VLT® 6000

Adjustable Frequency Drive

Metasys® N2
Instruction Manual

METASYS®
COMPATIBLE
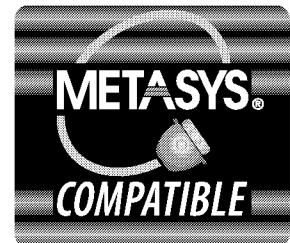
⚠DANGER

Rotating shafts and electrical equipment can be hazardous. Therefore, it is strongly recommended that all electrical work conform to National Electrical Code (NEC) and all local regulations. Installation, start-up and maintenance should be performed only by qualified personnel.

Factory recommended procedures, included in this manual, should be followed. Always disconnect electrical power before working on the unit.

Although shaft couplings or belt drives are generally not furnished by the manufacturer, rotating shafts, couplings and belts must be protected with securely mounted metal guards that are of sufficient thickness to provide protection against flying particles such as keys, bolts and coupling parts. Even when the motor is stopped, it should be considered "alive" as long as its controller is energized. Automatic circuits may start the motor at any time. Keep hands away from the output shaft until the motor has completely stopped and power is disconnected from the controller.

Motor control equipment and electronic controls are connected to hazardous line voltages. When servicing drives and electronic controls, there will be exposed components at or above line potential. Extreme care should be taken to protect against shock. Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case of an emergency. Disconnect power whenever possible to check controls or to perform maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electric control or rotating equipment.

Safety Guidelines
1. The drive must be disconnected from the AC line before any service work is done.

2. The "Stop/Off" key on the local control panel of the drive does not disconnect the equipment from the AC line and is not to be used as a safety switch.
3. Correct protective grounding of the equipment must be established. The user must be protected against supply voltage and the motor must be protected against overload in accordance with applicable national and local regulations.
4. Ground currents are higher than 3 mA.

Warnings Against Unintended Start
1. While the drive is connected to the AC line, the motor can be brought to a stop by means of external switch closures, serial bus commands or references. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stops are not sufficient.
2. During programming of parameters, the motor may start. Be certain that no one is in the area of the motor or driven equipment when changing parameters.
3. A motor that has been stopped may start unexpectedly if faults occur in the electronics of the drive, or if an overload, a fault in the supply AC line or a fault in the motor connection or other fault clears.
4. If the "Local/Hand" key is activated, the motor can only be brought to a stop by means of the "Stop/Off" key or an external safety interlock.

NOTE
It is responsibility of user or person installing drive to provide proper grounding and branch circuit protection for incoming power and motor overload according to National Electrical Code (NEC) and local codes.

The Electronic Thermal Relay (ETR) in UL listed VLTs provides Class 20 motor overload protection in accordance with NEC in single motor applications, when parameter 117 is set for "ETR TRIP 1", "ETR TRIP 2", "ETR TRIP 3", or "ETR TRIP 4", and parameter 105 is set for rated motor (nameplate) current.

⚠DANGER

Touching electrical parts may be fatal – even after equipment has been disconnected from AC line. To be sure that capacitors have fully discharged, wait 14 minutes after power has been removed before touching any internal component.

Table of Contents

■ Introduction

The VLT® 6000 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.*

■ 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 drive.

■ References

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

Installation, Operation and Maintenance Manual for the VLT 6000 Adjustable Frequency Drive, Danfoss Graham number 23-6108-00.

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

■ Trademarks

METASYS® N2 is a Johnson Controls Inc registered trademark.
VLT® is a Danfoss registered trademark.

■ Abbreviations and Definitions

ACK	Acknowledged
ADF	Internal Floating Points
ADI	Internal Integers
AI	Analog Inputs (From the drive to the N2 bus.)
AO	Analog Outputs (From the N2 bus to the drive.)
BI	Binary Inputs (From the drive to the N2 bus.)
BO	Binary Outputs (From the N2 bus to the drive.)
COS	Change of State
HPFB	High Performance Field Bus
JCI	Johnson Controls Inc., developers of the METASYS N2 protocol.
N2	METASYS N2
N2 master	An 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 1 to 255, or 0 to 254.)
NPT	N2 Point Type
PARA	Parameter Number
VLT	VLT 6000 Adjustable Frequency Drive

■ Network Connection

Connect signal wires to terminal 68 (P+) 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 DC link. It is highly recommended to use twisted-pair cables to reduce the differential mode interference between the conductors.
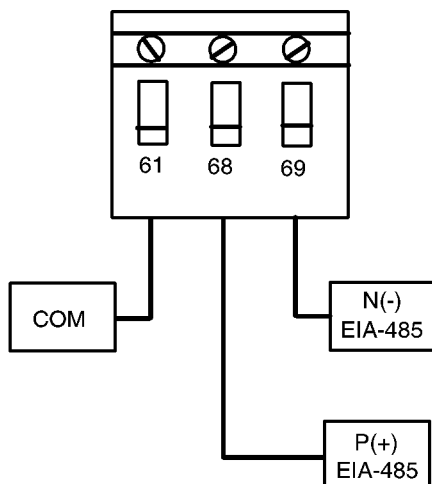
Figure 1. Network Connection

■ Control Wiring and Terminal Tightening Torque Specifications

Terminal tightening and control wire specifications are defined in the table below.

Control Wiring and Torque Specifications

Torque Specs	4.5 in lb/0.5 Nm
Control Wire	18 - 24 AWG, shielded, twisted pair/1.5 mm, shielded twisted pair

■ VLT 6000 Hardware Setup

Two dip switches on the main control board of the VLT 6000 are used to configure the drives on the N2 bus. They are used for serial communication and external DC supply. The switch position shown is the factory setting.
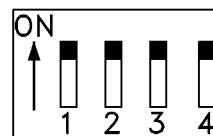
Figure 2. Dip Switch

Dip Switch Settings

SWITCH	SETTING
Switch 1	No function
Switches 2 & 3	Used for terminating an RS-485 interface. When the drive is the first, last, or only device on a network, switches 2 and 3 must be ON. When the drive is in any other location on the network, switches 2 and 3 must be OFF.
Switch 4	Separates the common potential of the internal 24 VDC supply from the common potential of external 24 VDC supply. When switch 4 is in the OFF position, the external 24 VDC supply is isolated from the drive. See the *VLT 6000 Installation, Operation and Maintenance Manual* for more information on switch 4.

■ **VLT 6000 N2 Startup**

Use the VLT 6000 keypad, mounted either on the drive or remotely, to access the Extended Menu key and the 500 Group (serial communication) parameters. Set parameters 500, 501 and 502 as shown below. Other settings may be changed to meet application requirements. The settings shown will serve as a good starting reference. Refer to the VLT 6000 instruction manual for details on changing parameters and programming the drive.

■ **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 if the data is out of the 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 cannot 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 tripped except for BO 5 "reset."

N2 Serial Communication Startup Parameter Settings

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

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

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 VLT 6000 N2
ACK, no action	8	1	-	-	-	-	Upload	-	Optional, not support in VLT 6000 N2
ACK, no action	8	3	-	-	-	-	Upload Record	-	Optional, not support in VLT 6000 N2
ACK, no action	8	4	-	-	-	-	Upload Complete	-	Optional, not support in VLT 6000 N2
ACK, no action	9	0	-	-	-	-	Download	-	Optional, not support in VLT 6000 N2
ACK, no action	9	1	-	-	-	-	Download	-	Optional, not support in VLT 6000 N2
ACK, no action	9	3	-	-	-	-	Download Record	-	Optional, not support in VLT 6000 N2
ACK, no action	9	4	-	-	-	-	Download Complete	-	Optional, not support in VLT 6000 N2

General Commands (Not Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	Comments
NAK	0	1	-	-	-	-	Read Memory	01	Slave device memory read based on memory addresses.
NAK	0	8	-	-	-	-	Warm Start	01	JCI use only.

Analog Input (AI) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute number	Attribute Type	Message	Error Code	Comments
ACK	1	-	1	1-24	1	Byte	Read Analog Input	-	Read Object Configuration attribute associated with each individual point.
ACK	1	-	1	1-24	2	Byte	Read Analog Input	-	1) Read Object Status attribute associated with each individual point.
ACK	1	-	1	1-24	3	Float	Read Analog Input	-	2) Read Analog Input Value attribute associated with each individual point.
ACK	1	-	1	1-24	8	Float	Read Analog Input	-	Read Low Alarm attribute associated with each individual point.
ACK	1	-	1	1-24	9	Float	Read Analog Input	-	Read Low Warning attribute associated with each individual point.
ACK	1	-	1	1-24	10	Float	Read Analog Input	-	Read High Warning attribute associated with each individual point.
ACK	1	-	1	1-24	11	Float	Read Analog Input	-	Read High Alarm attribute associated with each individual point.
ACK	1	-	1	1-24	12	Float	Read Analog Input	-	Read Differential attribute associated with each individual point.
ACK	2	-	1	1-24	1	Byte	Write Analog Input	-	Write to Object Configuration attribute associated with each individual point.
ACK	2	-	1	1-24	8	Float	Write Analog Input	-	Write to Low Alarm Limit attribute associated with each individual point.
ACK	2	-	1	1-24	9	Float	Write Analog Input	-	Write to Low Warning Limit attribute associated with each individual point.
ACK	2	-	1	1-24	10	Float	Write Analog Input	-	Write to High Warning Limit attribute associated with each individual point.
ACK	2	-	1	1-24	11	Float	Write Analog Input	-	Write to High Alarm Limit attribute associated with each individual point.
ACK	2	-	1	1-24	12	Float	Write Analog Input	-	Write to Differential attribute associated with each individual point.
ACK, no action	7	2	1	1-24	-	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	1-24	-	-	Override Release	-	Analog inputs are "outputs" from the VLT 6000 and should not be written over by the network controller.
ACK, no action	7	7	1	1-24	-	-	Write Analog Input Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes.
ACK, no action	7	8	1	1-24	-	-	Read Analog Input Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time.

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	1-24	4	Float	Read Analog Input	11	Read Linear Ranging Parameter 1 attribute associated with each individual point. (JCI use only)
NAK	1	-	1	1-24	5	Float	Read Analog Input	11	Read Linear Ranging Parameter 2 attribute associated with each individual point. (JCI use only)
NAK	1	-	1	1-24	6	Float	Read Analog Input	11	Read Linear Ranging Parameter 3 attribute associated with each individual point. (JCI use only)
NAK	1	-	1	1-24	7	Float	Read Analog Input	11	Read Linear Ranging Parameter 4 attribute associated with each individual point. (JCI use only)
NAK	1	-	1	1-24	13	Integer	Read Analog Input	11	Read Filter Weight attribute associated with each individual point. (JCI use only)
NAK	1	-	1	1-24	14	Float	Read Analog Input	11	Read AI_Offset attribute associated with each individual point. (JCI use only)
NAK	2	-	1	1-24	2	Byte	Write Analog Input	11	Object Status not writeable.
NAK	2	-	1	1-24	3	Float	Write Analog Input	11	Analog Input Value not writeable.
NAK	2	-	1	1-24	4	Float	Write Analog Input	11	Write to Linear Ranging Parameter 1 attribute associated with each individual point. (JCI use only)
NAK	2	-	1	1-24	5	Float	Write Analog Input	11	Write to Linear Ranging Parameter 2 attribute associated with each individual point. (JCI use only)
NAK	2	-	1	1-24	6	Float	Write Analog Input	11	Write to Linear Ranging Parameter 3 attribute associated with each individual point. (JCI use only)
NAK	2	-	1	1-24	7	Float	Write Analog Input	11	Write to Linear Ranging Parameter 4 attribute associated with each individual point. (JCI use only)
NAK	2	-	1	1-24	13	Integer	Write Analog Input	11	Write to Filter Weight attribute associated with each individual point. (JCI use only)
NAK	2	-	1	1-24	14	Float	Write Analog Input	11	Write to AI Offset attribute associated with each individual point. (JCI use only)

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

Analog Output (AO) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	Comments
ACK	1	-	3	1-2	1	Byte	Read Analog Output	-	Read Object Configuration attribute associated with each individual point.
ACK	1	-	3	1-2	2	Byte	Read Analog Output	-	Read Object Status attribute associated with each individual point.
ACK	1	-	3	1-2	3	Float	Read Analog Output	-	Read Current Value attribute associated with each individual point.
ACK	2	-	3	1-2	1	Byte	Write Analog Output	-	Write to Object Configuration attribute associated with each individual point.
ACK	7	2	3	1-2	-	Float	Override Analog Output	-	Write to analog output current value (frequency setpoint).
ACK	7	3	3	1-2	-	-	Override Release	-	Set the current value, the value that it was before the Override Command was issued
ACK, no action	7	7	3	1-2	-	-	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	1-2	-	-	Read Analog Output Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time.

Analog Output (AO) Commands (Not Acknowledged)

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

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

Binary Input (BI) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	Comments
ACK	1	-	2	1-72	1	Byte	Read Binary Input	-	Read Object Configuration attribute associated with each individual point.
ACK	1	-	2	1-72	2	Byte	Read Binary Input	-	Read Object Status attribute associated with each individual point.
ACK	2	-	2	1-72	1	Byte	Write Binary Input	-	Write to Object Configuration attribute associated with each individual point.
ACK, no action	7	2	2	1-72	-	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	1-72	-	-	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	1-72	-	-	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	1-72	-	-	Read Binary Input Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time.

Binary Input (BI) Commands (Not Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object no.	Attribute Number	Attribute Type	Message	Error Code	Comments
NAK	1	-	2	1-72	3	Integer	Read Binary Input	11	Read Debouncing Value in Msec attribute associated with each individual point. (JCI use only)
NAK	1	-	2	1-72	4	Integer 32	Read Binary Input	11	Read Accumulator Value attribute associated with each individual point. (JCI use only)
NAK	2	-	2	1-72	2	Byte	Write Binary Input	11	Object Status not writeable.
NAK	2	-	2	1-72	3	Integer	Write Binary Input	11	Write Debouncing Value in msec attribute associated with each individual point. (JCI use only)
NAK	2	-	2	1-72	4	Integer 32	Write Binary Input	11	Write Accumulator value attribute associated with each individual point.(JCI use only)

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

Binary Output (BO) Commands (Acknowledged)

VLT Response	Command	Subcommand	Region	NPA Object No.	Attribute Number	Attribute Type	Message	Error Code	Comments
ACK	1	-	4	1-9	1	Byte	Read Binary Output	-	Read structure attributes associated with each individual point.
ACK	1	-	4	1-9	2	Byte	Read Binary Output	-	Read structure attributes associated with each individual point.
ACK	2	-	4	1-9	1	Byte	Write Binary Output	-	Write to Object Configuration attribute associated with each individual point.
ACK	7	2	4	1-9	-	Byte (0/1)	Override Binary Output	-	Write to binary output current state (VLT 6000 control word).
ACK	7	3	4	1-9	-	-	Override Release	-	Set the current value, the value that it was before the Override Command was issued
ACK, no action	1	-	4	1-9	3	Integer	Read Binary Output	-	Read Minimum On-time attribute associated with each individual point. **Return value = 0**
ACK, no action	1	-	4	1-9	4	Integer	Read Binary Output	-	Read Minimum Off-time attribute associated with each individual point. **Return value = 0**
ACK, no action	1	-	4	1-9	5	Integer	Read Binary Output	-	Read Maximum Cycles/Hour attribute associated with each individual point. **Return value = 0**
ACK, no action	2	-	4	1-9	3	Integer	Write Binary Output	-	Write Minimum On-time attribute associated with each individual point.
ACK, no action	2	-	4	1-9	4	Integer	Write Binary Output	-	Write Minimum Off-time attribute associated with each individual point.
ACK, no action	2	-	4	1-9	5	Integer	Write Binary Output	-	Write Maximum Cycles/Hour attribute associated with each individual point.
ACK, no action	7	7	4	1-9	-	-	Write Binary Output Attributes	-	Optional command for slave devices. Only used for N2 commissioning purposes.
ACK, no action	7	8	4	1-9	-	-	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	1-9	6	Integer	Read Binary Output	11	Read Interstage on delay attribute associated with each individual point. (JCI use only)
NAK	1	-	4	1-9	7	Integer	Read Binary Output	11	Read Interstage off delay attribute associated with each individual point. (JCI use only)
NAK	2	-	4	1-9	2	Byte	Write Binary Output	11	Object Status not writeable.
NAK	2	-	4	1-9	6	Integer	Write Binary Output	11	Write Interstage on delay attribute associated with each individual point. (JCI use only)
NAK	2	-	4	1-9	7	Integer	Write Binary Output	11	Write Interstage off delay attribute associated with each individual point. (JCI use only)

Error code 11 is used because attributes are considered as fields/records in the point map.

Internal Integers (ADI) Commands (Acknowledged)

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

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	1-42	1	Byte	Read Internal Parameter of object type float	-	Read Object Status attribute associated with each individual point
ACK	1	-	5	1-42	2	Float	Read Internal Parameter of object type float	-	Read Current Value attribute associated with each individual point
ACK	2	-	5	1-42	-	Float	Write Internal Parameter of object type float	-	Write to Current Value attribute associated with each individual point.
ACK	2	-	5	1-42	-	Float	Write Internal Parameter of object type float	-	Write to Current Value attribute associated with each individual point.
ACK	7	2	5	1-42	-	Float	Override Internal Parameter of object type float	-	Write to internal parameter current value (set-up parameters for VLT).
ACK	7	3	5	1-42	-	-	Override Release	-	Set the current value, the value that it was before the 1. Override Command was issued

Appendix A

METASYS POINT MAPPING TABLES

NOTE

The default values on the following pages are shown in BOLD.

Any point not listed on the following pages is reserved for future use.

Analog Inputs (AI)

NPT	NPA	UNIT	DESCRIPTION	PARAMETER NUMBER
AI	1	%	Reference [%]	509
AI	2	-	Reference [Unit]	510
AI	3	-	Feedback	511
AI	4	Hz	Frequency	512
AI	5	-	User defined readout	513
AI	6	A	Current	514
AI	7	kW	Power	515
AI	8	hp	Power	516
AI	9	V	Output voltage	517
AI	10	V	DC voltage	518
AI	11	%	Motor thermal protection	519
AI	12	%	Inverter thermal protection	520
AI	13	V	Terminal 53 analog	522
AI	14	V	Terminal 54 analog	523
AI	15	A	Terminal 60 analog	524
AI	16	Hz	Pulse reference	525
AI	17	%	External reference	526
AI	18	°C	Heatsink temperature	528
AI	19	Hour	Operating hours	600
AI	20	Hour	Running hours	601
AI	21	kWh	kWh counter	602
AI	22	-	Number of power-ups	603
AI	23	-	Number of over temps	604
AI	24	-	Number of over voltages	605

Binary Inputs (BI)

NPT	NPA	DESCRIPTION	SELECTION	PARAMETER NUMBER
BI	1	Timers status	**0=OK** 1=Limit	527
BI	2	Current status	**0=OK** 1=Limit	527
BI	3	Voltage status	**0=OK** 1=Limit	527
BI	4	Inverter status	**0=OK** 1=Stall, Auto-start	527
BI	5	Running status	**0=Not Running** 1=Running	527
BI	6	Frequency status	0=Out of Range **1=In Range**	527
BI	7	Control status	0=Local **1=Bus**	527
BI	8	Reference status	0=Not on Ref. **1=On Ref.**	527
BI	9	Warning status	**0=OK** 1= Warning	527
BI	10	Tripped status	**0=OK** 1=Tripped	527
BI	11	Drive Enabled status	0=Not Enabled **1=Enabled**	527
BI	12	Drive Ready status	0=Not Ready **1=Ready**	527
BI	13	Drive Controller status	0=Not Ready **1=Ready**	527
BI	17	AMA – suspicious UNOM	**0=OK** 1=Warning	531
BI	18	AMA – suspicious INOM	**0=OK** 1=Warning	531
BI	19	AMA - motor too big	**0=OK** 1=Warning	531
BI	20	AMA - motor too small	**0=OK** 1=Warning	531
BI	21	Frequency low	**0=OK** 1=Warning	531
BI	22	Frequency high	**0=OK** 1=Warning	533
BI	23	Current low	**0=OK** 1=Warning	531
BI	24	Profibus warning	**0=OK** 1=Warning	531
BI	25	Output frequency limited	**0=OK** 1=Warning	531
BI	26	Current high	**0=OK** 1=Warning	531
BI	27	Feedback low	**0=OK** 1=Warning	531
BI	28	Feedback high	**0=OK** 1=Warning	531
BI	29	Reference low	**0=OK** 1=Warning	531
BI	30	10 Volt low	**0=OK** 1=Warning	531
BI	31	Live zero error	**0=OK** 1=Warning	531
BI	32	Phase loss	**0=OK** 1=Warning	531
BI	33	DC link voltage high	**0=OK** 1=Warning	531
BI	34	DC link voltage low	**0=OK** 1=Warning	531
BI	35	DC link over voltage	**0=OK** 1=Warning	531
BI	36	DC link under voltage	**0=OK** 1=Warning	531
BI	37	Drive thermal	**0=OK** 1=Warning	531
BI	38	Motor thermal	**0=OK** 1=Warning	531
BI	39	Motor thermistor	**0=OK** 1=Warning	531
BI	40	Current limit	**0=OK** 1=Warning	531
BI	41	Over current	**0=OK** 1=Warning	531
BI	42	Standard bus time-out	**0=OK** 1=Warning	531
BI	43	HPFB time-out	**0=OK** 1=Warning	531
BI	44	EEPROM error power card	**0=OK** 1=Warning	531

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

Appendix A

Binary Inputs (BI) - Continued

NPT	NPA	DESCRIPTION	SELECTION	PARAMETER NUMBER
BI	45	EEPROM error control card	**0=OK** 1=Warning	531
BI	46	Reference high	**0=OK** 1=Warning	531
BI	49	External fault (safety interlock)	**0=OK** 1=Alarm	529
BI	50	Current low	**0=OK** 1=Alarm	529
BI	51	Inverter fault	**0=OK** 1=Alarm	529
BI	52	Profibus fault	**0=OK** 1=Alarm	529
BI	53	Missing motor phase U	**0=OK** 1=Alarm	529
BI	54	Missing motor phase V	**0=OK** 1=Alarm	529
BI	55	Missing motor phase W	**0=OK** 1=Alarm	529
BI	56	Over temperature	**0=OK** 1=Alarm	529
BI	57	Live zero	**0=OK** 1=Alarm	529
BI	58	Phase loss	**0=OK** 1=Alarm	529
BI	59	DC link over voltage	**0=OK** 1=Alarm	529
BI	60	DC link under voltage	**0=OK** 1=Alarm	529
BI	61	Drive thermal	**0=OK** 1=Alarm	529
BI	62	Motor thermal	**0=OK** 1=Alarm	529
BI	63	Motor thermistor	**0=OK** 1=Alarm	529
BI	64	Current limit	**0=OK** 1=Alarm	529
BI	65	Over current	**0=OK** 1=Alarm	529
BI	66	Earth fault	**0=OK** 1=Alarm	529
BI	67	Supply fault	**0=OK** 1=Alarm	529
BI	68	Short circuit	**0=OK** 1=Alarm	529
BI	69	Std bus time-out	**0=OK** 1=Alarm	529
BI	70	HPFB time-out	**0=OK** 1=Alarm	529
BI	71	AMA fault	**0=OK** 1=Alarm	529
BI	72	Trip lock	**0=OK** 1=Trip lock	529
BI	73	Unknown fault	**0=OK** 1=Alarm	529
BI	84	Start inhibit	**0=FALSE** 1=TRUE	532
BI	85	Control ready	**0=FALSE** 1=TRUE	532
BI	86	Unit ready	**0=FALSE** 1=TRUE	532
BI	87	Relay 123	**0=FALSE** 1=TRUE	532
BI	88	Enabled	**0=FALSE** 1=TRUE	532
BI	89	DC stop	**0=FALSE** 1=TRUE	532
BI	90	Stop	**0=FALSE** 1=TRUE	532
BI	91	Standby	**0=FALSE** 1=TRUE	532
BI	92	Jog request	**0=FALSE** 1=TRUE	532
BI	93	Jogging	**0=FALSE** 1=TRUE	532
BI	94	Freeze request	**0=FALSE** 1=TRUE	532
BI	95	Freeze output	**0=FALSE** 1=TRUE	532
BI	96	Run request	**0=FALSE** 1=TRUE	532
BI	97	Run request signal	**0=FALSE** 1=TRUE	532
BI	98	Hand mode	**0=Auto mode** 1=Hand mode	532

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

Appendix A

Binary Inputs (BI) - Continued

NPT	NPA	DESCRIPTION	SELECTION	PARAMETER NUMBER
BI	99	Off	**0=FALSE** 1=TRUE	532
BI	100	Local Reference	**0=Remote ref.** 1=Local ref.	
BI	101	Running	**0=FALSE** 1=TRUE	532
BI	102	Running at reference	**0=FALSE** 1=TRUE	532
BI	103	Reverse direction	**0=FALSE** 1=TRUE	532
BI	104	Ramping	**0=FALSE** 1=TRUE	532
BI	105	Start forward reverse	**0=FALSE** 1=TRUE	532
BI	106	Adaptive tuning running	**0=FALSE** 1=TRUE	532
BI	107	Adaptive tuning finished	**0=FALSE** 1=TRUE	532
BI	108	Sleep mode	**0=FALSE** 1=TRUE	532
BI	109	Sleep boost	**0=FALSE** 1=TRUE	532
BI	110	Start delay	**0=FALSE** 1=TRUE	532
BI	111	OVC active (Auto ramp)	**0=FALSE** 1=TRUE	532
BI	113	Reverse	**0=FALSE** 1=TRUE	530
BI	114	Setup MSB	**0=FALSE** 1=TRUE	530
BI	115	Setup LSB	**0=FALSE** 1=TRUE	530
BI	116	Catch up or Relay 04 Out 45	**0=FALSE** 1=TRUE	530
BI	117	Slow down or Relay 01 Out 42	**0=FALSE** 1=TRUE	530
BI	118	Reserved, always 0	**0=FALSE**	
BI	119	Jog	**0=FALSE** 1=TRUE	530
BI	120	Reset	**0=FALSE** 1=TRUE	530
BI	121	Start	**0=FALSE** 1=TRUE	530
BI	122	Freeze output	**0=FALSE** 1=TRUE	530
BI	123	Q-stop	**0=FALSE** 1=TRUE	530
BI	124	Coast	**0=FALSE** 1=TRUE	530
BI	125	Switch 3 on inverse or DC brake	**0=FALSE** 1=TRUE	530
BI	126	Switch 2 on inverse or Preset ref. MSB	**0=FALSE** 1=TRUE	530
BI	127	Switch 1 on inverse or Preset ref. LSB	**0=FALSE** 1=TRUE	530
BI	129	Terminal 33	**0=FALSE** 1=TRUE	521
BI	130	Terminal 32	**0=FALSE** 1=TRUE	521
BI	131	Terminal 29	**0=FALSE** 1=TRUE	521
BI	132	Terminal 27	**0=FALSE** 1=TRUE	521
BI	133	Terminal 19	**0=FALSE** 1=TRUE	521
BI	134	Terminal 18	**0=FALSE** 1=TRUE	521
BI	135	Terminal 17	**0=FALSE** 1=TRUE	521
BI	136	Terminal 16	**0=FALSE** 1=TRUE	521

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

Appendix A

Analog Outputs (AO)

NPT	NPA	DESCRIPTION	RANGE	PARAMETER NUMBER
AO	1	Bus reference	-200% to 200% proportionally mapped into the range of -32,768 to 32,767	-
AO	2	Bus feedback 1	-16,384 to 16,384	535
AO	3	Bus feedback 2	-16,384 to 16,384	536

Binary Outputs (BO)

NPT	NPA	DESCRIPTION	RANGE	PARAMETER NUMBER
BO	1	DC brake inverse	**0=Active** 1 = Not active	-
BO	2	Coast inverse (safety interlock)	**0=Active** 1 = Not active	-
BO	3	Stop inverse	**0=Active** 1 = Not active	-
BO	4	Freeze output inverse	**0=Active** 1 = Not active	-
BO	5	Start	**0= Not active** 1 = Active	-
BO	6	Reset	**0= Not active** 1 = Active	-
BO	7	Jogging	**0= Not active** 1 = Active	-
BO	9	Relay 01	**0= Not active** 1 =Active	-
BO	10	Relay 04	**0= Not active** 1 = Active	-
BO	11	Reversing	**0= Not active** 1 = Active	-

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

Appendix A

Internal Floating Point (ADF)

NPT	NPA	UNIT	DESCRIPTION	RANGE	PARAMETER NUMBER
ADF	1	-	Custom display readout	0 - 999,999.999	005
ADF	11	HP	Motor power	0.33, 0.5, 0.75, 1.0, 1.5, 2.0, 3.0, 5.0, 7.5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 100, 125, 150, 175, 200, 300, 350, 450, 500, 600	102[1]
ADF	12	V	Motor voltage	200, 208, 220, 230, 240, 380, 400, 415, 440, 460, 575	103[1]
ADF	13	Hz	Motor frequency	24 to 1000	104[1]
ADF	14	A	Motor current	0 to nameplate	105
ADF	15	RPM	Motor nominal speed	100 to 60,000	106[1]
ADF	16	V	Start voltage	0 to motor voltage	108
ADF	17	%	Resonance damping	0 to 500	109
ADF	18	Sec	Break away torque boost	0.0 to 0.5	110
ADF	19	Sec	Start delay	0.0 to 120.0	111
ADF	20	%	Preheat DC current	0 to 100	113[1]
ADF	21	%	DC brake current	0 to rated motor current	114
ADF	22	Sec	DC braking time	0.0 to 60.0	115
ADF	23	Hz	DC brake cut-in frequency	0.0 to output freq. high limit (para. 202)	116
ADF	31	Hz	Output freq. low limit	0.0 to output freq. high limit (para. 202)	201
ADF	32	Hz	Output freq. high limit	Para. 201 to para. 200	202
ADF	33	Unit	Min reference	0.000 to max reference	204
ADF	34	Unit	Max. reference	Min ref. to (feedback in closed loop or 100 Hz in open loop)	205
ADF	35	Sec	Ramp up time	0 to 3600	206
ADF	36	Sec	Ramp down time	0 to 3600	207
ADF	37	Hz	Jog frequency	0 to max. frequency	209
ADF	38	%	Digital reference 1	-100 to +100	211
ADF	39	%	Digital reference 2	-100 to +100	212
ADF	40	%	Digital reference 3	-100 to +100	213
ADF	41	%	Digital reference 4	-100 to +100	214
ADF	42	A	Current limit	0 to max. current	215
ADF	43	Hz	Frequency bypass bandwidth	0 to 100	216
ADF	44	Hz	Frequency 1 bypass	0 to (120 or 1000 par.200)	217
ADF	45	Hz	Frequency 2 bypass	0 to (120 or 1000 par.200)	218
ADF	46	Hz	Frequency 3 bypass	0 to (120 or 1000 par.200)	219
ADF	47	Hz	Frequency 4 bypass	0 to (120 or 1000 par.200)	220
ADF	48	A	Warning current low	0 to current high	221
ADF	49	A	Warning current high	Current low to max. current	222

[1]The drive must be stopped to change this point.

Appendix A

Internal Floating Point (ADF) - Continued

NPT	NPA	UNIT	DESCRIPTION	RANGE	PARAMETE RNUMBER
ADF	50	Hz	Warning frequency low	0 to frequency high	223
ADF	51	Hz	Warning frequency high	Frequency low to 120 or 1000 (see para 200)	224
ADF	52	Unit	Warning reference low	-999,999.999 to Ref. high	225
ADF	53	Unit	Warning reference high	Ref low to 999,999.999	226
ADF	54	Unit	Warning feedback low	-999,999.999 to FB high	227
ADF	55	Unit	Warning feedback high	FB low to 999,999.999	228
ADF	61	VDC	Terminal 53 min. scale	0.0 to 10.0	309
ADF	62	VDC	Terminal 53 max. scale	0.0 to 10.0	310
ADF	63	VDC	Terminal 54 min. scale	0.0 to 10.0	312
ADF	64	VDC	Terminal 54 max. scale	0.0 to 10.0	313
ADF	65	mA	Terminal 60 min. scale	0.0 to 20.0	315
ADF	66	mA	Terminal 60 max. scale	0.0 to 20.0	316
ADF	67	Hz	Term.42 output pulse scale	1 to 32000	320
ADF	68	Hz	Term.45 output pulse scale	1 to 32000	322
ADF	69	Sec	Relay ON delay	0 to 600	324
ADF	70	Sec	Relay OFF delay	0 to 600	325
ADF	71	Hz	Pulse reference max. freq.	100 to 65000	327
ADF	72	Hz	Pulse feedback max. freq.	100 to 65000	328
ADF	81	Sec	Automatic restart time	0 to 600	401
ADF	82	Sec	Sleep mode timer	0 to 300	403
ADF	83	Hz	Sleep frequency	Min. freq. to wake up freq.	404
ADF	84	Hz	Wake up frequency	Sleep freq. to max. freq.	405
ADF	85	%	Boost set point	1 to 200	406
ADF	86	kHz	Switch Frequency	2.5 to 16 (power dependent)	407
ADF	87	Unit	Minimum feedback	-999,999.999 to max. FB	413
ADF	88	Unit	Maximum feedback	Min. FB to 999,999.999	414
ADF	89	Unit	Set point 1	Min. FB to max. FB	418
ADF	90	Unit	Set point 2	Min. FB to max. FB	419
ADF	91	Hz	PID start frequency	Min. freq. to max. freq.	422
ADF	92	-	PID proportional gain	0.00 to10.00	423
ADF	93	Sec	PID integration time	0.01 to 9999.00	424
ADF	94	Sec	PID differential time	0.00 to10.00	425
ADF	95	-	PID D-gain limit	5.0 to 50.0	426
ADF	96	Sec	PID feedback filter time	0.01 to10.00	427
ADF	102	-	Override release time	0 to 65,534	560

Appendix A

Internal Integers (ADI)

NPT	NPA	UNIT	DESCRIPTION	RANGE	PARAMETER NUMBER
ADI	1	-	Language Selection	0 to 9	001
ADI	2	-	Setup Copy Function	0 to 5	003[1]
ADI	3	-	Custom readout unit	0 to 38	006
ADI	4	-	Large readout	0 to 27	007
ADI	5	-	Small readout 1	0 to 27	008
ADI	6	-	Small readout 2	0 to 27	009
ADI	7	-	Small readout 3	0 to 27	010
ADI	8	-	Unit of local reference	0 to 1	011
ADI	9	-	Hand start button	0 to 1	012
ADI	10	-	Off/Stop button	0 to 1	013
ADI		-	Auto start button	0 to 1	014
ADI	12	-	Reset button	0 to 1	015
ADI	13	-	Data change lock	0 to 1	016
ADI	14	-	Operating state at power up	0 to 1	017
ADI	21	-	Configuration mode	0 to 1	100[1]
ADI	22	-	VT Characteristics	0 to 1	101[1]
ADI	23	-	Automatic motor adaptation	0 to 2	107[1]
ADI	24	-	Motor preheat	0=disable 1=enable	112
ADI	25	-	Motor thermal protection	0 to 10	117
ADI	31	-	Frequency range	0 to 1	200[1]
ADI	32	-	Reference site	0 to 2	203
ADI	33	-	Auto ramping	0=disable 1=enable	208
ADI	34	-	Reference function	0 to 2	210
ADI	41	-	Digital input 16	0 to 12	300
ADI	42	-	Digital input 17	0 to 13	301
ADI	43	-	Digital input 18	0 to 1	302
ADI	44	-	Digital input 19	0 to 3	303
ADI	45	-	Digital input 27	0 to 3	304
ADI	46	-	Digital input 29	0 to 16	305
ADI	47	-	Digital input 32	0 to 12	306
ADI	48	-	Digital input 33	0 to 13	307
ADI	49	-	Analog input 53	0 to 3	308
ADI	50	-	Analog input 54	0 to 3	311
ADI	51	-	Analog input 60	0 to 2	314
ADI	52	Sec	Live zero time out	1 to 99	317
ADI	53	-	Live zero function	0 to 5	318
ADI	54	-	Signal output 42	0 to 43	319
ADI	55	-	Signal output 45	0 to 43	321
ADI	56	-	Relay 1 output	0 to 28	323

[1]The drive must be stopped to change this point.

Appendix A

Internal Integers (ADI) - Continued

NPT	NPA	UNIT	DESCRIPTION	RANGE	PARAMETER NUMBER
ADI	57	-	Relay 2 output	0 to 28	326
ADI	61	-	Reset function	0 to 8	400
ADI	62	-	Flying start	0 to 2	402
ADI	63	-	Noise reduction method	0 to 2	408[1]
ADI	64	-	Function at low current	0=trip 1=warn	409[1]
ADI	65	Sec	Trip delay on overload	0 to 60	412
ADI	66	-	Reference/Feedback unit	0 to 39	415
ADI	67	-	Feedback conversion	0 to 1	416
ADI	68	-	Two feedback calculation	0 to 6	417
ADI	69	-	PID Normal/Inverse	0=normal 1=invert	420
ADI	70	-	PID Anti-windup	0=disable 1=enable	421
ADI	81	-	Coasting	0 to 3	503
ADI	82	-	DC Brake	0 to 3	504
ADI	83	-	Start	0 to 3	505
ADI	84	-	Reversing	0 to 3	506
ADI	85	-	Select setup	0 to 3	507
ADI	86	-	Select speed	0 to 3	508
ADI	91	-	Reset kWh counter	0=no reset 1=reset	618
ADI	92	-	Reset running hours counter	0=no reset 1=reset	619
ADI	93	-	Operation mode	0 to 3	620[1]
ADI	255	-	Active setup	0 to 5	002

[1]The drive must be stopped to change this point.

Appendix A