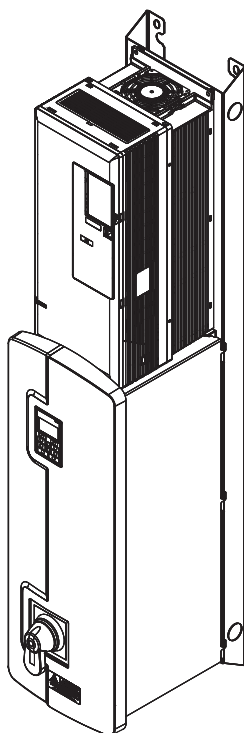




Yaskawa AC Drive - Z1000 Bypass Network Protocol **Metasys® N2** Technical Manual

Type: Z1B1

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.



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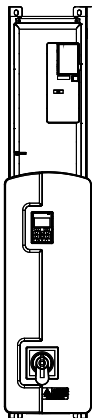
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1 Preface and Safety

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer or end user. Yaskawa accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Yaskawa product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Yaskawa must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Yaskawa must be promptly provided to the end user. Yaskawa offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Yaskawa manual. **NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED.** Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

◆ Applicable Documentation

The following manuals are available for the Z1000 Bypass:

	Yaskawa AC Drive Z1000 Bypass Technical Manual for HVAC Fan and Pump (SIEPYAIZ1B01)
	Read this manual first. This manual is packaged together with the product and contains basic information required to install and wire the bypass. It also gives detailed information on fault diagnostics, parameter settings, and BACnet specifications. The purpose of this manual is to prepare the Z1000 Bypass for a trial run with an application and for basic operation. This manual is also available for download on the Yaskawa documentation website, www.yaskawa.com .
	Z1000-Series AC Drive User Manual (TOEPC71061645)
	This manual contains basic information required to install and wire the drive. It also gives detailed information on fault diagnostics, parameter settings, and BACnet specifications. The purpose of this manual is to prepare the drive for a trial run with an application and for basic operation. This manual is available for download on the Yaskawa documentation website, www.yaskawa.com .
	Z1000-Series AC Drive Programming Manual (SIEPC71061645)
	This manual provides detailed information on parameter settings, drive functions, maintenance, and MEMOBUS/Modbus specifications. Use this manual to expand drive functionality. This manual is available for download on the Yaskawa documentation website, www.yaskawa.com .

■ Software Applicability

The Metasys N2 communication protocol is applicable in Z1000 drive software version VSE910000.

◆ Terms

Note: Indicates supplemental information that is not related to safety messages.

Drive: Yaskawa Z1000-Series Drive

Bypass: Yaskawa Z1000 Bypass

◆ Registered Trademarks

Metasys® N2 is a trademark of Johnson Controls, Inc.

All other trademarks are the property of their respective owners.

◆ Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this option. The option must be installed according to this manual and local codes.

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

WARNING

Read and understand this manual before installing, operating or servicing this drive. The drive must be installed according to this manual and local codes.

⚠ WARNING

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or fatal injury or damage to the products or to related equipment and systems.

⚠ DANGER

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

⚠ WARNING

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

WARNING! may also be indicated by a bold key word embedded in the text followed by an italicized safety message.

⚠ CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

CAUTION! may also be indicated by a bold key word embedded in the text followed by an italicized safety message.

NOTICE

Indicates a property damage message.

NOTICE: may also be indicated by a bold key word embedded in the text followed by an italicized safety message.

■ General Safety**General Precautions**

- The diagrams in this manual may be indicated without covers or safety shields to show details. Replace the covers or shields before operating the drive and run the drive according to the instructions described in this manual.
- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.
- When ordering a new copy of the manual due to damage or loss, contact your Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover.
- If nameplate becomes worn or damaged, order a replacement from your Yaskawa representative or the nearest Yaskawa sales office.

⚠ DANGER**Heed the safety messages in this manual.**

Failure to comply will result in death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

Electrical Shock Hazard**Do not connect or disconnect wiring while the power is on.**

Failure to comply will result in death or serious injury.

Failure to comply will result in death or serious injury. Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait for at least the time specified on the warning label once all indicators are OFF, and then measure the DC bus voltage level to confirm it has reached a safe level.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Do not perform a withstand voltage test on any part of the drive.

Failure to comply could result in damage to the sensitive devices within the drive.

Do not operate damaged equipment.

Failure to comply could result in further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

Do not expose the drive to halogen group disinfectants.

Failure to comply may cause damage to the electrical components in the drive.

Do not pack the drive in wooden materials that have been fumigated or sterilized.

Do not sterilize the entire package after the product is packed.

2 N2 Specifications and Configuration

The bypasses can be monitored and controlled by a controller on a Metasys N2 network (N2) using RS-485 technology. The bypass act as slaves on the N2 network.

Up to 255 bypasses can communicate on a single N2 network. If more bypasses or N2 devices are required, another N2 network is required.

The N2 node address is configurable by a parameter in the bypass. This defines the physical address of the bypass on the N2 network.

Once the addressing is set, a controller can initiate communication to the bypass. The bypass will perform the specified function and then send a response back to the controller.

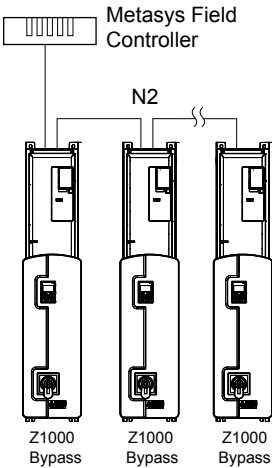


Figure 1 Connecting Multiple Bypasses to a Metasys N2 Network

N2 specifications appear in the following table:

Item	Specifications
Interface	RS-485
Communication Parameters	Communication Speed: 9600 bps Data Length: 8-bit (fixed) Parity: None Stop Bit: 1-bit (fixed)
Protocol	Metasys N2
Max Number of Drives	255 per N2 Network Segment

3 Connecting to a Network

This section explains how to connect the drive to an N2 network and the network termination required for a connection.

◆ Network Cable Connection

Follow the instructions below to connect the bypass to a N2 network.

1. With the power shut off, connect the communications cable to the bypass controller and the master. Use terminal TB3 for N2.

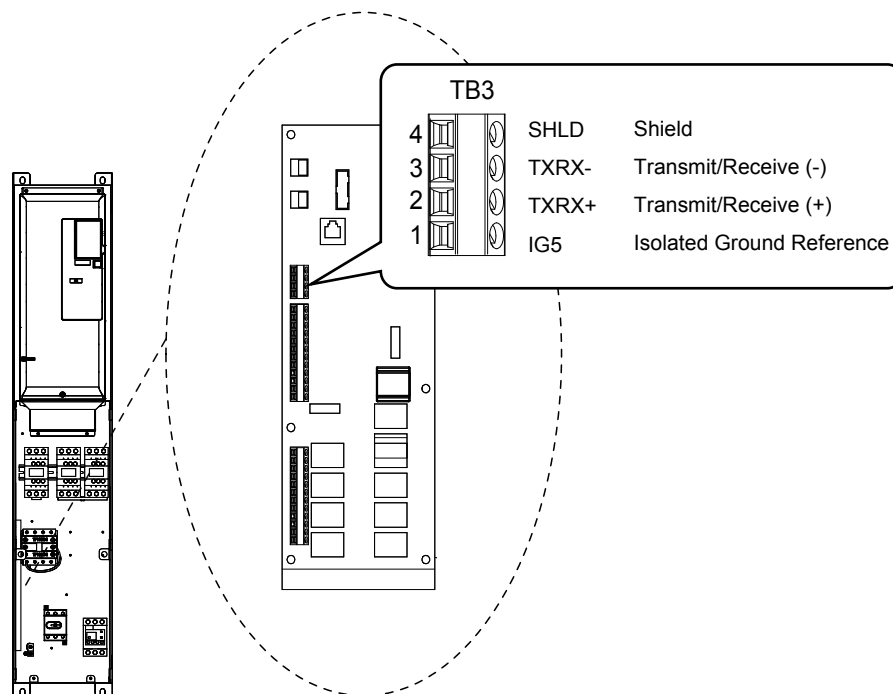


Figure 2 Serial Communications Cable Connection Terminal (TB3)

Note: Separate the communications cables from the main circuit cables and other wiring and power cables. Use shielded cables for the communications cables, and properly shielded clamps to prevent problems caused by electrical interference.

2. Check or set the termination resistor selection at all slaves. Refer to the description in the **Network Termination** section for details on the termination resistor.
3. Switch the power on.
4. Set the parameters needed for serial communications (Z3-01 through Z3-11) using the digital operator.
5. Shut the power off and wait until the display on the digital operator goes out completely.
6. Turn the power back on.
7. The bypass is now ready to begin communicating with the master.

◆ Wiring Diagram for Multiple Connections

Figure 3 explains the wiring diagrams for multiple connections using N2 communication.

■ RS-485 Interface

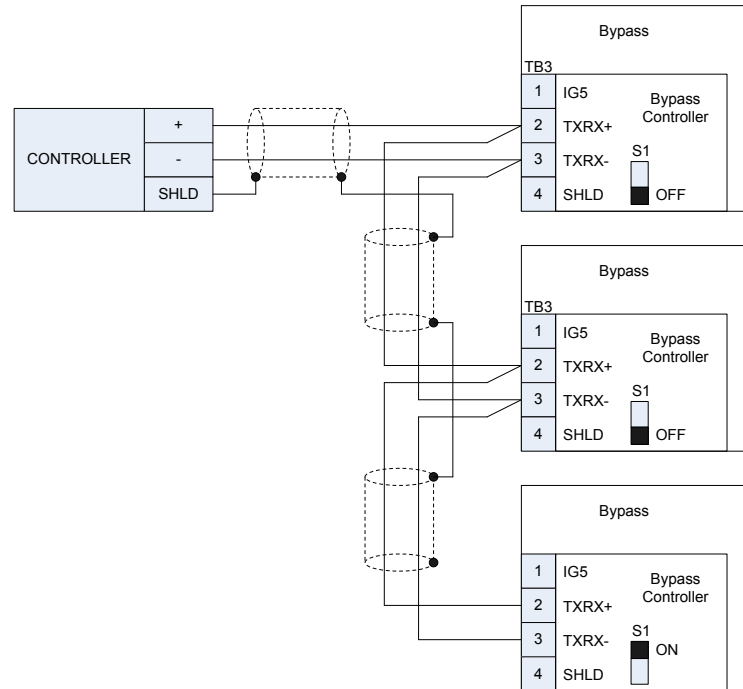


Figure 3 RS-485 Interface

Note: Turn on DIP switch S1 on the bypass that is located at the end of the network. If S1 is missing, then an external 120 ohm resistor must be placed across terminals TXRX+ and TXRX-. All other slave devices must have this DIP switch set to the OFF position (or if S1 is missing, no external resistor must be used).

◆ Network Termination

The two ends of the network line must be terminated with a 120 ohm resistor between the TXRX+ and TXRX- signals. The Z1000 Bypass has a built in termination resistor that can be enabled or disabled using DIP switch S1. If a bypass is located at the end of a network line, enable the termination resistor by setting DIP switch S1 to the ON position. Disable the termination resistor on all slaves that are not located at the network line end.

Note: Some bypass controllers do not have DIP switch S1. In such cases an external 120 ohm resistor must be placed across the TXRX+ and TXRX- signals if the bypass controller is at the end of a network line.

4 N2 Setup Parameters

◆ N2 Serial Communication

This section describes parameters necessary to set up N2 communications.

■ Z3-01: Serial Communications Protocol Select

Selects the communications protocol.

No.	Name	Setting Range	Default
Z3-01	Serial Communications Protocol Selection	0 to 3	0

Setting 0: MEMOBUS/Modbus

Setting 1: N2

Setting 2: P1

Setting 3: BACnet

■ Z3-02: Serial Communications Node Address Select

Sets the drive slave address used for communications.

Note: Cycle the power after changing this parameter to enable the new setting.

No.	Name	Setting Range	Default
Z3-02	Serial Communications Node Address Select	0 to FFH	1FH

Each slave drive must be assigned a unique slave address for serial communications to work. Slave addresses do not need to be assigned in sequential order, but no two drives may share the same address.

■ Z3-03: Serial Communications Baud Rate Select

Sets the communication speed.

Note: 1. Cycle the power after changing this parameter to enable the new setting.

No.	Name	Setting Range	Default
Z3-03	Serial Communications Baud Rate Select	0 to 8	3

Z3-03	Communication Speed Z30	Z3-03	Communication Speed
0	1200 bps	4	19200 bps
1	2400 bps	5	38400 bps
2	4800 bps	6	57600 bps
3	9600 bps	7	76800 bps
–	–	8	115200 bps

■ Z3-04: Serial Communications Parity Select

Sets the parity used for communications.

Note: Cycle the power after changing this parameter to enable the new setting.

No.	Name	Setting Range	Default
Z3-04	Serial Communications Parity Select	0 to 2	0

Setting 0: No parity

Setting 1: Even parity

Setting 2: Odd parity

■ Z3-05: Serial Communications Fault Select

Selects the action to take when a serial communications fault is selected. If communications is lost for more than the time programmed in Z3-06, then a communication fault is detected.

Note: Cycle the power after changing this parameter to enable the new setting.

No.	Name	Setting Range	Default
Z3-05	Serial Communications Fault Select	0 to 4	1

Setting 0: Ignore

Setting 1: Alarm

Setting 2: Fault with EF0.

Fault FB14 will display in the operator and an EF0 fault will be sent to the drive.

Setting 3: Fault with EF0 and Open Bypass Contactor K3.

Fault FB14 will display in the operator, an EF0 fault will be sent to the drive, and bypass contactor K3 will be opened.

Setting 4: Alarm and run at preset speed set in Z3-10.

Alarm AL14 will display in the operator.

■ Z3-06: Serial Communications Fault Time Select

Sets the time allowed to elapse since receiving serial communications before triggering a communications fault. A value of 0.0 means to never time out.

No.	Name	Setting Range	Default
Z3-06	Serial Communications Fault Detection Time	0.0 to 99.9 s	2.0 s

■ Z3-07: Serial Communications Receive to Transmit Wait Time

Sets the time to delay a serial communications response to a serial communications command.

No.	Name	Setting Range	Default
Z3-07	Serial Communications Receive to Transmit Wait Time	0 to 99 ms	5 ms

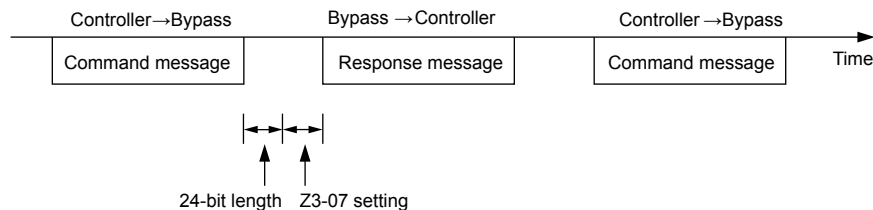


Figure 4 Serial Communications Receive to Transmit Wait Time Setting

■ Z3-10: Cable Loss Pre-set Speed

When a serial communications fault is detected and Z3-05=4, the value here will become the frequency reference.

No.	Name	Setting Range	Default
Z3-10	Cable Loss Pre-set Speed	0.0 to 60.0 Hz	0.0 Hz

■ Z3-11: Serial Communication Fault Detection Selection

Enables or disables the serial communications fault detection.

No.	Name	Setting Range	Default
Z3-11	Serial Communication Fault Detection Selection	0 or 1	1

Setting 0: Disabled

No communication error detection. Ignore setting in Z3-05.

Setting 1: Enabled

If the bypass does not receive data from the master for longer than the time set to Z3-06, then a FB14 Serial Communications fault will be triggered and the bypass will operate as determined by parameter Z3-05.

5 Bypass Operations by N2

The drive operations that can be performed by N2 communication depend on drive parameter settings. This section explains the functions that can be used and related parameter settings.

◆ Observing the Bypass Operation

A controller can perform the following actions with N2 communications at any time regardless of parameter settings (except for Z3-□□ parameters):

- Observe drive status and drive control terminal status from a controller
- Read and write parameters
- Set and reset faults
- Set multi-function inputs.

Note: Input settings from the input terminals S□ and from N2 communications are both linked by a logical OR operation.

◆ Controlling the Bypass

Select an external reference and adjust the parameters in [Table 1](#) accordingly to start and stop the drive or set the frequency reference using N2 communications.

Table 1 Setting Parameters for Bypass Control from N2

Reference Source	Parameter	Name	Required Setting
External Reference 1	Z1-07	Frequency Reference Select	2
	Z1-08	Run Command Select	2

Refer to the Z1000 Bypass Technical Manual for details on external reference parameter selections.

■ Z1000 Bypass Functions

Each of the following functions must be enabled during start-up:

Start and Stop the Bypass

Set the Run Forward Command (BO 1) to run the in the forward direction. Set the Run Reverse Command (BO 2) to run the in the reverse direction. Run/Stop Monitor (BI 1) shows the current run status. Forward/Reverse Monitor (BI 2) shows the current direction.

NOTICE: *Damage to Equipment. Improper motor direction may damage HVAC equipment if parameter b1-04, Reverse Enable, is set to 0 (Enable).*

Lock the Z1000 Bypass Panel

This function is not supported in the Z1000 Bypass.

Digital Inputs

Multi-Function Input S3 (BO 5) through Multi-Function Input S7 (BO 9) are physical digital inputs on the bypass. They can be set either by external devices, such as limit or pressure switches, or by the network. Their function depends on how the bypass has been programmed. Refer to the Z1000 Bypass Technical Manual section on Multi-Function Inputs (Z2-03 through Z2-07) for detailed information on the use and programming of the multi-function inputs. The multi-function input status can be monitored through Multi-Function Input 3 Monitor (BI 15) through Multi-Function Input 7 Monitor (BI 19). The Multi-Function Input # Monitor state is the logical OR of the serial command value (BO 5 through BO 9) and the state of the external connection.

Note: The multi-function inputs can be set by both external devices or over the network. Use caution when connecting the multi-function inputs to external devices to ensure correct system operation.

Digital Outputs

Multi-Function Output 7 (BI 10) through Multi-Function Output 9 (BI 12) are physical digital outputs on the bypass. Their function depends on how the bypass is programmed. Refer to the Z1000 Bypass Technical Manual section on Multi-Function Outputs (Z2-23 through Z2-25) for detailed information on the use and programming of the multi-function outputs.

Loop Gain

PI Proportional Gain (AO 4) and PI Integral Time (AO 5) are the gain and integral time parameters used by the Z1000. The Z1000 PI loop is structured differently than the Metasys loop. Refer to the Z1000 Bypass Technical Manual section on PI for information on Z1000 PI loop functions.

Reading and Resetting Faults

The Fault Monitor (BI 4) and Drive Ready Monitor (BI 3) show the current status of the bypass. The Fault Code (AI 10) contains the code for the most current fault. The LST Fault Code (AI 19) contains the code for the previous drive fault. [Refer to Fault Trace / History Register Contents on page 14](#) for descriptions of the fault codes. The drive faults can be reset through the Fault Reset Command (BO 4). The Fault Reset Command is only available when the Run Forward Command and the Run Reverse Command are both OFF.

■ Cable Loss Configuration and Behavior

This section describes the configurable cable loss feature of the drive. This feature offers a user maximum flexibility in determining drive response to a loss of communication.

Drive Behavior at Loss of Communication

The drive can be configured to respond to an interval without receipt of a message in one of the following methods:

- Continue at last speed
- Continue at last speed with alarm
- Continue at preset speed
- Ramp to Stop with FB14 fault
- Coast to Stop with FB14 fault
- Emergency Stop with FB14 fault

Metasys N2 I/O

Three Metasys N2 outputs are used to select the desired behavior:

- AO 21 – Cable Loss Timeout
- AO 22 – Cable Loss Speed
- BO 11 – Communication Fault Enable

Table 2 Cable Loss Behavior Summary

Behavior	F6-03	Z3-05	Cable Loss Timeout (AO 21)	Cable Loss Speed (AO 22)	Communication Fault Enable (BO 11)
Decelerate to stop (stop time in C1-02) FB14 Fault. Note: In Bypass mode, bypass contactor will open and motor will coast to stop.	0	3	Timeout Interval	X	On
Coast to stop FB14 fault. Note: In Bypass mode, bypass contactor will open and motor will coast to stop.	1	3	Timeout Interval	X	On
Fast stop (stop time in C1-09) FB14 fault. Note: In Bypass mode, bypass contactor will open and motor will coast to stop.	2	3	Timeout Interval	X	On
Continue at last speed	3	0	0	X	X
Continue at last speed with alarm	3	1	Timeout Interval	X	On
Continue at preset speed with alarm	3	4	Timeout Interval	Preset speed	On

- Note:**
1. Communication must first be established and then lost for these features to function as described. If a bypass is powered-up without a cable connected or with the master controller offline, a communications timeout does not occur.
 2. For modes that describe the bypass running after a communications timeout, a run command must have been issued (BO 1 = 'On' or BO 2 = 'On') prior to loss of communications. For safety purposes, the drive will not automatically restart from a stopped condition. If a user requires the drive to restart automatically, additional external wiring is required to accomplish this (consult factory).
 3. Upon expiration of the communications timeout interval, the FAULT LED lights and remains lit until communication is restored.

Continue at Last Speed

In this mode, Cable Loss Timeout (AO 21) is set to 0, disabling the cable loss feature. The other two settings Cable Loss Speed (AO 22) and Communication Fault Enable (BO 11) are ignored. If communication is lost, the drive simply maintains its last commanded state. The drive will not display an alarm or fault to indicate it has lost communication. This behavior can also be achieved by setting parameter Z3-05 to "0".

Continue at Last Speed with Alarm

5 Bypass Operations by N2

For this condition, Communication Fault Enable (BO 11) must be enabled and Cable Loss Speed (AO 22) should be set to a value other than 0. An AL14 Serial Communications Alarm is shown.

Continue at Preset Speed with Alarm

In this mode, Cable Loss Timeout (AO 21) is set to the desired interval, Cable Loss Speed (AO 22) is set to the desired preset speed and Z3-05 is set to “4”. If the time between messages exceeds the timeout interval, the drive speed command (AO 1) is set to the Cable Loss Speed (AO 22) and the drive continues running at this new speed. Communication Fault Enable (BO 11) must be set to ‘On’.

Stop with Fault (FB14)

Communication Fault Enable (BO 11) must be set to ‘On’. In this mode, Cable Loss Timeout (AO 21) is set to the desired interval and parameter F6-03 is set to a value of 0, 1 or 2. If the time between messages exceeds the timeout interval, the drive will declare an EF0 fault and the drive speed command (AO 1) will be set to 0. The stopping method is determined by the setting of F6-03.

- F6-03 = 0 selects Ramp to Stop. The deceleration time or the slope of the ramp is determined by the setting of drive parameter C1-02
- F6-03 = 1 selects Coast to Stop. The drive does not attempt to control the rate of deceleration.
- F6-03 = 2 selects Emergency or Fast Stop. The deceleration time is determined by the setting of drive parameter C1-09.

■ Z1000 Bypass Fault Numbers

Table 3 Fault Trace / History Register Contents

Fault Code	Fault Name	Fault Code	Fault Name
0002H	Undervoltage (Uv1)	003BH	Too Many Speed Search Restarts (SEr)
0003H	Control Power Supply Undervoltage (Uv2)	0041H	PI Feedback Loss (FbH)
0004H	Soft Charge Circuit Fault (Uv3)	0042H	External Fault 1, Input Terminal S1 (EF1)
0006H	Ground Fault (GF)	0043H	External Fault 2, Input Terminal S2 (EF2)
0007H	Overcurrent (oC)	0046H	Current Offset Fault (CoF)
0008H	Overvoltage (ov)	0047H	PLC Detection Error 1 (PE1)
0009H	Heatsink Overheat (oH)	0048H	PLC Detection Error 2 (PE2)
000AH	Heatsink Overheat (oH1)	004DH	Output Voltage Detection Fault (voF)
000BH	Motor Overload (oL1)	0052H	Node Setup Fault (nSE)
000CH	Drive Overload (oL2)	005AH	Motor Underload Protection (UL6)
000DH	Overtorque Detection 1 (oL3)	0083H	A/D Conversion Error (CPF02)
0010H	Braking Resistor Overheat (rH)	0084H	PWM Data Fault (CPF03)
0011H	External Fault at Input Terminal S3 (EF3)	0087H	EEPROM Memory Data Error (CPF06)
0012H	External Fault at Input Terminal S4 (EF4)	0088H	Terminal Board Connection Error (CPF07)
0013H	External Fault at Input Terminal S5 (EF5)	0089H	EEPROM Serial Communication Fault (CPF08)
0014H	External Fault at Input Terminal S6 (EF6)	008CH	RAM Fault (CPF11)
0015H	External Fault at Input Terminal S7 (EF7)	008DH	Flash Memory Circuit Exception (CPF12)
001BH	Input Phase Loss (PF)	008EH	Watchdog Circuit Exception (CPF13)
001CH	Output Phase Loss (LF)	008FH	Control Circuit Fault (CPF14)
001DH	Motor Overheat (PTC input) (oH3)	0091H	Clock Fault (CPF16)
001EH	Digital Operator Connection (oPr)	0092H	Timing Fault (CPF17)
001FH	EEPROM Write Error (Err)	0093H	Control Circuit Fault (CPF18)
0020H	Motor Overheat (PTC input) (oH4)	0094H	Control Circuit Fault (CPF19)
0021H	MEMOBUS/Modbus Communication Error (CE)	0095H	Hardware Fault at Power Up (CPF20)
0022H	Option Communication Error (bUS)	0096H	Hardware Fault at Communication Start Up (CPF21)
0027H	Option External Fault (EF0)	0097H	A/D Conversion Fault (CPF22)
0028H	PI Feedback Loss (FbL)	0098H	PWM Feedback Fault (CPF23)
0029H	Undertorque Detection 1 (UL3)	0099H	Drive Unit Signal Fault (CPF24)
002BH	High Slip Braking Overload (oL7)	009AH	Terminal Board is Not Properly Connected. (CPF25)
0030H	Hardware Fault (including oFx)	009BH	ASIC BB Circuit Error (CPF26)
0036H	Output Current Imbalance (LF2)	009CH	ASIC PWM Setting Register Error (CPF27)
0037H	Pullout Detection (Sto)	009DH	ASIC PWM Pattern Error (CPF28)

Fault Code	Fault Name
009EH	ASIC On-delay Error (CPF29)
009FH	ASIC BBON Error (CPF30)
00A0H	ASIC Code Error (CPF31)
00A1H	ASIC Start-up Error (CPF32)
00A2H	Watch-dog Error (CPF33)
00A3H	ASIC Power/Clock Error (CPF34)
00A4H	External A/D Converter Error (CPF35)
00A9H	Control Circuit Error (CPF40)
00AAH	Control Circuit Error (CPF41)
00ABH	Control Circuit Error (CPF42)
00ACH	Control Circuit Error (CPF43)
00ADH	Control Circuit Error (CPF44)
00AEH	Control Circuit Error (CPF45)
0101H	Option Compatibility Error (oFA00)
0102H	Option Not Properly Connected (oFA01)
0106H	A/D Conversion Error (oFA05)
0107H	Option Response Error (oFA06)
0111H	Option RAM Fault (oFA10)
0112H	Option Operation Mode Fault (SLMOD) (oFA11)
0113H	Drive Receive CRC Error (oFA12)
0114H	Drive Receive Frame Error (oFA13)
0115H	Drive Receive Abort Error (oFA14)
0116H	Option Receive CRC Error (oFA15)
0117H	Option Receive Frame Error (oFA16)
0118H	Option Receive Abort Error (oFA17)
0131H	Comm. ID Error (oFA30)
0132H	Model Code Error (oFA31)
0133H	Sumcheck Error (oFA32)
0134H	Comm. Option Timeout Waiting for Response (oFA33)
0135H	MEMOBUS Timeout (oFA34)

Fault Code	Fault Name
0136H	Drive Timeout Waiting for Response (oFA35)
0137H	CI Check Error (oFA36)
0138H	Drive Timeout Waiting for Response (oFA37)
0139H	Control Command Selection Error (oFA38)
013AH	Drive Timeout Waiting for Response (oFA39)
013BH	Control Response Selection 1 Error (oFA40)
013CH	Drive Timeout Waiting for Response (oFA41)
013DH	Control Response Selection 2 Error (oFA42)
013EH	Control Response Selection Error (oFA43)
0401H	Time Not Set (TIM)
0402H	Operator Battery Low (bAT)
0403H	Time Data Error (TdE)
0404H	Time Interval Error (TiE)
0405H	Overvoltage 2 (ov2)
0407H	External Fan Fault (Fn1)
1389H	Safety Open
138AH	BAS InterLock Open
138BH	External Fault (EFB)
138CH	Not Used
138DH	Motor Overload
138EH	Ext Motor1 Overload
138FH	Ext Motor2 Overload
1390H	PL Brownout
1391H	PL Blackout
1392H	No Bypass to Drive Communications
1393H	Bypass Board Hardware Error
1394H	Option Board Communication Fault
1395H	Loss of Load
1396H	Serial Communications Timeout

6 Communications Timing

To prevent a communications overrun in the slave drive, the master should wait a certain time between sending messages to the same drive. In the same way, the slave drive must wait before sending response messages to prevent an overrun in the master. This section explains the message timing.

◆ Command Messages from Master to Bypass

The master must wait for a specified time between receiving a response and resending the same type of command to the same slave bypass to prevent overrun and data loss. The minimum wait time depends on the command as shown in [Table 4](#).

Table 4 Minimum Wait Time for Sending Messages

Command Type	Example	Minimum Wait Time
1	- Control command (Run, Stop) - Set inputs/outputs - Read monitors and parameter values	5 ms <i></i></i>
2	Write parameters	H5-11 = 0: 50 ms H5-11 = 1: 200 ms <i></i></i>
3	Save changes using an Enter command	200 ms to 2 s, depending on the number of parameters that were changed <i></i></i>
4	Enter with storage to drive EEPROM after initialization	5 s

</i>1> If the bypass receives command type 1 data during the minimum wait time, it will perform the command and then respond. However, if it receives a command type 2 or 3 during that time, either a communication error will result or the command will be ignored.

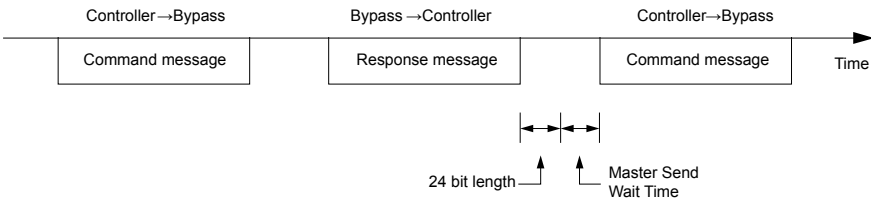


Figure 5 Minimum Wait Time for Sending Messages

Set a timer in the master to check how long it takes for the slave bypass units to respond to the master. If no response is received within a certain amount of time, the master should try resending the message.

◆ Response Messages from Bypass to Master

If the bypass receives a command from the master, it will process the data received and wait for the time set in Z3-07 until it responds. Increase Z3-07 if the drive response causes overrun in the master.

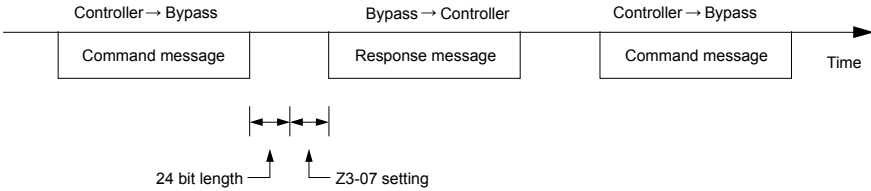


Figure 6 Minimum Response Wait Time

7 Metasys N2 Point Database

This section describes the Metasys N2 point database. This database features 100 logical points: 38 Analog Inputs (AI), 32 Analog Outputs (AO), 19 Binary Inputs (BI) and 11 Binary Outputs (BO). These points configure, control, and monitor the operation of the drive.

◆ Metasys N2 Analog Input (AI) Summary

Table 5 Metasys N2 Analog Input Summary (Bypass to Metasys N2)

Object ID	Object Name	Units	Bypass Parameter
AI 1	Speed Reference	0.01 Hz	U1-01
AI 2	Output Speed	0.01 Hz	U1-02
AI 3	Output Current	0.1 A	U1-03/UB-01 in Drive/Bypass Mode
AI 4	kWatt Hour Meter	kWh	U4-10
AI 5	Output Power	0.1 kWh	U1-08
AI 6	Drive Temperature	1 °C	U4-08
AI 7	PI Feedback	0.01%	U5-01
AI 8	AC Output Voltage	0.1 Vac	U1-06
AI 9	DC Bus Voltage	1 Vdc	U1-07
AI 10	Fault Code	–	U2-01/UB-09. Reads UB-09 first and if 0 returns U2-01
AI 11	Elapsed Time - Hours	1 hour	U4-01
AI 12	Elapsed Time - 10K Hours	10K hours	U4-01
AI 13	MWatt Hour meter	MWh	U4-11
AI 14	Drive Rated Current	A	n9-01
AI 15	Communication Error Code	–	Not supported. Always returns 0
AI 16	PI Deviation	0.01%	U5-02
AI 17	PI Output Capacity	0.01%	U5-03
AI 18	PI Reference	0.01%	U5-04
AI 19	Last Fault Code	–	U2-02
AI 20	Freq Ref @ Fault	0.01 Hz	U2-03
AI 21	Output Freq @ Fault	0.01 Hz	U2-04
AI 22	Output Current @ Fault	0.1 A	U2-05
AI 23	Out Volt Ref @ Fault	0.1 Vac	U2-07
AI 24	DC Bus Volts @ Fault	1 Vdc	U2-08
AI 25	Output Power @ Fault	0.1 kW	U2-09
AI 26	Input Term Status @ Fault	–	U2-11
AI 27	Output Term Status @ Fault	–	U2-12
AI 28	Operation Status @ Fault	–	U2-13
AI 29	Elapsed Operation Time @ Fault	1 hour	U2-14
AI 30	Most Recent Fault	–	U3-01
AI 31	2nd Most Recent Fault	–	U3-02
AI 32	3rd Most Recent Fault	–	U3-03
AI 33	4th Most Recent Fault	–	U3-04
AI 34	Elapsed Time @ Current Fault	1 hour	U3-11
AI 35	Elapsed Time @ 2nd Fault	1 hour	U3-12
AI 36	Elapsed Time @ 3rd Fault	1 hour	U3-13
AI 37	Elapsed Time @ 4th Fault	1 hour	U3-14
AI 38	Read Parameter Data	–	–

◆ Metasys N2 Analog Output (AO) Summary

Table 6 Metasys N2 Analog Output Summary (Bypass to Metasys N2)

Object ID	Object Name	Units	Default Value	Bypass Parameter
AO 1	Speed Command	0.01 Hz	–	–
AO 2	Acceleration Time	seconds	30.0	C1-01
AO 3	Deceleration Time	seconds	30.0	C1-02
AO 4	PI Proportional Gain	–	2.00	b5-02
AO 5	PI Integral Time	seconds	5.0	b5-03
AO 6	Stall Prevention Level – Run	%	120	L3-06
AO 7	Stall Prevention Level – Accel	%	120	L3-02
AO 8	Frequency Reference Selection	–	0	Z1-07
AO 9	Run Command Selection	–	1	Z1-08
AO 10	PI Mode Select	–	0	b5-01
AO 11	Frequency Command Upper Limit	% of Max	100.0	d2-01
AO 12	Frequency Command Lower Limit	% of Max	0.0	d2-02
AO 13	Motor Rated Current	A	Motor model dependent	E2-01
AO 14	Jump Frequency 1	0.1 Hz	0.0	d3-01
AO 15	Jump Frequency 2	0.1 Hz	0.0	d3-02
AO 16	Jump Frequency 3	0.1 Hz	0.0	d3-03
AO 17	Jump Frequency Bandwidth	0.1 Hz	1.0	d3-04
AO 18	Number of Auto Restarts	–	0	L5-01
AO 19	Operator Display Mode	–	0	o1-03
AO 20	Power Loss Ride-Thru	seconds	Drive model dependent	L2-02
AO 21	Cable Loss Timeout	seconds	2.0	Z3-06
AO 22	Cable Loss Speed	0.01 Hz	0.00	Z3-10
AO 23	PI Integral Limit	0.1%	100.0	b5-04
AO 24	PI Upper Limit Value	0.1	100.0	b5-06
AO 25	PI Offset Adjustment	0.1	0.0	b5-07
AO 26	PI Primary Delay Time	0.01	0.00	b5-08
AO 27	PI Feedback Reference Missing Detection Select	1	0	b5-12
AO 28	PI Feedback Reference Missing Detection Level	1%	0	b5-13
AO 29	PI Feedback Reference Missing Detection Time	0.1 s	1.0	b5-14
AO 30	Read Parameter Number	–	–	–
AO 31	Write Parameter Number	–	–	–
AO 32	Write Parameter Data	–	–	–

◆ Metasys N2 Binary Input (BI) Summary

Table 7 Metasys N2 Binary Input Summary (Bypass to Metasys N2)

Object ID	Object Name	Default	Off (0) State	On (1) State
BI 1	Run/Stop Monitor	0	Stopped	Running
BI 2	Forward/Reverse Monitor	0	Forward	Reverse
BI 3	Drive Ready Monitor	0	Not Ready	Ready
BI 4	Fault Monitor	0	Not Faulted	Faulted
BI 5	Zero Speed	0	Not Zero Speed	Zero Speed
BI 6	Speed Agree	0	Not Speed Agree	Speed Agree
BI 7	Minor Fault	0	No Minor Fault	Minor Fault
BI 8	Major Fault	0	No Major Fault	Major Fault
BI 9	Drive Communication Error Monitor	0	No Error	Error

Object ID	Object Name	Default	Off (0) State	On (1) State
BI 10	Multi-Function Output 7 (Z2-23)	0	Off	On
BI 11	Multi-Function Output 8 (Z2-24)	0	Off	On
BI 12	Multi-Function Output 9 (Z2-25)	0	Off	On
BI 13	Safety Interlock Monitor	0	Safety Clear	Safety Set
BI 14	HAND/AUTO Reference Monitor	0	AUTO or OFF	HAND
BI 15	Multi-Function Input 3 Monitor	0	Off	On
BI 16	Multi-Function Input 4 Monitor	0	Off	On
BI 17	Multi-Function Input 5 Monitor	0	Off	On
BI 18	Multi-Function Input 6 Monitor	0	Off	On
BI 19	Multi-Function Input 7 Monitor	0	Off	On

◆ Metasys N2 Binary Output (BO) Summary

Table 8 Metasys N2 Binary Output Summary (Bypass to Metasys N2)

Object ID	Object Name	Default	Off (0) State	On (1) State
BO 1	Run Forward Command	0	Stop	Forward
BO 2	Run Reverse Command	0	Stop	Reverse
BO 3	External Fault (EFB) Command	0	No Fault	Fault (EFB)
BO 4	Fault Reset Command	0	No Reset	Reset
BO 5	Multi-Function Input 3 (Z2-03)	0	Off	On
BO 6	Multi-Function Input 4 (Z2-04)	0	Off	On
BO 7	Multi-Function Input 5 (Z2-05)	0	Off	On
BO 8	Multi-Function Input 6 (Z2-06)	0	Off	On
BO 9	Multi-Function Input 7 (Z2-07)	0	Off	On
BO10	Panel Lock Note: Not supported	0	—	—
BO 11	Communication Fault Enable	0	FB14 Not Activated if Cable Loss Occurs	FB14 Activated if Cable Loss Occurs

8 Mailbox Function

◆ Reading Drive Parameters

Two points are defined for reading drive parameters:

- AO 30 – Specifies the parameter to be read from the bypass.
- AI 38 – Reports the value of the parameter specified in AO 30.

When this point is read, it retrieves data from the parameter and sends it to the controller

Example: Writing a value of 387 (183 hex) to AO 30 specifies drive parameter b1-04. Reading AI 38 returns the current setting of parameter b1-04 to the controller.

◆ Writing Drive Parameters

Two points are defined for writing to drive parameters:

- AO 31 – Specifies the parameter to be written to
- AO 32 – Entry location of the value to be written to the parameter specified in AO 31. When this point is written to, it will write the value to the drive. An ENTER or ACCEPT command does not need to be sent for the data to be taken by the drive. The behavior of the write is the same as with the digital operator. If the drive is running, there are a limited number of drive parameters that can be written to.

Example: Writing a value of 387 (183 hex) to AO 31 specifies drive parameter b1-04. Writing a value of 1 to AO 32 sets b1-04 to 1 and disables the drive for reverse run.

9 Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.

Date of Publication	Revision Number	Section	Revised Content
September 2012	-	-	First Edition.

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Yaskawa AC Drive - Z1000 Bypass Network Protocol

Metasys® N2

Technical Manual

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