK**, 1=Alarm	
73	6	Torque Limit	**0=OK**,1=Alarm	
74	5	Over Current	**0=OK**,1=Alarm	
75	4	Ctrl. Word Timeout	**0=OK**,1=Alarm	
76	3	Ctrl. Card Temp	**0=OK**,1=Alarm	
77	2	Earth Fault	**0=OK**,1=Alarm	
78	1	Pwr. Card Temp	**0=OK**,1=Alarm	
79	0	Brake check	**0=OK**,1=Alarm	
80	31		**0=FALSE**, 1=TRUE	Par. 16-94 *Ext. Status Word*
81	30		**0=FALSE**, 1=TRUE	
82	29		**0=FALSE**, 1=TRUE	
83	28		**0=FALSE**, 1=TRUE	
84	27		**0=FALSE**, 1=TRUE	
85	26		**0=FALSE**, 1=TRUE	
86	25		**0=FALSE**, 1=TRUE	
87	24		**0=FALSE**, 1=TRUE	
88	23		**0=FALSE**, 1=TRUE	
89	22		**0=FALSE**, 1=TRUE	
90	21		**0=FALSE**, 1=TRUE	
91	20		**0=FALSE**, 1=TRUE	
92	19		**0=FALSE**, 1=TRUE	
93	18		**0=FALSE**, 1=TRUE	
94	17		**0=FALSE**, 1=TRUE	
95	16		**0=FALSE** , 1=TRUE	
96	15	OVC Active	**0=FALSE** , 1=TRUE	
97	14	Out of Speed Reange	**0=Auto mode,** 1=Hand mode	

Binary Inputs (BI), continued..

NPA	Unit	Description	Selection	FC Par. Number
98	13	Braking	**0=FALSE**, 1=TRUE	Par. 16-94 *Ext. Status Word*
99	12	Braking Max	**0=Remote ref.,** 1=Local ref.	
100	11	Brake Check Ok	**0=FALSE**, 1=TRUE	
101	10	Output Frequency Low	**0=FALSE**, 1=TRUE	
102	9	Output Frequency High	**0=FALSE**, 1=TRUE	
103	8	Output Current Low	**0=FALSE**, 1=TRUE	
104	7	Output Current High	**0=FALSE**, 1=TRUE	
105	6	Feedback Low	**0=FALSE**, 1=TRUE	
106	5	Feedback High	**0=FALSE**, 1=TRUE	
107	4	Catch Up	**0=FALSE**, 1=TRUE	
108	3	Slow Down	**0=FALSE**, 1=TRUE	
109	2	Start CW/CCW	**0=FALSE**, 1=TRUE	
110	1	AMA Running	**0=FALSE**, 1=TRUE	
111	0	Ramping	**0=FALSE**, 1=TRUE	
112	9	Ramp	**0=RAMP 1**, 1=RAMP 2	Par. 16-00 *Control Word*
113	15	Reverse	**0=No function**, 1=reverse	
114	14	Setup MSB	**0=FALSE**, 1=TRUE	
115	13	Setup LSB	**0=FALSE**, 1=TRUE	
116	12	Relay02	**0=Relay04 off**, 1=Relay04 on	
117	11	Relay01	**0=Relay01 off**, 1=Relay01 on	
118	10	Res., always 0 (data valid)	**0=FALSE**	
119	8	Jog	**0=No Function**, 1=Jog	
120	7	Reset	**0=No Function**, 1=Reset	
121	6	Start	**0=start**, 1=stop	
122	5	Freeze Output	**0=Freeze output**, 1=Ramping	
123	4	Q-stop	**0=Q-stop**, 1=Ramping	
124	3	Coast	**0=Coasting**, 1=no Coast	
125	2	DC Brake	**0=DC Brake**, 1=Ramp stop	
126	1	Preset ref. MSB	**0=FALSE**, 1=TRUE	
127	0	Preset ref. LSB	**0=FALSE**, 1=TRUE	
128	0	Terminal 33	**0=FALSE**, 1=TRUE	Par. 16-60 *Digital Input*
129	1	Terminal 32	**0=FALSE**, 1=TRUE	
130	2	Terminal 29	**0=FALSE**, 1=TRUE	
131	3	Terminal 27	**0=FALSE**, 1=TRUE	
132	4	Terminal 19	**0=FALSE**, 1=TRUE	
133	5	Terminal 18	**0=FALSE**, 1=TRUE	
134	6	GPIO Term X30/2	**0=FALSE**, 1=TRUE	
135	7	GPIO Term X30/3	**0=FALSE**, 1=TRUE	
136	8	GPIO Terminal X30/4	**0=FALSE**, 1=TRUE	

3

Binary Inputs (BI), continued..

NPA	Unit	Description	Selection[1)]	FC Par. Number
150	10	ECB Manual Bypass Override	**0=FALSE**, 1=TRUE	Par. 31-10 *Bypass Status Word*
151	9	ECB External Interlock	**0=FALSE**, 1=TRUE	
152	8	ECB M3 Contactor Fault	**0=FALSE**, 1=TRUE	
153	7	ECB M2 Contactor Fault	**0=FALSE**, 1=TRUE	
154	6	ECB Overload Trip	**0=FALSE**, 1=TRUE	
155	5	ECB Motor Running from Bypass/Drive	**0=FALSE**, 1=TRUE	
156	4	ECB Reserved	**0=FALSE**, 1=TRUE	
157	3	ECB Bypass Mode	**0=FALSE**, 1=TRUE	
158	2	ECB Automatic Bypass Mode	**0=FALSE**, 1=TRUE	
159	1	ECB Drive Mode	**0=FALSE**, 1=TRUE	
160	0	ECB Test Mode	**0=FALSE**, 1=TRUE	
187	31	-	**0=FALSE**, 1=TRUE	Par. 16-95 *Ext. Status Word 2*
188	30	-	**0=FALSE**, 1=TRUE	
189	29	-	**0=FALSE**, 1=TRUE	
190	28	-	**0=FALSE**, 1=TRUE	
191	27	-	**0=FALSE**, 1=TRUE	
192	26	-	**0=FALSE**, 1=TRUE	
193	25	Fire Mode	**0=FALSE**, 1=TRUE	
194	24	Drive Bypass	**0=FALSE**, 1=TRUE	
195	23	Running	**0=FALSE**, 1=TRUE	
196	22	Sleep Boost	**0=FALSE**, 1=TRUE	
197	21	Sleep	**0=FALSE**, 1=TRUE	
198	20	Start Delay	**0=FALSE**, 1=TRUE	
199	19	Start Applied	**0=FALSE**, 1=TRUE	
200	18	Start	**0=FALSE**, 1=TRUE	
201	17	Start Request	**0=FALSE**, 1=TRUE	
202	16	Jog	**0=FALSE**, 1=TRUE	
203	15	Jog Request	**0=FALSE**, 1=TRUE	
204	14	Freeze Output	**0=FALSE**, 1=TRUE	
205	13	Freeze Output Request	**0=FALSE**, 1=TRUE	
206	12	Standby	**0=FALSE**, 1=TRUE	
207	11	Stop	**0=FALSE**, 1=TRUE	
208	10	DC Brake	**0=FALSE**, 1=TRUE	
209	9	Quick Stop	**0=FALSE**, 1=TRUE	
210	8	Drive Ready	**0=FALSE**, 1=TRUE	
211	7	Control Ready	**0=FALSE**, 1=TRUE	
212	6	Start Prevented	**0=FALSE**, 1=TRUE	
213	5	Relay 123 Active	**0=FALSE**, 1=TRUE	
214	4	Profibus OFF3 Active	**0=FALSE**, 1=TRUE	
215	3	Profibus OFF2 Active	**0=FALSE**, 1=TRUE	
216	2	Profibus OFF1 Active	**0=FALSE**, 1=TRUE	
217	1	Auto/Hand	**0=AUTO**, 1=TRUE	
218	0	OFF	**0=AUTO**, 1=TRUE	

[1)]The values in **bold** are the default values

3.1.3 Analog Outputs (AO)

NPA	Unit	Description	Range	FC Par. Number
0	%	Bus reference[1]	-200 to 200 Proportionally mapped into the range -32768 to 32767	Shared Variable
1		Bus Feedback 1		8-94
2		Bus Feedback 2		8-95
3		Bus Feedback 3		8-96
4		Analog Output 42		6-53
5		Pulse Output 27		5-93
6		Pulse Output 29		5-95
7		Analog Output, GPIOTerminal X30/8		6-63
8		Analog Output, IO Option X42/7		26-53
9		Analog Output, IO Option X42/9		26-63
10		Analog Output, IO Option X42/11		26-73

3

3.1.4 Binary Outputs (BO)

NPA	Unit	Description	Range [1]	FC Par. Number
0	2	DC Brake Inverse	0=Active, **1=Not Active**	Par. 16-00 *Control Word*
1	3	Coast Inverse	0=Active, **1=Not Active**	
2	4	Stop Inverse	0=Active, **1=Not Active**	
3	5	Freeze Output Inverse	0=Active, **1=Not Active**	
4	6	Start	**0=Not active**, 1=Active	
5	7	Stop	**0=Not active**, 1=Active	
6	8	Jog	**0=Not active**, 1=Active	
8	11	Relay01	**0=Not active**, 1=Active	
9	12	Relay02	**0=Not active**, 1=Active	
10	15	Reversing	**0=Not active**, 1=Active	
11	13	Setup LSB	**0=Not active**, 1=Active	
12	14	Setup MSB	**0=Not active**, 1=Active	
13	0	Preset ref. LSB	**0=Not active**, 1=Active	
14	1	Preset ref. MSB	**0=Not active**, 1=Active	
20	0	Output Terminal 27	**0=Not active**, 1=Active	Par. 5-90 *Digital & Relay Bus Control*
21	1	Output Terminal 29	**0=Not active**, 1=Active	
22	2	Output Terminal X30/6	**0=Not active**, 1=Active	
23	3	Output Terminal X30/7	**0=Not active**, 1=Active	
24	4	CC Relay 1	**0=Not active**, 1=Active	
25	5	CC Relay 2	**0=Not active**, 1=Active	
26	6	Option B Relay 1	**0=Not active**, 1=Active	
27	7	Option B Relay 2	**0=Not active**, 1=Active	
28	8	Option B Relay 3	**0=Not active**, 1=Active	
29	9	Reserved	**0=Not active**, 1=Active	
30	10	Reserved	**0=Not active**, 1=Active	
31	11	Reserved	**0=Not active**, 1=Active	
32	12	Reserved	**0=Not active**, 1=Active	
33	13	Reserved	**0=Not active**, 1=Active	
34	14	Reserved	**0=Not active**, 1=Active	
35	15	Reserved	**0=Not active**, 1=Active	
36	16	Option C Relay 1	**0=Not active**, 1=Active	
37	17	Option C Relay 2	**0=Not active**, 1=Active	
38	18	Option C Relay 3	**0=Not active**, 1=Active	
39	19	Option C Relay 4	**0=Not active**, 1=Active	
40	20	Option C Relay 5	**0=Not active**, 1=Active	
41	21	Option C Relay 6	**0=Not active**, 1=Active	
42	22	Option C Relay 7	**0=Not active**, 1=Active	
43	23	Option C Relay 8	**0=Not active**, 1=Active	
44	24	Reserved	**0=Not active**, 1=Active	
45	25	Reserved	**0=Not active**, 1=Active	
46	26	Reserved	**0=Not active**, 1=Active	
47	27	Reserved	**0=Not active**, 1=Active	
48	28	Reserved	**0=Not active**, 1=Active	
49	29	Reserved	**0=Not active**, 1=Active	
50	30	Reserved	**0=Not active**, 1=Active	
52		ECB Activate		31-19
60		No Flow Detection	**0=Not active**, 1=Active	22-21
61		Enable Interval between starts	**0=Disable**, 1=Enable	22-75

[1] The values in **BOLD** are the default values.

3.1.5 Internal Floating Point (ADF)

NPA	Unit	Description	Range	FC Par. Number
0	-	Max value of custom readout		0-32
1	-	Min value of custom readout		0-31
13	A	Motor Current($I_{M.N}$)		1-24
14	RPM	Motor nom. Speed		1-25
16	%	Resonance damping		1-64
18	Sec	Start delay		1-71
19	%	Preheat DC-current		2-00
20	%	DC brake current		2-01
21	Sec	DC braking time		2-02
22	Hz	DC brake cut-in frequency		2-03
29	-	Max output Frequency		4-19
34	Sec	Ramp Up Time		3-41
35	Sec	Ramp Down Time		3-42
36	Hz	Jog Frequency		3-11
37	%	Digital Reference 1		3-10:0
38	%	Digital Reference 2		3-10:1
39	%	Digital Reference 3		3-10:2
40	%	Digital Reference 4		3-10:3
41	A	Current Limit		4-18
42	Hz	Frequency 1. Bypass start		4-61:0
43	Hz	Frequency 1. Bypass stop		4-63:0
44	Hz	Frequency 2. Bypass start		4-61:1
45	Hz	Frequency 2. Bypass stop		4-63:1
46	Hz	Frequency 3. Bypass start		4-61:2
47	A	Frequency 3. Bypass stop		4-63:2
48	A	Frequency 4. Bypass start		4-61:3
49	Hz	Frequency 4. Bypass stop		4-63:3
50	A	Warning Current Low(I_{LOW})		4-50
51	A	Warning Current High (I_{HIGH})		4-51
52	Hz	Warning Freq. Low(F_{LOW})		4-52
53	Hz	Warning Freq. High(F_{HIGH})		4-53
54	Unit	Warning Low Ref.(Ref_{LOW})		4-54
55	Unit	Warning High Ref.(Ref_{HIGH})		4-55
56	Unit	Warning Low FB.(FB_{LOW})		4-56
57	Unit	Warning High FB.(FB_{HIGH})		4-57
60	V	Terminal 53 min scale V		6-10
61	V	Terminal 53 max scale V		6-11
62	V	Terminal 53 min scale mA		6-12
63	V	Terminal 53 max scale mA		6-13
64	A	Terminal 54 min. scale V		6-20
65	V	Terminal 54 max. scale V		6-21
66	V	Terminal 54 min. scale mA		6-22
67	A	Terminal 54 max. scale mA		6-23
68	Hz	Terminal 42 output puls scale		5-62
69	Hz	Terminal 45 output puls scale		5-65
70	mSec	CC Relay 1 ON Delay		5-41:0
71	mSec	CC Relay 1 ON Delay		5-42:0
72	mSec	CC Relay 1 ON Delay		5-41:1
73	Sec	CC Relay 1 ON Delay		5-42:1

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Internal Floating Point (ADF), continued..

NPA	Unit	Description	Range	FC Par. Number
80	Sec	No Flow Timer	0-600	22-24
81	Sec	Dry Pump Timer	0-600	22-27
82	Sec	Minimum Run Time	0-600	22-40
83	Hz	Minimum Sleep Time	0-600	22-41
84	%	Boost setpoint	-100% - +100%	22-45
85	Hz	Wake-up Speed	Par. 4-12 to 4-14	22-43
86	Sec	Max Boost Time	0-600	22-46
87	kHz	Switch Frequency		14-01
88	Unit	Set point 1		20-21
89	Unit	Set point 2		20-22
90	Hz	PID Start Frequency		20-83
91	-	PID Proportional Gain		20-93
92	Sec	PID Integration Time		20-94
93	Sec	PID Differentiation Time		20-95
94	-	PID D-gain Limit		20-96
95	Unit	Set Point 3		20-23
100	-	Control Timeout Function		8-04
101	-	Control Timeout Time		8-03
110	Sec	Option B Relay 1 ON Delay	0.01 to 600.00	5-41:6
111	Sec	Option B Relay 1 OFF Delay	0.01 to 600.00	5-42:6
112	Sec	Option B Relay 2 ON Delay	0.01 to 600.00	5-41:7
113	Sec	Option B Relay 2 OFF Delay	0.01 to 600.00	5-42:7
114	Sec	Option B Relay 3 ON Delay	0.01 to 600.00	5-41:8
115	Sec	Option B Relay 3 OFF Delay	0.01 to 600.00	
120	V	Analogue Input, GPIO option X30/11, Low Voltage		6-30
121	V	Analogue Input, GPIO option X30/11, High Voltage		6-31
122	V	Analogue Input, GPIO option X30/12 Low Voltage		6-40
123	V	Analogue Input, GPIO option X30/12, High Voltage		6-41
124	V	Analogue Input, IO X42/1, Low Voltage	0.07 to 10.00	26-10
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3.1.6 Internal Integers (ADI)

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11	-	Reset Button		0-43
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23	-	Motor Preheat		2-00
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43	-	Digital Input 29		5-13
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51	Sec	Live Zero Time Out		6-00
52	-	Live Zero Function		6-01
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Internal Integers (ADI), continued..

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73	-	Feedback 2 Source Unit		20-05
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102	-	Analogue Input, IO option X42/3 Mode	0 - 3	26-01
103	-	Analogue Input, IO option X42/5 Mode	0 - 3	26-02
104	-	Analogue Input, GPIO option X30/8 Mode		6-60
105	-	Analogue Input, IO option X42/7 mode	0 -145	26-50
106	-	Analogue Input, IO option X42/9 Mode	0 -145	26-60
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