TRANE®

Metasys® N2 Communications Protocol Operating Instructions

TR200

November 2009

BAS-SVX26B-EN

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Safety

Warnings, Cautions and Notices

Note that warnings, cautions and notices appear at appropriate intervals throughout this manual. Warnings are provided to alert installing contractors to potential hazards that could result in personal injury or death. Cautions are designed to alert personnel to hazardous situations that could result in personal injury, while notices indicate a situation that could result in equipment or property-damage-only accidents.
Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

Warnings, Cautions and Notices appear at appropriate sections throughout this literature. Read these carefully.

⚠WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTE

Indicates a situation that could result in equipment or property-damage only accidents.

Note
Indicates something important to be noted by the reader.

★	Indicates default setting

High voltage warning

⚠WARNING

The voltage of the adjustable frequency drive is dangerous whenever it is connected to line power. Incorrect installation of the motor or adjustable frequency drive could result indeath, serious injury or damage to the equipment. Consequently, it is essential to comply with the instructions in this manual as well as local and national rules and safety regulations.

Safety Note

⚠WARNING

The voltage of the adjustable frequency drive is dangerous whenever connected to line power. Incorrect installation of the motor, adjustable frequency drive or serial communication bus could result in death, serious personal injury or damage to the equipment. Consequently, the instructions in this manual, as well as national and local rules and safety regulations, must be complied with.

⚠WARNING

Failure to follow instructions below could result in death or serious injury.

Safety Regulations

1. The adjustable frequency drive must be disconnected from line power if repair work is to be carried out. Make sure that the line power supply has been disconnected and that the necessary time has passed before removing motor and line power plugs.
2. The [STOP/RESET] key on the keypad of the adjustable frequency drive does not disconnect the equipment from line power and is thus 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. The ground leakage currents are higher than 3.5 mA.
5. Protection against motor overload is set by par.1-90 Motor Thermal Protection. If this function is desired, set par.1-90 Motor Thermal Protection to data value [ETR trip] (default value) or data value [ETR warning]. Note: The function is initialized at 1.16 x rated motor current and rated motor frequency. For the North American market: The ETR functions provide class 20 motor overload protection in accordance with NEC.
6. Do not remove the plugs for the motor and line power supply while the adjustable frequency drive is connected to line power. Make sure that the line power supply has been disconnected and that the necessary time has passed before removing motor and line power plugs.
7. Please note that the adjustable frequency drive has more voltage inputs than L1, L2 and L3, when load sharing (linking of DC intermediate circuit) and external 24 Vdc have been installed. Make sure that all voltage inputs have been disconnected and that the necessary time has passed before commencing repair work.

Installation at high altitudes

⚠WARNING

Installation at high altitude:
380–500 V, enclosure A, B and C: At altitudes above 6,561 ft [2 km], please contact Trane regarding PELV/Class II.
380–500 V, enclosure D, E and F: At altitudes above 9,842 ft [3 km], please contact Trane regarding PELV/Class II.
If the drive is to be installed over 6,561 ft, [2 km] altitude, then the PELV specifications are not fulfilled anymore, i.e., the distances between components and critical parts become too small. To maintain the clearance for functional insulation anyway, the risk for overvoltage must be reduced by means of external protective devices or some kind of galvanic isolation. De-rating should also be taken into consideration, since cooling the drive is more difficult at high altitude. Please contact Trane in such cases.

⚠WARNING

Warning against Unintended Start

1. The motor can be brought to a stop by means of digital commands, bus commands, references or a local stop, while the adjustable frequency drive is connected to line power. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient.
2. While parameters are being changed, the motor may start. Consequently, the stop key [STOP/RESET] must always be activated, following which data can be modified.
3. A motor that has been stopped may start if faults occur in the electronics of the adjustable frequency drive, or if a temporary overload or a fault in the supply line power or the motor connection ceases.

⚠WARNING

Touching the electrical parts could result in death or serious injury - even after the equipment has been disconnected from line power.

Also make sure that other voltage inputs have been disconnected, such as external 24 VDC, load sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic backup. Refer to the Instruction Manual for further safety guidelines.
Failure to follow recommendations could result in death or serious injury.

⚠WARNING

The adjustable frequency drive DC link capacitors remain charged after power has been disconnected. To avoid an electrical shock hazard, disconnect the adjustable frequency drive from line power before carrying out maintenance. Wait at least as follows before doing service on the adjustable frequency drive:
Failure to follow recommendations could result in death or serious injury.

Voltage (V)	Min. Waiting Time (Minutes)				
	4	15	20	30	40
200 - 240	1.5–5 hp [1.1–3.7 kW]	7.5–60 hp [5.5 –45 kW]			
380 - 480	1.5–10 hp [1.1–7.5 kW]	15–125 hp [11–90 kW]	150–350 hp [110–250 kW]		450–1350 hp [315–1000 kW]
525-600	1.5–10 hp [1.1–7.5 kW]	15–125 hp [11–90 kW]			
525-690		15–125 hp [11–90 kW]	60–550 hp [45–400 kW]	600–1875 hp [450–1400 kW]	

Be aware that there may be high voltage on the DC link even when the LEDs are turned off.

Before commencing repair work

⚠WARNING

Hazardous Voltage!

1. Disconnect the adjustable frequency drive from line power.
2. Disconnect DC bus terminals 88 and 89
3. Wait at least the time mentioned above in the section General Warning.
4. Remove motor cable

Failure to follow recommendations could result in death or serious injury.

Special conditions

Electrical ratings:
The rating indicated on the nameplate of the adjustable frequency drive is based on a typical 3-phase line power supply within the specified voltage, current and temperature ranges, which are expected to be used in most applications.

The adjustable frequency drives also support other special applications, which affect the electrical ratings of the adjustable frequency drive.
Special conditions that affect the electrical ratings might be:

- Single phase applications.
- High temperature applications that require derating of the electrical ratings.
- Marine applications with more severe environmental conditions.

Other applications might also affect the electrical ratings.

Consult the relevant sections in this manual and in the for information about the electrical ratings.

Installation requirements:
The overall electrical safety of the adjustable frequency drive requires special installation considerations regarding:

- Fuses and circuit breakers for overcurrent and short-circuit protection
- Selection of power cables (line power, motor, brake, load sharing and relay)
- Grid configuration (grounded delta transformer leg, IT,TN, etc.)
- Safety of low-voltage ports (PELV conditions).

Consult the relevant clauses in these instructions and in the for information about the installation requirements.

IT line power

⚠WARNING

Do not connect adjustable frequency drives with RFI filters to line power supplies with a voltage between phase and ground of more than 440 V for 400 V drives and 760 V for 690 V drives.
For 400 VT IT line power and delta ground (grounded leg), AC line voltage may exceed 440 V between phase and ground.
For 690 VT IT line power and delta ground (grounded leg), AC line voltage may exceed 760 V between phase and ground.
Failure to follow recommendations could result in death or serious injury.

Par.14-50 RFI 1 can be used to disconnect the internal RFI capacitors from the RFI filter to ground.

Software Version and Approvals: TR200

TR200
Software version:1.1.x

This manual can be used with all TR200 adjustable frequency drives with software version 1.1.x
The software version number can be seen from par.15-43 Software Version.

Disposal instructions

Equipment containing electrical components may not be disposed of together with domestic waste.
It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

Overview

Introduction

The adjustable frequency drive 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 RS485 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 adjustable frequency drive for communication over a Metasys network.

For specific information on operation of the drive, refer to the *TR200 Instruction Manual.*

About this Manual

This manual is for both instructional and 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 adjustable frequency drive.

References

In addition to this manual, the following two manuals should be consulted: *TR200 Instruction Manual* and *Johnson Controls METASYS N2 System Protocol Specification for Vendors, Johnson Controls number 04-3402-22, rev A*.

Instructions

Abbreviations and Definitions

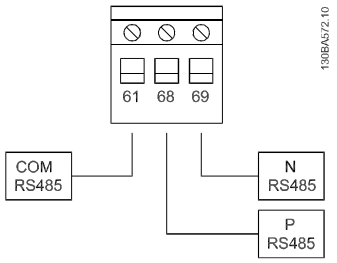
Abbreviations and definitions

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

Network Connection

Connect signal wires to terminal 68 (N+) and terminal 69 (N-) on main control board of the drive. If shielded cabling is used, connect one end of the shield to terminal 61. This terminal is connected to ground via an internal RC link. It is highly recommended to use twisted-pair cables to reduce the differential mode interference between the conductors

Torque Specifications:	4.5 in lb (0.5 Nm)
Control wire:	18 - 24 AWG, shielded, twisted pair



Hardware Set-up

RS485 Bus Connection:
One or more adjustable frequency drives can be connected to a control (or master) using the RS-485 standardized interface. Terminal 68 is connected to the P signal (TX+, RX+), while terminal 69 is connected to the N signal (TX-, RX-). If more than one adjustable frequency drive is connected to a master, use parallel connections.

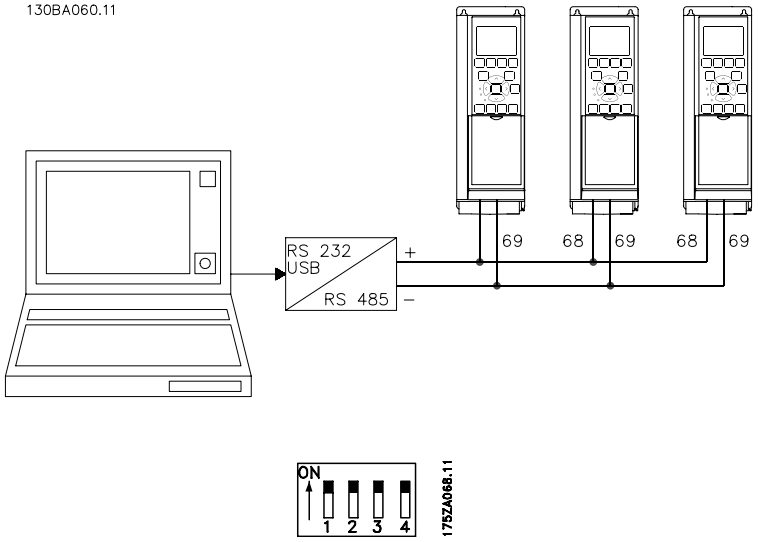


Figure 3. 1: Bus termination switch

In order to avoid potential equalizing currents in the screen, ground the cable shield via terminal 61, which is connected to the frame via an RC link.
Bus termination: The RS485 bus must be terminated by a resistor network at both ends. For this purpose, set switch S801 on the control card to "ON". For more information, see the paragraph: Switches S201, S202 and S801.

Note
Communication protocol must be set to Metasys N2 par. 8-30.

Error Codes

Error codes

Error Code 00	is issued after power-up or after a timeout in which all overridden points have been 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 message has a checksum error.
Error Code 03	is issued if the N2 message receive buffer exceeds 256 characters.
Error Code 05	is issued if the received N2 message is too long.
Error Code 10	is issued the data is out of expected range
Error Code 11	is issued when: 1 A point attributes or attribute bit is unused. . 2 A point attributes or attribute bit is for JCI use only. . 3 An internal data point attribute for current value 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 trip locked except for BO 5 "reset"

Drive Parameters

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

Parameter list

DRIVEPARAMETER	DESCRIPTION	DEFAULT	DESIRED SETTING
8-01	Control Side	Digital & Ctrl. Word	
8-02	Control Source	Drive Port	Drive Port
8-03	Control Word Timeout	60 s	1–18000 s
8-30	Protocol	Drive	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

General Commands (Acknowledged)

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

Table 3. 1: No Region, Attribute Number and Type in this table.

Analog Input Commands (Acknowledged)

DRIVE Response	Command	Subcommand	Region	NPA Object no.	Attribute No.	Attribute Message Type		Comments
ACK	1	-	1	0-23	1	Byte	Read Analog Input	Read Object Configuration attribute associated with each individual point
ACK	1	-	1	0-23	2	Byte	Read Analog Input	1) Read Object Status attribute associated with each individual point
ACK	1	-	1	0-23	3	Float	Read Analog Input	2) Read Analog Input Value attribute associated with each individual point
ACK	1	-	1	0-23	8	Float	Read Analog Input	Read Low Alarm attribute associated with each individual point
ACK	1	-	1	0-23	9	Float	Read Analog Input	Read Low Warning attribute associated with each individual point
ACK	1	-	1	0-23	10	Float	Read Analog Input	Read High Warning attribute associated with each individual point
ACK	1	-	1	0-23	11	Float	Read Analog Input	Read High Alarm attribute associated with each individual point
ACK	1	-	1	0-23	12	Float	Read Analog Input	Read Differential attribute associated with each individual point
ACK	2	-	1	0-23	1	Byte	Write Analog Input	Write to Object Configuration attribute associated with each individual point
ACK	2	-	1	0-23	8	Float	Write Analog Input	Write to Low Alarm Limit attribute associated with each individual point
ACK	2	-	1	0-23	9	Float	Write Analog Input	Write to Low Warning Limit attribute associated with each individual point
ACK	2	-	1	0-23	10	Float	Write Analog Input	Write to High Warning 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 adjustable frequency drive 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 adjustable frequency drive 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

Table 3. 2: No Error code in this table.

Analog Input Commands (Not Acknowledged)

DRIVE 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[1]	Read Linear Ranging Parameter 1 attribute associated with each individual point. (JCI use only)
NAK	1	1	0-23	5	Float	Read Analog Input	11[1]	Read Linear Ranging Parameter 2 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	2	Byte	Write Analog Input	11[1]	Object Status writeable
NAK	2	-	0-23	3	Float	Write Analog Input	11[1]	Analog Input Value not writeable
NAK	2	-	0-23	4	Float	Write Analog Input	11[1]	Write to Linear Ranging Parameter 1 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	5	Float	Write Analog Input	11[1]	Write to Linear Ranging Parameter 2 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	6	Float	Write Analog Input	11[1]	Write to Linear Ranging Parameter 3 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	7	Float	Write Analog Input	11[1]	Write to Linear Ranging Parameter 4 attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	13	Integer	Write Analog Input	11[1]	Write to Filter Weight attribute associated with each individual point. (JCI use only)
NAK	2	-	0-23	14	Float	Write Analog Input	11[1]	Write to AI Offset attribute associated with each individual point. (JCI use only)

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

Table 3. 3: No Subcommand column in this table.

Analog Output Commands (Acknowledged)

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

Table 3. 4: No Error Code column in this table.

Analog Output Commands (Not Acknowledged)

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

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

Table 3. 5: No Subcommand column in this table.

Binary Input (BI) Commands (Acknowledged)

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

Binary Input (BI) Commands (Not Acknowledged)

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

Table 3. 6: No Subcommand column in this table.

Binary Output Commands (Acknowledged)

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

Table 3. 7: No Error Code column in this table.

Binary Output (BO) Commands (Not Acknowledged)

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

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

Table 3. 8: No Subcommand column in this table.

Internal Integers (ADI) Commands (Acknowledged)

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

Table 3. 9: No Error Code column in this table.

Internal Floating Point Commands (Acknowledged)

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

Table 3. 10: No Error Code column in this table.

Start-up of the Adjustable Frequency Drive

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

Examples of typical settings. Program the following:

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

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

Example 1:

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

Message 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

Message code:

>XX72040401YY <CR>

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

Example 3:

Override 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

Message code:

>XX7203004E000000<CR>

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

Example 4:

Bus stop, BO override 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

Message code:

>XX72040400YY <CR>

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

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 3. 11: Reference/feedback values

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

Status Update Request

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

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

Status codes with associated alarms and descriptions

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

Read / Write Notes

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

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

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

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

The release after override timeout:

During an override release timeout, all points which are overridden, will be released in the order, which they are specified in Appendix POINTMAP:

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

Change of State (COS)/POLLING

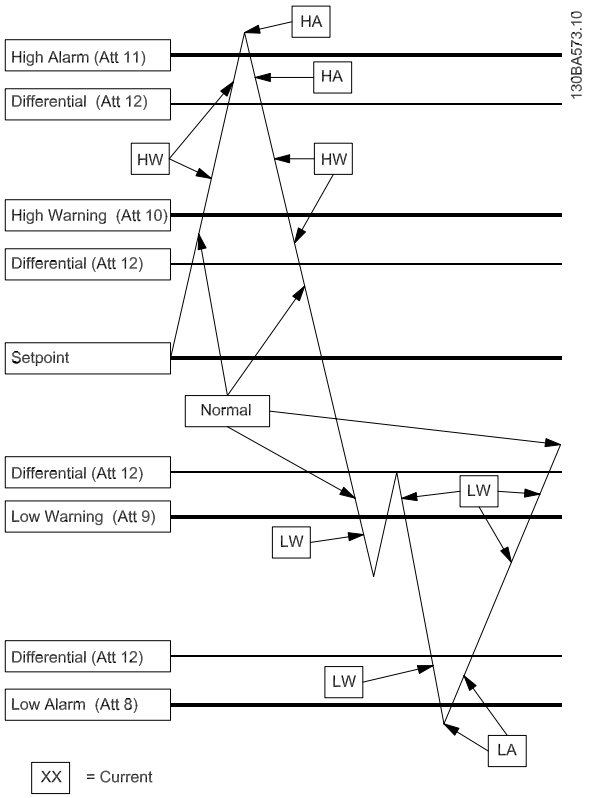
A change of state occurs when a new command has been issued for the drive. This command can be issued through the bus or through a drive related status change or command. The master can issue a series of poll commands to the network devices to get an update on any status changes from the time of the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

Handling of Poll Message Commands

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

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

The drawing below illustrates the AI COS handling.



For AI:

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

For BI:

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

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

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

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

Appendix

Analog Inputs (AI)

NPT	NPA	UNIT	DESCRIPTION	RANGE	PAR.NUM-BER
AI	0	%	Reference [%]	-	16-02
AI	1	-	Reference [Unit]	-	16-01
AI	2	-	Feedback	-	16-52
AI	3	Hz	Frequency	-	16-13
AI	4	-	User defined readout	-	16-09
AI	5	A	Current	-	16-14
AI	6	kW	Power	-	16-10
AI	7	hp	Power	-	16-11
AI	8	V	Output Voltage	-	16-12
AI	9	V	DC Voltage	-	16-30
AI	10	%	Motor Thermal Protec-tion	-	16-18
AI	11	%	Inverter Thermal Protec-tion	-	16-35
AI	12	V	Terminal 53 analog	-	16-62
AI	13	V	Terminal 54 analog	-	16-64
AI	14		Reserved	-	
AI	15		Reserved	-	
AI	16	%	External reference	-	16-50
AI	17	C	Heatsink temperature	-	16-34
AI	18	Hour	Operating hours	-	15-00
AI	19	Hour	Running hours	-	15-01
AI	20	kWh	kWh counter	-	15-02
AI	21	-	Number of Power-ups	-	15-03
AI	22	-	Number of Overtemps	-	15-04
AI	23	-	Number of Overvoltages	-	15-05
AI	24		Start-ups		15-08
AI	25		Torque [%]		16-22
AI	26		Speed [rpm]		16-17
AI	27		Analog Input, GPIO X30/11		16-75
AI	28		Analog Input, GPIO X30/12		16-76
AI	29		Analog Input X42/1	-20.000 to +20.000	18-30
AI	30		Analog Input, X42/3	-20.000 to +20.000	18-31
AI	31		Analog Input, X42/5	-20.000 to +20.000	18-32
AI	40		Bypass Running Hours	$0\text{-}2^{32}/10$	31-11

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

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

Binary Inputs (BI)

NPT	NPA	UNIT	DESCRIPTION	RANGE	PAR. NUMBER
BI	0	-	Timers Status	**0=OK**, 1=Limit	16-03
BI	1	-	Current Status	**0=OK**, 1=Limit	16-03
BI	2	-	Voltage Status	**0=OK**, 1=Limit	16-03
BI	3	-	Inverter Status	**0=OK**, 1 =Stall, Auto-start	16-03
BI	4	-	Running Status	**0=Not Running, 1**=Running	16-03
BI	5	-	Frequency Status	**0=Out of Range, 1**=In Range	16-03
BI	6	-	Control Status	**0=Local, 1**= Bus	16-03
BI	7	-	Reference Status	**0=Not on Ref., 1**=On Ref.	16-03
BI	8	-	Warning Status	**0=No Warning**, 1= Warning	16-03
BI	9	-	Tripped Status	**0=No Trip**, 1=Tripped	16-03
BI	10	-	Drive Enabled Status	**0=Not Enabled**, 1=Enabled	16-03
BI	11	-	Drive Ready Status	**0=Not Ready**, 1=Ready	16-03
BI	12	-	Drive Controller Status	**0=Not Ready**, 1=Ready	16-03
BI	16	-	AMA-ze suspicious UNOM	**0=OK**, 1=Warning	16-92
BI	17	-	AMA-ze suspicious INOM	**0=OK**, 1=Warning	16-92
BI	18	-	AMA-ze motor too big	**0=OK**, 1=Warning	16-92
BI	19	-	AMA-ze motor too small	**0=OK**, 1=Warning	16-92
BI	20	-	Frequency low	**0=OK**, 1=Warning	16-92
BI	21	-	Frequency high	**0=OK**, 1=Warning	16-92
BI	22	-	Current low	**0=OK**, 1=Warning	16-92
BI	23	-	Profibus warning	**0=OK**, 1=Warning	16-92
BI	24	-	Output frequency limited	**0=OK**, 1=Warning	16-92
BI	25	-	Current high	**0=OK**, 1=Warning	16-92
BI	26	-	Feedback low	**0=OK**, 1=Warning	16-92
BI	27	-	Feedback high	**0=OK**, 1=Warning	16-92
BI	28	-	Reference low	**0=OK**, 1=Warning	16-92
BI	29	-	10 Volt low	**0=OK**, 1=Warning	16-92
BI	30	-	Live zero error	**0=OK**, 1=Warning	16-92
BI	31	-	Phase loss	**0=OK**, 1=Warning	16-92
BI	32	-	DC link voltage high	**0=OK**, 1=Warning	16-92
BI	33	-	DC link voltage low	**0=OK**, 1=Warning	16-92
BI	34	-	DC link overvoltage	**0=OK**, 1=Warning	16-92
BI	35	-	DC link undervoltage	**0=OK**, 1=Warning	16-92
BI	36	-	Drive thermal	**0=OK**, 1=Warning	16-92
BI	37	-	Motor thermal	**0=OK**, 1=Warning	16-92
BI	38	-	Motor thermistor	**0=OK**, 1=Warning	16-92
BI	39	-	Current limit	**0=OK**, 1=Warning	16-92
BI	40	-	Overcurrent	**0=OK**, 1=Warning	16-92
BI	41	-	Standard bus timeout	**0=OK**, 1=Warning	16-92
BI	42	-	HPFB timeout	**0=OK**, 1=Warning	16-92
BI	43	-	EEPROM error power card	**0=OK**, 1=Warning	16-92

Binary Inputs (BI), continued..

NPT	NPA	UNIT	DESCRIPTION	RANGE	PAR. NUMBER
BI	44	-	EEPROM error control card	**0=OK**, 1=Warning	16-92
BI	45	-	Reference high	**0=OK**, 1=Warning	16-92
BI	46	-	Pwr. Card temp	**0=OK**, 1=Warning	16-92
BI	47	-	Brake check	**0=OK**, 1=Warning	16-92
BI	48	-	External fault (Safety interlock)	**0=OK**, 1=Alarm	16-90/91
BI	49	-	Current low	**0=OK**, 1=Alarm	16-90/91
BI	50	-	Inverter fault	**0=OK**, 1=Alarm	16-90/91
BI	51	-	Profibus fault	**0=OK**, 1=Alarm	16-90/91
BI	52	-	Missing motor phase U	**0=OK**, 1=Alarm	16-90/91
BI	53	-	Missing motor phase V	**0=OK**, 1=Alarm	16-90/91
BI	54	-	Missing motor phase W	**0=OK**, 1=Alarm	16-90/91
BI	55	-	Overtemperature	**0=OK**, 1=Alarm	16-90/91
BI	56	-	Live zero	**0=OK**, 1=Alarm	16-90/91
BI	57	-	Phase loss	**0=OK**, 1=Alarm	16-90/91
BI	58	-	DC link overvoltage	**0=OK**, 1=Alarm	16-90/91
BI	59	-	DC link undervoltage	**0=OK**, 1=Alarm	16-90/91
BI	60	-	Drive thermal	**0=OK**, 1=Alarm	16-90/91
BI	61	-	Motor thermal	**0=OK**, 1=Alarm	16-90/91
BI	62	-	Motor thermistor	**0=OK**, 1=Alarm	16-90/91
BI	63	-	Current limit	**0=OK**, 1=Alarm	16-90/91
BI	64	-	Overcurrent	**0=OK**, 1=Alarm	16-90/91
BI	65	-	Ground fault	**0=OK**, 1=Alarm	16-90/91
BI	66	-	Supply fault	**0=OK**, 1=Alarm	16-90/91
BI	67	-	Short circuit	**0=OK**, 1=Alarm	16-90/91
BI	68	-	Std bus timeout	**0=OK**, 1=Alarm	16-90/91
BI	69	-	HPFB timeout	**0=OK**, 1=Alarm	16-90/91
BI	70	-	AMA fault	**0=OK**, 1=Alarm	16-90/91
BI	71	-	Trip lock	**0=Trip, 1**=Trip lock	16-90/91
BI	72	-	Unknown fault	**0=OK**, 1=Alarm	16-90/91
BI	73	-	Torque Limit	**0=OK**, 1=Alarm	16-90/91
BI	74	-	Overcurrent	**0=OK**, 1=Alarm	16-90/91
BI	75	-	Ctrl. Word Timeout	**0=OK**, 1=Alarm	16-90/91
BI	76	-	Ctrl. Card temp	**0=OK**1=Alarm	16-90/91
BI	77	-	Ground fault	**0=OK**, 1=Alarm	16-90/91
BI	78	-	Pwr. Card temp	**0=OK**, 1=Alarm	16-90/91
BI	79	-	Brake check	**0=OK**, 1=Alarm	16-90/91
BI	80	-		**0=FALSE**, 1=TRUE	16-94/95
BI	81	-		**0=FALSE**, 1=TRUE	16-94/95
BI	82	-		**0=FALSE**, 1=TRUE	16-94/95
BI	83	-	Start inhibit	**0=FALSE**, 1=TRUE	16-94/95
BI	84	-	Control ready	**0=FALSE**, 1=TRUE	16-94/95
BI	85	-	Unit ready	**0=FALSE**, 1=TRUE	16-94/95
BI	86	-	Relay 123	**0=FALSE**, 1=TRUE	16-94/95
BI	87	-	Enabled	**0=FALSE**, 1=TRUE	16-94/95
BI	88	-	DC stop	**0=FALSE**, 1=TRUE	16-94/95
BI	89	-	Stop	**0=FALSE**, 1=TRUE	16-94/95
BI	90	-	Standby	**0=FALSE**, 1=TRUE	16-94/95
BI	91	-	Jog request	**0=FALSE**, 1=TRUE	16-94/95
BI	92	-	Jogging	**0=FALSE**, 1=TRUE	16-94/95
BI	93	-	Freeze request	**0=FALSE**, 1=TRUE	16-94/95
BI	94	-	Freeze output	**0=FALSE**, 1=TRUE	16-94/95
BI	95	-	Run request	**0=FALSE**, 1=TRUE	16-94/95
BI	96	-	Run request signal	**0=FALSE**, 1=TRUE	16-94/95
BI	97	-	Hand mode	**0=Auto mode, 1**=Hand mode	16-94/95

Binary Inputs (BI), continued..

NPT	NPA	UNIT	DESCRIPTION	SELECTION	PAR. NUMBER
BI	98	-	Off	**0=FALSE**, 1=TRUE	16-94/95
BI	99	-	Local Reference	**0=Remote ref., 1**=Local ref.	16-94/95
BI	100	-	Running	**0=FALSE**, 1=TRUE	16-94/95
BI	101	-	Running at reference	**0=FALSE**, 1=TRUE	16-94/95
BI	102	-	Reverse direction	**0=FALSE**, 1=TRUE	16-94/95
BI	103	-	Ramping	**0=FALSE**, 1=TRUE	16-94/95
BI	104	-	Start forward reverse	**0=FALSE**, 1=TRUE	16-94/95
BI	105	-	Adaptive tuning running	**0=FALSE**, 1=TRUE	16-94/95
BI	106	-	Adaptive tuning finished	**0=FALSE**, 1=TRUE	16-94/95
BI	107	-	Sleep mode	**0=FALSE**, 1=TRUE	16-94/95
BI	108	-	Sleep boost	**0=FALSE**, 1=TRUE	16-94/95
BI	109	-	Start delay	**0=FALSE**, 1=TRUE	16-94/95
BI	110	-	OVC active (Auto ramp)	**0=FALSE**, 1=TRUE	16-94/95
BI	112	-	Ramp	**0=RAMP 1**, 1=RAMP 2	16-00
BI	113	-	Reverse	**0=No function**, 1=reverse	16-00
BI	114	-	Set-up MSB	**0=FALSE**, 1=TRUE	16-00
BI	115	-	Set-up LSB	**0=FALSE**, 1=TRUE	16-00
BI	116	-	Relay02	**0=Relay04 off**, 1=Relay04 on	16-00
BI	117	-	Relay01	**0=Relay01 off**, 1=Relay01 on	16-00
BI	118	-	Res., always 0 (data valid)	**0=FALSE**	16-00
BI	119	-	Jog	**0=No Function**, 1=Jog	16-00
BI	120	-	Reset	**0=No Function**, 1=Reset	16-00
BI	121	-	Start	**0=start**, 1=stop	16-00
BI	122	-	Freeze output	**0=Freeze output**, 1=Ramping	16-00
BI	123	-	Q-stop	**0=Q-stop**, 1=Ramping	16-00
BI	124	-	Coast	**0=Coasting**, 1=no Coast	16-00
BI	125	-	DC brake	**0=DC Brake**, 1=Ramp stop	16-00
BI	126	-	Preset ref. MSB	**0=FALSE**, 1=TRUE	16-00
BI	127	-	Preset ref. LSB	**0=FALSE**, 1=TRUE	16-00
BI	128	-	Terminal 33	**0=FALSE**, 1=TRUE	16-60
BI	129	-	Terminal 32	**0=FALSE**, 1=TRUE	16-60
BI	130	-	Terminal 29	**0=FALSE**, 1=TRUE	16-60
BI	131	-	Terminal 27	**0=FALSE**, 1=TRUE	16-60
BI	132	-	Terminal 19	**0=FALSE**, 1=TRUE	16-60
BI	133	-	Terminal 18	**0=FALSE**, 1=TRUE	16-60
BI	134	-	GPIO Term X30/2	**0=FALSE**, 1=TRUE	16-60
BI	135	-	GPIO Term X30/3	**0=FALSE**, 1=TRUE	16-60

Binary Inputs (BI), continued..

NPT	NPA	UNIT	DESCRIPTION	SELECTION	PAR. NUMBER
BI	136	-	GPIO Terminal X30/4	**0=FALSE**, 1=TRUE	16-60
BI	150	-	ECB Manual Bypass Override	**0=FALSE**, 1=TRUE	31-10
BI	151	-	ECB External Interlock	**0=FALSE**, 1=TRUE	31-10
BI	152	-	ECB M3 Contactor Fault	**0=FALSE**, 1=TRUE	31-10
BI	153	-	ECB M2 Contactor Fault	**0=FALSE**, 1=TRUE	31-10
BI	154	-	ECB Overload Trip	**0=FALSE**, 1=TRUE	31-10
BI	155	-	ECB Motor running from bypass/drive	**0=FALSE**, 1=TRUE	31-10
BI	156	-	ECB Reserved	**0=FALSE**, 1=TRUE	31-10
BI	157	-	ECB Bypass Mode	**0=FALSE**, 1=TRUE	31-10
BI	158	-	ECB Automatic Bypass Mode	**0=FALSE**, 1=TRUE	31-10
BI	159	-	ECB Drive Mode	**0=FALSE**, 1=TRUE	31-10
BI	160	-	ECB Test Mode	**0=FALSE**, 1=TRUE	31-10

The values marked in **bold** are default values

Analog Outputs (AO)

NPT	NPA	UNIT	DESCRIPTION	RANGED	PAR. NUMBER
AO	0	%	Bus reference[1]	-200 to 200 Proportionally mapped into the range -32768 to 32767	-
AO	1		Bus feedback 1	Please refer to [4]	8-94
AO	2		Bus feedback 2	Please refer to [4]	8-95
AO	3		Bus feedback 3	Please refer to [4]	8-96
AO	4		Analog Output Term 42		6-53
AO	5		Pulse Output Term 27		5-93
AO	6		Pulse Output Term 29		5-95
AO	7		GPIO Analog Output Terminal X30/8		6-63
AO	8		Analog Option Output Terminal X42/7		26-53
AO	9		Analog Option Output Terminal X42/9		26-63
AO	10		Analog Option Output Terminal X42/11		26-60

1) Please refer to scaling of Bus Reference and Feedback, Section on Scaling or Bus Reference and Feedbacks.

Binary Outputs (BO)

NPT	NPA	UNIT	DESCRIPTION	RANGE [1]	PAR. NUMBER
BO	0	-	DC brake inverse	0=Active, **1=Not Active**	16-00
BO	1	-	Coast inverse	0=Active, **1=Not Active**	16-00
BO	2	-	Stop inverse	0=Active, **1=Not Active**	16-00
BO	3	-	Freeze output inverse	0=Active, **1=Not Active**	16-00
BO	4	-	Start	**0=Not active**, 1=Active	16-00
BO	5	-	Stop	**0=Not active**, 1=Active	16-00
BO	6	-	Jog	**0=Not active**, 1=Active	16-00
BO	8	-	Relay01	**0=Not active**, 1=Active	16-00
BO	9	-	Relay02	**0=Not active**, 1=Active	16-00
BO	10	-	Reversing	**0=Not active**, 1=Active**0=Not active**, 1=Active	16-00
BO	11	-	Set-up LSB	**0=Not active**, 1=Active	16-00
BO	12	-	Set-up MSB	**0=Not active**, 1=Active	16-00
BO	13	-	Preset ref. LSB	**0=Not active**, 1=Active	16-00
BO	14	-	Preset ref. MSB	**0=Not active**, 1=Active	16-00
BO	20	-	Output Terminal 27	**0=Not active**, 1=Active	5-90
BO	21	-	Output Terminal 29	**0=Not active**, 1=Active	5-90
BO	22	-	Output Terminal X30/6	**0=Not active**, 1=Active	5-90
BO	23	-	Output Terminal X30/7	**0=Not active**, 1=Active	5-90
BO	24	-	CC Relay 1	**0=Not active**, 1=Active	5-90
BO	25	-	CC Relay 2	**0=Not active**, 1=Active	5-90
BO	26	-	Option B Relay 1	**0=Not active**, 1=Active	5-90
BO	27	-	Option B Relay 2	**0=Not active**, 1=Active	5-90
BO	28	-	Option B Relay 3	**0=Not active**, 1=Active	5-90
BO	29	-	Reserved	**0=Not active**, 1=Active	5-90
BO	30	-	Reserved	**0=Not active**, 1=Active	5-90
BO	31	-	Reserved	**0=Not active**, 1=Active	5-90
BO	32	-	Reserved	**0=Not active**, 1=Active	5-90
BO	33	-	Reserved	**0=Not active**, 1=Active	5-90
BO	34	-	Reserved	**0=Not active**, 1=Active	5-90
BO	35	-	Reserved	**0=Not active**, 1=Active	5-90
BO	36	-	Option C Relay 1	**0=Not active**, 1=Active	5-90
BO	37	-	Option C Relay 2	**0=Not active**, 1=Active	5-90
BO	38	-	Option C Relay 3	**0=Not active**, 1=Active	5-90
BO	39	-	Option C Relay 4	**0=Not active**, 1=Active	5-90
BO	40	-	Option C Relay 5	**0=Not active**, 1=Active	5-90
BO	41	-	Option C Relay 6	**0=Not active**, 1=Active	5-90
BO	42	-	Option C Relay 7	**0=Not active**, 1=Active	5-90
BO	43	-	Option C Relay 8	**0=Not active**, 1=Active	5-90
BO	44	-	Reserved	**0=Not active**, 1=Active	5-90
BO	45	-	Reserved	**0=Not active**, 1=Active	5-90
BO	46	-	Reserved	**0=Not active**, 1=Active	5-90
BO	47	-	Reserved	**0=Not active**, 1=Active	5-90
BO	48	-	Reserved	**0=Not active**, 1=Active	5-90
BO	49	-	Reserved	**0=Not active**, 1=Active	5-90
BO	50	-	Reserved	**0=Not active**, 1=Active	5-90
BO	52	-	ECB Activate		31-19
BO	60	-	No Flow Detection	**0=Not active**, 1=Active	22-10
BO	61	-	Enable Interval between starts	**Disable**, 1=Enable	22-75

1) The values in **BOLD** are the default values.

Internal Floating Point (ADF)

NPT	NPA	UNIT	DESCRIPTION	RANGE	PAR. NUMBER
ADF	0	-	Max value of custom readout	Please refer to	0-30
ADF	10	kW	Motor power		1-20
ADF	11	V	Motor voltage		1-22
ADF	12	Hz	Motor frequency		1-23
ADF	13	A	Motor Current (IM.N)		1-24 (mAmp)
ADF	14	RPM	Motor nom. Speed		1-25
ADF	16	%	Resonance damping		1-64
ADF	18	Sec	Start delay		1-71 (mSec!)
ADF	19	%	Preheat DC-current		2-00
ADF	20	%	DC brake current		2-01
ADF	21	Sec	DC braking time		2-02
ADF	22	Hz	DC brake cut-in frequency		2-04
ADF	30	Hz	Output freq. low limit (FMIN)		4-12
ADF	31	Hz	Output freq. high limit (FMAX)		4-19
ADF	32	Unit	Min reference (RefMIN)		3-02
ADF	33	Unit	Max. reference (RefMAX)		3-03
ADF	34	Sec	Ramp-up Time		3-41
ADF	35	Sec	Ramp Down Time		3-42
ADF	36	Hz	Jog Frequency		3-11
ADF	37	%	Digital Reference 1		3-10:0
ADF	38	%	Digital Reference 2		3-10:1
ADF	39	%	Digital Reference 3		3-10:2
ADF	40	%	Digital Reference 4		3-10:3
ADF	41	A	Current Limit		4-51
ADF	42	Hz	Frequency bypass bandwidth		4-61:0
ADF	43	Hz	Frequency 1 Bypass		4-63:0
ADF	44	Hz	Frequency 2 Bypass		4-61:1
ADF	45	Hz	Frequency 3 Bypass		4-63:1
ADF	46	Hz	Frequency 4 Bypass		4-61:2
ADF	47	A	Warning Current Low (ILOW)		4-63:2
ADF	48	A	Warning Current High (IHIGH)		4-61:3
ADF	49	Hz	Warning Freq. Low (FLOW)		4-63:3

Internal Floating Point (ADF), continued..

NPT	NPA	UNIT	DESCRIPTION	RANGE	PAR. NUMBER
ADF	50	A	Warning Current Low (I_{LOW})		4-50
ADF	51	A	Warning Current High (I_{HIGH})		4-51
ADF	52	Hz	Warning Freq. Low (F_{LOW})		4-52
ADF	53	Hz	Warning Freq. High (F_{HIGH})		4-53
ADF	54	Unit	Warning Low Ref. (Ref_{LOW})		4-54
ADF	55	Unit	Warning High Ref. (Ref_{HIGH})		4-55
ADF	56	Unit	Warning Low FB. (FB_{LOW})		4-56
ADF	57	Unit	Warning High FB. (FB_{HIGH})		4-57
ADF	60	Unit	Warning High Ref. (Ref_{HIGH})		6-10
ADF	61	Unit	Warning Low FB. (FB_{LOW})		6-11
ADF	62	Unit	Warning High FB. (FB_{HIGH})		6-12
ADF	63	V	Terminal 53 min. scale V		6-13
ADF	64	V	Terminal 53 max. scale V		6-20
ADF	65	V	Terminal 54 min. scale V		6-21
ADF	66	V	Terminal 54 max. scale V		6-22
ADF	67	A	Terminal 54 min. scale mA		6-23
ADF	68	Hz	Terminal 42 output puls scale		5-62
ADF	69	Hz	Terminal 45 output puls scale		5-65
ADF	70	mSec	CC Relay 1 ON Delay		5-41:0
ADF	71	mSec	CC Relay 1 ON Delay	0.01 to 600.00	5-42:0
ADF	72	mSec	CC Relay 1 ON Delay	0.01 to 600.00	5-41:1
ADF	73	Sec	CC Relay 1 ON Delay	0.01 to 600.00	5-42:1
ADF	80	Sec	No Flow Timer		22-24
ADF	81	Sec	Dry Pump Timer		22-27
ADF	82	Sec	Minimum Run Time		22-40
ADF	83	Hz	Minimum Sleep Time		22-41
ADF	84	%	Boost setpoint		22-45
ADF	85	Hz	Wake-up Speed		22-43
ADF	86	Sec	Minimum Boost Time		22-46
ADF	87	kHz	Switch Frequency		14-01
ADF	88	Unit	Setpoint 1		20-21
ADF	89	Unit	Setpoint 2		20-22
ADF	90	Hz	PID Start Frequency		20-83
ADF	91	-	PID Proportional Gain		20-93
ADF	92	Sec	PID Integration Time		20-94
ADF	93	Sec	PID Differentiation Time		20-95
ADF	94	-	PID D-gain Limit		20-96
ADF	95	Unit	Setpoint 3		20-23

Internal Floating Point (ADF), continued..

NPT	NPA	UNIT	DESCRIPTION	RANGE	PARAMETER NUMBER
ADF	100	-	Control Timeout Function		8-04
ADF	101	-	Control Timeout Time		8-03
ADF	110	Sec	Option B Relay 1 ON Delay	0.01 to 600.00	5-41:6
ADF	111	Sec	Option B Relay 1 OFF Delay	0.01 to 600.00	5-42:6
ADF	112	Sec	Option B Relay 2 ON Delay	0.01 to 600.00	5-41:7
ADF	113	Sec	Option B Relay 2 OFF Delay	0.01 to 600.00	5-42:7
ADF	114	Sec	Option B Relay 3 ON Delay	0.01 to 600.00	5-41:8
ADF	115	Sec	Option B Relay 3 OFF Delay	0.01 to 600.00	5-42:8
ADF	120	V	Analog Input X30/11 Low Voltage	0.07 to 10.00	6-30
ADF	121	V	Analog Input X30/1 High Voltage	0.07 to 10.00	6-31
ADF	122	V	Analog Input X30/12 Low Voltage	0.07 to 10.00	6-40
ADF	123	V	Analog Input X30/12 High Voltage	0.07 to 10.00	6-41
ADF	124	V	Analog Input X42/1 Low Voltage	0.07 to 10.00	26-10
ADF	125	V	Analog Input X42/1 High Voltage	0.07 to 10.00	26-11
ADF	126	V	Analog Input X42/3 Low Voltage	0.07 to 10.00	26-20
ADF	127	V	Analog Input X42/3 High Voltage	0.07 to 10.00	26-21
ADF	128	V	Analog Input X42/5 Low Voltage	0.07 to 10.00	26-30
ADF	129	V	Analog Input X42/5 High Voltage	0.07 to 10.00	26-31
ADF	130	%	Analog Output 42 Timeout Preset		6-54
ADF	131	%	Analog Output X30/8 Timeout Preset		6-64
ADF	132	%	Analog Output X42/7 Timeout Preset	0.00 to 100.00	26-54
ADF	133	%	Analog Output X42/9 Timeout Preset	0.00 to 100.00	26-64
ADF	134	%	Analog Output X42/11 Timeout Preset	0.00 to 100.00	26-74

[1] "Feedback" if closed-loop - and "100 Hz" if open-loop

[2] Unit is power dependent

[3] The drive must be stopped to change this point

[4] The point is global in all 4 set-ups

[5] Not availabele in all units.

Internal Integers (ADI)

NPT	NPA	UNIT	DESCRIPTION	RANGE	PAR. NUMBER
ADI	0	-	Language Selection		0-01
ADI	1	-	Set-up Copy Function		0-51
ADI	2	-	Custom Readout Unit		0-30
ADI	3	-	Large Readout		0-23
ADI	4	-	Small Readout 1		0-20
ADI	5	-	Small Readout 2		0-21
ADI	6	-	Small Readout 3		0-22
ADI	7	-	Unit of Local Reference		0-05
ADI	8	-	Hand Start Button		0-40
ADI	9	-	Off/Stop Button		0-41
ADI	10	-	Auto Start Button		0-42
ADI	11	-	Reset Button		0-43
ADI	13	-	Operating State at Power-up		0-04
ADI	20	-	Configuration Mode		1-00
ADI	21	-	Torque Characteristics		1-03
ADI	22	-	Automatic Motor Adaptation		1-29
ADI	23	-	Motor Preheat		2-00
ADI	24	-	Motor Thermal Protection		1-90
ADI	31	-	Reference Site		3-13
ADI	32	-	Over Volt Control		2-17
ADI	33	-	Reference Function		3-04
ADI	40	-	Digital Input 18		5-10
ADI	41	-	Digital Input 19		5-11
ADI	42	-	Digital Input 27		5-12
ADI	43	-	Digital Input 29		5-13
ADI	44	-	Digital Input 32		5-14
ADI	45	-	Digital Input 33		5-15
ADI	46	-	Reference 1 Source		3-15
ADI	47	-	Feedback 1 Source		20-00
ADI	48	-	Feedback 2 Source		20-03
ADI	51	Sec	Live Zero Timeout		6-00
ADI	52	-	Live Zero Function		6-01
ADI	53	-	Signal Output 42		6-50
ADI	55	-	CC Relay 1 Function	0 to 255	5-40:0
ADI	56	-	CC Relay 2 Function	0 to 255	5-40:1
ADI	57	-	Option B Relay 1 Function	0 to 255	5-40:6
ADI	58	-	Option B Relay 2 Function	0 to 255	5-40:7
ADI	59	-	Option B Relay 3 Function	0 to 255	5-40:8
ADI	60	-	Reset Function		14-20
ADI	61	-	Flying Start		1-73
ADI	62	-	Noise Reduction Method		14-04

Internal Integers (ADI), continued..

NPT	NPA	UNIT	DESCRIPTION	RANGE	PARAMETER NUMBER
ADI	63	-	Broken Belt Function		22-60
ADI	64	Sec	Trip Delay on Overload		14-25
ADI	68	-	PID Normal/Inverse		20-81
ADI	69	-	PID Anti Windup		20-91
ADI	70	-	Feedback 1 Conversion		20-01
ADI	71	-	Feedback 1 Source Unit		20-02
ADI	72	-	Feedback 2 Conversion		20-04
ADI	73	-	Feedback 2 Source Unit		20-05
ADI	74	-	Reference/Feedback Unit		20-12
ADI	75	-	Two Feedback Calculation		20-20
ADI	80	-	Coasting		8-50
ADI	81	-	DC Brake		8-52
ADI	82	-	Start		8-53
ADI	83	-	Reversing		8-54
ADI	84	-	Selection of Set-up		8-55
ADI	85	-	Selection of Speed		8-56
ADI	90	-	Reset kWh Counter		15-06
ADI	91	-	Reset Running Hours Counter		15-07
ADI	92	-	Operation Mode		14-22
ADI	101	-	Analog Input X42/1 Mode	0 to 3	26-00
ADI	102	-	Analog Input X42/3 Mode	0 to 3	26-01
ADI	103	-	Analog Input X42/5 Mode	0 to 3	26-02
ADI	104	-	Analog Input X30/8 Mode		6-60
ADI	105	-	Analog Input X42/7 mode	0 to 145	26-50
ADI	106	-	Analog Input X42/9 Mode		26-60
ADI	107	-	Analog Input X42/11 Mode		26-70
ADI	110	-	ECB Bypass Mode		31-00
ADI	111	-	ECB Bypass Start Timer Delay		31-01
ADI	112	-	ECB Bypass Trip Bypass Delay		31-02
ADI	120	-	Dry Pump Function		22-26
ADI	121	-	Broken Belt Action		22-60
ADI	122	%	Broken Belt Torque		22-61
ADI	123	sec	Broken Belt Timer		22-62
ADI	124	sec	Interval Between Starts		22-76
ADI	125	sec	Minimum Run Time		22-77
ADI	254	-	Active Set-up	[4]	0-10K-10

[3] Drive must be stopped to change this point

[4] The point is global in all 4 set-ups

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