GPD 506/P5 Lonworks Interface Option
Technical Manual

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YASKAWA

GPD 506/P5

LonMark®

Models: CM047   Document Number: TM 4567

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1. Introduction

The LonWorks® communication option allows the **GPD506/P5** to be integrated into a new or existing LonWorks environment. With this option installed, the drive can be fully configured and controlled over the LonWorks network.

This manual describes the steps necessary for hardware installation, network identification, and operation of the interface. Refer to the appropriate Technical Manual for additional information regarding drive operation and setup.

2. Hardware Installation

This chapter describes steps necessary to install the option card and configure the drive for its use. Since this option is available pre-installed or in kit form, many of these steps may have been completed at the factory. If already installed, users are encouraged to review these steps to become familiar with the procedure. Refer to **Figure 1** for the physical location of switches, LEDs and connectors.
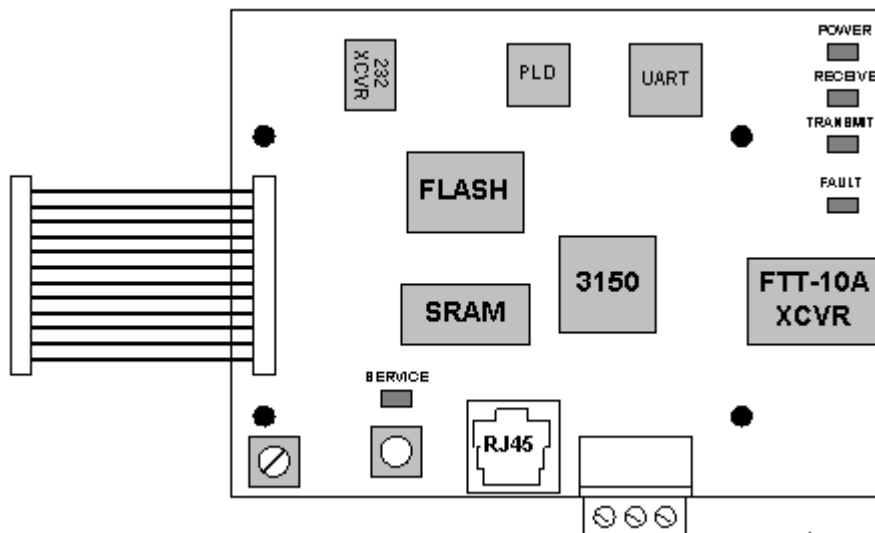
Figure 1. Option Card Layout

2.1 Option Card Mounting

CAUTION:	Make sure that the input power to the drive is TURNED OFF and the CHARGE lamp inside the unit is OFF before installing the option card.

Step 1. Remove the digital operator, applying pressure to the locking plate on its lower right side, as illustrated in **Figure 2**. Lift the operator out by pulling forward.
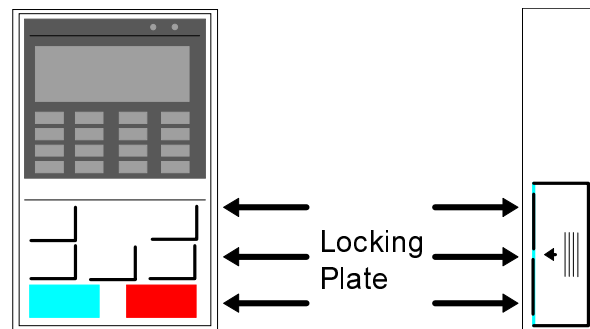
Figure 2. Operator Removal

Step 2. Remove the drive cover, applying pressure to the locking tabs on either side of the cover as illustrated in **Figure 3**. With the locking tabs disengaged, pivot the cover out from the bottom. Continue pivoting it until the top hinge disengages.
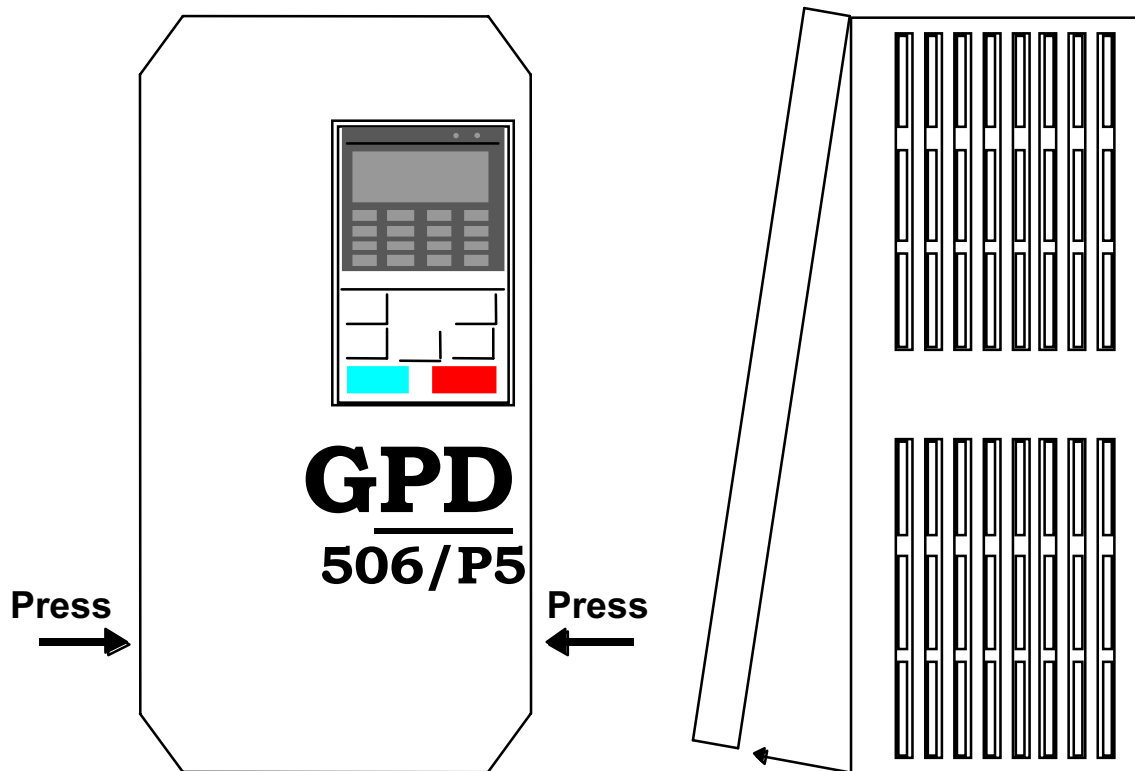
Figure 3. Cover Removal

Step 3. Position the option card so that the 12-pin interface cable is to the left, as illustrated in **Figure 4**. Carefully press the attached cable connector into connector 2CN until it is firmly seated. Please note the orientation of the locking tab relative to the connector mounted on the control board.

Step 4. Position the option board mounting holes directly over the four standoffs on the control board. Carefully press the option board onto the standoffs until it is firmly seated.

Step 5. Install a green ground wire to the Ground Terminal of the CM047 Lonworks interface, to a noise free control ground (Typically this will be either the panel power supply line ground, or the ground connection referenced at the local controller). Note: It is preferred to ground the Lonworks interface to correctly supply reference to the network. However, if a noise free ground is not available, leave the ground terminal on the Lonworks interface un-terminated. Refer to **Figure 4**.
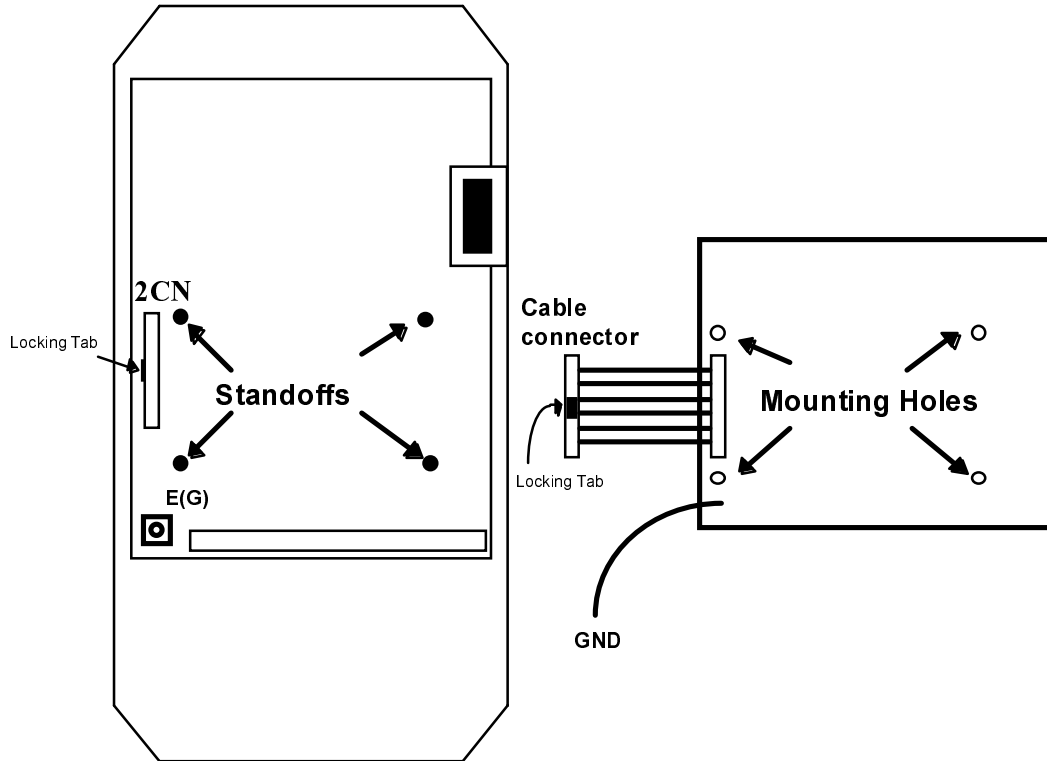
Figure 4. Option Card Positioning

2.2 Drive Set-up

The drive must be properly configured to communicate with the option card, as described below:

GPD506 Parameter	Setting	Description
n104	1	Address (01)
n105	2	Baud Rate (9600)
n106	0	Parity (None)

NOTE: Parameter n001 must be set to 3 to change these parameters. New settings will not take affect until drive power is cycled.

If any of these settings is incorrect, "*CALL*" will blink on the digital operator, as will the **RECEIVE**, **TRANSMIT** and **FAULT** LEDs. This is an indication that the drive has not yet established communication with the option card. Once the drive has properly exchanged messages with the option card, all blinking should stop.

NOTE: "*CALL*" also flashes if the node is in the unconfigured state on power-up (see Chapter 3, "Network Installation").

2.3 Network Connection

The LonWorks interface features Echelon's twisted pair free topology transceiver (FTT-10A). The FTT-10A transceiver is also directly compatible with Echelon's LPT-10 Link Power transceiver. A single twisted pair cable can be shared by these transceiver types.

Primary network connection is facilitated by a pluggable 3-way Phoenix-style connector included with the option card. The center position is for the shield while the outer positions are for the twisted pair cable, as illustrated in **Figure 5**. The network connection is ***polarity insensitive***.
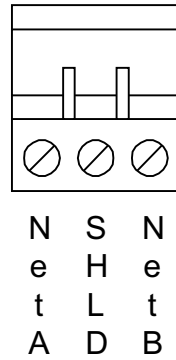
Figure 5. Phoenix-Style Network Connector

A second method of network connection is a modular RJ-45 plug. Pins 1 and 2 are the network connections, as illustrated in **Figure 6**. The network connection is ***polarity insensitive***.
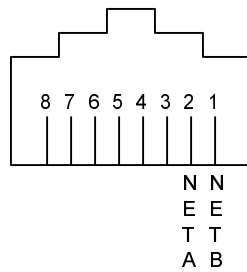
Figure 6. RJ45 Network Connector

3. Network Installation

With the option card properly installed and connected to the network, the node is ready to be installed on the LonWorks network.

3.1 Installation Files

Included with each option card is a diskette containing several files made available to assist in node installation and identification. These are the External Interface File (GPD506.XIF) and the Device Resource Files (GPD506.TYP, GPD506.ENU, GPD506.FPT, and GPD506.FMT).

3.1.1 External Interface File

The external interface file contains a detailed description of a node's network variables and configuration properties, including network variable type and self-documentation information. Hardware characteristics, such as transceiver type and initial communication parameters, are also defined. By importing this file, many network management tools can "pre-define" a device type prior to connection of the first node. This can greatly reduce installation time.

3.1.2 Device Resource Files

Device resource files define the components of an external interface for a LonWorks device. These files allow installation tools and operator interface applications to interpret and format data properly. Standard resource files are made available by the LonMark® Interoperability Association and contain the definition for Standard Network Variable Types (SNVTs), Standard Configuration Property Types (SCPTs) and Standard Functional Profile Types (SFPTs). The resource files included on the installation disk contain additional information specific to this interface. These files should be placed in the \TYPES sub-directory associated with the user's network management tool and registered in the resource file catalog.

3.2 Network Identification

The LonWorks interface is shipped in the **unconfigured** state. This implies that the application is loaded and communication parameters are defined, but it has not been installed on a network.

On power up, the **unconfigured** state can be recognized by the **SERVICE** LED flashing at a 0.5 Hz rate. If this is not the initial power-up state, attempt to re-initialize the node as described in **Section 3.3**, "**Reclaiming a Node**". If this state cannot be restored, see **Chapter 8**,"**Diagnostic LEDs**" to determine the state of the option card.

Network identification is accomplished with an installation tool. Unique network identities are established by pairing "logical" addresses with a device's 48-bit Neuron ID. The two most common methods of node installation are described below.

3.2.1 Service Button

Each option card has a Service Button. If using a tool which utilizes this feature, a user is prompted to press the Service Button at some point in the installation procedure. When pressed, a broadcast message is sent which contains the Neuron ID and program ID, and this uniquely identifies the node on the network. This method works best for small networks or with portable installation tools.

3.2.2 Find and Wink

When it is impractical to press each node's Service Button for installation (e.g. in large networks or a node is physically enclosed), the "find and wink" installation method is useful. With this method, the installation tool queries the network for all unconfigured nodes. Nodes respond with their Neuron ID and a logical address is assigned. A "wink" command can then be sent to each logical address. In response to this command, the **TRANSMIT** and **RECEIVE** LEDs will blink rapidly for several seconds. In this manner, the exact physical location of each node can be identified.

3.3 Reclaiming a Node

A node can be "reclaimed", or returned to its **unconfigured** state, as follows:

- Remove drive power.
- Press and hold the Service Button.
- Re-apply drive power, continuing to press and hold the Service Button.
- After approximately 5 seconds, the **SERVICE** LED should begin flashing at a 0.5 Hz rate, indicating the **unconfigured** state.
- This procedure sets both domain table entries to "undefined" and sets the channel ID to 0.

4. Application Overview

This interface uses LonMark objects to communicate on a LonWorks network, as defined in the LonMark functional profile for Variable Speed Motor Drives (6010). Two objects are implemented - the Node Object (0) and the Variable Frequency Drive Object (1), as illustrated in **Figure 7**.
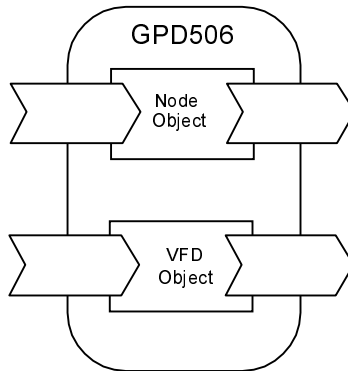
Figure 7. LonMark Objects

The network variables and configuration properties for each object are summarized below. **Chapter 5**, "**Node Object Operation**" and **Chapter 6**, "**VFD Object Operation**" contain additional detail on the operation of each object.

4.1 Node Object Network Variable Summary

Variable Name	Variable Type	Description
nviRequest	SNVT_obj_request	Used to request a particular mode for an object. **Modes supported**: • RQ_NORMAL • RQ_DISABLED • RQ_UPDATE_STATUS • RQ_REPORT_MASK • RQ_CLEAR_ALARM
nvoStatus	SNVT_obj_status	Used to report the status of an object. **Status bits supported**: • INVALID_ID • INVALID_REQUEST • DISABLED • IN_ALARM • REPORT_MASK

4.2 Node Object Configuration Property Summary

Property Name	Variable Type	Default	Description
nciDevMajVer	Unsigned short	0	Identifies the major version of the device interface.
nciDevMinVer	Unsigned short	0	Identifies the minor version of the device interface.

4.3 VFD Object Network Variable Summary

Index	Variable Name	Variable Type	Description
nv1	nviDrvSpeedStpt	SNVT_switch	Controls start/stop and a low resolution speed setpoint as a percentage of **nciNmlFreq**.
nv2	nviDrvSpeedScale	SNVT_lev_percent	Controls scaling for **nviDrvSpeedStpt**. Negative values indicate reverse motor direction.
nv3	nvoDrvCurnt	SNVT_amp	Reports output current.
nv4	nvoDrvSpeed	SNVT_lev_percent	Reports output speed as a percentage of **nciNmlFreq**.
nv5	nvoDrvVolt	SNVT_volt	Reports AC output voltage.
nv6	nvoDrvPwr	SNVT_power_kilo	Reports output power. **This output is only available on GPD506 drives.**
nv7	nvoDrvRunHours	SNVT_time_hour	Reports accumulated run time.
nv8	nviOpCommands	SNVT_state	Controls the following operational commands: • bit 0 - External Fault (**EF0**) • bit 1 - Fault Reset • bit 2 - Multifunction Input 1 (terminal S3) • bit 3 - Multifunction Input 2 (terminal S4) • bit 4 - Multifunction Input 3 (terminal S5) • bit 5 - Multifunction Input 4 (terminal S6)
nv9	nviReadParamNum	SNVT_count	Requests a read of the specified drive parameter. The response value is reported in **nvoReadParamVal**.
nv10	nviWriteParamNum	SNVT_count	Requests a write of the specified drive parameter. The write value is contained in **nviWriteParamVal**.
nv11	nviWriteParamVal	SNVT_count	Contains the value to be written to the drive parameter specified in **nviWriteParamNum**.
nv12	nvoDrvStatus	SNVT_state	Reports drive operational status: • bit 0 - Drive Running • bit 1 - Reverse Run Commanded • bit 2 - Drive Ready • bit 3 - Drive Faulted • bit 4 - Modbus Error • bit 5 - Multifunction Output 1 • bit 6 - Multifunction Output 2 • bit 7 - Terminal S1 State • bit 8 - Terminal S2 State • bit 9 - Terminal S3 State • bit 10 - Terminal S4 State • bit 11 - Terminal S5 State • bit 12 - Terminal S6 State • bit 13 - n/a • bit 14 - n/a • bit 15 - GPD506 Flag

Index	Variable Name	Variable Type	Description
nv13	nvoFltStatus	SNVT_state	Reports drive fault status: • bit 0 - Overcurrent, Ground, Short Circuit • bit 1 - Overvoltage • bit 2 - Drive Overload • bit 3 - Overheat • bit 4 - n/a • bit 5 - Main Circuit • bit 6 - Brake Transistor • bit 7 - External • bit 8 - Hardware • bit 9 - Motor Overload • bit 10 - n/a • bit 11 - Undervoltage • bit 12 - Power Loss • bit 13 - Phase • bit 14 - n/a • bit 15 - n/a
nv14	nvoSpdStptFb	SNVT_lev_percent	Reports the speed setpoint as a percentage of *nciNmlFreq*.
nv15	nvoSpdCmd	SNVT_lev_percent	Reports the speed command as a percentage of *nciNmlFreq*, regardless of command source.
nv16	nvoPIDFb	SNVT_lev_percent	Reports the PID feedback as a percentage of *nciNmlFreq*. **This output is only available on GPD506 drives.**
nv17	nvoDrvEnergy	SNVT_elec_kwh	Reports cumulative drive energy. **This output is only available on GPD506 drives.**
nv18	nvoDrvTemp	SNVT_temp	Reports drive temperature. **This output is only available on GPD506 drives.**
nv19	nvoDCBus	SNVT_volt	Reports DC bus voltage.
nv20	nvoReadParamVal	SNVT_count	Reports the value of the requested read parameter.

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4.4 VFD Object Configuration Property Summary

Property Name	Variable Type	Default	GPD506 Parameter	Description
nciNmlSpeed	SNVT_rpm	1800 rpm	n/a	Configures nominal motor speed in rpm.
nciNmlFreq	SNVT_freq_hz	60 Hz	n/a	Configures nominal motor frequency in hertz. All speed related data in percent are referenced to this value.
nciMinSpeed	SNVT_lev_percent	0%	n032	Configures the minimum motor speed as a percentage of *nciNmlFreq*. Sets the drive's lower limit for frequency commands.
nciMaxSpeed	SNVT_lev_percent	100%	n031	Configures the maximum motor speed as a percentage of *nciNmlFreq*. Sets the drive's upper limit for frequency commands.
nciRampUpTm	SNVT_time_sec	10 sec	n018	Configures motor ramp up time from 0 to its operating setpoint. Sets the drive's output acceleration rate.
nciRampDownTm	SNVT_time_sec	10 sec	n019	Configures motor ramp down time from its operating setpoint to 0. Sets the drive's output deceleration rate.
nciSndHrtBt	SNVT_time_sec	0 sec (off)	n/a	Configures the maximum period of time that expires before automatic propagation of *nvoDrvCurnt*, *nvoDrvSpeed*, *nvoDrvVolt*, and *nvoDrvPwr*.
nciRcvHrtBt	SNVT_time_sec	0 sec (off)	n/a	Configures the maximum period of time that expires between network variable updates before a cable loss condition is declared and the drive is stopped.
nciMinOutTm	SNVT_time_sec	1 sec	n/a	Configures the minimum period of time that expires before changes in output network variables are propagated.
nciLocation	SNVT_str_asc	all "\0"	n/a	Available for a description of the physical location of the node.
nciDrvSpeedScale	SNVT_lev_percent	100%	n/a	Scales the speed setpoint *nviDrvSpeedStpt*.
nciOpMode	SNVT_count	3	n002	Selects the source for start/stop and speed commands.
nciDrvMaxFreq	SNVT_freq_hz	60.0 Hz	n011	Reports the maximum output frequency of the drive (**read-only**).
nciMtrFLA	SNVT_amp	**Note 1**	n033	Sets the full load current rating of the motor.
nciPLRideThru	SNVT_count	0	n055	Selects the drive's response to momentary power loss.
nciAutoRstrt	SNVT_count	0	n060	Selects the number of times the drive attempts to automatically restart after certain faults.
nciProFreq1	SNVT_freq_hz	0 Hz	n062	Sets the center frequency for the first band of prohibit frequencies.
nciProFreq2	SNVT_freq_hz	0 Hz	n063	Sets the center frequency for the second band of prohibit frequencies.
nciProFreqBW	SNVT_freq_hz	1.0 Hz	n064	Sets the bandwidth for prohibit frequencies.
nciPIDSel	SNVT_count	0	n084	Selects the mode of the PID controller.
nciPID_PGain	SNVT_multiplier	1.0	n086	Sets the proportional gain of the PID controller.
nciPID_ITime	SNVT_time_sec	10.0 sec	n087	Sets the integral time constant of the PID controller.
nvoDrvRatedCur	SNVT_amp	**Note 1**	**Note 2**	Reports the output current rating of the drive (**read-only**).
nciStallLevAcc	SNVT_count	**Note 1**	n073	Sets the stall level for output current during acceleration.
nciStallLevRun	SNVT_count	**Note 1**	n074	Sets the stall level for output current while at set speed.
nciCblLossSpeed	SNVT_lev_percent	0%	n/a	Sets speed level commanded if network communication is lost.
nciCblLossFltEna	SNVT_switch	Off	n/a	Enables an **EF0** fault to be declared if network communication is lost.

Notes

1. Value dependent on drive capacity. Refer to appropriate Technical Manual.
2. Internal value only available via serial communication.

5. Node Object Operation

The node object supports 2 network variables for controlling the mode and reporting the status of the objects. 2 configuration properties are used to identify the revision level of the interface firmware.
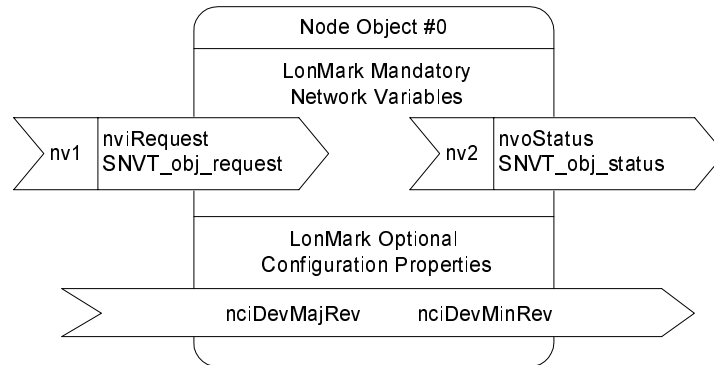
Figure 8. Node Object

5.1 Object Requests - nviRequest

The following table summarizes the supported request modes.

Mode Request	Node Object #0 Response	VFD Object #1 Response
RQ_NORMAL (0)	• All objects and network variables are re-enabled. • *nvoStatus* is updated and reported.	• VFD object network variables are re-enabled. • *nvoStatus* is updated and reported
RQ_DISABLE (1)	• If running, the motor shall come to a controlled stop. • All objects and network variables are disabled, except the node object. Input updates are ignored and outputs are not propagated. • *nvoStatus* is updated and reported.	• If running, the motor shall come to a controlled stop. • VFD object network variables are disabled. Input updates are ignored and outputs are not propagated. • Node object network variables remain enabled. • *nvoStatus* is updated and reported
RQ_UPDATE_STATUS (2)	• *nvoStatus* is updated for all objects and reported.	• *nvoStatus* is updated and reported.
RQ_REPORT_MASK (5)	• Invalid request. • *nvoStatus* is updated for all objects and reported.	• Each status bit supported by the VFD object is set in *nvoStatus* and reported.
RQ_CLEAR_ALARM (10)	• Invalid request. • *nvoStatus* is updated and reported.	• Fault reset is issued to drive. • *nvoStatus* is updated and reported.
All other requests	• Invalid request. • *nvoStatus* is updated and reported.	• Invalid request. • *nvoStatus* is updated and reported.

5.2 Object Status - nvoStatus

The output *nvoStatus* is propagated in response to any request. The following status fields are supported:

- **object_id** - indicates the object whose status is being reported.
- **invalid_id** - indicates a request to an undefined object id.
- **invalid_request** - indicates an invalid request to the specified object id.
- **disabled** - indicates the specified object is disabled.
- **in_alarm** - indicates the specified object is in alarm. For the VFD object, this bit is set when the drive is faulted.
- **report_mask** - indicates the status reported contains a '**1**' for each status bit supported.

5.3 Firmware Revision – nciDevMajVer, nciDevMinVer

These two configuration properties are used to identify the major and minor versions of the interface firmware.

The major version number is incremented when the network interface for the device changes. Major revisions require an upgrade of both the external interface file (.xif) and application image file (.nxe). The new external interface file re-defines the network interface to any network management tools in use. The new application image file is downloaded to an installed device to upgrade it's functionality and network interface definition.

The minor version number is incremented for changes which affect device functionality but do not affect the device's network interface. Minor revisions require an upgrade of the application image file (.nxe) only. The new application image file is downloaded to an installed device to upgrade it's functionality and network interface definition.

6. VFD Object Operation

The VFD object supports 20 network variables and 27 configuration properties for configuring, controlling, and monitoring the operation of the drive, as illustrated in **Figure 9**.
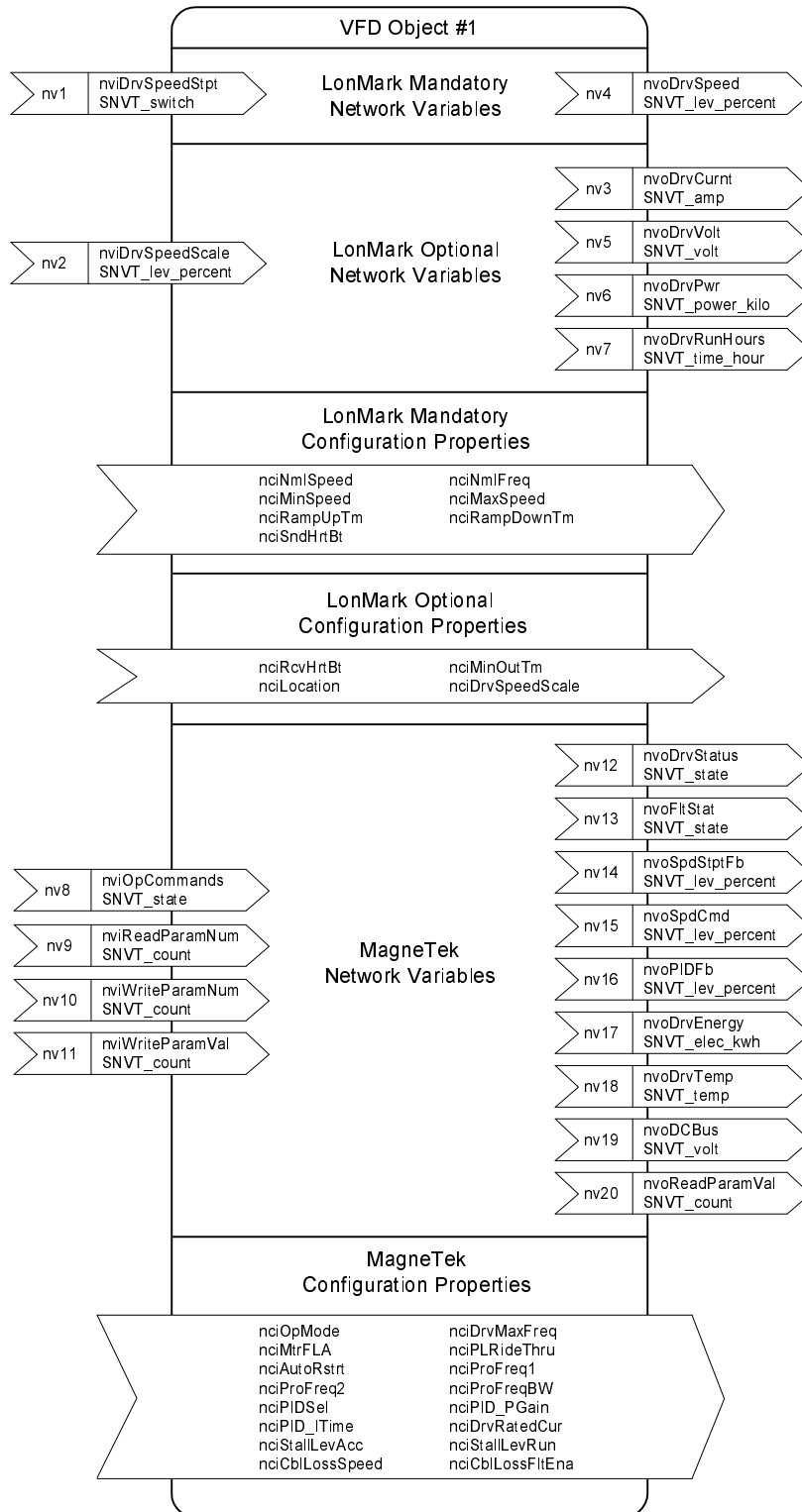
Figure 9. VFD Object

6.1 Drive Configuration

This section describes the configuration properties used to configure the drive. Refer to the appropriate Technical Manual for additional information.

6.1.1 Accel/Decel Times – nciRampUpTm, nciRampDownTm

These configuration properties define the ramp rates for starting and stopping the motor, configuring the drive as described below:

Property Name	Variable Type	Default	GPD506 Parameter	Description
nciRampUpTm	SNVT_time_sec	10 sec	n018	Configures motor ramp up time from 0 to its operating setpoint. Sets the drive's output acceleration rate.
nciRampDownTm	SNVT_time_sec	10 sec	n019	Configures motor ramp down time from its operating setpoint to 0. Sets the drive's output deceleration rate.

6.1.2 PID Configuration – nciPIDSel, nciPID_PGain, nciPID_ITime

These configuration properties define the mode and gains of the PID controller. The modes selectable by **nciPIDSel** are described below:

nciPIDSel	PID Mode
0	PID Disabled
1	PID Enabled
2	PI with Feed Forward
3	Inverted PID

These properties configure the drive as described below:

Property Name	Variable Type	Default	GPD506 Parameter	Description
nciPIDSel	SNVT_count	0	n084	Selects the mode of the PID controller.
nciPID_PGain	SNVT_multiplier	1.0	n086	Sets the proportional gain of the PID controller.
nciPID_ITime	SNVT_time_sec	10.0 sec	n087	Sets the integral time constant of the PID controller.

6.1.3 Stall Prevention – nciStallLevAcc, nciStallLevRun

These points define the stall prevention levels during acceleration and run. Each value is specified as a percentage of the drive's current rating (**nciDrvRatedCur**). If the output current (**nvoDrvCurnt**) reaches the specified level during acceleration or run, the output frequency is maintained or lowered as needed to sufficiently reduce the output current. These properties configure the drive as described below:

Property Name	Variable Type	Default	GPD506 Parameter	Description
nciStallLevAcc	SNVT_count	**Note 1**	n073	Sets the stall level for output current during acceleration.
nciStallLevRun	SNVT_count	**Note 1**	n074	Sets the stall level for output current while at set speed.

Notes

1. Value dependent on drive capacity. Refer to appropriate Technical Manual.

6.1.4   Operational Mode - nciOpMode

This configuration property defines the source for run and speed commands, as described below:

nciOpMode	Run/Reverse Command Source	Speed Command Source	Remarks
0	Digital Operator	Digital Operator	*nviDrvSpeedStpt*, *nviDrvSpeedScale* have no affect.
1	External Terminals	Digital Operator	*nviDrvSpeedStpt*, *nviDrvSpeedScale* have no affect.
2	Digital Operator	External Terminals	*nviDrvSpeedStpt*, *nviDrvSpeedScale* have no affect.
3	External Terminals	External Terminals	*nviDrvSpeedStpt*, *nviDrvSpeedScale* have no affect.
4	Digital Operator	LonWorks Network	*nviDrvSpeedStpt*, *nviDrvSpeedScale* determine speed command only.
5	External Terminals	LonWorks Network	*nviDrvSpeedStpt*, *nviDrvSpeedScale* determine speed command only.
6	LonWorks Network	LonWorks Network	*nviDrvSpeedStpt*, *nviDrvSpeedScale* determine run, reverse, and speed commands.
7	LonWorks Network	Digital Operator	*nviDrvSpeedStpt*, *nviDrvSpeedScale* determine run and reverse commands.
8	LonWorks Network	External Terminals	*nviDrvSpeedStpt*, *nviDrvSpeedScale* determine run and reverse commands.

This property configures the drive as described below:

Property Name	Variable Type	Default	GPD506 Parameter	Description
nciOpMode	SNVT_count	3	n002	Selects the source for start/stop and speed commands.

6.1.5   Motor Properties – nciNmlSpeed, nciNmlFreq, nciMaxSpeed, nciMinSpeed, nciMtrFLA

These properties define the motor characteristics, configuring the drive as described below:

Property Name	Variable Type	Default	GPD506 Parameter	Description
nciNmlSpeed	SNVT_rpm	1800 rpm	n/a	Configures nominal motor speed in rpm.
nciNmlFreq	SNVT_freq_hz	60 Hz	n/a	Configures nominal motor frequency in hertz. All speed related data in percent are referenced to this value.
nciMinSpeed	SNVT_lev_percent	0%	n032	Configures the minimum motor speed as a percentage of *nciNmlFreq*. Sets the drive's lower limit for frequency commands.
nciMaxSpeed	SNVT_lev_percent	100%	n031	Configures the maximum motor speed as a percentage of *nciNmlFreq*. Sets the drive's upper limit for frequency commands.
nciMtrFLA	SNVT_amp	**Note 1**	n033	Sets the full load current rating of the motor.

Notes

1.   Value dependent on drive capacity. Refer to appropriate Technical Manual.

6.1.6   Prohibit Frequencies - nciProFreq1, nciProFreq2, nciProFreqBW

These properties define bands of prohibited frequencies, selected to avoid certain areas of resonant motor vibration. Two separate bands can be defined, with a common bandwidth. When this feature is selected, the motor is accelerated and decelerated through the prohibited areas. These properties configure the drive as described below:

Property Name	Variable Type	Default	GPD506 Parameter	Description
nciProFreq1	SNVT_freq_hz	0 Hz	n062	Sets the center frequency for the first band of prohibit frequencies.
nciProFreq2	SNVT_freq_hz	0 Hz	n063	Sets the center frequency for the second band of prohibit frequencies.
nciProFreqBW	SNVT_freq_hz	1.0 Hz	n064	Sets the bandwidth for prohibit frequencies.

6.1.7   Automatic Restarts - nciAutoRstrt

This configuration property defines the number of automatic restarts that will be attempted under certain fault conditions, as described below:

Restartable Faults

- Overcurrent (oC), Overvoltage (ou), Undervoltage (Uu1), Ground Fault (GF)

Non-Restartable Faults

- Overload (oL_), External (EF_), Hardware (CPF_), Fuse Blown (PUF)
- Overcurrent (oC) or Overvoltage (ou) during deceleration
- When Power Loss Ride-Through is disabled (*nciPLRideThru* = 0)

This property configures the drive as described below:

Property Name	Variable Type	Default	GPD506 Parameter	Description
nciAutoRstrt	SNVT_count	0	n060	Selects the number of times the drive attempts to automatically restart after certain faults.

6.1.8   Power Loss Ride-Through - nciPLRideThru

This configuration property defines how the drive will react to a momentary power loss, as described below:

nciPLRideThru	RideThru Mode
0	RideThru Disabled
1	RideThru Enabled for up to 2 seconds
2	RideThru Enabled indefinitely, provided control power is maintained

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This property configures the drive as described below:

Property Name	Variable Type	Default	GPD506 Parameter	Description
nciPLRideThru	SNVT_count	0	n055	Selects the drive's response to momentary power loss.

6.1.9 General Purpose Setup - nviWriteParamNum, nviWriteParamVal

Two network variables are defined for setting any drive parameter:

nviWriteParamNum - Specifies the drive parameter to be set. Writing to this point initiates the write sequence.

nviWriteParamVal - Specifies the value to be written to the specified parameter. Writing to this point completes the write sequence and causes the value to be sent to the drive.

Refer to the appropriate Technical Manual for a detailed description of all parameters.

NOTE: The increment listed in the Technical Manual must be considered when specifying a value. For example, to set GPD506 **parameter** n070, **DC Injection Time at Stop, to 1 second,** nviWriteParamVal **must be set to 10, since the increment for this parameter is 0.1 seconds.**

6.2 Drive Command and Control

This section describes the network variables used to command and control the drive. Refer to the appropriate Technical Manual for additional information.

6.2.1 Run/Stop Command – nviDrvSpeedStpt

This network variable controls the run/stop command to the drive, as described below. The drive must be configured for a network Run/Stop Command (**nciOpMode = 6,7,8**) for this input to control the drive.

nviDrvSpeedStpt		Run/Stop Command
State	Value	
0	don't care	Stop
1	0	Run
1	> 0	Run

6.2.2 Speed Setpoint - nviDrvSpeedStpt, nviDrvSpeedScale

These two network variables are used together with **nciNmlFreq** to control the speed setpoint, as follows:

Speed Setpoint = nciNmlFreq * nviDrvSpeedStpt.value * nviDrvSpeedScale

For example:

nciNmlFreq	nviDrvSpeedStpt.value	nviDrvSpeedScale	Frequency Setpoint
60 Hz	100%	100%	60 Hz
60 Hz	100%	75%	45 Hz
60 Hz	75%	50%	22.5 Hz
50 Hz	60%	35%	10.5 Hz

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6.2.3 Reverse Command - *nviDrvSpeedScale*

This network variable is used to reverse the direction of the motor. A negative value for *nviSpeedScale* will cause the motor to reverse direction.

6.2.4 Fault / Fault Reset Control - *nviOpCommands*

Bit 0 of this network variable is used to command an external fault. Commanding this bit to a '**1**' will fault the drive and bring it to a controlled stop. '**EF0**' is annunciated on the digital operator.

Bit 1 of this input variable is used to reset the fault state of the drive. If no fault conditions exist, the fault state of the drive will be reset immediately upon receipt of this command. If fault conditions persist, the reset command remains latched until all fault conditions are cleared, at which time the fault state is reset. The fault state of the drive may also be reset by issuing a **RQ_CLEAR_ALARM** mode request to the node object (see **Section 5.1, "Object Requests - nviRequest"**).

6.2.5 MultiFunction Input Commands - *nviOpCommands*

Bit 2, **bit 3**, **bit 4**, and **bit 5** of this network variable control the multifunction input commands, as described below. These commands are equivalent to contact closures on external terminals **S3 - S6**, respectively. Function selection for the multifunction inputs are configured in parameters **n037-n040** on the **GPD506**.

bit #	Point Description	Off (0) State	On (1) State	Default
2	Multifunction Input 1 Command	Depends on Terminal S3 function selection	Depends on Terminal S3 function selection	Off
3	Multifunction Input 2 Command	Depends on Terminal S4 function selection	Depends on Terminal S4 function selection	Off
4	Multifunction Input 3 Command	Depends on Terminal S5 function selection	Depends on Terminal S5 function selection	Off
5	Multifunction Input 4 Command	Depends on Terminal S6 function selection	Depends on Terminal S6 function selection	Off

6.2.6 Terminal S1 Safety Interlock Control

In certain applications, a normally closed system safety may be wired to the drive's terminal S1. The basis for this design is a hard-wired run command at terminal S1. If a safety is placed in series with this run contact, the drive stops when the safety opens.

With this option card, the same functionality can be achieved with a network run command. It is enabled by setting **GPD506** parameter **n040** to **21**. With this feature enabled, a network run command starts the drive only if the contact on S1 is closed. If the contact opens, the drive is stopped and then restarted once the contact closes.

6.3 Drive Monitoring

This section describes the network variables used to monitor the drive. Refer to the appropriate Technical Manual for additional information.

6.3.1 Operating Status

The following table summarizes the network variables available for monitoring the drive's operating status.

Index	Variable Name	Variable Type	Description
nv3	nvoDrvCurnt	SNVT_amp	Reports output current.
nv4	nvoDrvSpeed	SNVT_lev_percent	Reports output speed as a percentage of *nciNmlFreq*.
nv5	nvoDrvVolt	SNVT_volt	Reports AC output voltage.
nv6	nvoDrvPwr	SNVT_power_kilo	Reports output power. **This output is only available on GPD506 drives.**
nv7	nvoDrvRunHours	SNVT_time_hour	Reports accumulated run time.
nv12	nvoDrvStatus	SNVT_state	Reports drive operational status: • bit 0 - Drive Running • bit 1 - Reverse Run Commanded • bit 2 - Drive Ready • bit 3 - Drive Faulted • bit 4 - Modbus Error • bit 5 - Multifunction Output 1 • bit 6 - Multifunction Output 2 • bit 7 - Terminal S1 State • bit 8 - Terminal S2 State • bit 9 - Terminal S3 State • bit 10 - Terminal S4 State • bit 11 - Terminal S5 State • bit 12 - Terminal S6 State • bit 13 - n/a • bit 14 - n/a • bit 15 - GPD506 Flag
nv13	nvoFltStatus	SNVT_state	Reports drive fault status: • bit 0 - Overcurrent, Ground, Short Circuit • bit 1 - Overvoltage • bit 2 - Drive Overload • bit 3 - Overheat • bit 4 - n/a • bit 5 - Main Circuit • bit 6 - Brake Transistor • bit 7 - External • bit 8 - Hardware • bit 9 - Motor Overload • bit 10 - n/a • bit 11 - Undervoltage • bit 12 - Power Loss • bit 13 - Phase • bit 14 - n/a • bit 15 - n/a
nv14	nvoSpdStptFb	SNVT_lev_percent	Reports the speed setpoint as a percentage of *nciNmlFreq*.
nv15	nvoSpdCmd	SNVT_lev_percent	Reports the speed command as a percentage of *nciNmlFreq*, regardless of command source.
nv16	nvoPIDFb	SNVT_lev_percent	Reports the PID feedback as a percentage of *nciNmlFreq*. **This output is only available on GPD506 drives.**
nv17	nvoDrvEnergy	SNVT_elec_kwh	Reports cumulative drive energy. **This output is only available on GPD506 drives.**
nv18	nvoDrvTemp	SNVT_temp	Reports drive temperature. **This output is only available on GPD506 drives.**
nv19	nvoDCBus	SNVT_volt	Reports DC bus voltage.
nv20	nvoReadParamVal	SNVT_count	Reports the value of the requested read parameter.

6.3.2   Reading Other Parameters - *nviReadParamNum, nvoReadParamNum*

Two network variables are defined for reading any drive parameter:

nviReadParamNum - Specifies the parameter to be read.

nvoReadParamVal - Reports the value of the specified parameter.

Refer to the appropriate Technical Manual for a detailed description of all parameters.

NOTE: **The increment listed in the Technical Manual must be considered when interpreting a reported value. For example, a read of** GPD506 **parameter** n070**, DC Injection Time at Stop, which reports 10 in** *nvoReadParamVal* **is actually a setting of 1, since the increment for this parameter is 0.1 seconds.**

6.4 Configurable Network Traffic

This section describes the configuration properties available for customizing the drive's periodic traffic on the network.

6.4.1   Send Heartbeat - *nciSndHrtBt*

This configuration property defines the maximum period of time that expires before the current values of *nvoDrvCurnt*, *nvoDrvSpeed*, *nvoDrvVolt*, and *nvoDrvPwr* are automatically transmitted. When enabled, this functionality is intended to indicate to the network that this node is functioning normally. When disabled, the values of these variables are only transmitted upon change.

The **default** value for this configuration property is **0**, which is the disabled state.

6.4.2   Minimum Send Time - *nciMinOutTm*

This configuration property defines the minimum period of time between updates of output network variables. When enabled, this functionality reduces network traffic by limiting the automatic propagation of network variables. When disabled, changes in these network variables are transmitted on each change.

The **default** value for this configuration property is **1** second.

6.5 Cable Loss Behavior

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

After some interval without receipt of a message, the drive can be configured to respond in one of the following manners:

- Continue at last frequency
- Continue at preset frequency
- Stop
- Fault (**EF0**)

Three configuration properties are used to select the desired behavior:

- **nciRcvHrtBt** – Receive Heartbeat
- **nciCblLossSpeed** – Cable Loss Speed
- **nciCblLossFltEna** – Cable Loss Fault Enable

The following table summarizes the settings for each type of behavior *(X = don't care):*

Behavior	nciRcvHrtBt	nciCblLossSpeed	nciCblLossFltEna
Continue at last frequency	0	X	X
Continue at preset frequency	Timeout Interval	Preset Speed	Off
Stop Running	Timeout Interval	0	Off
Fault (EF0)	Timeout Interval	X	On

Each behavior is described in additional detail below.

Notes

1. Communication must first be established and then lost for these features to function as described. If a drive is powered-up without a cable connected or without receiving any messages, a timeout does not occur.

2. For modes which describe the drive running after a timeout, a run command must have been issued prior to loss of communications. For safety purposes, it will not automatically start from a stopped condition. If a user requires the drive to start automatically, additional external wiring may be added to accomplish this (consult factory).

3. Upon expiration of the timeout interval, the **FAULT** LED lights and remains lit until communication is restored.

6.5.1   Continue Running at Last Frequency

In this mode, *nciRcvHrtBt* is set to **0**, disabling the cable loss feature. The other 2 settings are ignored. If communication is lost, the drive simply maintains its last commanded state.

6.5.2   Continue Running at Preset Frequency

In this mode, *nciRcvHrtBt* is set to the desired interval and *nciCblLossSpeed* is set to the desired preset speed. If the time between messages exceeds the timeout interval, the drive's speed command is set to *nciCblLossSpeed* and the drive continues running at this new speed. *nciCblLossFltEna* must be set to **'Off'**.

6.5.3 Stop Running

In this mode, *nciRcvHrtBt* is set to the desired interval and *nciCblLossSpeed* is set to **0**. If the time between messages exceeds the timeout interval, the drive's speed command is set to **0** and the run command is set to **'Off'**. *nciCblLossFltEna* must be set to **'Off'**.

6.5.4 Fault

In this mode, *nciRcvHrtBt* is set to the desired interval and *nciCblLossFltEna* is set to '**On**'. If the time between messages exceeds the timeout interval, an '**EF0**' fault is declared and the drive stops. *nciCblLossSpeed* is ignored.

7. Bypass Applications

For many applications, the drive is integrated into a **bypass** or **engineered** package. This type of package typically features an enclosure with contactors which allow the user to run the motor from line power (bypass mode) or from the drive (drive mode). This package also provides the flexibility for interfacing normally closed safety interlocks (firestat, freezestat, vibration sensors, etc.) which stop the drive if the contacts open.

7.1 Typical Parameter Settings

Because of the widespread use of this type of application, the following parameter set-up table is provided to aid in the start-up of such a drive.

GPD506 Parameter	GPD506 Setting	Description
n001	3	Enables Parameter Write Access
n002	6	Operational Mode (Network Control)
n006	1	Reverse Run Disabled
n007	0	Local/Remote Button Disabled
n018	60	Accel Time (secs)
n019	60	Decel Time (secs)
n024	10	Initial Reference (Hz)
n025	6	Alternate Reference (Hz)
n038	5	Terminal S4 Select - Local/Remote
n039	10	Terminal S5 Select - Manual Speed
n040	21	Terminal S6 Select - PID Disable (**see note**)
n055	1	Momentary Power Loss
n068	50	DC Injection Braking Level (%)
n070	5	DC Injection Time at Start (sec)
n101	1	Modbus Timeout Enabled
n102	0	Ramp to Stop on Modbus Timeout

NOTE: **If safety interlocks are interfaced to the bypass package at Terminal S1 and a network run command is used, Terminal S6 Select must be set as listed to stop the motor if the safety opens.**

8. Diagnostic LEDs

8.1 POWER

The option card receives its power from the drive control board. As such, this LED should be lit anytime power is applied to the drive.

If this LED is not lit when drive power applied, check the connection between the option card and the control board.

8.2 SERVICE

Figure 10 depicts the different type of expected **SERVICE** LED behavior, defined as follows:

- **Applicationless** - Only communication parameters are loaded, allowing access by a network management tool. To bring the node to its fully operational state, the application image file must be downloaded and network identity assigned.
- **Unconfigured** - Communication parameters and the application are loaded, but not a network image. To bring the node to its fully operational state, its network identity must be assigned.
- **Configured** - This is the fully operational state of the node.
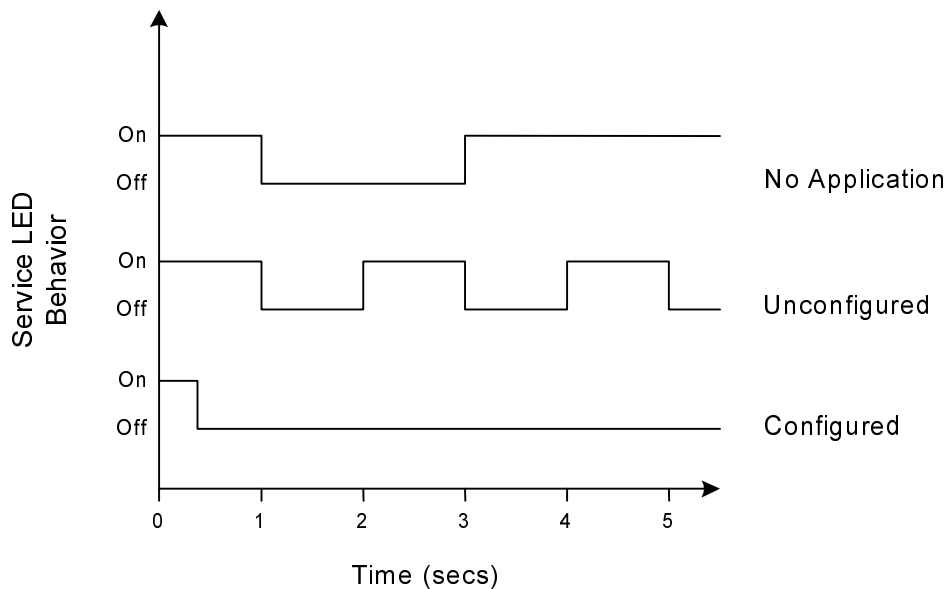
Figure 10. SERVICE LED Behavior

If some other type of behavior is noted, attempt to return the node to its unconfigured state as described in **Section 3.3**, "**Reclaiming a Node**". If this cannot be accomplished, there may be a problem with the node hardware.

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8.3 RECEIVE

This LED's functionality applies when the node is in its **configured** state. It is lit under the following conditions:

- While the drive is attempting to establish communication with the option card, the **RECEIVE**, **TRANSMIT**, and **FAULT** LEDs blink in unison and "**CALL**" blinks on the digital operator. If this condition occurs, repeat the steps outlined in **Section 2.2, Drive Set-up**.

- During normal operation with the drive attached and configured on the network, this LED blinks anytime the drive receives a network variable update. Its blinking under these conditions indicates a "healthy" link between the drive and the network.

- During normal operation with the drive either unattached or unconfigured on the network, this LED blinks while the option card is communicating with the drive. Its blinking under these conditions indicates a "healthy" link between the drive and the option card.

8.4 TRANSMIT

This LED's functionality applies when the node is in its **configured** state. It is lit under the following conditions:

- While the drive is attempting to establish communication with the option card, the **RECEIVE**, **TRANSMIT**, and **FAULT** LEDs blink in unison and "**CALL**" blinks on the digital operator. If this condition occurs, repeat the steps outlined in **Section 2.2, Drive Set-up**.

- During normal operation, this LED blinks anytime the option card completes a network variable update. Its blinking indicates a "healthy" link between the drive and the network.


8.5 FAULT

This LED's functionality applies when the node is in its **configured** state. It is lit under the following conditions:

- While the drive is attempting to establish communication with the option card, the **RECEIVE**, **TRANSMIT**, and **FAULT** LEDs blink in unison and "**CALL**" blinks on the digital operator. If this condition occurs, repeat the steps outlined in **Section 2.2, Drive Set-up**.

- During normal operation, this LED is lit if a cable loss is detected (**See Section 6.4, "Configurable Network "**). Once communication is re-established, this LED should be off.

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Appendix A. Board Template
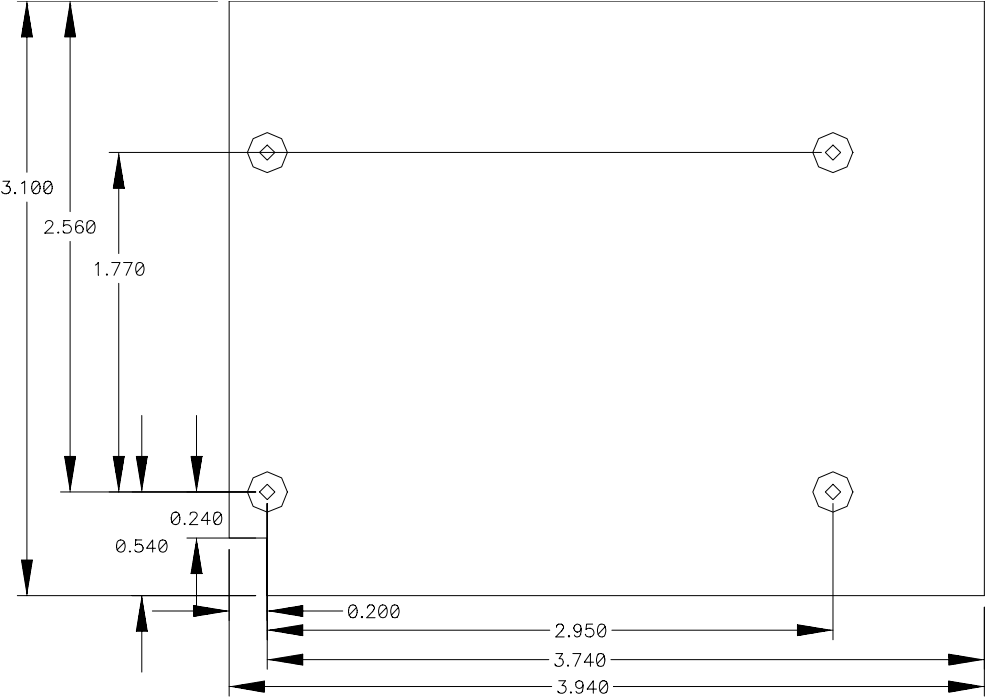
All dimensions shown are in inches.

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