



Instruction Manual

Metasys N2



VLT® 6000 HVAC



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■ Introduction

The VLT® 6000 HVAC 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 VLT for communication over a Metasys network.

For specific information on operation of the drive, refer to the Installation, Operation and Maintenance Manual for the VLT® 6000 HVAC, MG.60.Ax.xx.

■ 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 VLT® 6000 HVAC drive.

■ References

In addition to this manual, the following two manuals should be referenced:

Installation, Operation and Maintenance Manual for the VLT® 6000 HVAC, MG.60.Ax.xx

Johnson Controls METASYS N2 System Protocol Specification for Vendors, Johnson Controls number 04-3402-22 rev A.



■ 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
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

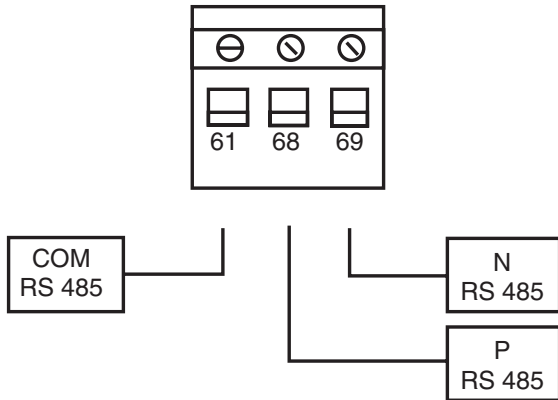
Instructions

■ **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 twisted-pair cables to reduce the differential mode interference between the conductors.

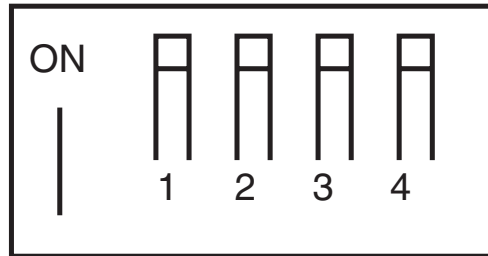
Torque Specs: 4.5 in.lb. (0.5 Nm)

Control wire: 18 - 24 AWG, shielded, twisted pair



■ VLT Hardware Setup

A dip switch on the main control board of the VLT® 6000 HVAC is used to configure the drives on the N2 bus. It is used for serial communication and external DC supply. The switch position shown is the factory setting.

Terminator Switch


SWITCH	SETTING
Switch 1	No function
Switches 2 & 3	Used for terminating an RS 485 interface. In the first and last drives in the network, switches 2 and 3 must be ON .
Switch 4	In all other drives, 2 and 3 must be OFF . Separates the common potential for the internal 24 V DC supply from the common potential of the external 24 V DC supply. ¹

¹ When switch 4 is in the OFF position, the external 24 V DC supply is isolated from the drive.



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■ 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: <ol style="list-style-type: none">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: <ol style="list-style-type: none">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"

■ VLT Parameters

The following parameters may need to be manually set for each drive in the Metasys N2 network. Refer to the Installation, Operation and Maintenance Manual for the VLT® 6000 HVAC for programming the drive.

VLT PARAMETER	DESCRIPTION	DEFAULT	DESIRED SETTING
500	Protocol	FC	Metasys N2
501	Address	001	1 - 255
502	Baud Rate	9600	9600 (Fixed in Metasys)
560	Override Release Time	Off	0-65533 sec.



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■ General Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	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. 621), days in service (Par. 600) and device status.
ACK	F	-	-	-	-	-	Identify Device Type	-	Slave device responds with an identification number of 10H to indicate non JCI device.
ACK, no action	0	0	-	-	-	-	Synch Time	-	No internal clock is available on the basic control card.
ACK, no action	8	0	-	-	-	-	Upload	-	Optional, not support in VLT6000 N2
ACK, no action	8	1	-	-	-	-	Upload	-	Optional, not support in VLT6000 N2
ACK,8 no action	3	-	-	-	-	-	Upload Record	-	Optional, not support in VLT6000 N2
ACK, no action	8	4	-	-	-	-	Upload Complete	-	Optional, not support in VLT6000 N2
ACK, no action	9	0	-	-	-	-	Download	-	Optional, not support in VLT6000 N2
ACK, no action	9	1	-	-	-	-	Download	-	Optional, not support in VLT6000 N2
ACK,9 no action	3	-	-	-	-	-	Download Record	-	Optional, not support in VLT6000 N2
ACK, no action	9	4	-	-	-	-	Download Complete	-	Optional, not support in VLT6000 N2
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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■ Analog Input (AI) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Objectno.	Attribute number	Attribute Type	Message	Error Code	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 Limit attribute 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 Input	-	Analog inputs are "outputs" from the VLT 6000 and should not be written over by the network controller.
ACK no-action	7	3	1	0-23	-	-	Override Release	-	Analog inputs are "outputs" from the VLT 5000 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.



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■ Analog Input (AI) Commands (Not Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	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 not 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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■ Analog Output (AO) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	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	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 Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time.
ACK, no action	7	8	3	0-2	-	-	Read Analog Output Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time.



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■ Analog Output (AO) Commands (Not Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	Comments
0-2	1	-	3	0-2	4	Float	Read Analog Output	111	Read Low Linear Ranging Parameter attribute associated with each individual point. (JCI use only)
NAK	1	-	3	0-2	5	Float	Read Analog Output	111	Read High Linear Ranging Parameter attribute associated with each individual point. (JCI use only)
NAK	2	-	3	0-2	2	Byte	Write Analog Output	111	Object Status not writeable.
NAK	2	-	3	0-2	3	Float	Write Analog Output	111	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	111	Write Debouncing Value in msec attribute associated with each individual point. (JCI use only)
NAK	2	-	3	0-2	5	Float	Write Analog Output	111	Write Accumulator value attribute associated with each individual point. (JCI use only)



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■ Binary Input (BI) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	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 VLT 6000 and should not be written over by the network controller. (Status word, Warnings, and Alarms)
ACK no-action	7	3	2	0-135	-	-	Override Release	-	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 Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time.
ACK, no action	7	8	2	0-135	-	-	Read Binary Input Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time.



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■ Binary Input (BI) Commands (Not Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	Comments
NAK	2	-	2	0-135	2	Byte	Write Binary Input	111	Object Status not writeable.
NAK	2	-	2	0-135	3	Integer	Write Binary Input	111	Write Debouncing Value in Msec attribute associated with each individual point.(JCI use only)
NAK	2	-	2	0-135	4	Integer32	Write Binary Input	111	Write Accumulator value attribute associated with each individual point (JCI use only)



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Binary Output Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	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 Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes.
ACK, no action	7	8	4	0-10	-	-	Read Binary Output Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes.

Binary Output (BO) Commands (Not Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	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.

Internal Integers (ADI) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	Comments
ACK	1	-	6	0-254	1	Integer	Read Internal Parameter of object type integer (16 bit)	-	Read Object Status attribute 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



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■ Internal Floating Point (ADF) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	Comments
ACK	1	-	5	0-101	1	Byte	Read Internal Parameter of object type float	-	Read Object Status attribute associated with each individual point
				0-101					
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

■ VLT® 6000 HVAC N2 Startup

Use the VLT® 6000 HVAC keypad mounted either on the drive or remote. Use the Extended Menu key to access the 500 Group (serial communication) parameters. 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

Program the following:

Parameter 500 (Protocol)	=	METASYS N2
Parameter 501 (Address)	=	01
Parameter 502 (Baudrate)	=	9600 BAUD (fixed at 9600 for N2 protocol)
Parameter 503 (Coasting)	=	LOGIC OR
Parameter 504 (DC brake)	=	LOGIC OR
Parameter 505 (Start)	=	LOGIC OR
Parameter 506 (Reversing)	=	DIGITAL INPUT
Parameter 507 (Select setup)	=	LOGIC OR
Parameter 508 (Select speed)	=	LOGIC OR
Parameter 535 (Bus feedback 1)	=	00000
Parameter 536 (Bus feedback 2)	=	00000
Parameter 560 (Bus time out)	=	OFF

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

Example: *F command*

Device address	XX
Char1 command	F
Checksum	YY

Telegram

>XXFYY<CR>

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

Example: *Bus start, BO override command.*

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

>XX72040401YY <CR>

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



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Example: *Override analog output, speed (50%) change command.*

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

>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: *Bus stop, BO override release command.*

Device address	XX
Char1 command	7
Char1 subcommand	2
Char2 region	04
Char2 object number (NPA)	04 (Start)
Char2 override value	00 (Not active)
Checksum	Y

Telegram

>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.

■ Scaling of Bus Reference and Feedbacks

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

The reference/feedback value is the percentage of the range of parameter 204 and 205.

Values within the ranges 100% to 200% and -100% to -200% applies only to the reference.

The Float representation of the value 200% must be limited to max. 32767 and min. -32768.

■ 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.

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.

■ Override/Override Release Commands and Time Out, Parameter 560

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 APENDIX 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.

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 VLT® 6000 HVAC 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.

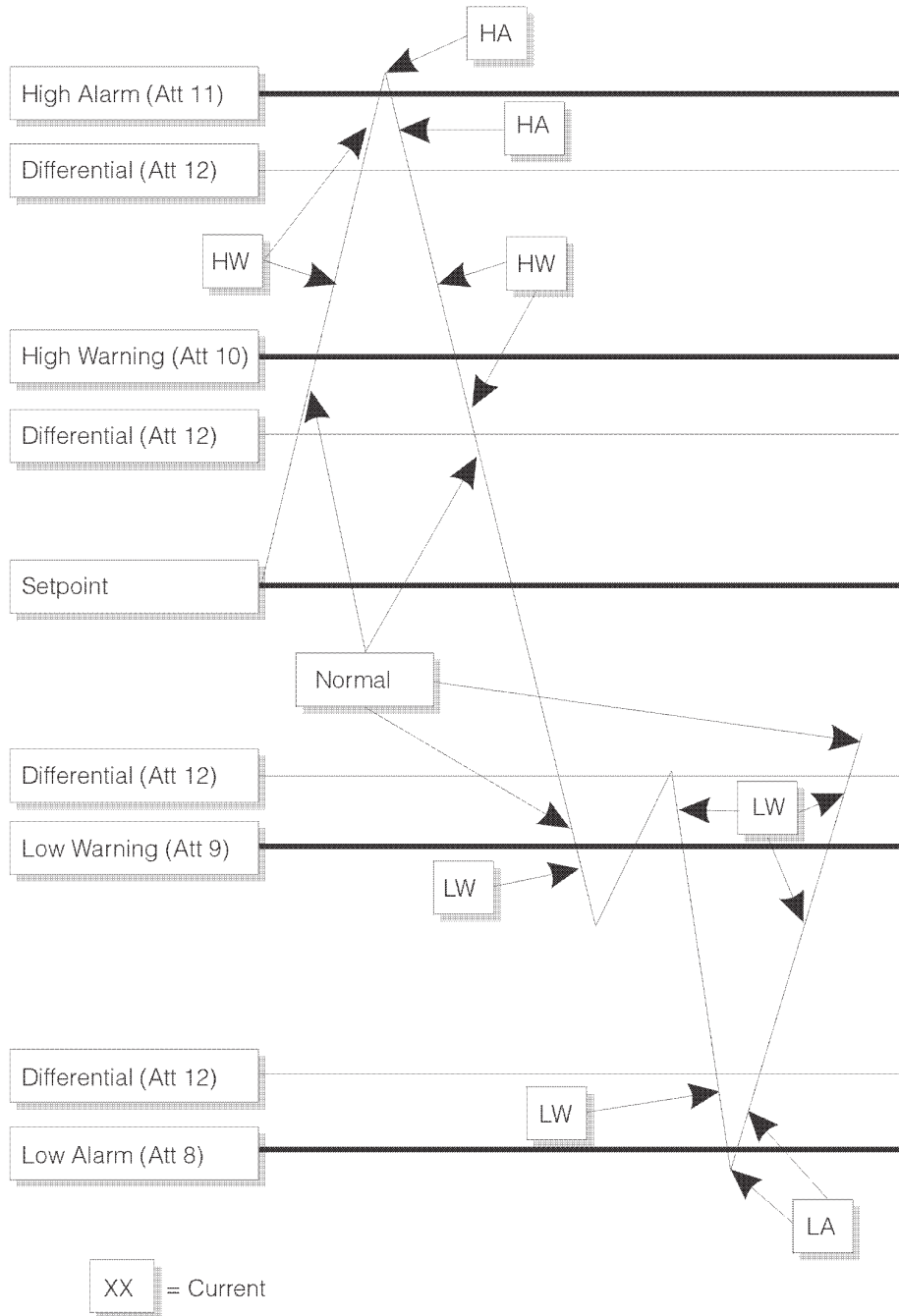
Handling of Poll Message Commands

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 drive will begin exporting the requested information. The drive 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 drive to retransmit its latest response.

The drawing on the next page illustrates the AI COS handling.

AI COS





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Instructions

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).

■ Appendix
■ METASYS POINT MAPPING TABLES

 Analog Inputs (AI)

NPT	NPA	UNIT	DESCRIPTION	SELECTION	PARAMETER NUMBER
AI	0	%	Reference [%]	-	509
AI	1	-	Reference [Unit]	-	510
AI	2	-	Feedback	-	511
AI	3	Hz	Frequency	-	512
AI	4	-	User defined readout	-	513
AI	5	A	Current	-	514
AI	6	kW	Power	-	515
AI	7	hp	Power	-	516
AI	8	V	Output Voltage	-	517
AI	9	V	DC Voltage	-	518
AI	10	%	Motor Thermal Protection	-	519
AI	11	%	Inverter Thermal Protection	-	520
AI	12	V	Terminal 53 analog	-	522
AI	13	V	Terminal 54 analog	-	523
AI	14	A	Terminal 60 analog	-	524
AI	15	Hz	Pulse reference	-	525
AI	16	%	External reference	-	526
AI	18	Hour	Operating hours	-	600
AI	19	Hour	Running hours	-	601
AI	20	kWh	kWh counter	-	602
AI	21	-	Number of Power-ups	-	603
AI	22	-	Number of Over temps	-	604
AI	23	-	Number of Over voltages	-	605

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.



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■ Binary Inputs (BI)

NPT	NPA	UNIT	DESCRIPTION	SELECTION	PARAMETER NUMBER
BI	0	-	Timers Status	0=OK , 1=Limit	527
BI	1	-	Current Status	0=OK , 1=Limit	527
BI	2	-	Voltage Status	0=OK , 1=Limit	527
BI	3	-	Inverter Status	0=OK , 1=Stall, Auto-start	527
BI	4	-	Running Status	0=Not Running , 1=Running	527
BI	5	-	Frequency Status	0=Out of Range , 1=In Range	527
BI	6	-	Control Status	0=Local , 1=Bus	527
BI	7	-	Reference Status	0=Not on Ref., 1=On Ref.	527
BI	8	-	Warning Status	0=No Warning , 1= Warning	527
BI	9	-	Tripped Status	0=No Trip , 1=Tripped	527
BI	10	-	Drive Enabled Status	0=Not Enabled , 1=Enabled	527
BI	11	-	Drive Ready Status	0=Not Ready , 1=Ready	527
BI	12	-	Drive Controller Status	0=Not Ready , 1=Ready	527
BI	16	-	AMA - suspicious UNOM	0=OK , 1=Warning	531
BI	17	-	AMA - suspicious INOM	0=OK , 1=Warning	531
BI	18	-	AMA - motor too big	0=OK , 1=Warning	531
BI	19	-	AMA - motor too small	0=OK , 1=Warning	531
BI	20	-	Frequency low	0=OK , 1=Warning	531
BI	21	-	Frequency high	0=OK , 1=Warning	533
BI	22	-	Current low	0=OK , 1=Warning	531
BI	23	-	Profibus warning	0=OK , 1=Warning	531
BI	24	-	Output frequency limited	0=OK , 1=Warning	531
BI	25	-	Current high	0=OK , 1=Warning	531
BI	26	-	Feedback low	0=OK , 1=Warning	531
BI	27	-	Feedback high	0=OK , 1=Warning	531
BI	28	-	Reference low	0=OK , 1=Warning	531
BI	29	-	10 Volt low	0=OK , 1=Warning	531
BI	30	-	Live zero error	0=OK , 1=Warning	531
BI	31	-	Phase loss	0=OK , 1=Warning	531
BI	32	-	DC link voltage high	0=OK , 1=Warning	531
BI	33	-	DC link voltage low	0=OK , 1=Warning	531
BI	34	-	DC link over voltage	0=OK , 1=Warning	531
BI	35	-	DC link under voltage	0=OK , 1=Warning	531
BI	36	-	VLT thermal	0=OK , 1=Warning	531
BI	37	-	Motor thermal	0=OK , 1=Warning	531
BI	38	-	Motor thermistor	0=OK , 1=Warning	531
BI	39	-	Current limit	0=OK , 1=Warning	531
BI	40	-	Over current	0=OK , 1=Warning	531
BI	41	-	Standard bus time-out	0=OK , 1=Warning	531
BI	42	-	HPFB time-out	0=OK , 1=Warning	531
BI	43	-	EEPROM error power card	0=OK , 1=Warning	531

■ Binary Inputs - Continued

NPT	NPA	UNIT	DESCRIPTION	SELECTION	PARAMETER NUMBER
BI	44	-	EEPROM error control card	0=OK , 1=Warning	531
BI	45	-	Reference high	0=OK , 1=Warning	531
BI	48	-	External fault(Safety interlock)	0=OK , 1=Alarm	529
BI	49	-	Current low	0=OK , 1=Alarm	529
BI	50	-	Inverter fault	0=OK , 1=Alarm	529
BI	51	-	Profibus fault	0=OK , 1=Alarm	529
BI	52	-	Missing motor phase U	0=OK , 1=Alarm	529
BI	53	-	Missing motor phase V	0=OK , 1=Alarm	529
BI	54	-	Missing motor phase W	0=OK , 1=Alarm	529
BI	55	-	Over temperature	0=OK , 1=Alarm	529
BI	56	-	Live zero	0=OK , 1=Alarm	529
BI	57	-	Phase loss	0=OK , 1=Alarm	529
BI	58	-	DC link over voltage	0=OK , 1=Alarm	529
BI	59	-	DC link under voltage	0=OK , 1=Alarm	529
BI	60	-	VLT thermal	0=OK , 1=Alarm	529
BI	61	-	Motor thermal	0=OK , 1=Alarm	529
BI	62	-	Motor thermistor	0=OK , 1=Alarm	529
BI	63	-	Current limit	0=OK , 1=Alarm	529
BI	64	-	Over current	0=OK , 1=Alarm	529
BI	65	-	earth fault	0=OK , 1=Alarm	529
BI	66	-	Supply fault	0=OK , 1=Alarm	529
BI	67	-	Short circuit	0=OK , 1=Alarm	529
BI	68	-	Std bus time-out	0=OK , 1=Alarm	529
BI	69	-	HPFB time-out	0=OK , 1=Alarm	529
BI	70	-	AMA fault	0=OK , 1=Alarm	529
BI	71	-	Trip lock	0=Trip , 1=Trip lock	529
BI	72	-	Unknown fault	0=OK , 1=Alarm	529
BI	83	-	Start inhibit	0=FALSE , 1=TRUE	532
BI	84	-	Control ready	0=FALSE , 1=TRUE	532
BI	85	-	Unit ready	0=FALSE , 1=TRUE	532
BI	86	-	Relay 123	0=FALSE , 1=TRUE	532
BI	87	-	Enabled	0=FALSE , 1=TRUE	532
BI	88	-	DC stop	0=FALSE , 1=TRUE	532
BI	89	-	Stop	0=FALSE , 1=TRUE	532
BI	90	-	Standby	0=FALSE , 1=TRUE	532
BI	91	-	Jog request	0=FALSE , 1=TRUE	532
BI	92	-	Jogging	0=FALSE , 1=TRUE	532
BI	93	-	Freeze request	0=FALSE , 1=TRUE	532
BI	94	-	Freeze output	0=FALSE , 1=TRUE	532
BI	95	-	Run request	0=FALSE , 1=TRUE	532
BI	96	-	Run request signal	0=FALSE , 1=TRUE	532
BI	97	-	Hand mode	0=Auto mode , 1=Hand mode	532



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■ Binary Inputs - Continued

NPT	NPA	UNIT	DESCRIPTION	SELECTION	PARAMETER NUMBER
BI	98	-	Off	0=FALSE , 1=TRUE	532
BI	99	-	Local Reference	0=Remote ref. , 1=Local ref.	
BI	100	-	Running	0=FALSE , 1=TRUE	532
BI	101	-	Running at reference	0=FALSE , 1=TRUE	532
BI	102	-	Reverse direction	0=FALSE , 1=TRUE	532
BI	103	-	Ramping	0=FALSE , 1=TRUE	532
BI	104	-	Start forward reverse	0=FALSE , 1=TRUE	532
BI	105	-	Adaptive tuning running	0=FALSE , 1=TRUE	532
BI	106	-	Adaptive tuning finished	0=FALSE , 1=TRUE	532
BI	107	-	Sleep mode	0=FALSE , 1=TRUE	532
BI	108	-	Sleep boost	0=FALSE , 1=TRUE	532
BI	109	-	Start delay	0=FALSE , 1=TRUE	532
BI	110	-	OVC active (Auto ramp)	0=FALSE , 1=TRUE	532
BI	112	-	Reverse	0=FALSE , 1=TRUE	530
BI	113	-	Setup MSB	0=FALSE , 1=TRUE	530
BI	114	-	Setup LSB	0=FALSE , 1=TRUE	530
BI	115	-	Catch up or Relay 04 Out 45	0=FALSE , 1=TRUE	530
BI	116	-	Slow down or Relay 01 Out 42	0=FALSE , 1=TRUE	530
BI	117	-	Reserved, always 0.	0=FALSE	530
BI	118	-	Jog	0=FALSE , 1=TRUE	530
BI	119	-	Reset	0=FALSE , 1=TRUE	530
BI	120	-	Start	0=FALSE , 1=TRUE	530
BI	121	-	Freeze output	0=FALSE , 1=TRUE	530
BI	122	-	Q-stop	0=FALSE , 1=TRUE	530
BI	123	-	Coast	0=FALSE , 1=TRUE	530
BI	124	-	Switch 3 on inverse or DC brake	0=FALSE , 1=TRUE	530
BI	125	-	Switch 2 on inverse or Preset ref. MSB	0=FALSE , 1=TRUE	530
BI	126	-	Switch 1 on inverse or Preset ref. LSB	0=FALSE , 1=TRUE	530
BI	128	-	Terminal 33	0=FALSE , 1=TRUE	521
BI	129	-	Terminal 32	0=FALSE , 1=TRUE	521
BI	130	-	Terminal 29	0=FALSE , 1=TRUE	521
BI	131	-	Terminal 27	0=FALSE , 1=TRUE	521
BI	132	-	Terminal 19	0=FALSE , 1=TRUE	521
BI	133	-	Terminal 18	0=FALSE , 1=TRUE	521
BI	134	-	Terminal 17	0=FALSE , 1=TRUE	521
BI	135	-	Terminal 16	0=FALSE , 1=TRUE	521

The values marking in **bold** are default values.

■ Analog Outputs (AO)

NPT	NPA	UNIT	DESCRIPTION	SELECTION ¹	PARAMETER NUMBER
AO	0		Bus reference ²	-2 ¹⁵ to 2 ¹⁵ -1	-
AO	1		Bus feedback ¹	-16,384 to 16,384	535
AO	2		Bus feedback ²	-16,384 to 16,384	536

¹ Please refer to scaling of Bus Reference and Feedback, page 18.

² Requires VLT 6000 software version 1.04 or later.

■ Binary Outputs (BO)

NPT	NPA	UNIT	DESCRIPTION	RANGE	VLT 6000 PARAMETER NUMBER
BO	0	-	DC brake inverse	0=Active , 1 = Not active	-
BO	1	-	Coast inverse	0=Active , 1 = Not active	-
BO	2	-	Stop inverse	0=Active , 1 = Not active	-
BO	3	-	Freeze output inverse	0=Active , 1 = Not active	-
BO	4	-	Start	0= Not active, 1 = Active	-
BO	5	-	Reset	0= Not active, 1 = Active	-
BO	6	-	Jogging	0= Not active, 1 = Active	-
BO	8	-	Relay01	0= Not active 1 =Active	-
BO	9	-	Relay04	0= Not active, 1 = Active	-
BO	10	-	Reversing	0= Not active, 1 = Active	-

The values in **bold** are the default values.



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Appendix

■ Internal Floating Point (ADF)

NPT	NPA	UNIT	DESCRIPTION	RANGE	PARAMETER NUMBER
ADF	0	-	Custom Display Readout	0 - 999,999.999	005
ADF	10	kW	Motor power	25, 37, 55, 75, 110, 150, 220, 300, 400, 550, 750, 1100, 1500, 1850, 2200, 3000, 3700, 4500, 5500, 7500, 9000, 11000, 13200, 16000, 20000, 25000, 30000, 35000, 45000, 50000, 60000	102 ³
ADF	11	V	Motor voltage	200, 208, 220, 230, 240, 380, 400, 415, 440, 460, 550, 575	103 ³
ADF	12	Hz	Motor frequency	24 to 1000	104 ³
ADF	13	A	Motor Current(I _{M,N})	0 to nameplate	105
ADF	14	RPM	Motor nom. Speed	100 to 60,000 (Set nameplate speed)	106 ³
ADF	15	V	Start Voltage	0 to motor voltage	108
ADF	16	%	Resonance damping	0 to 500	109
ADF	17	Sec	Break away torque boost	0.0 to 0.5	110
ADF	18	Sec	Start delay	0.0 to 120.0	111
ADF	19	%	Preheat DC-current	0 to 100	113 ³
ADF	20	%	DC brake current	0 to rated motor current	114
ADF	21	Sec	DC braking time	0.0 to 60.0	115
ADF	22	Hz	DC brake cut-in frequency	0.0 to output freq. high limit (par. 202)	116
ADF	30	Hz	Output freq. low limit(F _{MIN})	0.0 to output freq. high limit (par. 202)	201
ADF	31	Hz	Output freq. high limit(F _{MAX})	Par. 201 to par. 200	202
ADF	32	Unit	Min reference (Ref _{MIN})	0.000 to RefMAX	204
ADF	33	Unit	Max. reference (Ref _{MAX})	Ref _{MIN} to (Feedback or 1000)1	205
ADF	34	Sec	Ramp Up Time	0 to 3600	206
ADF	35	Sec	Ramp Down Time	0 to 3600	207
ADF	36	Hz	Jog Frequency	0 to F _{MAX}	209
ADF	37	%	Digital Reference 1	-100 to +100	211
ADF	38	%	Digital Reference 2	-100 to +100	212
ADF	39	%	Digital Reference 3	-100 to +100	213
ADF	40	%	Digital Reference 4	-100 to +100	214
ADF	41	A	Current Limit	0 to I _{VLTMAX}	215

Internal Floating Point - Continued

ADF	42	Hz	Frequency bypass bandwidth	0 to 100	216
ADF	43	Hz	Frequency 1. Bypass	0 to (120 or 1000 par.200)	217
ADF	44	Hz	Frequency 2. Bypass	0 to (120 or 1000 par.200)	218
ADF	45	Hz	Frequency 3. Bypass	0 to (120 or 1000 par.200)	219
ADF	46	Hz	Frequency 4. Bypass	0 to (120 or 1000 par.200)	220
ADF	47	A	Warning Current Low(I_{LOW})	0 to I_{HIGH}	221
ADF	48	A	Warning Current High(I_{HIGH})	I_{LOW} to I_{VLTMAX}	222
ADF	49	Hz	Warning Freq. Low(F_{LOW})	0 to F_{HIGH}	223
ADF	50	Hz	Warning Freq. High(F_{HIGH})	F_{LOW} to (120 or 1000par.200)	224
ADF	51	Unit	Warning Low Ref.(Ref_{LOW})	-999.999,999 to Ref_{HIGH}	225
ADF	52	Unit	Warning High Ref.(Ref_{HIGH})	Ref_{LOW} to 999.999,999	226
ADF	53	Unit	Warning Low FB.(FB_{LOW})	-999.999,999 to FB_{HIGH}	227
ADF	54	Unit	Warning High FB.(FB_{HIGH})	FB_{LOW} to 999.999,999	228
ADF	60	V	Terminal 53 min. scale	0.0 to 10.0	309
ADF	61	V	Terminal 53 max. scale	0.0 to 10.0	310
ADF	62	V	Terminal 54 min. scale	0.0 to 10.0	312
ADF	63	V	Terminal 54 max. scale	0.0 to 10.0	313
ADF	64	A	Terminal 60 min. scale	0.0 to 20.0	315
ADF	65	A	Terminal 60 max. scale	0.0 to 20.0	316
ADF	66	Hz	Term.42 output pulse scale	1 to 32000	320
ADF	67	Hz	Term.45 output pulse scale	1 to 32000	322
ADF	68	Sec	Relay ON Delay	0 to 600	324
ADF	69	Sec	Relay OFF Delay	0 to 600	325
ADF	70	Hz	Pulse reference max. freq.	100 to 65000	327
ADF	71	Hz	Pulse feedback max. freq.	100 to 65000	328
ADF	80	Sec	Automatic restart time	0 to 600	401
ADF	81	Sec	Sleep mode timer	0 to 300	403
ADF	82	Hz	Sleep frequency(F_{SLEEP})	F_{MIN} to F_{WAKEUP}	404
ADF	83	Hz	Wake up frequency(F_{WAKEUP})	F_{SLEEP} to F_{MAX}	405
ADF	84	%	Boost set point	1 to 200	406
ADF	85	kHz	Switch Frequency	(2.5 to 16) ²	407
ADF	86	Unit	Minimum feedback(FB_{MIN})	-999,999.999 to FB_{MAX}	413
ADF	87	Unit	Maximum feedback (FB_{MAX})	FB_{MIN} to 999,999.999	414
ADF	88	Unit	Set point 1	FB_{MIN} to FB_{MAX}	418
ADF	89	Unit	Set point 2	FB_{MIN} to FB_{MAX}	419
ADF	90	Hz	PID Start frequency	F_{MIN} to F_{MAX}	422
ADF	91	-	PID Proportional gain	0.00 to 10.00	423
ADF	92	Sec	PID Integration time	0.01 to 9999.00	424
ADF	93	Sec	PID Differential time	0.00 to 10.00	425
ADF	94	-	PID D-gain limit	5.0 to 50.0	426
ADF	95	Sec	PID Feedback filter time	0.01 to 10.00	427
ADF	101	-	Override release time	0 to 65,534	560

¹ "Feedback" if closed loop and "100 Hz" if open loop

² Unit is power dependent

³ The drive must be stopped to change this point

⁴ The point is global in all 4 setups

⁵ Not available on all units.

Internal Integers (ADI)

NPT	NPA	UNIT	DESCRIPTION	RANGE	PARAMETER NUMBER
ADI	0	-	Language Selection	0 to 8	001 ⁴
ADI	1	-	Setup Copy Function	0 to 5	003 ^{3,4}
ADI	2	-	Custom readout unit	0 to 38	006
ADI	3	-	Large readout	0 to 27	007
ADI	4	-	Small readout 1	0 to 27	008
ADI	5	-	Small readout 2	0 to 27	009
ADI	6	-	Small readout 3	0 to 27	010
ADI	7	-	Unit of local reference	0 to 1	011
ADI	8	-	Hand start button	0 to 1	012
ADI	9	-	Off/Stop button	0 to 1	013
ADI	10	-	Auto start button	0 to 1	014
ADI	11	-	Reset button	0 to 1	015
ADI	12	-	Data change lock	0 to 1	016
ADI	13	-	Operating state at power up	0 to 1	017
ADI	20	-	Configuration mode	0 to 1	100 ³
ADI	21	-	VT Characteristics	0 to 1	101 ³
ADI	22	-	Automatic motor adaptation	0 to 2	107 ³
ADI	23	-	Motor preheat	(0)Disable , (1)Enable	112
ADI	24	-	Motor thermal protection	0 to 10	117
ADI	30	-	Frequency range	0 to 1	200 ³
ADI	31	-	Reference site	0 to 2	203
ADI	32	-	Auto ramping	(0)Disable , (1)Enable	208
ADI	33	-	Reference function	0 to 2	210
ADI	40	-	Digital input 16	0 to 12	300
ADI	41	-	Digital input 17	0 to 13	301
ADI	42	-	Digital input 18	0 to 1	302
ADI	43	-	Digital input 19	0 to 3	303
ADI	44	-	Digital input 27	0 to 3	304
ADI	45	-	Digital input 29	0 to 16	305
ADI	46	-	Digital input 32	0 to 12	306
ADI	47	-	Digital input 33	0 to 13	307
ADI	48	-	Analog input 53	0 to 3	308
ADI	49	-	Analog input 54	0 to 3	311
ADI	50	-	Analog input 60	0 to 2	314
ADI	51	Sec	Live zero time out	1 to 99	317
ADI	52	-	Live zero function	0 to 5	318
ADI	53	-	Signal output 42	0 to 43	319
ADI	54	-	Signal output 45	0 to 43	321
ADI	55	-	Relay 1 output	0 to 28	323
ADI	56	-	Relay 2 output	0 to 28	326
ADI	60	-	Reset function	0 to 8	400
ADI	61	-	Flying start	0 to 2	402
ADI	62	-	Noise reduction method	0 to 2	408 ³
ADI	63	-	Function at low current	(0)Trip, (1)Warning	409 ³



VLT® 6000 HVAC

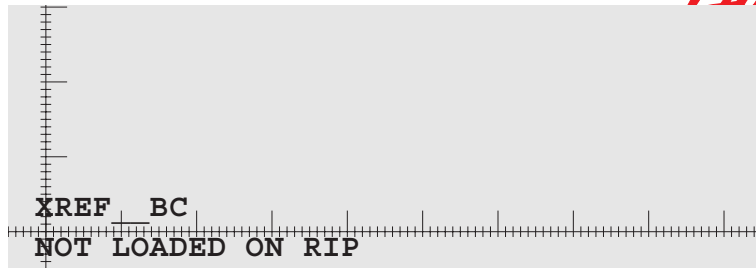
ADI	64	Sec	Trip delay on overload	0 to 60	412
ADI	65	-	Reference/Feedback unit	0 to 39	415
ADI	66	-	Feedback conversion	0 to 1	416
ADI	67	-	Two feedback calculation	0 to 6	417
ADI	68	-	PID Normal/Inverse	(0)Normal, (1)Inverted	420
ADI	69	-	PID Anti windup	(0)Disable, (1)Enable	421
ADI	80	-	Coasting	0 to 3	503
ADI	81	-	DC Brake	0 to 3	504
ADI	82	-	Start	0 to 3	505
ADI	83	-	Reversing	0 to 3	506
ADI	84	-	Selection of setup	0 to 3	507
ADI	85	-	Selection of speed	0 to 3	508
ADI	90	-	Reset kWh counter	(0)No reset, (1) Reset	618 ⁴
ADI	91	-	Reset running hours counter	(0)No reset, (1) Reset	619 ⁴
ADI	92	-	Operation mode	0 to 3	620 ³
ADI	254	-	Active setup	0 to 5	002 ⁴

³ Drive must be stopped to change this point

⁴ The point is global in all 4 setups



■ NOTES



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