

# Operating Instructions

## VLT<sup>®</sup> DriveMotor FCP 106 and FCM 106 Metasys N2





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# 1 Introduction

## 1.1 Purpose of the Manual

This manual provides the information required to install and set up communication using Metasys N2 protocol.

Find the most essential information for quick installation and set-up in these chapters:

- Chapter 1 Introduction
- Chapter 3 Installation
- Chapter 4 System Configuration

For more detailed information, including the full range of set-up options and diagnosis tools, refer to the chapters:

- Chapter 5 Metasys N2 Commands and Point Mapping
- Chapter 6 Parameters
- Chapter 7 Diagnostics and Troubleshooting

Read the entire manual before programming. It is assumed that the reader has full knowledge of the capabilities and limitation of the controller node; and of the frequency converter.

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## 1.2 Additional Resources

Literature available:

- *VLT® DriveMotor FCP 106 and FCM 106 Operating Instructions*, for information required to install and commission the frequency converter.
- *VLT® DriveMotor FCP 106 and FCM 106 Design Guide*, provides information required for integration of the frequency converter into a diversity of applications.
- *VLT® DriveMotor FCP 106 and FCM 106 Programming Guide*, for how to program the unit, including complete parameter descriptions.
- *VLT® LCP Instruction*, for operation of the local control panel (LCP).
- *VLT® LOP Instruction*, for operation of the local operation pad (LOP).
- *Modbus RTU Operating Instructions, VLT® DriveMotor FCP 106 and FCM 106 BACnet Operating Instructions and VLT® DriveMotor FCP 106 and FCM 106 Metasys Operating Instructions*, for information required for controlling, monitoring, and programming the frequency converter.

- *PC-based Configuration Tool MCT 10*, enables configuration of the frequency converter from a Windows™ based PC environment.
- *Danfoss VLT® Energy Box software*, for energy calculation in HVAC applications.

Technical literature and approvals are available online at [www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/Technical+Documentation](http://www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/Technical+Documentation).

Danfoss VLT® Energy Box software is available at [www.danfoss.com/BusinessAreas/DrivesSolutions](http://www.danfoss.com/BusinessAreas/DrivesSolutions), PC software download area.

In addition to Danfoss literature, refer also to *Johnson Controls METASYS N2 System Protocol Specification for Vendors*, Johnson Controls number 04-3402-22, rev A.

## 1.3 Document and Software Version

This manual is regularly reviewed and updated. All suggestions for improvement are welcome. *Table 1.1* shows the document version and the corresponding software version.

In the frequency converter, read the software version in *15-43 Software Version*.

Edition	Remarks	Software version
MG03P1	New document	1.00

Table 1.1 Document and Software Version

## 1.4 Copyright

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### 1.5 Technical Overview

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 regarded 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.

### 1.6 Abbreviations and Conventions

#### Conventions

- Numbered lists indicate procedures
- Bullet lists indicate
  - other information, and
  - description of illustrations
- Italicised text indicates
  - cross reference
  - link
  - parameter name
- \* indicates default setting of a parameter

ACI	Acyclical Control Interval
ACK	Acknowledge
ADF	Internal Floating Points
ADI	Internal Integers
AI	Analog Inputs
AO	Analog Outputs
AOC	Application Orientated Controller
AV	Analog Values
BI	Binary Inputs
BMS	Building Management System
BO	Binary Outputs
BV	Binary Values
COS	Change Of State
CTW	Control Word
EEPROM	Electrical Erasable Programmable Read Only Memory
EIA	Electronic Industries Association: Specifies of the EIA Standard RS-485-A
EMC	Electromagnetic Compatibility
HPFB	High Performance Field Bus
I/O	Input/Output
ISO	International Standards Organization
JCI	Johnson Controls Inc. developers of the METASYS N2 protocol
LCP	Local Control Panel
LED	Light Emitting Diode
MAV	Main Actual Value
MRV	Main Reference Value
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
PC	Personal Computer
PDU	Protocol Data Unit
PELV	Protected Extra Low Voltage
PLC	Programmable Logic Control
PNU	Parameter Number
STW	Status Word

Table 1.2 Abbreviations

2

## 2 Safety

### 2.1 Safety

The following symbols are used in this document:



Indicates a potentially hazardous situation which could result in death or serious injury.



Indicates a potentially hazardous situation which could result in minor or moderate injury. It may also be used to alert against unsafe practices.



Indicates important information, including situations that may result in damage to equipment or property.

### 2.2 Qualified Personnel

Correct and reliable transport, storage, installation, operation and maintenance are required for the trouble-free and safe operation of the frequency converter. Only qualified personnel is allowed to install or operate this equipment.

Qualified personnel is defined as trained staff, who are authorised to install, commission, and maintain equipment, systems and circuits in accordance with pertinent laws and regulations. Additionally, the personnel must be familiar with the instructions and safety measures described in this document.

### 2.3 Safety Precautions



#### HIGH VOLTAGE

Frequency converters contain high voltage when connected to AC mains input power. Failure to perform installation, start up, and maintenance by qualified personnel could result in death or serious injury.

- Only qualified personnel are permitted to perform installation, start up, and maintenance.



#### UNINTENDED START

When the frequency converter is connected to AC mains, the motor may start at any time, causing risk of death, serious injury, equipment, or property damage. The motor can start by means of an external switch, a serial bus command, an input reference signal from the LCP or LOP, via remote operation using MCT 10 software, or after a cleared fault condition.

- Disconnect the frequency converter from mains whenever personal safety considerations make it necessary to avoid unintended motor start.
- Press [Off/Reset] on the LCP, before programming parameters.
- The frequency converter, motor, and any driven equipment must be in operational readiness when the frequency converter is connected to AC mains.



#### DISCHARGE TIME

The frequency converter contains DC-link capacitors, which can remain charged even when the frequency converter is not powered. Failure to wait the specified time after power has been removed before performing service or repair work, could result in death or serious injury.

1. Stop motor.
2. Disconnect AC mains, permanent magnet type motors, and remote DC-link power supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.
3. Wait for the capacitors to discharge fully, before performing any service or repair work. The duration of waiting time is specified in *Table 2.1*.

Voltage [V]	Power Range <sup>1)</sup> [kW]	Minimum waiting time (min)
3x400	0.55–7.5	4
High voltage can be present even when the warning LED indicator lights are off.		

Table 2.1 Discharge Time

1) Power ratings relate to NO, see VLT® DriveMotor FCP 106 and FCM 106 Operating Instructions.

**⚠ WARNING****EQUIPMENT HAZARD**

Contact with rotating shafts and electrical equipment can result in death or serious injury.

- Ensure that only trained and qualified personnel perform installation, start up, and maintenance.
- Ensure that electrical work conforms to national and local electrical codes.
- Follow the procedures in this manual.

**⚠ CAUTION****WINDMILLING**

Unintended rotation of permanent magnet motors causes risk of personal injury and equipment damage.

- Ensure that permanent magnet motors are blocked to prevent unintended rotation.

**⚠ WARNING****LEAKAGE CURRENT HAZARD**

Follow national and local codes regarding protective earthing of equipment with a leakage current exceeding 3.5 mA. Frequency converter technology implies high frequency switching at high power. This switching generates a leakage current in the ground connection. A fault current in the frequency converter at the output power terminals can contain a DC component which can charge the filter capacitors and cause a transient ground current. The ground leakage current depends on various system configurations including RFI filtering, screened motor cables, and frequency converter power. EN/ IEC61800-5-1 (Power Drive System Product Standard) requires special care because the leakage current exceeds 3.5 mA. See EN60364-5-54 paragraph 543.7 for further information.

- Ensure correct grounding of the equipment by a certified electrical installer.
- Grounding must be reinforced in one of the following ways:
  - Ensure ground wire with cross-section of at least 10 mm<sup>2</sup>, or
  - Ensure 2 separate ground wires, both complying with the dimensioning rules.

**NOTICE****HIGH ALTITUDES**

For installation at altitudes above 2000 m, contact Danfoss regarding PELV.

**⚠ CAUTION****SHOCK HAZARD**

The frequency converter can cause a DC current in the PE conductor.

- When a residual current-operated protective device (RCD) is used for protection against electrical shock, only an RCD of Type B is permitted on the supply side.

Failure to follow the recommendation means the RCD may not provide the intended protection.

**⚠ WARNING****GROUNDING HAZARD**

For operator safety, it is important to ground the frequency converter properly in accordance with national and local electrical codes, as well as the instructions in this manual. Ground currents are higher than 3.5 mA. Failure to ground the frequency converter properly could result in death or serious injury.

It is the responsibility of the user or certified electrical installer, to ensure correct grounding of the equipment in accordance with national and local electrical codes and standards.

- Follow all local and national electrical codes to ground electrical equipment properly.
- Establish proper protective grounding for equipment with current higher than 3.5 mA.
- A dedicated ground wire is required for input power, motor power, and control wiring.
- Use the clamps provided with on the equipment for proper ground connections.
- Do not ground one frequency converter to another in a "daisy chain" fashion.
- Keep the ground wire connections as short as possible.
- Use of high-strand wire to reduce electrical noise is recommended.
- Follow motor manufacturer wiring requirements.

## 3 Installation

### 3.1 Metasys N2 Interface

#### 3.1.1 Safety Instructions

See *chapter 2 Safety* for general safety instructions.

#### **⚠ WARNING**

##### INDUCED VOLTAGE

Induced voltage from output motor cables that run together can charge equipment capacitors even with the equipment turned off and locked out. Failure to run output motor cables separately or use screened cables could result in death or serious injury.

- run output motor cables separately, or
- use screened cables

#### **⚠ CAUTION**

##### SHOCK HAZARD

The frequency converter can cause a DC current in the PE conductor. Failure to follow the recommendation below means that the RCD may not provide the intended protection.

- When a residual current-operated protective device (RCD) is used for protection against electrical shock, only an RCD of Type B is permitted on the supply side.

##### Overcurrent protection

- Additional protective equipment such as short circuit protection or motor thermal protection between frequency converter and motor is required for applications with multiple motors.
- Input fusing is required to provide short circuit and overcurrent protection. If not factory-supplied, the installer provides fuses. See maximum fuse ratings in *VLT® DriveMotor FCP 106 and FCM 106 Operating Instructions*.

##### Wire Type and Ratings

- All wiring must comply with local and national regulations regarding cross section and ambient temperature requirements.
- Power connection wire recommendation: minimum 75 °C rated copper wire.

See *VLT® DriveMotor FCP 106 and FCM 106 Operating Instructions* for recommended wire sizes and types.



### 3.1.2 Overview

RS-485 is a 2-wire bus interface compatible with multi-drop network topology, that is, nodes can be connected as a bus, or via drop cables from a common trunk line. A total of 32 nodes can be connected to one network segment. Repeaters divide network segments, see *Illustration 3.1*.

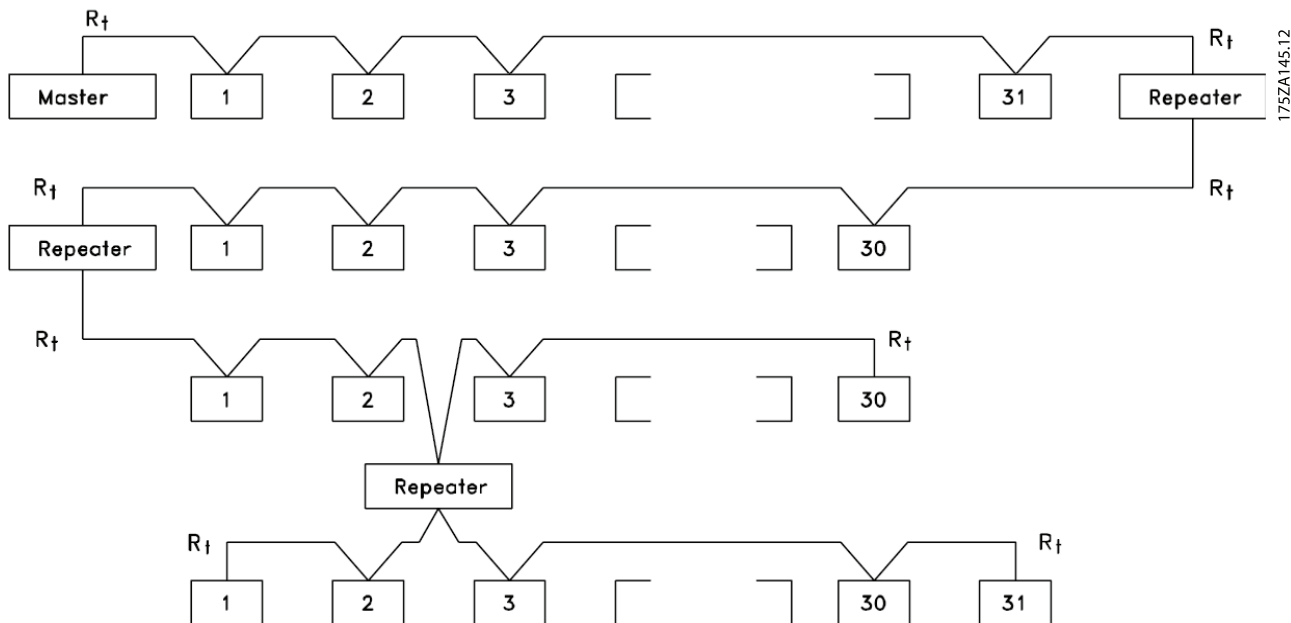


Illustration 3.1 RS-485 Bus Interface

#### NOTICE

Each repeater functions as a node within the segment in which it is installed. Each node connected within a given network must have a unique node address across all segments.

Terminate each segment at both ends, using either the termination switch (S801) of the frequency converters or a biased termination resistor network. Always use screened twisted pair (STP) cable for bus cabling, and follow good common installation practice, according to *Illustration 3.2*.

Low-impedance ground connection of the screen at every node is important, including at high frequencies. Thus, connect a large surface of the screen to ground, for example with a cable clamp or a conductive cable gland. It may be necessary to apply potential-equalising cables to maintain the same earth potential throughout the network - particularly in installations with long cables. To prevent impedance mismatch, always use the same type of cable throughout the entire network. When connecting a motor to the frequency converter, always use screened motor cable.

Cable	Screened twisted pair (STP)
Impedance [Ω]	120
Cable length [m]	Max. 1200 (including drop lines) Max. 500 station-to-station

Table 3.1 Cable Specifications

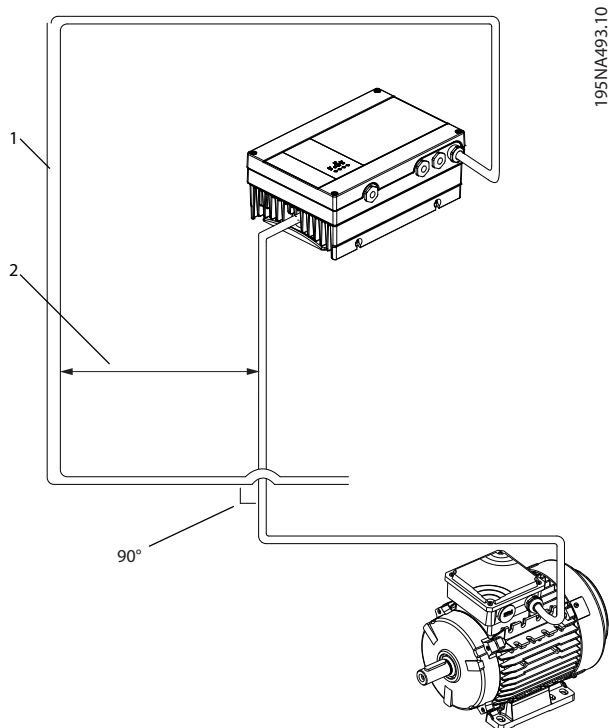
3

### 3.1.3 EMC Precautions

To achieve interference-free operation of the RS-485 network, Danfoss recommends the following EMC precautions.

**NOTICE**

Observe relevant national and local regulations, for example regarding protective earth connection. To avoid coupling of high-frequency noise between the cables, the RS-485 communication cable must be kept away from motor and brake resistor cables. Normally, a distance of 200 mm (8 inches) is sufficient. Maintain the greatest possible distance between the cables, especially where cables run in parallel over long distances. When crossing is unavoidable, the RS-485 cable must cross motor and brake resistor cables at an angle of 90°.



1	Fieldbus cable
2	Minimum 200 mm distance

Illustration 3.2 Minimum Distance between Communication and Power Cables

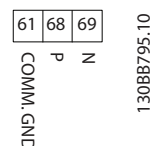
### 3.1.4 Network Connection

Connect the frequency converter to the RS-485 network as follows (see also *Illustration 3.3*):

1. Connect signal wires to terminal 68 (P+) and terminal 69 (N-) on the main control board of the frequency converter.
2. Connect the cable screen to the cable clamps.
3. Terminal 61 is normally not used. However when there is a large potential difference between frequency converters, connect the screen of the RS-485 cable to terminal 61. Terminal 61 has an RC filter to eliminate current noise on the cable.

**NOTICE**

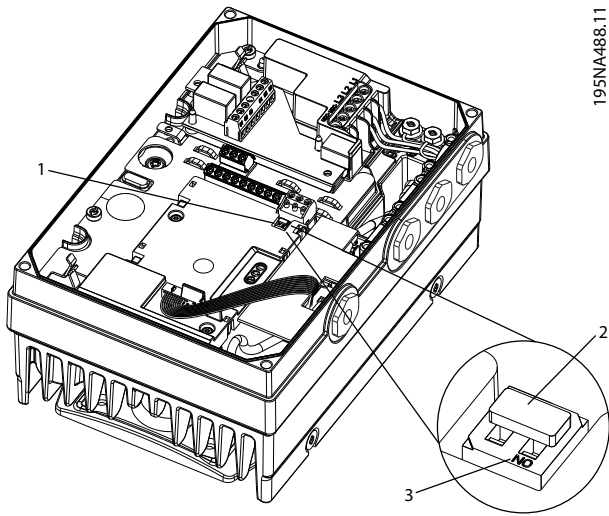
Screened, twisted-pair cables are recommended to reduce noise between conductors.



COMM. GND	Communication ground
P	(P+) Positive
N	(N-) Negative

Illustration 3.3 Network Connection

4. Set the control card DIP switch to ON to terminate the RS-485 bus, and activate RS-485. For position of DIP switch, see *Illustration 3.4*. The factory setting for the DIP switch is OFF.



1	DIP switch
2	DIP switch set to factory setting, OFF position
3	DIP switch ON position

Illustration 3.4 DIP Switch set to Factory Setting

## 4 System Configuration

### 4.1 Start-up Configuration

For information about user interfaces, changing parameters and programming the frequency converter, refer to the *VLT® DriveMotor FCP 106 and FCM 106 Programming Guide*. Use the optional LCP or other user interface to set up the frequency converter. Use the Extended Menu key to access the 8-\*\* Serial Communication group parameters. The settings in *Table 4.1* are typical and serve as a good starting reference. Some settings may be changed to meet the application requirements.

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

Table 4.1 Example of Typical Settings

#### **NOTICE**

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

Table 4.2 Example of F Command Settings

#### 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

Table 4.3 Example of Run Command

#### 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

Table 4.4 Example of Frequency Reference

\* Default setting

#### Telegram code:

>XX7203004E000000<CR>

To calculate override value for speed:

- Refer to *chapter 4.2.1 Scaling of Bus Reference and Feedback*.
- Issue an override release command through the master to the device. See example in *Table 4.5*.

**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

**Table 4.5 Example of Override Release Command**
**Telegram code**

>XX72040400YY <CR>

For commands issued according to *Table 4.5*, the frequency converter accelerates to 50% after issuing the speed reference. After the override release, the frequency converter stops.

## 4.2 Further Configuration

### 4.2.1 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 4.6 Reference/Feedback Values**

The reference/feedback value is the percentage of the range of 3-02 *Minimum Reference* and 3-03 *Maximum Reference*. Values within the ranges 100% to -200% and -200 to -100% apply only to the reference. The float representation of the value 200% must be limited to maximum 32767 and minimum -32768.

### 4.2.2 Status Update Request

A Status Update Request causes the frequency converter to report its current operating status. The status codes, descriptions and associated alarms are shown in *Table 4.7*.

The Device Status Code consists of 2 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 frequency converter.

**Status codes with associated alarms and descriptions**

Device Status Code1	Alarm No.	Description
0x0000	-	Device OK
0x0102	2	Live zero error
0x0204	4	Mains phase loss
0x0107	7	DC overvoltage
0x0108	8	DC undervoltage
0x0109	9	Inverter overloaded
0x010A	10	Motor ETR over temperature
0x010B	11	Motor thermistor over temperature
0x020D	13	Over current (Trip lock)
0x020E	14	Earth fault (Trip lock)
0x0210	16	Short circuit (Trip lock)
0x0111	17	Control word timeout
0x011E	30	Motor phase U missing
0x011F	31	Motor phase V missing
0x0120	32	Motor phase W missing
0x0226	38	Internal fault
0x022C	44	Earth fault DESAT
0x022E	46	Gate drive voltage fault
0x022F	47	24 V Supply Low
0x0133	51	AMA U <sub>nom</sub> , I <sub>nom</sub>
0x0134	52	AMA low I <sub>nom</sub>
0x0135	53	AMA motor too big
0x0136	54	AMA motor too small
0x0137	55	AMA parameter out of range
0x0138	56	AMA interrupted by user
0x0139	57	AMA timeout
0x013A	58	AMA internal fault
0x013B	59	Current limit
0x013C	60	External interlock
0x013F	63	Mechanical brake low
0x0245	69	Pwr card temperature
0x0150	80	Drive initialized to default value
0x015F	95	Broken belt
0x0163	99	Locked rotor
0x0165	101	Flow/pressure info missing
0x017E	126	Motor rotating

**Table 4.7 Status Codes with Associated Alarms and Descriptions**
**Read/write notes**

A write command to an ADF (Internal Floating Point) or BD (Internal Byte) point type is stored in the frequency converter EEPROM.

**NOTICE**

If write command is issued to an overridden point, the new value is not stored in the frequency converter EEPROM.

**4.2.3 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 frequency converter behaves during the override release time out or for release commands issued by the N2 master. This is due to the fact that the active set-up can be changed to a different setup. If one would release the active set-up before the values that have been overridden in that set-up, the back-up values would then be restored to the wrong set-up, leaving the overridden values in the old set-up unchanged.

**The release after override time out:**

During an override release time-out, all points which are overridden, are 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.

**4.2.4 Change of State (COS)/POLLING**

A change of state occurs when a new command has been issued for the frequency converter. This command can be issued through the bus or through a frequency converter-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.

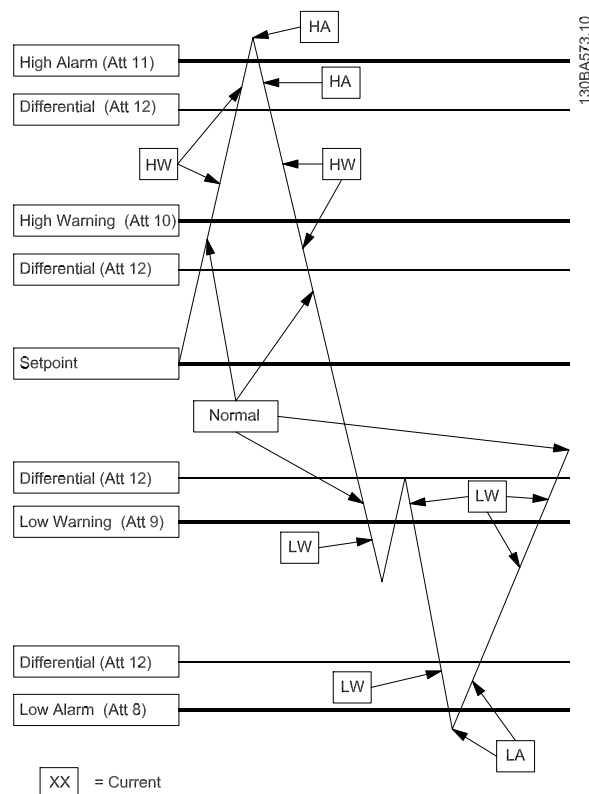
**4.2.5 Handling of Poll Message Commands**

The Identity Command causes the frequency converter to report all AI, AO, BI and BO points, which are available when the next Poll (0/4) is received. The frequency converter also supports COS for AI and BI point types. The

frequency converter is limited to responses of 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 begins exporting the requested information. The frequency converter continues to export new information upon receiving the 0/5 Poll until it has sent all requested information. Then it responds 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 causes the frequency converter to re-transmit its latest response.

Illustration 4.1 shows the AI COS handling.



**Illustration 4.1 AI COS Handling**

**For AI:**

Set Alarm Enable or Warning Enable in the Object Configuration Attribute (Attribute 1). Programme Low/High Alarm limits (Attribute 8, 11) or Low/High Warning limits (Attribute 9, 10) and Differential Value (Attribute 12).

**For BI:**

Set Alarm Enable in the Object Configuration Attribute (Attribute 1).

Programme Normal state 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 are cleared only 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 sets 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).

## 5 Metasys N2 Commands and Point Mapping

### 5.1 Metasys N2 Commands

#### 5.1.1 General Commands (Acknowledged)

VLT response	Command	Subcommand	NPA object no.	Attribute message type	Error code	Comments
ACK	0	4	-	Poll Message No Acknowledge	-	The follower responds with any data points, analog or binary I/O that have been flagged for COS
ACK	0	5	-	Poll Message With Acknowledge	-	The follower responds with any data points, analog or binary I/O that have been flagged for COS
ACK	0	9	-	Status update Message	-	Follower device responds with <ul style="list-style-type: none"> <li>• device manufacturing model number, <i>15-40 FC Type</i></li> <li>• power range, <i>15-41 Power Section</i></li> <li>• voltage, <i>15-42 Voltage</i></li> <li>• software version <i>15-43 Software version</i></li> </ul> and device status
ACK	F	-	-	Identify Device Type	-	Follower device responds with an identification number of 10H to indicate non JCI device
ACK	0	0	-	Synch Time	-	The internal clock is synchronized 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	Follower device memory read based on memory addresses
NAK	0	8	-	Warm Start	01	JCI use only



## 5.1.2 Analog Input Commands (Acknowledged)

VLT response	Command	Sub-command	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	<sup>1)</sup> Read Object Status attribute associated with each individual point
ACK	1	-	1	0-23	3	Float	Read Analog Input	<sup>2)</sup> 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 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

## 5.1.3 Analog Input Commands (Not Acknowledged)

VLT response	Command	Region	NPA object no.	Attribute no.	Attribute message type		Error code	Comments
NAK	1	1	0-23	4	Float	Read Analog Input	11 <sup>1)</sup>	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 <sup>1)</sup>	Read Linear Ranging Parameter 2 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	2	Byte	Write Analog Input	11 <sup>1)</sup>	Object Status writeable
NAK	2	-	0-23	3	Float	Write Analog Input	11 <sup>1)</sup>	Analog Input Value not writeable
NAK	2	-	0-23	4	Float	Write Analog Input	11 <sup>1)</sup>	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 <sup>1)</sup>	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 <sup>1)</sup>	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 <sup>1)</sup>	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 <sup>1)</sup>	Write to Filter Weight attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	14	Float	Write Analog Input	11 <sup>1)</sup>	Write to AI Offset attribute associated with each individual point. (JCI use only)

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

## 5.1.4 Analog Output Commands (Acknowledged)

VLT response	Command	Sub-command	Region	NPA object no.	Attribute no.	Attribute message type		Comments
ACK	1	-	3	0-1	1	Byte	Read Analog Output	Read Object Configuration attribute associated with each individual point
ACK	1	-	3	0-1	2	Byte	Read Analog Output	Read Object Status attribute associated with each individual point
ACK	0	9	-	-	-	-	Status update Message	Follower device responds with <ul style="list-style-type: none"> <li>• device manufacturing model number, 15-40 <i>FC Type</i></li> <li>• power range, 15-41 <i>Power Section</i></li> <li>• voltage, 15-42 <i>Voltage</i></li> <li>• software version, 15-43 <i>Software version</i></li> </ul> and device status
ACK	1	-	3	0-1	3	Float	Read Analog Output	Read Current Value attribute associated with each individual point
ACK	2	-	3	0-1	1	Byte	Write Analog Output	Write to Object Configuration attribute associated with each individual point
ACK	7	2	3	0-1	-	Float	Override Analog Output	Write to analog output current value (frequency setpoint)
ACK	7	2	3	0-1	-	Float	Override Analog Output	Write to analog output current value (frequency setpoint)
ACK	7	3	3	0-1	-	-	Override Release	Set the current value, the value that it was before the 1. Override Command was issued
ACK, no action	7	7	3	0-1	-	-	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	0-1	-	-	Read Analog Output Attributes	Optional command for no action slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time

## 5.1.5 Analog Output Commands (Not Acknowledged)

VLT response	Command	Sub-command	Region	NPA object no.	Attribute no.	Attribute message type		Comments
0-2	1	3	0-1	4	Float	Read Analog Output	11 <sup>1</sup>	Read Low Linear Ranging Parameter attribute associated with each individual point. (JCI use only)
NAK	1	3	0-1	5	Float	Read Analog Output	11 <sup>1</sup>	Read High Linear Ranging Parameter attribute associated with each individual point. (JCI use only)
NAK	2	3	0-1	2	Byte	Write Analog Output	11 <sup>1</sup>	Object Status not writeable
NAK	2	3	0-1	3	Float	Write Analog Output	11 <sup>1</sup>	Write to Current Value structure attributes associated with each individual point. (N2 does not support this, override function must be used)
NAK	2	3	0-1	4	Float	Write Analog Output	11 <sup>1</sup>	Write Debouncing Value in msec attribute associated with each individual point.(JCI use only)
NAK	2	3	0-1	5	Float	Write Analog Output	11 <sup>1</sup>	Write Accumulator value attribute associated with each individual point. (JCI use only)

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

## 5.1.6 Binary Input (BI) Commands (Acknowledged)

VLT response	Command	Sub-command	Region	NPA object no.	Attribute no.	Attribute message yype		Comments
ACK	1	-	2	0-133	1	Byte	Read Binary Input	Read Object Configuration attribute associated with each individual point
ACK	1	-	2	0-133	2	Byte	Read Binary Input	Read Object Status attribute associated with each individual point
ACK	2	-	2	0-133	1	Byte	Write Binary Input	Write to Object Configuration attribute associated with each individual point
ACK, no action	7	2	2	0-133	-	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	0-133	-	-	OverrideRelease	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	7	2	0-133	-	-	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	0-133	-	-	Read Binary Input	Optional command for Attributes slave devices. Only used for N2 commissioning purposes. Not to be implemented at this time

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## 5.1.7 Binary Input (BI) Commands (Not Acknowledged)

VLT response	Command	Sub-command	Region	NPA object no.	Attribute no.	Attribute message yype		Comments
NAK	2	2	0-133	2	Byte	Write Binary Input	11 <sup>1)</sup>	Object Status not writeable
NAK	2	2	0-133	3	Integer	Write Binary Input	11 <sup>1)</sup>	Write Debouncing Value in msec attribute associated with each individual point.(JCI use only)
NAK	2	2	0-133	4	Integer32	Write Binary Input	11 <sup>1)</sup>	Write Accumulator value attribute associated with each individual point (JCI use only)

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

## 5.1.8 Binary Output Commands (Acknowledged)

VLT response	Command	Sub-command	Region	NPA object no.	Attribute no.	Attribute message yype		Comments
ACK	1	-	4	0-25	1	Byte	Read Binary Output	Read structure attributes associated with each individual point
ACK	1	-	4	0-25	2	Byte	Read Binary Output	Read structure attributes associated with each individual point
ACK	2	-	4	0-25	1	Byte	Write Binary Output	Write to Object Configuration attribute associated with each individual point
ACK	7	2	4	0-25	-	Byte(0/1)	Override Binary Output	Write to binary output current state (VLT control word)
ACK	7	2	4	0-25	-	Byte(0/1)	Override Binary Output	Write to binary output current state (VLT control word)
ACK	7	3	4	0-25	-	-	Override Release	Set the current value, the value that it was before the 1. Override Command was issued
ACK, no action	1	-	4	0-25	3	Integer	Read Binary Output	Read Minimum On-time attribute associated with each individual point. Return value = 0
ACK, no action	1	-	4	0-25	4	Integer	Read Binary Output	Read Minimum Off-time attribute associated with each individual point. Return value = 0
ACK, no action	1	-	4	0-25	5	Integer	Read Binary Output	Read Maximum Cycles/ Hour attribute associated with each individual point. Return value = 0
ACK, no action	2	-	4	0-25	3	Integer	Write Binary Output	Write Minimum On-time attribute associated with each individual point
ACK, no action	2	-	4	0-25	4	Integer	Write Binary Output	Write Minimum Off-time attribute associated with each individual point
ACK, no action	2	-	4	0-25	5	Integer	Write Binary Output	Write Maximum Cycles/ Hour attribute associated with each individual point
ACK, no action	7	7	4	0-25	-	-	Write Binary Output	Optional command for slave devices. Only Attributes used for N2 commissioning purposes
ACK, no action	7	8	4	0-25	-	-	Read Binary Output	Optional command for slave devices. Only Attributes used for N2 commissioning purposes

### 5.1.9 Binary Output (BO) Commands (Not Acknowledged)

VLT response	Command	Sub-command	Region	NPA object no.	Attribute no.	Attribute message type		Comments
NAK	1	4	0-25	6	Integer	Read Binary Output	11 <sup>1)</sup>	Read Interstage on delay attribute associated with each individual point. (JCI use only)
NAK	1	4	0-25	7	Integer	Read Binary Output	11 <sup>1)</sup>	Read Interstage off delay attribute associated with each individual point. (JCI use only)
NAK	2	4	0-25	2	Byte	Write Binary Output	11 <sup>1)</sup>	Object Status not writeable
NAK	2	4	0-25	6	Integer	Write Binary Output	11 <sup>1)</sup>	Write Interstage on delay attribute associated with each individual point. (JCI use only)
NAK	2	4	0-25	7	Integer	Write Binary Output	11 <sup>1)</sup>	Write Interstage off delay attribute associated with each individual point. (JCI use only)

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

### 5.1.10 Internal Integers (ADI) Commands (Acknowledged)

VLT response	Command	Sub-command	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 frequency converter)
ACK	7	3	6	0-254	-	-	Override Release	Set the current value, the value that it was before the 1. Override Command was issued

## 5.1.11 Internal Floating Point Commands (Acknowledged)

VLT response	Command	Sub-command	Region	NPA object no.	Attribute no.	Attribute message yype		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

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## 5.2 Metasys Point Mapping Tables

### 5.2.1 Analog Inputs (AI)

NPA	Unit	Description	Range	Parameter
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

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Any point not listed in the tables, *chapter 5.2.2 Binary Inputs (BI) to chapter 5.2.6 Internal Integers (ADI)*, is reserved for future use.

Metasys softwares use different conventions for object numbers:

- Object number range 0-255
  - The software interprets object number 0 as 0, and 1 as 1, and so on.
  - Use the NPA number directly from the tables.
- Object number range 1-254
  - The software interprets object number 0 as 1, and 1 as 2, and so on.
  - To access the proper point with this Metasys software, add 1 to the NPA number in the tables.

## 5.2.2 Binary Inputs (BI)

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NPA	Unit	Description	Range	Parameter
0	15	Timers Status	0*=OK, 1=Limit	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		
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	
26	21	Speed Limit	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	
42	5	Over Current	0*=OK, 1=Warning	
43	4	Ctrl. Word Timeout	0*=OK, 1=Warning	
45	2	Earth Fault	0*=OK, 1=Warning	
46	1	Pwr. Card Temp	0*=OK,1=Warning	

NPA	Unit	Description	Range	Parameter
48	31	Reserved		16-90 Alarm Word
49	30	Reserved		
50	29	Drive Initialized	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	
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	
74	5	Over Current	0*=OK,1=Alarm	
75	4	Ctrl. Word Timeout	0*=OK,1=Alarm	
77	2	Earth Fault	0*=OK,1=Alarm	
78	1	Pwr. Card Temp	0*=OK,1=Alarm	
80	31		0*=FALSE, 1=TRUE	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	
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	

NPA	Unit	Description	Range	Parameter
112	9	Ramp	0*=RAMP 1, 1=RAMP 2	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	
130	2	Terminal 29	0*=FALSE, 1=TRUE	16-60 Digital Input
131	3	Terminal 27	0*=FALSE, 1=TRUE	
132	4	Terminal 19	0*=FALSE, 1=TRUE	
133	5	Terminal 18	0*=FALSE, 1=TRUE	

\* indicates default value.

### 5.2.3 Analog Outputs (AO)

NPA	Unit	Description	Range	Parameter
0	%	Bus reference	-200 to 200 Proportionally mapped into the range -32768 to 32767	Shared Variable
1		Bus Feedback 1		8-94

## 5.2.4 Binary Outputs (BO)

NPA	Unit	Description	Range	Parameter
0	2	DC Brake Inverse	0=Active, 1*=Not Active	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	
24	4	CC Relay 1	0*=Not active, 1=Active	5-90 Digital & Relay Bus Control
25	5	CC Relay 2	0*=Not active, 1=Active	
29	9	Reserved	0*=Not active, 1=Active	

\* indicates default value.

## 5.2.5 Internal Floating Point (ADF)

NPA	Unit	Description	Range	Parameter
0	-	Max value of custom readout		0-32
1	-	Min value of custom readout		0-31
13	A	Motor Current(I <sub>M,N</sub> )		1-24
14	RPM	Motor nom. Speed		1-25
16	%	Resonance damping		1-64
18	Sec	Start delay		1-71
20	%	DC brake current		2-01
21	Sec	DC braking time		2-02
22	Hz	DC brake cut-in frequency		2-03
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
50	A	Warning Current Low(I <sub>LOW</sub> )		4-50
51	A	Warning Current High (I <sub>HIGH</sub> )		4-51
52	Hz	Warning Freq. Low(F <sub>LOW</sub> )		4-52
53	Hz	Warning Freq. High(F <sub>HIGH</sub> )		4-53
54	Unit	Warning Low Ref.(Ref <sub>LOW</sub> )		4-54
55	Unit	Warning High Ref.(Ref <sub>HIGH</sub> )		4-55
56	Unit	Warning Low FB.(FB <sub>LOW</sub> )		4-56
57	Unit	Warning High FB.(FB <sub>HIGH</sub> )		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
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
90	Hz	PID Start Frequency		20-83
91	-	PID Proportional Gain		20-93
92	Sec	PID Integration Time		20-94
100	-	Control Timeout Function		8-04
101	-	Control Timeout Time		8-03

## 5.2.6 Internal Integers (ADI)

NPA	Unit	Description	Range	Parameter
0	-	Language Selection		0-01
1	-	Setup Copy Function		0-51
2	-	Custom Readout Unit		0-30
8	-	Hand Start Button		0-40
9	-	Off/Stop Button		0-41
10	-	Auto Start Button		0-42
13	-	Operating State at Power Up		0-04
21	-	Torque Characteristics		1-03
24	-	Motor Thermal Protection		1-90
32	-	Over Volt Control		2-17
40	-	Digital Input 18		5-10
41	-	Digital Input 19		5-11
42	-	Digital Input 27		5-12
43	-	Digital Input 29		5-13
51	Sec	Live Zero Time Out		6-00
52	-	Live Zero Function		6-01
53	-	Signal Output 42		6-50
55	-	CC Relay 1 Function	0 to 255	5-40:0
56	-	CC Relay 2 Function	0 to 255	5-40:1
60	-	Reset Function		14-20
61	-	Flying Start		1-73
63	-	Broken Belt Function		22-60
68	-	PID Normal/Inverse		20-81
69	-	PID Anti Windup		20-91
70	-	Feedback 1 Conversion		20-01
71	-	Feedback 1 Source Unit		20-02
80	-	Coasting		8-50
81	-	DC Brake		8-52
82	-	Start		8-53
83	-	Reversing		8-54
84	-	Selection of Setup		8-55
85	-	Selection of Speed		8-56
90	-	Reset kWh Counter		15-06
91	-	Reset Running Hours Counter		15-07
92	-	Operation Mode		14-22
120	-	Dry Pump Function	0 - 2	22-26
121	-	Broken Belt Action	0 - 2	22-60
122	%	Broken Belt Torque	0 - 100%	22-61
123	sec	Broken Belt Timer	0 - 600	22-62
254	-	Active Setup		0-10

## 6 Parameters

### 6.1 Parameter List

For each frequency converter in the Metasys N2 network, set the parameters in *Table 6.1* as required. For parameter details, refer to the *VL<sup>T</sup> DriveMotor FCP 106 and FCM 106 Programming Guide*.

Parameter	Description	Default	Desired Setting
8-01	Control Side	Digital & Ctrl. Word	
8-02	Control Source	FC Port	FC Port
8-03	Control Timeout Time	60 s	1-6500 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

Table 6.1 Parameter List

### 6.2 Parameter Description

#### 6.2.1 8-0\* General Settings

8-01 Control Site		
Option:	Function:	
		Select [0] <i>Digital and ctrl.word</i> for using digital input and control word. Select [1] <i>Digital only</i> to use digital inputs only. Select [2] <i>Control word only</i> to use control word only. This parameter overrules settings in 8-50 <i>Coasting Select</i> to 8-56 <i>Preset Reference Select</i> .
[0] *	Digital and ctrl.word	Control by using both digital input and control word.
[1]	Digital only	Control by using digital inputs only.
[2]	Controlword only	Control by using control word only.

8-02 Control Source		
Option:	Function:	
		<b>NOTICE</b> This parameter cannot be adjusted while the motor is running.  Select the source of the control word.
[0]	None	
[1] *	FC Port	

8-03 Control Timeout Time		
Range:	Function:	
1 s*	[0.1 - 6500 s]	Enter the maximum time expected to pass between the reception of 2 consecutive

8-03 Control Timeout Time		
Range:	Function:	
		telegrams. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in 8-04 <i>Control Timeout Function Control Time-out Function</i> is carried out.

8-04 Control Timeout Function		
Option:	Function:	
		Select the timeout function. The time-out function is activated when the control word fails to be updated within the time period specified in <i>parameter 8-03 Control Timeout Time</i> .
[0] *	Off	
[1]	Freeze output	
[2]	Stop	
[3]	Jogging	
[4]	Max. speed	
[5]	Stop and trip	
[20]	N2 Override Release	

#### 6.2.2 8-3\* FC Port Settings

8-30 Protocol		
Option:	Function:	
		Select the protocol for the integrated RS-485 port. Change of settings in may change the baud rate.
[0]	FC	Communication according to the FC Protocol.



8-30 Protocol		
Option:	Function:	
[2]	Modbus RTU	Communication according to the Modbus RTU protocol.
[3]	Metasys N2	Communication protocol. The N2 software protocol is designed to accommodate the unique properties each device may have.
[5]	BACNet	

8-31 Address		
Range:	Function:	
1*	[ 0.0 - 247 ]	Enter the address for the RS-485 port. Valid range: <ul style="list-style-type: none"> <li>• 1-126 for FC-bus</li> <li>• 1-247 for Modbus</li> <li>• 1-255 for Metasys</li> </ul>

**8-32 Baud Rate**

Option:	Function:	
		Select the baud rate for the RS-485 port Default refers to the FC Protocol. Changing Protocol in <i>8-30 Protocol</i> may change the Baud Rate. Changing Protocol in <i>8-30 Protocol</i> may change the Baud Rate.
[0]	2400 Baud	
[1]	4800 Baud	
[2] *	9600 Baud	Default setting for <ul style="list-style-type: none"> <li>• Modbus RTU</li> <li>• BACnet</li> <li>• Metasys N2</li> </ul>
[3]	19200 Baud	
[4]	38400 Baud	
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

**8-33 Parity / Stop Bits**

Option:	Function:	
		Parity and stop bits for the protocol using the FC Port. For some of the protocols, not all options are available. Default refers to the FC Protocol. Changing Protocol in <i>8-30 Protocol</i> may change the Baud Rate.
[0]	Even Parity, 1 Stop Bit	
[1]	Odd Parity, 1 Stop Bit	
[2]	No Parity, 1 Stop Bit	
[3]	No Parity, 2 Stop Bits	

8-35 Minimum Response Delay		
Range:	Function:	
0.01 s*	[ 0.0010 - 0.5 s]	Specify the minimum delay time between receiving a request and transmitting a response. This is used for overcoming modem turnaround delays.

8-36 Maximum Response Delay		
Range:	Function:	
Size related*	[ 0.1 - 10.0 s]	Specify the maximum permissible delay time between receiving a request and transmitting the response. If this time is exceeded, no response is returned.

## 7 Diagnostics and Troubleshooting

Error code no.	Error description
00	The error 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.
01	The command is not supported or not known by the frequency converter.
02	The received telegram has a checksum error.
03	The N2 telegram receive buffer exceeds 256 characters.
05	The received N2 telegram is too long.
10	The data is out of expected range.
11	<ol style="list-style-type: none"> <li>1. A point attributes or attribute bit is unused.</li> <li>2. A point attributes or attribute bit is for JCI use only.</li> <li>3. An internal data point attribute for current value cannot be changed while running</li> </ol>
12	<ol style="list-style-type: none"> <li>1. The N2 master tries to change attribute 2 bit 6 "Current State" on a BO and the frequency converter is tripped.</li> <li>2. The N2 master tries to change attribute 2 bit 6 "Current State" on a BO and the frequency converter is trip locked except for BO 5 "reset"</li> </ol>

Table 7.1 Error Codes

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