
**HIGH PERFORMANCE ADJUSTABLE SPEED DRIVE
QUIET ASD SERIES**

TOSHIBA



**VARIABLE TORQUE
ADJUSTABLE SPEED DRIVE**



METASYS N2 COMMUNICATIONS INTERFACE MANUAL

August, 1998
ICC #10035-002

Introduction

Thank you for purchasing the “Metasys N2 Communications Interface” for the Toshiba EIII Quiet Transistor Inverter. This communications interface allows the EIII inverter to connect directly to the Johnson Controls Metasys N2 communications network. Before using the Metasys N2 interface, please be sure to thoroughly read the instructions and precautions contained in this manual. In addition, please make sure that this instruction manual is delivered to the end user of the inverter unit into which the communications interface is installed, and keep this instruction manual in a safe place for future reference or inverter inspection.

This instruction manual describes the device specifications, installation and wiring methods, maintenance procedures, I/O point map and functions for the EIII Metasys N2 communications interface.

Please note that this communications interface can also be used in other Toshiba 3-series adjustable speed drives, such as the G3. Not all functions may be accessible, however, in other units. These exceptions will be noted where applicable. Also, use of this interface in other Toshiba 3-series drives may require the use of an additional plug-in communications option ROM. For more information regarding the required combinations of adjustable speed drives, interface boards and option ROMs, please contact your local distributor or Toshiba International Corporation.

Usage Precautions

Operating Environment

- Please use the communications interface only when the ambient temperature of the inverter unit into which the interface is installed is within the following specified temperature limits:

Operation: -10 ~ +40°C (+14 ~ +104°F)

Storage: -25 ~ +65°C (-13 ~ +149°F)

- Avoid installation locations that may be subjected to large shocks or vibrations.
- Avoid installation locations that may be subjected to rapid changes in temperature or humidity.

Installation · Wiring

- Do not touch charged parts such as the terminal block while the inverter's CHARGE lamp is lit. A charge will still be present in the inverter unit's internal electrolytic capacitors, and therefore touching these areas may result in an electrical shock. Always turn all inverter input power supplies OFF, and wait at least 5 minutes after the CHARGE lamp has gone out before wiring the communication cables or motor wiring.
- When installing the communications interface into the inverter and making wiring connections, make certain that no clippings or wiring leads that could cause device failure fall into the inverter or onto electronic components.
- Proper ground connections are vital for both safety and signal reliability reasons. For proper grounding procedures, please refer to the section in this manual pertaining to grounding (section 2).
- Route the communication cables separate from the inverter input/output power wiring.
- To avoid the possibility of electric shock due to leakage currents, always ground the inverter unit's E/GND terminal and the motor. To avoid misoperation, do not connect the communication interface's SHIELD terminal to either of the above-mentioned grounds or any other power ground.

Other Precautions

- The inverter's EEPROM has a life span of 10,000 write cycles. Do not write to BO #9, BO #10, or AO #2 ~ AO #13 more than 10,000 times.
- Do not touch or insert a rod or any other item into the inverter while power is applied, as this may lead to electrical shock or inverter damage.
- Commission the disposal of the communications interface to a specialist.
- Do not assign the same address to more than one inverter in the same network.
- Individual device addresses can be set from 1 ~ 255. Address 0 is invalid and will cause the inverter to trip “E-10” (communication interface card error).
- When the inverter's control power supply is turned on, the inverter performs initialization functions for approximately 3 seconds, during which communications capabilities are disabled. Communications capabilities will also be disabled for approximately 3 seconds after momentary control power supply outages or inverter resets.

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1. Interface Board Installation / Removal

The EIII inverter does not require any additional hardware components other than the Metasys N2 communications interface board in order to connect to and communicate with the N2 network. This portion of the manual will detail the procedure used to install and remove the interface board. If at any time you experience problems during the installation / removal process, please call Toshiba International Corporation for assistance.

1.1 Installation Procedure

Installation of the Metasys N2 interface board into a EIII inverter should only be performed by a qualified technician familiar with the maintenance and operation of the EIII. To install the interface board, perform the following procedure:

1.  **CAUTION!** Verify that all input power sources to the inverter have been turned OFF and are locked and tagged out.
2.  **DANGER!**  Wait at least 5 minutes for the inverter's electrolytic capacitors to discharge before proceeding to the next step. **Do not touch any internal parts with power applied to the inverter, or for at least 5 minutes after power to the inverter has been removed. A hazard exists temporarily for electrical shock even if the source power has been removed.**
3.  Remove the inverter's cover (open the door on units with hinged doors). Verify that the CHARGE LED has gone out before continuing the installation process.
4. Loosen the 4 screws attaching the EIII's operation panel support bracket to the control board support bracket, and then remove the operation panel and support bracket as a unit (refer to Figure 1).
5. Install the 4 nylon standoffs into the holes provided in the control board support bracket (refer to Figure 2).
6. Install the N2 network cable through the access holes at the bottom of the inverter and route the cable in order to make connections to the interface board connector (TB1). Take care to not route the cable near any sharp edges or in positions where it may be pinched.

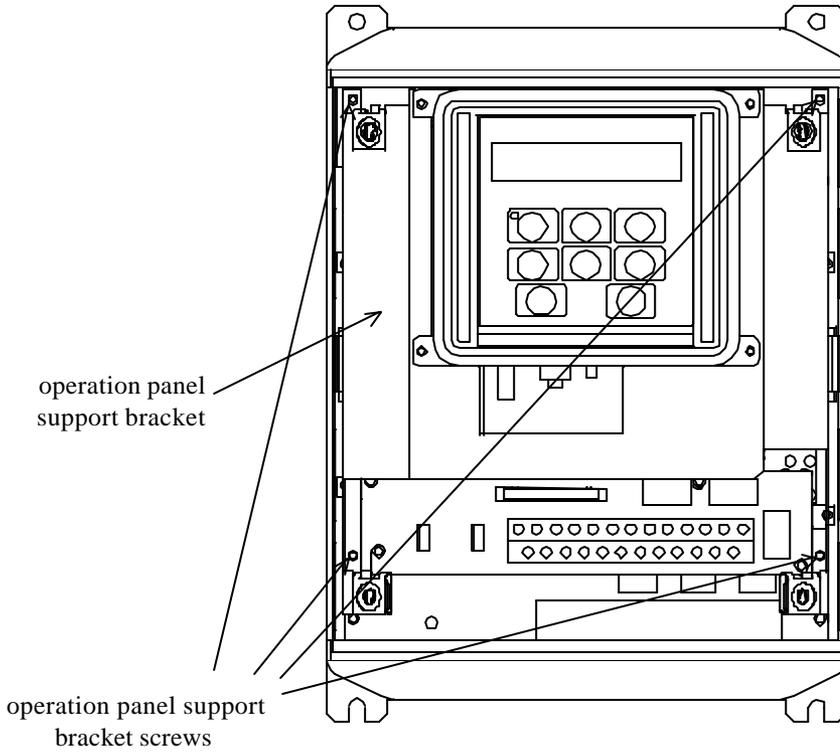


Figure 1: EIII with front cover removed

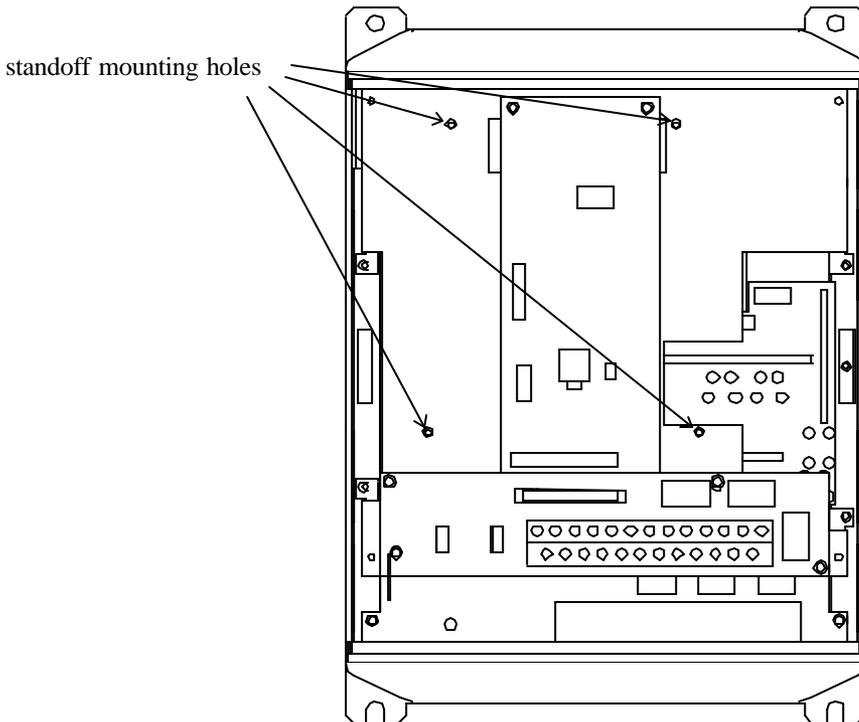


Figure 2: EIII with front cover and operation panel support bracket removed

7.  **CAUTION!** The Metasys N2 interface board is a static-sensitive device. Standard electrostatic-sensitive component handling precautions should be observed. Connect the N2 bus cable to the interface board connector (TB1). For more information on making connections to the N2 bus, refer to section 6.1 on page 13.

-  **CAUTION!** Extremely high voltages exist in the area near the interface board and connector (TB1) once installed in the EIII. Ensure that no stray wires (such as the shield on the N2 bus cable) come into contact with any internal inverter components. Also ensure that the N2 bus cable is not routed in such a manner that it may come into contact with high-voltage inverter components, or inverter components that may heat up during operation and damage the cable insulation.
8. Install the interface board into the inverter by carefully aligning the 4 nylon standoffs with the 4 mounting holes provided in the interface board. Ensure that connector CN5A on the back side of the interface board is aligned with connector CN5 on the front side of the control board.
9. Press the interface board firmly onto the standoffs and connector CN5 until the standoff retaining tabs lock. Ensure that CN5 and CN5A are thoroughly interlocked.
10. Carefully re-install the operation panel and support bracket and tighten the 4 screws that attach the operation panel support bracket to the control board support bracket.
11. Reinstall the inverter's cover (close and latch the door on units with hinged doors).

 **DANGER!**  **Do not operate the unit with the cover off / cabinet door open.**

12. Turn all power sources to the inverter unit ON, and verify that the inverter functions properly. If the inverter unit does not appear to power up, or does not function properly, immediately turn power OFF. **Repeat steps 1 ~ 3 to remove all power from the inverter.** Then, verify all connections. Contact Toshiba International Corporation for assistance if the problem persists.

1.2 Removal Procedure

Removal of the N2 interface board from a EIII inverter should only be performed by a qualified technician familiar with the maintenance and operation of the EIII. In order to protect the interface board connector's reliability, do not repeatedly connect and disconnect the interface board. Use the following procedure if it becomes necessary to remove the N2 interface board from the inverter.

 **CAUTION!** Do not remove the interface board while power is applied to the inverter. Removing the interface board with power applied may damage the inverter.

1.  **CAUTION!** Verify that all input power sources to the inverter have been turned OFF and are locked and tagged out.
2.  **DANGER!**  Wait at least 5 minutes for the inverter's electrolytic capacitors to discharge before proceeding to step 3. **Do not touch any internal parts with power applied to the inverter, or for at least 5 minutes after power to the inverter has been removed. A hazard exists temporarily for electrical shock even if the source power has been removed.**
3.  Remove the inverter's cover (open the door on units with hinged doors). Verify that the CHARGE LED has gone out before continuing the removal process.
4. Loosen the 4 screws attaching the operation panel support bracket to the control board support bracket and remove the operation panel and support bracket as a unit (refer to Figure 3).
5.  **CAUTION!** The communications interface is a static-sensitive device. Standard electrostatic-sensitive component handling precautions should be observed. Release the 4 corners of the interface board from the standoffs by pressing down on the standoff locking tabs with a small flat-headed screwdriver. Be careful to not apply any abnormal stress to the interface board while performing this, as this may damage the interface board or control board connectors.
6. Remove the interface board from the inverter.
7. Disconnect the N2 bus cable from the interface board connector (TB1), and pull the cable out through the access holes at the bottom of the inverter.
8. Carefully re-install the operation panel and support bracket and tighten the 4 screws that attach the operation panel support bracket to the control board support bracket.
9. Reinstall the inverter's cover (close and latch the door on units with hinged doors).

 **DANGER!**  **Do not operate unit with the cover off / cabinet door open.**

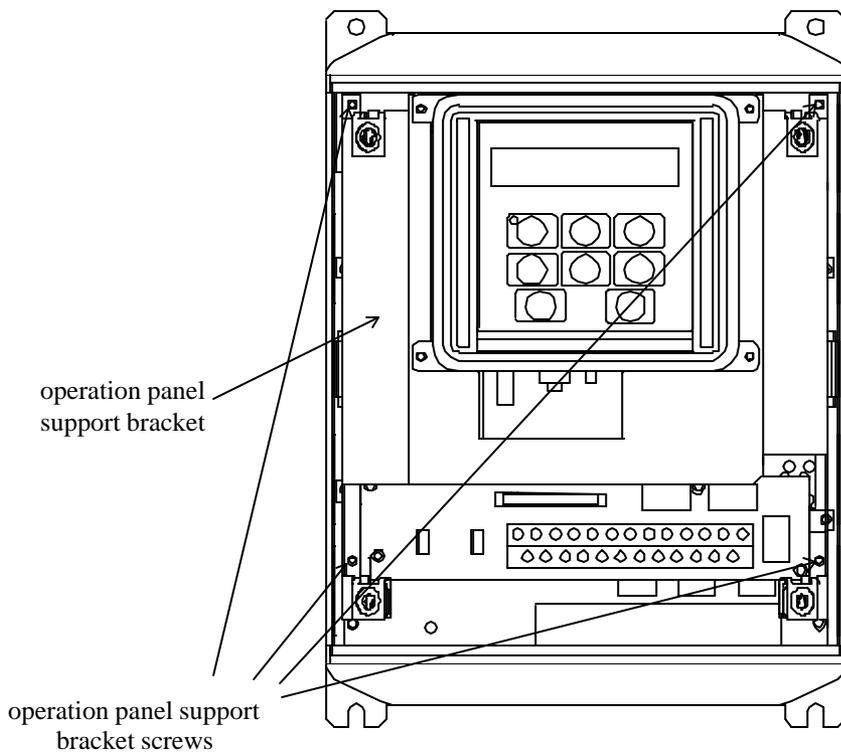


Figure 3: *EIII with front cover removed*

10. Turn all power sources to the inverter unit ON, and verify that the inverter functions properly. If the inverter unit does not appear to power up, or does not function properly, immediately turn power OFF. **Repeat steps 1 ~ 3 to remove all power from the inverter.** Then, verify all connections. Contact Toshiba International Corporation for assistance if the problem persists.

2. Grounding

Grounding is of particular importance for reliable, stable operation. Communication system characteristics may vary from system to system, depending on the system environment and grounding method used. A ground connection with an impedance of less than 100Ω should be used. Please be sure to consider the following points for making proper ground connections:

Grounding method checkpoints

1. Make all ground connections such that no ground current flows through the inverter case.
2. Ensure that all grounds are connected to points that are at the same potential as inverter grounds.
3. Do not connect the Metasys N2 interface board's SHIELD terminal to a power ground or any other potential noise-producing ground connection (such as the inverter's E/GND terminal).
4. Do not make connections to unstable grounds (paint-coated screw heads, grounds that are subjected to inductive noise, etc.)
5. Use copper wire with a cross-sectional area of 2mm^2 or larger, or aluminum wire with a cross-sectional area of 2.6mm^2 or larger for grounding.

3. Environmental Specifications

Item	Specification
Operating Environment	Indoors, less than 1000m above sea level, do not expose to direct sunlight or corrosive / explosive gasses.
Operating Temperature	$-10 \sim +40^{\circ}\text{C}$ ($+14 \sim +104^{\circ}\text{F}$)
Storage Temperature	$-25^{\circ}\text{C} \sim +65^{\circ}\text{C}$ ($-13 \sim +149^{\circ}\text{F}$)
Relative Humidity	20% ~ 90% (without condensation)
Vibration	5.9m/s^2 {0.6G} or less (10 ~ 55Hz)
Grounding	Use a ground connection with an impedance of less than 100Ω .
Cooling Method	Self-cooled

4. Maintenance And Inspection

Preventive maintenance and inspection is required to maintain the Metasys N2 communications interface in its optimal condition, and to ensure a long operational lifetime. Depending on usage and operating conditions, perform a periodic inspection once every three to six months. Before starting inspections, always turn off all power supplies to the inverter unit, and wait at least five minutes after the inverter's "CHARGE" lamp has gone out.



DANGER!



Do not touch any internal parts with power applied to the inverter, or for at least 5 minutes after power to the inverter has been removed. A hazard exists temporarily for electrical shock even if the source power has been removed.

Inspection Points

- Check that the wiring terminal screws are not loose. Tighten if necessary.
- Check that there are no defects in any wire terminal crimp points. Visually check that the crimp points are not scarred by overheating.
- Visually check the wiring and cables for damage.
- Clean off any accumulated dust and dirt. Place special emphasis on cleaning all installed PCBs and the ventilation ports of the inverter. Always keep these areas clean, as adherence of dust and dirt can cause premature component failure.
- If use of the inverter unit is discontinued for extended periods of time, turn the power on at least once every two years and confirm that the unit still functions properly.
- Do not perform hi-pot tests on the inverter or Metasys N2 interface board, as they may damage the unit's internal components.

Please pay close attention to all periodic inspection points and maintain a good operating environment.

5. Storage And Warranty

5.1 Storage

Observe the following points when the Metasys N2 interface is not used immediately after purchase or when it is not used for an extended period of time.

- Avoid storing the interface board in places that are hot or humid, or that contain large quantities of dust or metallic dust. Store the interface board in a well-ventilated location.
- When not using the interface board for an extended period of time, turn the power on at least once every two years and confirm that it still functions properly.

5.2 Warranty

The EIII Metasys N2 communications interface kit is covered under warranty for a period of 12 months from the date of installation, but not to exceed 18 months from the date of shipment from the factory. For further warranty or service information, please contact Toshiba International Corporation.

6. N2 Interface Configuration

6.1 N2 Network Connections

Each EIII Metasys N2 interface board can be directly connected to the N2 bus by using twisted-pair cable connected as shown in Figure 4. Connect the N2+ wire to terminal “A”, the N2- wire to terminal “B”, and the cable shield to terminal “SHIELD” on the interface board’s TB1 terminal block. Continue this connection scheme throughout the remainder of the network. Always connect each unit in a daisy-chain fashion, without drop lines, star configurations, etc. For further N2 network wiring requirements and procedures, please refer to the appropriate Johnson Controls network installation documentation.

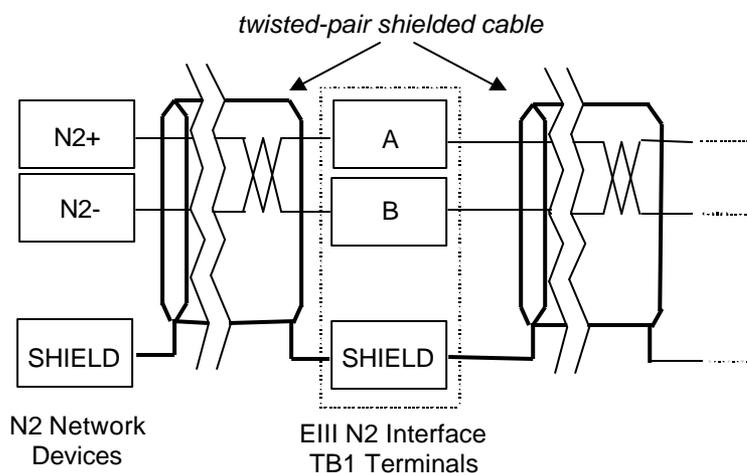


Figure 4. N2 Bus Cable Connection

6.2 Hardware Configuration

Other than installing the interface board and connecting the N2 network cable, the only other hardware configuration required is whether or not to terminate the N2 network at each individual interface board. A jumper on the interface board (labeled “JP1”) determines whether or not the N2 network is terminated at the interface board (termination is 121Ω resistor). Only the 2 devices at the extreme ends of the Metasys N2 network should have JP1 set to "TERM". All other devices should have JP1 set to "OPEN".

The 8-position DIP switch (labeled SW1) located on the right-hand side of the interface board is not used, and its switch settings are therefore irrelevant.

7. EIII Parameter Settings

Metasys N2 interface communications are enabled by setting parameter `OPT` in `GrGr` to 2 (Metasys / Modbus / Tosline-F10). No other Tosline-F10 communication parameter settings apply when using the Metasys N2 interface. When using any communication interface on the EIII inverter, the frequency command and command input received from the network can be enabled by setting parameters `FNOD` and `ENOD`, respectively, in `GrGr` to 3. For more information on methods for changing parameter settings, refer to the TOSHIBA [EIII Operation Manual](#).

The following is a list of the parameters settings that are required during setup to enable Metasys N2 communications:

Parameter	Group	Required Value
<code>blnd</code>	<code>GrGr</code>	1
<code>blEr</code>	<code>GrGr</code>	1
<code>OPT</code>	<code>GrGr</code>	2
<code>lna</code>	<code>GrGr</code>	any value other than 0

As is the same with all other communication configuration parameters, the inverter must be reset after making the parameter changes described above in order for the changed settings to be enabled.

IMPORTANT: *The standard factory setting for parameter `lna` is 0, which is reserved for Johnson Controls' use. If this parameter is not changed prior to enabling Metasys communications, the inverter will trip "Err8" (communication interface card error).*

If the EIII inverter into which a Metasys N2 communication option board is installed trips "Err8" (communication interface card error) for any reason during initialization or operation, it is incapable of being reset via the Metasys network. When this trip condition occurs, therefore, the inverter can only be reset locally via the panel or control terminal block.

If inverter control (frequency command input, RUN/STOP, etc.) is to be performed via setting Analog Output and Binary Output points from the N2 network, the following inverter parameters must also be set as shown:

Parameter	Group	Required Value
<code>ENOD</code>	<code>GrGr</code>	3
<code>FNOD</code>	<code>GrGr</code>	3

8. Network Programming Interface

8.1 Object Summaries

The EIII Metasys N2 bus interface has a predefined set of analog and binary I/O points used for controlling the inverter and for monitoring status items. These points can be summarized as follows:

- Analog input (AI) points are used for monitoring inverter status items such as output frequency, current and voltage. The EIII supports 16 different analog input points. All analog input points support low alarm limits, low warning limits, high warning limits, high alarm limits and differential values. Change of state (COS), alarm and warning functions can also be enabled. Analog input points will accept override commands, but will not change their actual values or indicate override active.
- Analog output (AO) points are used for setting and monitoring control points such as the inverter's frequency command and configuration parameters. The EIII supports 13 different analog output points. The values of all analog output points can be modified by issuing override commands. Issuing release commands will not cause the analog output points to automatically return to their pre-override values, nor will the analog output points automatically return to their pre-override values after a certain time period of no communication. COS is not supported for AO points.
- Binary input (BI) points are used for monitoring inverter status items such as terminal ON/OFF conditions and fault status. The EIII supports 19 different binary input points. All binary input points support COS, alarm enabling and normal/alarm status indications. Binary input points will accept override commands, but will not change their actual values or indicate override active.
- Binary output (BO) points are used for executing inverter commands such as RUN/STOP and trip clear. The EIII supports 10 different binary output points. The values of all binary output points can be modified by issuing override commands. Issuing release commands will not cause the binary output points to automatically return to their pre-override values, nor will the binary output points automatically return to their pre-override values after a certain time period of no communication. COS is not supported for BO points.

The device type for the EIII N2 interface is VND. To simplify the definition of points for a Johnson Controls network control unit (NCU), a Data Definition Language (DDL) file is included in section 10 of this manual.

8.2 I/O Point Map

NPT ¹	NPA ²	Units	Point Description	Range / Value
AI	1	Hz	Output frequency	0.00 ~ 400.00
AI	2	%	Output current	0 ~ 255
AI	3	%	Output voltage	0.0 ~ 232.0
AI	4	%	Input voltage	0.0 ~ 255.0
AI	5	%	IV terminal analog input value	0.00 ~ 100.00
AI	6	%	RR terminal analog input value	0.00 ~ 100.00
AI	7	%	RX terminal analog input value	-100.00 ~ 100.00
AI	8	kW	Input power	0.0 ~ 6553.4
AI	9	kW	Output power	-3276.8 ~ 3276.7
AI	10	kWh	System energy (KWh)	0 ~ 999.9
AI	11	MWh	System energy (MWh)	0 ~ 65534
AI	12	--	Present fault	0 ~ 82
AI	13	--	Past fault #1 (newest)	0 ~ 82
AI	14	--	Past fault #2	0 ~ 82
AI	15	--	Past fault #3	0 ~ 82
AI	16	--	Past fault #4 (oldest)	0 ~ 82
BI	1	--	Run / stop status	0=stopped 1=running
BI	2	--	Forward / reverse status	0=reverse 1=forward
BI	3	--	Acceleration/deceleration #1/#2 selection status	0=accel/decel #1 1=accel/decel #2
BI	4	--	Compulsory DC injection braking mode status	0=inactive 1=active
BI	5	--	Coast stop command status	0=normal 1=coast to stop
BI	6	--	Emergency off status	0=normal 1=emergency off
BI	7	--	Fault status	0=EIII not faulted 1=EIII faulted
BI	8	--	Feedback control enable status	0=feedback invalid 1=feedback valid
BI	9	--	"F" input terminal status	0=terminal-CC open 1=terminal-CC shorted
BI	10	--	"R" input terminal status	0=terminal-CC open 1=terminal-CC shorted
BI	11	--	"S1" input terminal status	0=terminal-CC open 1=terminal-CC shorted
BI	12	--	"S2" input terminal status	0=terminal-CC open 1=terminal-CC shorted
BI	13	--	"S3" input terminal status	0=terminal-CC open 1=terminal-CC shorted
BI	14	--	"S4" input terminal status	0=terminal-CC open 1=terminal-CC shorted

NPT ¹	NPA ²	Units	Point Description	Range / Value
BI	15	--	"RES" input terminal status	0=terminal-CC open 1=terminal-CC shorted
BI	16	--	"ST" input terminal status	0=terminal-CC open 1=terminal-CC shorted
BI	17	--	"FL" output contacts status	0=FLB-FLC shorted 1=FLA-FLC shorted
BI	18	--	"RCH" output status	0=RCH OFF 1=RCH ON
BI	19	--	"LOW" output contacts status	0=LOWA-LOWC open 1=LOWA-LOWC shorted
AO	1	Hz	Frequency command	0.00 Hz ~ 400.00 Hz
AO	2	Sec	Acceleration time #1	0.01 ~ 600.00 / 0.1 ~ 6000.0
AO	3	Sec	Deceleration time #1	0.01 ~ 600.00 / 0.1 ~ 6000.0
AO	4	%	Stall protection current level	10 ~ 215
AO	5	--	Command mode selection	0 ~ 4
AO	6	--	Frequency mode selection	0 ~ 4
AO	7	--	Proportional gain	0.01 ~ 2.55
AO	8	--	Integral gain	0.01 ~ 360.00
AO	9	Hz	PID lower limit frequency	0 ~ FH
AO	10	%	PID deviation upper limit	0 ~ 50
AO	11	%	PID deviation lower limit	0 ~ 50
AO	12	Sec	Loss of comm. timeout time	0.100 ~ 60.000
AO	13	--	Loss of comm. timeout action	0 ~ 4
BO	1	--	Run / stop command	0=stop 1=run
BO	2	--	Forward / reverse selection	0=reverse 1=forward
BO	3	--	Acceleration/deceleration #1/#2 selection	0=accel/decel #1 1=accel/decel #2
BO	4	--	Compulsory DC injection braking mode selection	0= no compulsory braking 1=compulsory DC inj. braking below DC injection starting frequency (dBf in G.P.F)
BO	5	--	Gate block (coast stop) command	0=no gate block 1=gate block
BO	6	--	Emergency off command	0=no action 1=emergency off
BO	7	--	Fault reset command	0=no action 1=reset
BO	8	--	Feedback control enable selection	0=feedback valid 1=feedback invalid
BO	9	--	Feedback control selection	0=no feedback 1=PID feedback control
BO	10	--	PID deviation limit selection	0=PID deviation limit disabled 1=PID deviation limit enabled

[NOTE 1]: NPT = Network Point Type.

[NOTE 2]: NPA = Network Point Address.

8.3 Individual Object Descriptions

This section gives a brief overview of each object, including any notable behavior or settings. For those parameters outlined here that directly map to internal EIII configuration parameters, refer to the [EIII Operation Manual](#) for further information regarding their usage or behavior.

8.3.1 Analog Input Objects

- AI #1.....Indicates the inverter's output frequency in Hz.
- AI #2.....Indicates the inverter's output current in % (100% = inverter rated current).
- AI #3.....Indicates the inverter's output voltage in % (100% = inverter voltage class).
- AI #4.....Indicates the inverter's input voltage in % (100% = inverter voltage class).
- AI #5.....Indicates the signal level currently being applied to the EIII's IV analog input terminal. This can be used to monitor such items as feedback sensor outputs and other process variables.
- AI #6.....Similar to AI #5, this object indicates the signal level currently being applied to the EIII's RR analog input terminal.
- AI #7.....Similar to AI #5, this object indicates the signal level currently being applied to the EIII's RX analog input terminal.
- AI #8.....Indicates the EIII's present input power usage (power consumed by the inverter/motor system).
- AI #9.....Indicates the EIII's present output power (power consumed by the motor).
- AI #10.....Indicates the EIII/system energy consumption in KWh. This point must be used in conjunction with AI #11 to arrive at an accurate representation of system energy consumption. Upon reaching 999.9 KWh, this point rolls over to 0.0 KWh, and the value of MWh (AI #11) is incremented. Use this point only when the communications interface is installed in a EIII inverter.
- AI #11.....Indicates the EIII/system energy consumption in MWh. This point must be used in conjunction with AI #10 to arrive at an accurate representation of system energy consumption. For example, if the value of AI #10 is 456.3, and the value of AI #11 is 34, the total system energy expenditure thus far is 34.4563 MWh, or 34,456.3 KWh. Use this point only when the communications interface is installed in a EIII inverter.
- AI #12.....Indicates the present inverter fault code (refer to section 9 for fault code meanings). Under normal inverter operation (no faults), this value will be 0. When the Metasys interface is installed in a 3-series adjustable speed drive other than the EIII, the maximum value possible is 41.
- AI #13 ~ AI #16.....Indicate the last 4 faults that occurred (refer to section 9 for fault code meanings). AI #13 contains the fault code for the most recent saved fault and AI #16 contains the fault code for the oldest saved fault. When a new fault occurs, the fault codes traverse down the fault stack, and the oldest fault is discarded. When the Metasys interface is installed in a 3-series adjustable speed drive other than the EIII, the maximum value possible is 41.

8.3.2 Binary Input Objects

- BI #1Indicates whether the inverter is running or stopped.
- BI #2Indicates whether the inverter is running in the forward or reverse direction.
- BI #3Indicates whether the inverter is currently using acceleration time #1 and deceleration time #1 or acceleration time #2 and deceleration time #2 when accelerating and decelerating.
- BI #4Indicates the status of compulsory DC injection braking. When using compulsory DC injection braking, the EIII will apply DC injection braking to the motor whenever the current output frequency drops below the frequency value set in parameter d_{bbF} in $\zeta_{r.PF}$. This differs from standard DC injection braking in that with standard DC injection braking, the EIII will apply DC injection braking only when a stop command is given and the frequency drops below the value set in parameter d_{bbF} in $\zeta_{r.PF}$.
- BI #5Indicates whether or not a coast-stop command was given to the EIII.
- BI #6Indicates whether or not the EIII is currently faulted “E”.
- BI #7Indicates whether or not the EIII is currently faulted (any fault).
- BI #8Indicates whether feedback control is enabled or not. Note that this BI object does not necessarily indicate that feedback is active; in order to use feedback control, parameter feedback control selection (BO #9, or parameter F_{bbP} in $\zeta_{r.Fb}$) must also be enabled. This BI object only indicates the enable selection status of BO #8.
- BI #9Indicates the current status of the “F” input contact terminal.
- BI #10Indicates the current status of the “R” input contact terminal.
- BI #11Indicates the current status of the “S1” input contact terminal.
- BI #12Indicates the current status of the “S2” input contact terminal.
- BI #13Indicates the current status of the “S3” input contact terminal.
- BI #14Indicates the current status of the “S4” input contact terminal.
- BI #15Indicates the current status of the “RES” input contact terminal.
- BI #16Indicates the current status of the “ST” input contact terminal.
- BI #17Indicates the current status of the “FL” output contacts.
- BI #18Indicates the current status of the “RCH” output terminal. When the Metasys interface is installed in a 3-series adjustable speed drive other than the EIII, the RCH terminal may consist of dry contact closures. In this case, the value 0 corresponds to RCHA-RCHC open, and the value 1 corresponds to RCHA-RCHC closed.
- BI #19Indicates the current status of the “LOW” output contacts.

8.3.3 Analog Output Objects

IMPORTANT: Most of the AO objects detailed in this section map directly to EIII configuration parameters (parameters accessible via the EIII's keypad). When these parameters are changed (from either the keypad or N2 network), they are stored in the EIII's non-volatile EEPROM. The EIII's EEPROM has a life span of 10,000 write cycles per parameter; therefore do not write to any of these AO objects more than 10,000 times.

AO #1Used to set the inverter's frequency command (note that the EIII will only use this value as its active frequency command if AO #6 or parameter $FREQ$ in $Gr.Ut$ is set to 3). Although the adjustment range for this object is 0.00Hz ~ 400.00Hz, the actual frequency command will be internally limited by the values of parameters UL , LL and FH in $Gr.F$.

AO #2Accesses the EIII's acceleration time #1 parameter ($ACC1$ in $Gr.F$). As indicated, the adjustment range and resolution depend on the setting of parameter $dSPt$ in $Gr.Ut$. The value of $dSPt$ is read by the Metasys interface only on inverter initialization; therefore, if the setting of $dSPt$ is changed, be sure to reset the inverter to validate the changed setting and provide correct network data interpretation.

AO #3Accesses the EIII's deceleration time #1 parameter ($dEC1$ in $Gr.F$). As indicated, the adjustment range and resolution depend on the setting of parameter $dSPt$ in $Gr.Ut$. The value of $dSPt$ is read by the Metasys interface only on inverter initialization; therefore, if the setting of $dSPt$ is changed, be sure to reset the inverter to validate the changed setting and provide correct N2 network data interpretation.

AO #4Accesses the EIII's stall protection level parameter ($StL1$ in $Gr.Pf$).

AO #5Accesses the EIII's command mode selection parameter ($CMOD$ in $Gr.Ut$). For Metasys network commands to affect the EIII's actual operation, this object must be set to a value of 3. Note that if this parameter is changed while the EIII is running, the changed value will not take effect until the inverter is stopped.

AO #6Accesses the EIII's frequency mode selection parameter ($FREQ$ in $Gr.Ut$). For the frequency command (AO #1) set via the Metasys network to affect the EIII's actual operation, this object must be set to a value of 3. Note that if this parameter is changed while the EIII is running, the changed value will not take effect until the inverter is stopped.

AO #7Accesses the EIII's process (PID) control proportional gain parameter (CP in $Gr.Fb$).

AO #8Accesses the EIII's process (PID) control integral gain parameter (CI in $Gr.Fb$).

AO #9Accesses the EIII's process (PID) control lower limit frequency parameter (PUL in $Gr.Fb$). Note that the adjustment range of this object depends on the setting of the maximum frequency parameter (FH in $Gr.F$). The value of FH is read only on inverter initialization; therefore, if the setting of FH is changed, be sure to reset the inverter to validate the changed setting and provide correct N2 network data limit checking.

AO #10..Accesses the EIII's process (PID) deviation upper limit parameter (P_{ULL} in C_{r.Fb}).

AO #11..Accesses the EIII's process (PID) deviation lower limit parameter (P_{ULL} in C_{r.Fb}).

AO #12 and AO #13..... The N2 interface provides a configurable "loss of communications" timer function, which can detect communication losses and perform certain actions if a valid N2 packet is not received and processed within a set time period.

AO #12 sets the loss of communication time value (adjustable from 100ms to 60.000s in 1ms increments, factory setting = 1.000s). If a valid (error-free) N2 reception-response cycle does not take place within this time limit, the timer will expire. If the timer expires, 5 possible actions can occur, as set by the value AO #13 (loss of communications timeout action):

AO #13 Setting	Action Taken Upon Timeout
0 (default)	No action: ignore timeout.
1	Flash "E" (communications warning indicator) on LED display only.
2	Flash "E" on LED display, stop EIII with decelerated stop.
3	Trip "ErrE" (communication interface card error). Note that the EIII must be reset locally in this case.
4	Flash "E" on LED display, set AO #1 (frequency command) to 400.00Hz (CAUTION!). Note that the actual internal frequency command will be limited by the upper limit frequency (parameter U _L in C _{r.F}).

Setting 0 is the default setting; when a communications timeout occurs, no action will be taken (function is disabled).

For setting 1 (flash "E" on LED display only), this condition will continue until the next error-free N2 packet is received and responded to. The warning condition will then be removed and the timer value reset.

For setting 2 (flash "E" on LED display, stop inverter with decelerated stop), the "E" warning will act as described in setting 1, but BO #1 (run/stop command) will also be set to 0 (stop). Note that the inverter stop condition will not be reset when an error-free N2 network packet is once again received and responded to. Note that although BO #1 is set to 0, this will cause the EIII to actually stop only if AO #5 or parameter command mode selection (C_{MOD} in C_{r.WE}) is set to 3 (communication interface input valid). The EIII will then remain stopped until commanded otherwise by the NCU.

Setting 3 does not depend on the command mode selection (AO #5 or C_{MOD} in C_{r.WE}) or frequency mode selection (AO #6 or F_{MOD} in C_{r.WE}) parameters. Note that the "ErrE" (communication interface card error) fault can only be cleared locally at the inverter.

Setting 4 will cause the Metasys N2 interface to automatically change the option frequency command (AO #1) to 400.00Hz upon a timeout occurrence.

Note that the actual internal frequency command will be limited by the upper limit frequency (parameter ω_{UL} in Cr.F). If the EIII was running at the time of the communications loss, it will then accelerate to and continuously run at the upper limit frequency; otherwise it will remain stopped even though the value of AO #1 has been modified. Similar to the stop command issued to the EIII by the N2 interface with setting 2 (see above), the value of AO #1 will not automatically return to its pre-timeout value once proper network communications are re-established. The NCU must specifically modify the value of AO #1 once communications are re-established to cause the EIII to run at the desired frequency once again. Note that in order for this setting to actually affect the EIII's operating frequency, AO #6 or parameter $FREQ$ in Cr.WE must be set to 3 (communication interface input valid).

USE EXTREME CAUTION WHEN SELECTING THIS SETTING!

Thoroughly verify that there is no possibility of personal injury or equipment damage due to the inverter running at the upper limit frequency setting, especially with the possibly that network communications may not be able to be re-established in a timely fashion (depending on what network condition caused the communications timeout in the first place).

Note that the values of AO #12 and AO #13 are non-volatile (stored in the EIII's EEPROM). Therefore, do not write to these objects more than 10,000 times. In addition, although these values may be changed via the N2 network, the N2 interface uses the values read upon initialization until the EIII is reset again. Therefore, the EIII must be reset after either of these values has been changed in order for them to take effect and provide the desired operation.

8.3.4 Binary Output Objects

IMPORTANT: BO #9 and BO #10 map directly to EIII configuration parameters (parameters accessible via the EIII's keypad). When these parameters are changed (from either the keypad or N2 network), they are stored in the EIII's non-volatile EEPROM. The EIII's EEPROM has a life span of 10,000 write cycles per parameter; therefore do not write to either of these BO objects more than 10,000 times.

Note that the actions detailed for BO #1 ~ BO #8 will affect the EIII's actual operation only if AO #5 or parameter EIII in EIII is set to 3.

BO #1....Run / stop command.

BO #2....Selects forward or reverse run direction.

BO #3....Selects whether the EIII will use acceleration time #1 and deceleration time #1 or acceleration time #2 and deceleration time #2 when accelerating and decelerating. This change can occur dynamically while the inverter is running.

BO #4....Selects whether or not to use compulsory DC injection braking. When using compulsory DC injection braking, the EIII will apply DC injection braking to the motor whenever the current output frequency drops below the frequency value set in parameter dB in EIII . This differs from standard DC injection braking in that with standard DC injection braking, the EIII will apply DC injection braking only when a stop command is given and the frequency drops below the value set in parameter dB in EIII .

BO #5....Issues a gate block (coast stop) command. This immediately ceases the output of both frequency and voltage to the motor.

BO #6....Causes the EIII to trip "E".

BO #7....Resets the EIII when faulted. This action will cause the EIII to lose communication with the N2 network for approximately 3 seconds while the system initializes. When done initializing, the N2 interface will be in the "offline" state, and will respond with a Metasys "N00" error to all N2 commands until the NCU sends an "identify device type" command.

BO #8....Enables or disables process (PID) feedback control. Note that this object does not activate (turn on) feedback control; it only enables or disables feedback control once it has already been activated. To activate feedback control, BO #9 (or parameter FB in EIII) must be set to 1. Once that has been completed, BO #8 can be used to disable and enable feedback control dynamically. The reason for this distinction is for those applications that require frequent activation/deactivation of PID control. Since BO #9 directly maps to the EIII's feedback control selection parameter (FB in EIII) which is stored in the EIII's EEPROM, BO #9 must not be written to more than a total of 10,000 times. In these applications, therefore, BO #8 can be used to effectively enable and disable PID control; because the value of BO #8 is not stored in non-volatile EEPROM, it can safely be written to an unlimited number of times.

BO #9....Activates/deactivates (turns on/off) process (PID) control. Maps to the EIII's feedback control selection parameter (FB in EIII). Refer to the discussion regarding BO #8 for more details.

BO #10..Accesses the EIII's PID deviation limit selection parameter (PL in EIII).

9. Inverter Fault Codes

LED Message	Fault Code	Explanation
nErr	0	No error has been recorded since the last inverter reset or trip clear
OC1	1	Overcurrent during acceleration
OC2	2	Overcurrent during deceleration
OC3	3	Overcurrent during constant-speed run
OCL	4	Load-end overcurrent detected at start-up (output terminals, motor wiring etc.)
OCA1	5	U-phase armature short circuit
OCA2	6	V-phase armature short circuit
OCA3	7	W-phase armature short circuit
EPH1	8	Lost input phase (option)
EPH0	9	Lost output phase (option)
OP1	10	Overvoltage during acceleration
OP2	11	Overvoltage during deceleration
OP3	12	Overvoltage during constant-speed run
OL In	13	Inverter overload
OL M	14	Motor overload
OLr	15	Dynamic braking resistor overload
OH	16	Inverter overheat
E	17	Emergency off
EEP1	18	EEPROM failure during write
EEP2	19	EEPROM failure during initial read
¾	20	Unused
Err2	21	RAM error
Err3	22	ROM error
Err4	23	CPU error
Err5	24	RS232C timer time-out
Err6	25	Gate array error
Err7	26	Output current detection circuit error
Err8	27	Communication interface card error
Err9	28	Option ROM error
UC	29	Low current
UP1	30	Main circuit undervoltage
¾	31	Unused
OT	32	Overtorque
EF1	33	Earth fault (software)
EF2	34	Earth fault (hardware)
EFU	35	Open fuse

LED Message	Fault Code	Explanation
OCr	36	Dynamic braking resistor overcurrent
OC 1P	37	Overcurrent in DC section during acceleration
OC2P	38	Overcurrent in DC section during deceleration
OC3P	39	Overcurrent in DC section during constant-speed run
Etn	40	Auto-tuning error
EtYP	41	Inverter typeform error
¾	42 ~ 80	Unused
dRNP	81	Closed damper detected
LOSS	82	Loss of IV input detected

10. NCU DDL File

Below is a Data Definition Language (DDL) file for the EIII Metasys direct N2 bus interface which can be input to an N2 Network Controller Unit (NCU).

An electronic version of this file can be downloaded via the internet from <http://www.iccdesigns.com>.

```
*****
**          Toshiba EIII Adjustable Speed Drive          **
*****
CSMODEL "EIII", "VND"

AITITLE "Analog Inputs"
BITITLE "Binary Inputs"
AOTITLE "Analog Outputs"
BOTITLE "Binary Outputs"

CSAI "AI1",N,N,"OUT FREQ","HZ"
CSAI "AI2",N,N,"CURRENT","%"
CSAI "AI3",N,N,"OUT VOLT","%"
CSAI "AI4",N,N,"INP VOLT","%"
CSAI "AI5",N,N,"IV INPUT","%"
CSAI "AI6",N,N,"RR INPUT","%"
CSAI "AI7",N,N,"RX INPUT","%"
CSAI "AI8",N,N,"INP POWR","kW"
CSAI "AI9",N,N,"OUT POWR","kW"
CSAI "AI10",N,N,"ENERGY k","kWh"
CSAI "AI11",N,N,"ENERGY M","MWh"
CSAI "AI12",N,N,"NOW FLT","CODE"
CSAI "AI13",N,N,"1ST FLT","CODE"
CSAI "AI14",N,N,"2ND FLT","CODE"
CSAI "AI15",N,N,"3RD FLT","CODE"
CSAI "AI16",N,N,"4TH FLT","CODE"

CSBI "BI1",N,N,"RUN STAT","STOP","RUN"
CSBI "BI2",N,N,"F/R STAT","REV","FWD"
CSBI "BI3",N,N,"ACC STAT","#1","#2"
CSBI "BI4",N,N,"INJ STAT","OFF","ON"
CSBI "BI5",N,N,"CST STAT","NORMAL","COAST"
CSBI "BI6",N,N,"E STAT","NORMAL","EOFF"
CSBI "BI7",N,N,"FLT STAT","NORMAL","FAULT"
CSBI "BI8",N,N,"FB STAT","DISABL","ENABL"
CSBI "BI9",N,N,"F TERM","OPEN","CLOSED"
CSBI "BI10",N,N,"R TERM","OPEN","CLOSED"
CSBI "BI11",N,N,"S1 TERM","OPEN","CLOSED"
CSBI "BI12",N,N,"S2 TERM","OPEN","CLOSED"
CSBI "BI13",N,N,"S3 TERM","OPEN","CLOSED"
CSBI "BI14",N,N,"S4 TERM","OPEN","CLOSED"
CSBI "BI15",N,N,"RES TERM","OPEN","CLOSED"
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CSBI "BI16",N,N,"ST TERM","OPEN","CLOSED"
CSBI "BI17",N,N,"FL OUTP","FLB-C","FLA-C"
CSBI "BI18",N,N,"RCH OUTP","OFF","ON"
CSBI "BI19",N,N,"LOW OUTP","OPEN","CLOSED"

CSAO "AO1",Y,Y,"FREQ CMD","HZ"
CSAO "AO2",Y,Y,"ACCEL #1","SEC"
CSAO "AO3",Y,Y,"DECEL #1","SEC"
CSAO "AO4",Y,Y,"STALL","%"
CSAO "AO5",Y,Y,"CMD MODE","-"
CSAO "AO6",Y,Y,"FRQ MODE","-"
CSAO "AO7",Y,Y,"P GAIN","-"
CSAO "AO8",Y,Y,"I GAIN","-"
CSAO "AO9",Y,Y,"PID LL","Hz"
CSAO "AO10",Y,Y,"FB DEV U","%"
CSAO "AO11",Y,Y,"FB DEV L","%"
CSAO "AO12",Y,Y,"LOSS SEC","SEC"
CSAO "AO13",Y,Y,"LOSS ACT","-"

CSBO "BO1",Y,Y,"RUN/STOP","STOP","RUN"
CSBO "BO2",Y,Y,"FWD/REV","FWD","REV"
CSBO "BO3",Y,Y,"ACC 1/2","#1","#2"
CSBO "BO4",Y,Y,"DC INJCT","DISABL","ENABLE"
CSBO "BO5",Y,Y,"CST CMD","-","COAST"
CSBO "BO6",Y,Y,"E CMD","-","EOFF"
CSBO "BO7",Y,Y,"RESET","-","RESET"
CSBO "BO8",Y,Y,"FB SEL","VALID","INVALID"
CSBO "BO9",Y,Y,"FB ENABL","DISABL","ENABLE"
CSBO "BO10",Y,Y,"FB DEV","DISABL","ENABLE"

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