

LONWORKS[®] Option Technical Manual

*This Manual
also available on
www.drives.com*



Warnings and Cautions

This Section provides warnings and cautions pertinent to this product, that if not heeded, may result in personal injury, fatality, or equipment damage. Yaskawa is not responsible for consequences of ignoring these instructions.

WARNING

YASKAWA manufactures component parts that can be used in a wide variety of industrial applications. The selection and application of YASKAWA products remain the responsibility of the equipment designer 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 to fail safely under all circumstances. All products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to that part's safe use and operation. 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.

WARNING

- Read and understand this manual before installing, operating, or servicing this drive. All warnings, cautions, and instructions must be followed. All activity must be performed by qualified personnel. The drive must be installed according to this manual and local codes.
- Do not connect or disconnect wiring while the power is on. Do not remove covers or touch circuit boards while the power is on. Do not remove or insert the digital operator while power is on.
- Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. Status indicator LEDs and Digital Operator display will be extinguished when the DC bus voltage is below 50 VDC. To prevent electric shock, wait at least 5 minutes after all indicators are OFF and measure the DC bus voltage level to confirm that it is at a safe level.
- Do not perform a withstand voltage test on any part of the unit. This equipment uses sensitive devices and may be damaged by high voltage.
- The drive is not suitable for circuits capable of delivering more than the specified RMS symmetrical amperes. Install adequate branch short circuit protection per applicable codes. Refer to the specification. Failure to do so may result in equipment damage and/or personal injury.
- Do not connect unapproved LC or RC interference suppression filters, capacitors, or over voltage protection devices to the output of the drive. Capacitors may generate peak currents that exceed drive specifications.
- To avoid unnecessary fault displays, caused by contactors or output switches placed between drive and motor, auxiliary contacts must be properly integrated into the control logic circuit.
- YASKAWA is not responsible for any modification of the product made by the user, doing so will void the warranty. This product must not be modified.
- Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.
- To meet CE directives, proper line filters and proper installation are required.
- Some drawings in this manual may be shown with protective covers or shields removed, to describe details. These must be replaced before operation.
- Observe Electrostatic Discharge Procedures when handling the drive and drive components to prevent ESD damage.
- The attached equipment may start unexpectedly upon application of power to the drive. Clear all personnel from the drive, motor and machine area prior to applying power. Secure covers, couplings, shaft keys, machine beds and all safety equipment before energizing the drive.

Introduction

This manual explains the specifications and handling of the Yaskawa *LONWORKS Option* for the Yaskawa models E7, P7, F7 and G7 drives. The *LONWORKS Option* connects the drive to a LONWORKS network and facilitates the exchange of data utilizing the LonTalk[®] protocol. In this document, the word “inverter”, “ac drive” and “drive” may be used interchangeably.

To ensure proper operation of this product, read and understand this manual. For details on installation and operation of the E7, P7, F7 and G7 drives, refer to the appropriate drive’s user and/or technical manual. All drive manuals and support files can be found on the CD that came with the drive. They are also available for download at www.drives.com.

For information on LONWORKS contact the Echelon at www.echelon.com.

LONWORKS[®] Option Installation Guide document reference **IG.AFD.20**

E7 User Manual document reference **TM.E7.01**

E7 Programming Manual document reference **TM.E7.02**

E7B Drive/Bypass technical Manual document reference **TM.E7B.01**

F7 User Manual document reference **TM.F7.01**

F7 Programming Manual document reference **TM.F7.02**

F7 Parameter Access Technical Manual document reference **TM.F7.11**

P7 User Manual document reference **TM.P7.01**

P7 Programming Manual document reference **TM.P7.02**

G7 Technical Manual document reference **TM.G7.01**

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Note: Installing the *LONWORKS Option* on an F7 or G7 drive obstructs the 3CN and 4CN connectors. This means that I/O and encoder feedback options cannot be installed concurrently with the *LONWORKS Option* on an F7 or G7 drive.

When used on a F7, G7 or P7 drive, the drive will appear as an E7 on the network.

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Chapter 1 Installation

This chapter describes how to install and setup the LONWORKS Option

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Installation Check Sheet

The following is a quick reference guide to install and configure the *LONWORKS Option*. Make a copy of this page and check-off each item as it is completed. For detailed information please refer to the sections that follow.

- 1:** Unpack the *LONWORKS Option* and verify that all components are present and undamaged. Refer to **Figure 1.1 – LONWORKS Option** and **Table 1.1 – Product Parts List**.
- 2:** Connect power to the drive and verify that the drive functions correctly. This includes running the drive from the operator keypad. Refer to the appropriate drive user and/or technical manual for information on connecting and operating the drive.
- 3:** Remove power from the drive and wait for the charge lamp to be completely extinguished. Wait at least five additional minutes for the drive to be completely discharged. Measure the DC bus voltage level to confirm that it is at a safe level.
- 4:** Install the *LONWORKS Option* on the drive.
 - 4.1:** Remove the operator keypad and all drive covers.
 - 4.2:** Mount the *LONWORKS Option* on the drive. Refer to **Figure 1.2 – Mount the LONWORKS Option**.
 - 4.3:** Install the communications cable. Refer to **Figure 1.3 – LONWORKS Option E7, P7 and F7 Drive Connections**, **Figure 1.4 – LONWORKS Option E7L and E7B Connections** and **Figure 1.5 – LONWORKS Option G7 Drive Connections**.
 - 4.4:** Connect a ground wire from the ground terminal on the *LONWORKS Option* to a noise free ground. If a noise free ground point cannot be found, leave the ground terminal un-terminated.
 - 4.5:** Set the termination resistor switch to the ON position on the drive's terminal assembly.
- 5:** Connect the *LONWORKS Option* to the LONWORKS communication network. Refer to **Figure 1.6 – LONWORKS Option Connections**.
- 7:** Configure the LONWORKS network for the drive. The External Interface File (E7_LW.XIF) and the Device Resource Files (E7_LW.TYP, E7_LW.ENU, E7_LW.FPT, and E7_LW.FMT) may be found on the CD supplied with the drive or downloaded from www.drives.com.
- 8:** Apply power to the drive. Set parameters b1-0, b1-02, H5-01, H5-02, H5-03 and H5-07 to their appropriate values. Refer to **Table 1.2 – Drive Parameter Settings**.
- 9:** Cycle power to the drive. After power has been removed, wait until the charge lamp has been extinguished before reapplying power.
- 10:** Verify that the diagnostic LEDs on the front of the *LONWORKS Option* are in their correct state. Refer to **Table 1.3 – Diagnostic LED Status**.
- 11:** Remove power from the drive and wait for the charge lamp to be completely extinguished. Wait at least five additional minutes for the drive to be completely discharged. Measure the DC bus voltage level to confirm that it is at a safe level.
- 12:** Reinstall the operator keypad and all drive covers.

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Unpack and Inspect

Prior to unpacking, check the package label and verify that the product received matches the product ordered. Unpack the option and verify that the following items are included in the product package and are undamaged.



Figure 1.1 –LonWORKS Option

Table 1.1 – Product Parts List		
Part		Qty.
LonWorks Option (46S03587-0121)		1
Installation Guide (IG.AFD.20)		1
UWR00567-1 (Drive Connection Cable - Included)	12" Cable	1
UWR00567-2 (Drive Connection Cable – Optional for E7L or E7B)	20" Cable	Opt
UWR00567-3 (Drive Connection Cable – Optional for E7L or E7B)	78" Cable	Opt

Notes: Cables UWR00567-2 and UWR00567-3 are used for E7L and E7B applications and must be ordered separately.

Installing the *LonWORKS Option* on an F7 or G7 drive obstructs the 3CN and 4CN connectors. This means that I/O and encoder feedback options cannot be installed concurrently with the *LonWORKS Option* on an F7 or G7 drive.

When mounted on an F7, G7 or P7 drive, the node will appear as an E7 drive to the system software.

The External Interface file (E7_LW.XIF) and the Device Resource files (E7_LW.TYP, E7_LW.ENU, E7_LW.FPT and E7_LW.FMT) can be found on the CD that accompanied the drive. They may also be downloaded from www.drives.com.

Installation and Wiring

The following describes the installation and configuration of the *LONWORKS Option*. For detailed information about the drive or the LONWORKS option, please refer to the appropriate sections of this manual or the appropriate drive user and/or technical manual..

◆ Verify Drive Operation

- Connect power to the drive and verify that the drive functions properly. This includes running the drive from the operator keypad. Refer to the appropriate drive technical manual, for information on connecting and operating the drive.
- Remove power from the drive and wait for the charge lamp to be completely extinguished. Wait at least five additional minutes for the drive to be completely discharged. Measure the DC BUS voltage and verify that it is at a safe level.
- Remove the operator keypad and terminal cover.

◆ Mount the LONWORKS Option

Mount the *LONWORKS Option* onto the drive by following the instructions below. An E7 drive is shown but the procedure is identical for the P7, F7 and G7 drives.

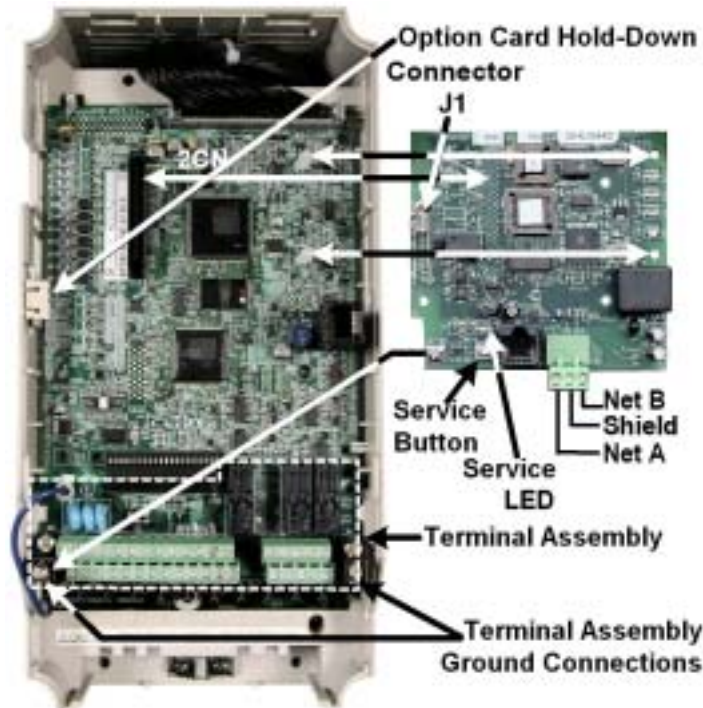


Figure 1.2 – Mount the LONWORKS Option

- Remove the option card hold down.
- Align the connector on the back of the option with its mating 2CN on the drive.
- Simultaneously align the two stand-offs on the drive control board with their respective holes on the *LONWORKS Option*.
- Press the option and the drive together until the connector is firmly seated and the stand-offs are locked through their associated mounting holes.
- Connect a ground wire from the Ground Terminal on the option card to a noise free control ground. If a noise free ground is not available, leave the ground terminal on the *LONWORKS Option* un-terminated.
- Connect the supplied cable (UWR00567-1) to connector J1 on the option board for the E7, P7, F7 and G7. For the E7L and E7B use the cable appropriate for that unit (UWR00567-2 or UWR00567-3). Pay close attention to keying of the J1 connector when connecting the cable to the *LONWORKS Option* and the color coding of the wires when connecting to the drive's terminal assembly
- Route the wires down the left side of the drive's control board and connect them to the terminal assembly as shown below.
- Insert the option card hold down.

◆ **Connect LONWORKS Option to the Drive.**

- Determine the drive family on which the *LONWORKS Option* is installed. Connect the *LONWORKS Option* communication cable to the drive as shown below. Also set the termination switch to ON.

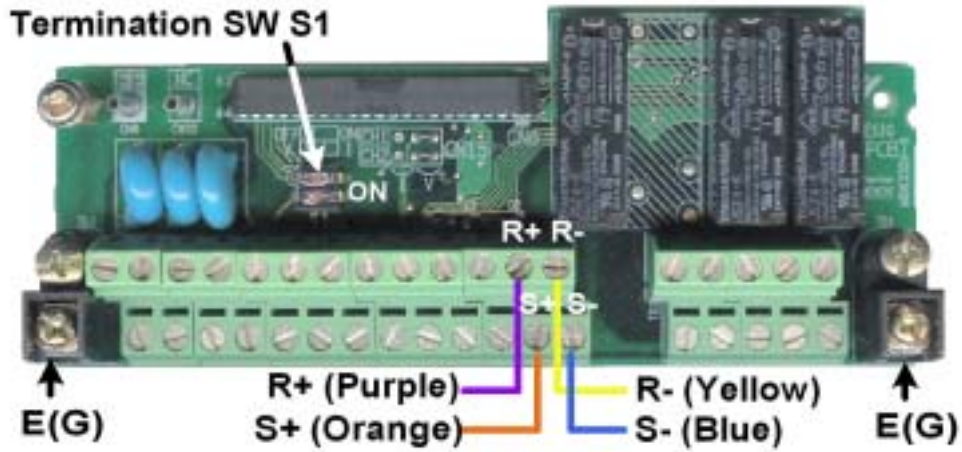


Figure 1.3 – LONWORKS Option E7, P7 and F7 Drive Connections

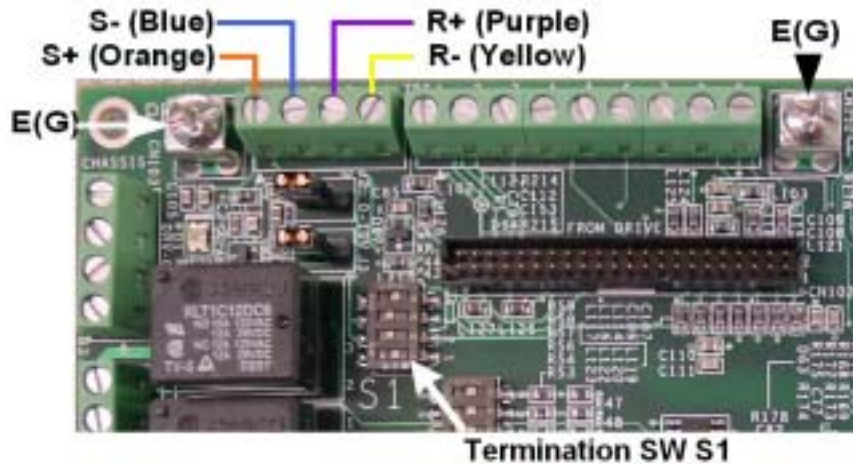


Figure 1.4 – LONWORKS Option E7L and E7B Connections

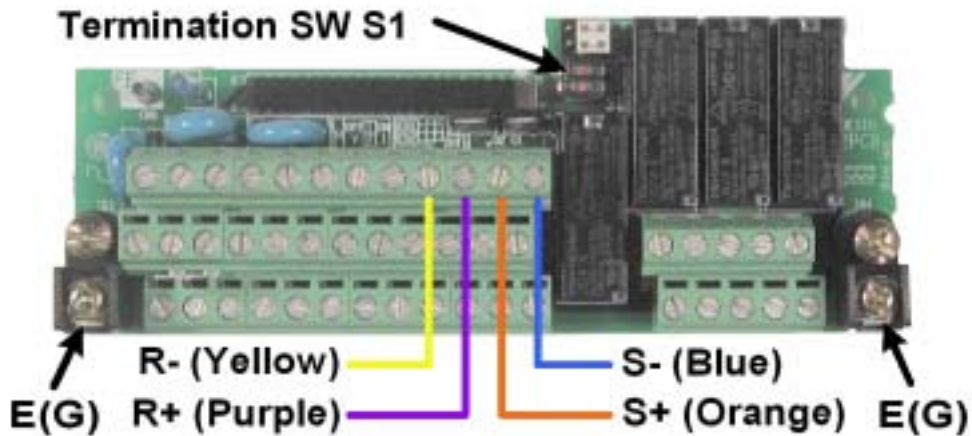


Figure 1.5 – LONWORKS Option G7 Drive Connections

◆ Connect The *LONWORKS Option* To The LONWORKS Communications Network.

The LonWorks interface features Echelon's Smart free topology transceiver (FT3150). The FT3150 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. The primary network connection is 3-way pluggable 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 shown below. The network connection is *polarity insensitive*.

- Connect the LONWORKS network cable to the 3-pin connector on the *LONWORKS Option* as shown below. The RJ45 connector is typically used as a local network access point and is not recommended for network connection.
- Tie the LONWORKS cable to a point near the connector to provide strain relief for the connector and cable connection.

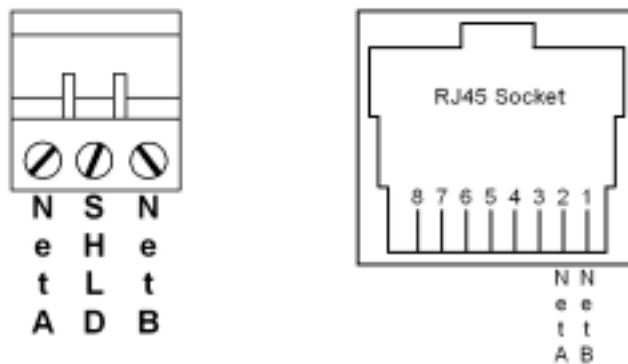


Figure 1.6 – LONWORKS Option Connections

◆ Set Drive Termination

Since the *LONWORKS Option* utilizes the RS485 connection to the drive, it is necessary to set the termination resistor to the ON position on each drive's terminal assembly. Refer to *Figure 1.3 – LONWORKS Option E7, P7 and F7 Drive Connections*, *Figure 1.4 – LONWORKS Option E7L Connections* and, *Figure 1.5 – LONWORKS Option G7 Drive Connections* above for the location of the termination switch on the drive's terminal assembly.

◆ Network installation

■ Installation Files

Included on the CD that came with the drive are several files that assist in node installation and identification. They may also be downloaded from www.drives.com. These are the External Interface File (E7_LW.XIF) and the Device Resource Files (E7_LW.TYP, E7_LW.ENU, E7_LW.FPT, and E7_LW.FMT).

■ 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.

■ 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.

◆ Network Identification and Node Configuration

The *LONWORKS Option* is shipped **unconfigured**. This implies that the application is loaded and communications parameters are defined but the option has not been installed on the network. On power up. An unconfigured node can be recognized by the **SERVICE LED** flashing at 0.5Hz.

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.

■ SERVICE Button

Each option card has a Service Button. If using a configuration tool utilizing this feature, press the Service Button when prompted to do so. When pressed, a broadcast message is sent which contains the Neuron ID and program ID. This uniquely identifies the node on the network. This method works best for small networks or with portable installation tools.

■ 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.

■ Reclaiming a Node

- A node can be “reclaimed”, or returned to its unconfigured state, as follows:
- Remove power from the drive and wait for the charge lamp to be completely extinguished.
- 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.

Set Drive Parameters

- Remove power from the drive and wait for the charge lamp to be completely extinguished. Wait at least five additional minutes for the drive to be completely discharged. Measure the DC BUS voltage and verify that it is at a safe level.
- Reinstall the operator keypad and all drive covers. Apply power to the drive.
- Set parameter A1-01 to 2, Advanced.
- Set parameters b1-01 and b1-02 to their appropriate values. Refer to the table below for available b1-01 and b1-02 values. Reference Selection and Operation Method Selection can have different values depending on the application. To control both frequency and run/stop over the network, set both b1-01 and b1-02 to 2, Serial Communications.
- Set parameter H5-01 to 1Fh (31dec)
- Set parameter H5-02 to 3, 9600 baud
- Set parameter H5-03 to 0, No Parity
- Set parameter H5-06 to 5, 5ms transmission wait
- Set parameter H5-07 to 0, Disabled
- Set parameter H5-08 to 0, MODBUS
- Parameters H5-04 (Stopping Method at Communications Fault), H5-05 (Serial Fault Detection) and H5-09 (CE Detect Time) should be set according to the desired drive performance during a communications timeout or failure.
- After all drive parameters have been set, power cycle the drive. Communications parameters will not take affect until power has been removed from the drive until the charge lamp has been extinguished and restored.
- If any of these settings is incorrect, “CALL” will blink on the digital operator, as will the **RECEIVE**, **TRANSMIT** and **FAULT** LEDs on the *LONWORKS Option*. 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, “CALL”.will no longer be displayed on the digital operator.
- **For By-Pass applications, refer to the parameter table accompanying the by-pass unit for parameter settings.**

Parameter	Function	Data	+/- Limits - Description	Default
A1-01	Access Level	0	Operator	2
		1	User	
		2	Advanced	
b1-01	Reference Selection	0	Digital Operator	1
		1	Terminals	
		2	Serial Communication (LonWorks)	
		3	Option PCB	
b1-02	Operation Method Selection	0	Digital Operator	1
		1	Terminals	
		2	Serial Communication (LonWorks)	
		3	Option PCB	
H5-01	Serial Communications Address	1F	0 – 1Fh (0 – 31 dec)	1Fh
H5-02	Serial Baud Rate Select	0	1200 baud	3
		1	2400 baud	
		2	4800 baud	
		3	9600 baud (LonWorks)	
		4	19200 baud	
H5-03	Serial Parity Select	0	None (LonWorks)	0
		1	Even parity	
		2	Odd parity	
H5-06	Transmit Wait	5	5 – 65ms	5
H5-07	RTS Control Select	0	Disabled (LonWorks)	0
		1	Enabled	
H5-08	Protocol Select	0	MODBUS (LonWorks)	0
		1	N2 (Metasys) (E7, E7B and E7L only)	
		2	P1 (APOGEE) (E7, E7B and E7L only)	

Option LEDs

The LONWORKS Option Unit is equipped with four indication LEDs for module and LONWORKS status indication. The LEDs are located on the unit according to the figure below.

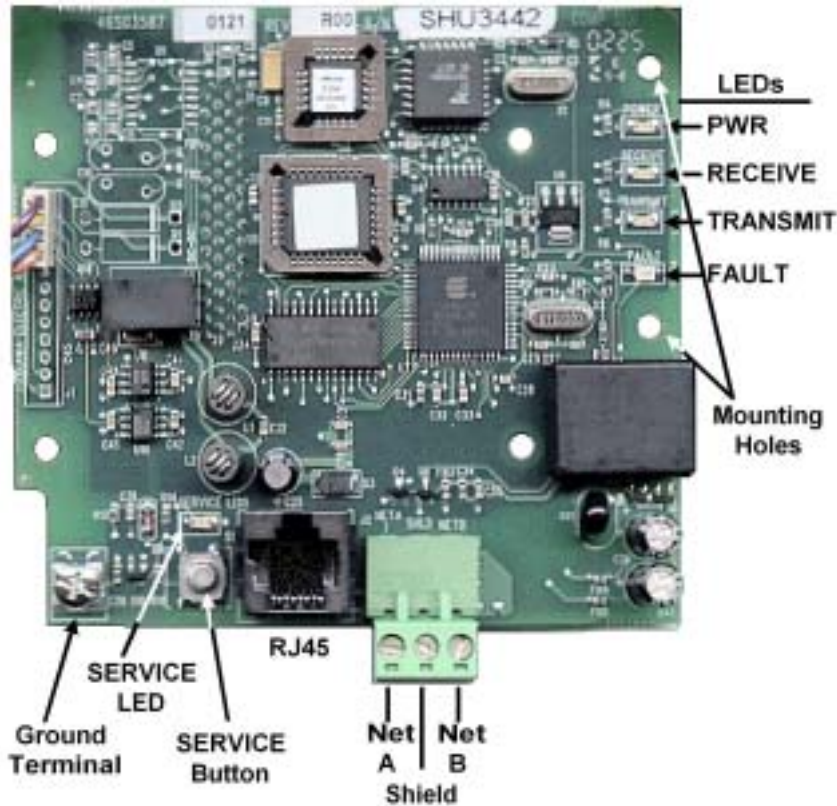


Figure 1.7 – LONWORKS LED Locations

◆ Verify LonWorks Option Operation

- Apply power to the drive.
- Verify that the diagnostic LEDs on the front of the *LONWORKS Option* are in their correct state.

LED Display					Condition	Solution
PWR	Receive	Transmit	Fault	Service		
				BLINK 0.5Hz	Option is Not Configured	<ul style="list-style-type: none"> ● Configure Option
				FLASH 1sON_2sOFF_ContON	Application missing	<ul style="list-style-type: none"> ● Download application image file ● Assign network Identity
OFF	OFF	OFF	OFF	OFF	Power not supplied	<ul style="list-style-type: none"> ● Check that drive has power ● Check option card seating in CN2 connector
ON	BLINK	BLINK	BLINK	OFF	Communications not established	<ul style="list-style-type: none"> ● Check drive parameters (refer to table above) ● Check connection between option and drive
ON			ON	OFF	Communications Loss	<ul style="list-style-type: none"> ● Check network cable connections
ON	FLASH		OFF	OFF	Normal communications	<ul style="list-style-type: none"> ● Flash each time serial task is complete ● approximately 0.5Hz when drive is at STOP ● approximately 1.0Hz when drive RUN is active
ON		FLASH	OFF	OFF	Normal communications	<ul style="list-style-type: none"> ● Flash for every 5 network variables updates

- Remove power from the drive and wait for the charge lamp to be completely extinguished. Wait at least five additional minutes for the drive to be completely discharged. Measure the DC BUS voltage and verify that it is at a safe level.
- Install the operator keypad and all drive covers.

Drive Faults

The following is a table of faults that could be caused by the *LONWORKS Option* that will be displayed on the Operator Keypad, their causes, and possible solutions. For any fault displayed on the operator that is not listed in the following table, please see the appropriate drive technical manual.

Table 1.4 – Drive Faults			
Fault	Content	Cause	Solution
BUS	Option PCB communications error	Communication is not established between LONWORKS Master and the drive.	<ul style="list-style-type: none"> ● Check LONWORKS communication LED display.
EF0	Option PCB external fault	Drive received an external fault command from the Option PCB	<ul style="list-style-type: none"> ● Check multi-function input settings ● Check PLC or controller program ● Eliminate cause of fault (machine device in fault state)
OPE05	Command selection fault	Parameter b1-01 is set to Option PCB and no card is detected	<ul style="list-style-type: none"> ● Install Option PCB ● Reprogram b1-01 ● Replace the Option PCB
OPE06	Control mode selection fault	Parameter b1-02 is set to Option PCB and no card is detected	<ul style="list-style-type: none"> ● Install Option PCB ● Reprogram b1-02 ● Replace the Option PCB

Chapter 2 Application Overview

This chapter provides an overview of the Node and VFD objects

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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 the figure below

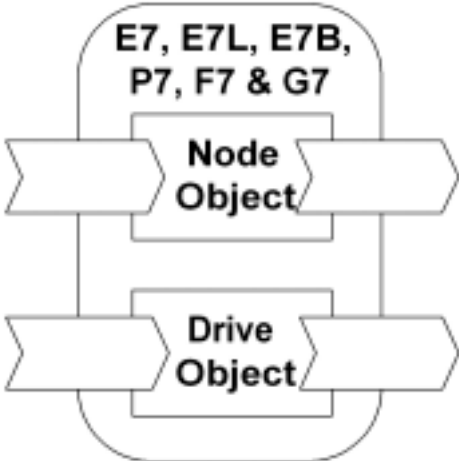


Figure 2.1 - LonMark Objects

The network variables and configuration properties for each object are summarized below. The following chapters contain additional detail on the operation of each object.

Node Object Network Variable Summary

Table 2.1 - 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: <ul style="list-style-type: none"> ■ 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: <ul style="list-style-type: none"> ■ INVALID_ID ■ INVALID_REQUEST ■ DISABLED ■ IN_ALARM ■ REPORT_MASK

◆ Node Object Configuration Property Summary

Table 2.2 - 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.

VFD Object Network Variable Summary

Table 2.3 - 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 nciNm1Freq
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 nciNm1Freq
nv5	nvoDrvVolt	SNVT_volt	Reports AC output voltage
nv6	nvoDrvPwr	SNVT_power_kilo	Reports output power
nv7	nvoDrvRunHours	SNVT_time_hour	Reports accumulated run time
nv8	nviOpCommands	SNVT_state	Controls the following operational commands: <ul style="list-style-type: none"> ■ 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) ■ bit 6 - Multifunction Input 5 (terminal S7) ■ bit 7 - Reserved
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: <ul style="list-style-type: none"> ■ bit 0 - Drive Running ■ bit 1 - Reverse Run Commanded ■ bit 2 - Drive Ready ■ bit 3 - Drive Faulted ■ bit 4 - Parameter Access Error ■ bit 5 - Multi-function Output 1 ■ bit 6 - Multi-function Output 2 ■ bit 7 - Reserved ■ bit 8 - Terminal S1 State ■ bit 9 - Terminal S2 State ■ bit 10 - Terminal S3 State ■ bit 11 - Terminal S4 State ■ bit 12 - Terminal S5 State ■ bit 13 - Terminal S6 State ■ bit 14 - Terminal S7 State ■ bit 15 - Reserved
nv13	nvoFltStatus	SNVT_state	Reports drive fault status: <ul style="list-style-type: none"> ■ bit 0 - Overcurrent Ground Short Circuit ■ bit 1 - Overvoltage ■ bit 2 - Drive Overload ■ bit 3 - Overheat ■ bit 4 - Reserved ■ bit 5 - Fuse Blown ■ bit 6 - PID Feedback Lost ■ bit 7 - External Fault ■ bit 8 - Hardware Fault ■ bit 9 - Overload/Overtorque Fault ■ bit 10 - Excessive Speed Deviation ■ bit 11 - Undervoltage Fault ■ bit 12 - Undervoltage/Power Loss Fault ■ bit 13 - Input/Output Phase Loss ■ bit 14 - Drive Communication Loss ■ bit 15 - Operator Error

Table 2.3 - VFD Object Network Variable Summary			
Index	Variable Name	Variable Type	Description
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
nv17	nvoDrvBus	SNVT_volt	Reports DC Bus voltage
nv18	nvoReadParamVal	SNVT_count	Reports value of requested parameter
nv19	nviDrvFltRst	SNVT_switch	Resets a drive fault
nv20	nvoRunStp	SNVT_switch	Reports the Run/Stop status of the drive
nv21	nvoDrvFlt	SNVT_switch	Reports drive fault condition
nv22	nvoDrvParamErr	SNVT_count	Reports parameter access error
nv23	nvoDrvTemp	SNVT_temp	Reports drive temperature
nv24	nvoDrvEnergyKwh	SNVT_elec_kwh	Reports cumulative energy in kWh
nv25	nvoDrvEnergyMwh	SNVT_elec_kwh	Reports cumulative energy in mWh

◆ Parameter Access Errors

These values are returned by nv22 when a communications error occurs.

- 0 - Normal
- 2 - Incorrect register error
- 33 - Data range error
- 34 - Parameter not writable in Run mode
- 35 - Write when drive is in Undervoltage
- 36 - Process busy
- 255 - Command timeout error

◆ VFD Object Configuration Property Summary

Table 2.4 - VFD Object Configuration Property Summary

Property Name	Variable Type	Default	Parameter	Description
nciNmlSpeed	SNVT_rpm	1800 rpm	n/a	Configures nominal motor speed in rpm
nciNmlFreq	SNVT_freq_hz	60Hz	n/a	Configures nominal motor frequency in hertz All speed related data in percent are referenced to this value
nciMinSpeed	SNVT_lev_percent	0%	d2-02	Configures the minimum motor speed as a percentage of <i>nciNmlFreq</i> Sets the drive's lower limit for frequency commands
nciMaxSpeed	SNVT_lev_percent	100%	d2-01	Configures the maximum motor speed as a percentage of <i>nciNmlFreq</i> Sets the drive's upper limit for frequency commands
nciRampUpTm	SNVT_time_sec	10sec	C1-01	Configures motor ramp up time from 0 to its operating setpoint Sets the drive's output acceleration rate
nciRampDownTm	SNVT_time_sec	10sec	C1-02	Configures motor ramp down time from its operating setpoint to 0 Sets the drive's output deceleration rate
nciSndHrtBt	SNVT_time_sec	0sec (off)	n/a	Configures the maximum period of time that expires before automatic propagation of <i>nvoDrvCurnt nvoDrvSpeed nvoDrvVolt</i> and <i>nvoDrvPwr</i>
nciRevHrtBt	SNVT_time_sec	0sec (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	1sec	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 <i>nviDrvSpeedStpt</i> (saved configured value)
nciOpModeRun	SNVT_count	1	b1-02	Selects the source for start/stop and speed commands
nciDrvMaxFreq	SNVT_freq_hz	60.0Hz	E1-04	Reports the maximum output frequency of the drive (read-only)
nciMtrFLA	SNVT_amp	*	E2-01	Sets the full load current rating of the motor
nciPLRideThru	SNVT_count	2.0sec	L2-02	Selects the drive's response to momentary power loss ride through time
nciAutoRstrt	SNVT_count	0	L5-01	Selects the number of times the drive attempts to automatically restart after certain faults
nciProFreq1	SNVT_freq_hz	0Hz	d3-01	Sets the center frequency for the first band of prohibit frequencies
nciProFreq2	SNVT_freq_hz	0Hz	d3-02	Sets the center frequency for the second band of prohibit frequencies
nciProFreqBW	SNVT_freq_hz	1.0Hz	d3-04	Sets the bandwidth for prohibit frequencies
nciPIDSel	SNVT_count	0	b5-01	Selects the mode of the PID controller
nciPID_PGain	SNVT_multiplier	20	b5-02	Sets the proportional gain of the PID controller
nciPID_ITime	SNVT_time_sec	5.0sec	b5-03	Sets the integral time constant of the PID controller
nvoDrvRatedCur	SNVT_amp	*	n9-01	Reports the output current rating of the drive (read-only)
nciStallLevAcc	SNVT_count	*	L3-02	Sets the stall level for output current during acceleration
nciStallLevRun	SNVT_count	*	L3-06	Sets the stall level for output current while at set speed
nciCbLossSpeed	SNVT_lev_percent	0%	n/a	Sets speed level commanded if network communication is lost
nciCbLossFltEna	SNVT_switch	Off	n/a	Enables an EF0 fault to be declared if network communication is lost
nciOpModeFreqRef	SNVT_count	1	b1-01	Selects frequency reference source

* - Value dependent on drive capacity. Refer to appropriate Parameter Access and/or Technical Manual.

Node Object

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.

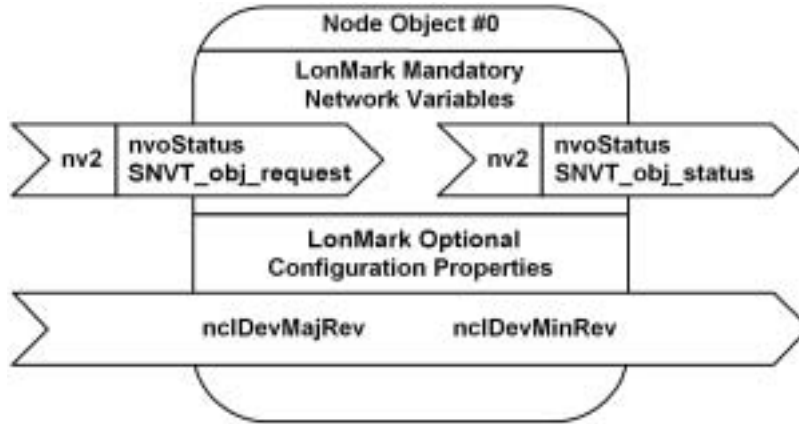


Figure 2.2 - Node Object

◆ Object Requests - nviRequest

The following table summarizes the supported request modes.

Table 2.5 - Object Requests - nviRequest		
Mode Request	Node Object #0 Response	VFD Object #1 Response
RQ_NORMAL (0)	<ul style="list-style-type: none"> All objects and network variables are re-enabled. <i>nvoStatus</i> is updated and reported. 	<ul style="list-style-type: none"> VFD object network variables are re-enabled. <i>nvoStatus</i> is updated and reported
RQ_DISABLE (1)	<ul style="list-style-type: none"> 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. <i>nvoStatus</i> is updated and reported. 	<ul style="list-style-type: none"> 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. <i>nvoStatus</i> is updated and reported
RQ_UPDATE_STATUS (2)	<ul style="list-style-type: none"> <i>nvoStatus</i> is updated for all objects and reported. 	<ul style="list-style-type: none"> <i>nvoStatus</i> is updated and reported.
RQ_REPORT_MASK (5)	<ul style="list-style-type: none"> Invalid request. <i>nvoStatus</i> is updated for all objects and reported. 	<ul style="list-style-type: none"> Each status bit supported by the VFD object is set in <i>nvoStatus</i> and reported.
RQ_CLEAR_ALARM (10)	<ul style="list-style-type: none"> Invalid request. <i>nvoStatus</i> is updated and reported. 	<ul style="list-style-type: none"> Fault reset is issued to drive. <i>nvoStatus</i> is updated and reported.
All other requests	<ul style="list-style-type: none"> Invalid request. <i>nvoStatus</i> is updated and reported. 	<ul style="list-style-type: none"> Invalid request. <i>nvoStatus</i> is updated and reported.

◆ 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.

◆ 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 its 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 its functionality and network interface definition.

VFD object

The VFD object supports 25 network variables and 28 configuration properties for configuring, controlling, and monitoring the operation of the drive, as shown below.

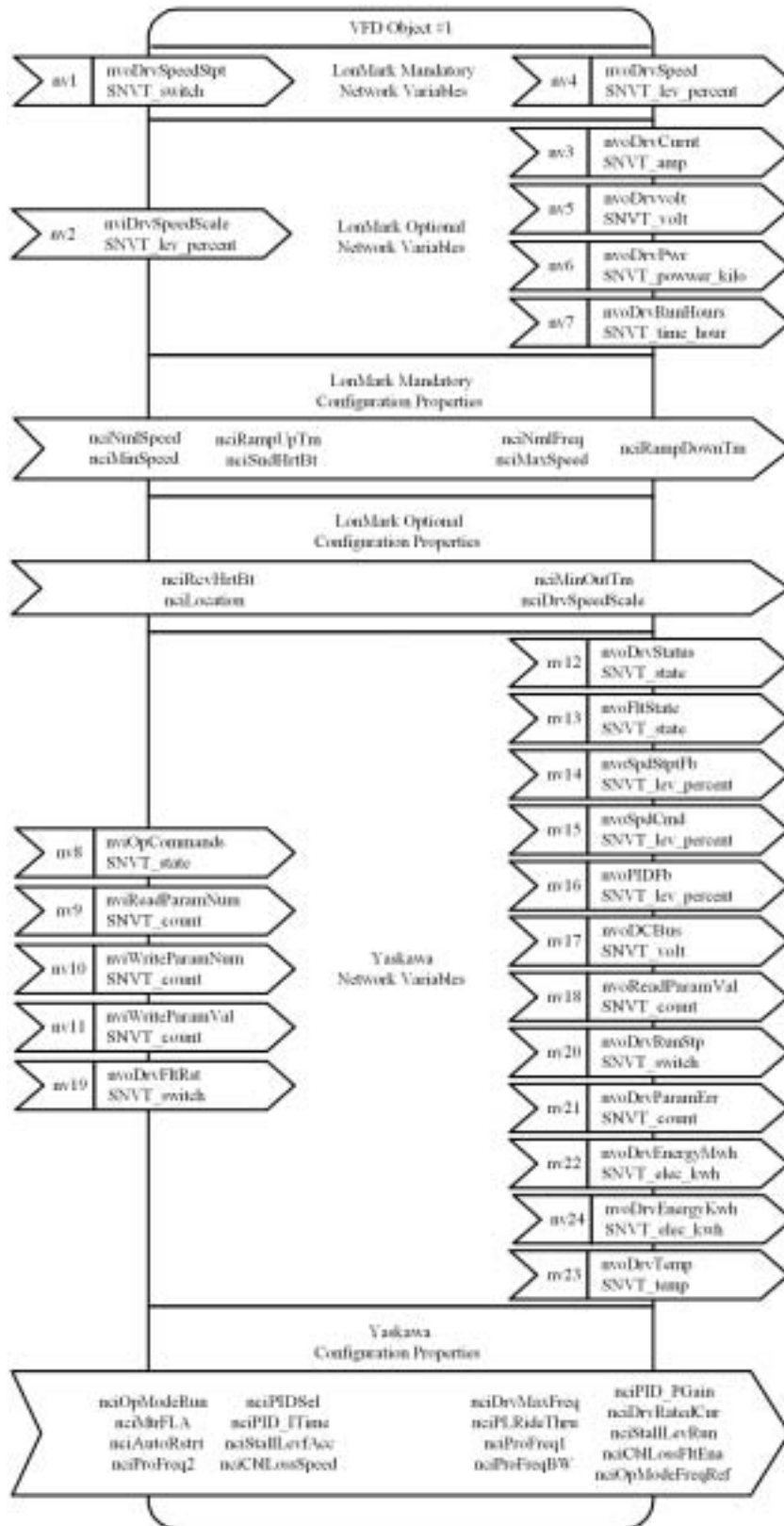


Figure 2.4 - VFD Object

Drive Configuration

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

◆ 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	Parameter	Description
nciRampUpTm	SNVT_time_sec	10 sec	C1-01	Configures motor ramp up time from 0 to its operating setpoint. Sets the drive's output acceleration rate.
nciRampDownTm	SNVT_time_sec	10 sec	C1-02	Configures motor ramp down time from its operating setpoint to 0. Sets the drive's output deceleration rate.

◆ 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:

Property Name	Variable Type	Default	Parameter	Description
nciPIDSel	SNVT_count	0	b5-01	Selects the mode of the PID controller.
nciPID_PGain	SNVT_multiplier	2.0	b5-02	Sets the proportional gain of the PID controller.
nciPID_ITime	SNVT_time_sec	5.0 sec	b5-03	Sets the integral time constant of the PID controller.

nciPIDSel	PID Mode
0	PID Disabled
1	PID Enabled (D = Feedback)
2	PID Enabled (D = Feed Forward) (Available on F7 and G7 drives only)
3	PID Enabled (Freq. Ref + PID Output (D = Feedback))
4	PID Enabled (Freq. Ref. + PID Output (D = Feed Forward)) (Available on F7 and G7 drives only)

◆ 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	Parameter	Description
nciStallLevAcc	SNVT_count	*	L3-02	Sets the stall level for output current during acceleration.
nciStallLevRun	SNVT_count	*	L3-06	Sets the stall level for output current while at set speed.

* Value dependent on drive capacity. Refer to appropriate Parameter Access and Technical Manual.

◆ Operational Mode – nciOpModeRun

Table 2.10 - Operational Mode - nciOpModeRun				
Property Name	Variable Type	Default	Parameter	Description
nciOpModeRun	SNVT_count	0	b1-02	Selects location of the Run/Stop command

Table 2.11 - nciOpModeRun		
nciOpModeRun	Run Command Source	Remarks
0	Digital Operator	<i>nviDrvSpeedStpt</i> has no effect
1	External Terminals	<i>nviDrvSpeedStpt</i> has no effect
2	Serial Communications (LONWORKS)	<i>nviDrvSpeedStpt</i> is controlled via the network
3	Option Card	<i>nviDrvSpeedStpt</i> has no effect

◆ Operational Mode – nciOpModeFreqRef

Table 2.12 - Operational Mode - nciOpModeRun				
Property Name	Variable Type	Default	Parameter	Description
nciOpModeFreqRef	SNVT_count	0	b1-01	Selects location of the frequency reference command

Table 2.13 - nciOpModeFreqRef		
nciOpModeFreqRef	Run Command Source	Remarks
0	Digital Operator	<i>nviDrvSpeedScale</i> has no effect
1	External Terminals	<i>nviDrvSpeedScale</i> has no effect
2	Serial Communications (LONWORKS)	<i>nviDrvSpeedScale</i> is controlled via the network
3	Option Card	<i>nviDrvSpeedScale</i> has no effect
4	Pulse Input	<i>nviDrvSpeedScale</i> has no effect (Available on F7 and G7 only)

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

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

Table 2.13 - Motor Properties – nciNmlSpeed, nciNmlFreq, nciMaxSpeed, nciMinSpeed, nciMtrFLA				
Property Name	Variable Type	Default	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%	d2-02	Configures the minimum motor speed as a percentage of <i>nciNmlFreq</i> . Sets the drive's lower limit for frequency commands.
nciMaxSpeed	SNVT_lev_percent	100%	d2-01	Configures the maximum motor speed as a percentage of <i>nciNmlFreq</i> . Sets the drive's upper limit for frequency commands.
nciMtrFLA	SNVT_amp	*	E2-01	Sets the full load current rating of the motor.

* Value is dependent on drive capacity. Refer to appropriate parameter access and/or technical manual.

◆ 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	Parameter	Description
nciProFreq1	SNVT_freq_hz	0 Hz	d3-01	Sets the center frequency for the first band of prohibit frequencies.
nciProFreq2	SNVT_freq_hz	0 Hz	d3-02	Sets the center frequency for the second band of prohibit frequencies.
nciProFreqBW	SNVT_freq_hz	1.0 Hz	d3-04	Sets the bandwidth for prohibit frequencies.

◆ Automatic Restarts - nciAutoRstrt

This configuration property defines the number of automatic restarts that will be attempted under certain fault conditions.

Property Name	Variable Type	Default	Parameter	Description
nciAutoRstrt	SNVT_count	0	L5-01	Selects the number of times the drive attempts to automatically restart after certain faults.

- 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)
 - Overvoltage (oV) during deceleration

◆ Power Loss Ride-Through – nciPLRideThru

Property Name	Variable Type	Default	Parameter	Description
nciPLRideThru	SNVT_count	0.1sec	L2-02	Sets the ride through time at momentary power loss

nciPLRideThru	Value	Remarks
0	Disabled	Momentary power loss ride through is disabled
0.1 ~ 25.5sec	Enabled	The ride through time at momentary power loss *

* Parameter L2-01 must be set to 1 in order for this variable to be available. A setting of 0 or 2 in parameter L2-01 will disable power loss ride through.

◆ 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. Refer to the appropriate drive user, parameter access, programming and/or technical manual for detailed information on drive parameters. The parameter addresses in the above manuals is supplied in hexadecimal format. Refer to your system documentation to determine the correct radix for the values entered. The default radix is decimal.

If an invalid parameter address is entered, 65535 (0xFFFFh) will be returned in *nvoReadParamVal*.

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 drive user, parameter access, programming and/or technical manual for a detailed description of all parameters. The parameter values in the above manuals may be supplied in either hexadecimal or decimal format. Refer to your system documentation to determine the correct radix for the values entered. The default radix is decimal.

Note: The increment listed in the technical manual must be considered when specifying a value. For example, to set parameter b2-04, DC Injection Time at Stop, to 1.00 seconds, *nviWriteParamVal* must be set to 100, since the increment for this parameter is 0.01 seconds.

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.

◆ 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 (*nciOpModeRun* = 2) for this input to control the drive.

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

◆ Speed Setpoint - nviDrvSpeedStpt, nviDrvSpeedScale

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

$$\text{Speed Setpoint} = \text{nciNmlFreq} * \text{nviDrvSpeedStpt.value} * \text{nviDrvSpeedScale}$$

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

◆ 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.

◆ 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.

◆ MultiFunction Input Commands - nviOpCommands

Bit 2, bit 3, bit 4, bit 5 and bit 6 of this network variable control the multifunction input commands, as described below. These commands are equivalent to contact closures on external terminals **S3 – S7**, respectively. Function selection for the multifunction inputs are configured in parameters **H1-01 through H1-05**.

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	Multifunction Input 5 Command	Depends on Terminal S7 function selection	Depends on Terminal S7 function selection	Off

◆ Terminal S1 Safety Interlock Control

In certain applications, a normally closed safety interlock may be connected to the drive's terminals S1 and S2. When the connection between S1 and S2 is broken, the drive will automatically stop. The drive Run will restart once the connection is re-established. Refer to the appropriate drive user, programming and/or technical manual for the proper use and wiring of a safety interlock circuit. If a safety interlock is not used, a jumper must be present between terminals S1 and S2.

For E7B and E7L units refer to the schematic and instructions that came with the unit, along with the appropriate technical manual.

Drive Monitoring

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

◆ Operating Status

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

Index	Variable Name	Variable Type	Description
nv1	nviDrvSpeedStpt	SNVT_switch	Controls start/stop and a low resolution speed setpoint as a percentage of nciNmIReq
nv2	nviDrvSpeedScale	SNVT_lev_percent	Controls scaling for nviDrvSpeedStpt Negative values indicate reverse motor direction
nv3	nvoDrvCurrt	SNVT_amp	Reports output current
nv4	nvoDrvSpeed	SNVT_lev_percent	Reports output speed as a percentage of nciNmIReq
nv5	nvoDrvVolt	SNVT_volt	Reports AC output voltage
nv6	nvoDrvPwr	SNVT_power_kilo	Reports output power
nv7	nvoDrvRunHours	SNVT_time_hour	Reports accumulated run time
nv8	nviOpCommands	SNVT_state	Controls the following operational commands: <ul style="list-style-type: none"> ■ 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) ■ bit 6 - Multifunction Input 5 (terminal S7) ■ bit 7 - Reserved
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: <ul style="list-style-type: none"> ■ bit 0 - Drive Running ■ bit 1 - Reverse Run Commanded ■ bit 2 - Drive Ready ■ bit 3 - Drive Faulted ■ bit 4 - Parameter Access Error ■ bit 5 - Multi-function Output 1 ■ bit 6 - Multi-function Output 2 ■ bit 7 - Reserved ■ bit 8 - Terminal S1 State ■ bit 9 - Terminal S2 State ■ bit 10 - Terminal S3 State ■ bit 11 - Terminal S4 State ■ bit 12 - Terminal S5 State ■ bit 13 - Terminal S6 State ■ bit 14 - Terminal S7 State ■ bit 15 - Reserved
nv13	nvoFltStatus	SNVT_state	Reports drive fault status: <ul style="list-style-type: none"> ■ bit 0 - Overcurrent Ground Short Circuit ■ bit 1 - Overvoltage ■ bit 2 - Drive Overload ■ bit 3 - Overheat ■ bit 4 - Reserved ■ bit 5 - Fuse Blown ■ bit 6 - PID Feedback Lost ■ bit 7 - External Fault ■ bit 8 - Hardware Fault ■ bit 9 - Overload/Overtorque Fault ■ bit 10 - Excessive Speed Deviation ■ bit 11 - Undervoltage Fault ■ bit 12 - Undervoltage/Power Loss Fault ■ bit 13 - Input/Output Phase Loss ■ bit 14 - Drive Communication Loss ■ bit 15 - Operator Error

Table 2.21 – Operating Status			
Index	Variable Name	Variable Type	Description
nv14	nvoSpdStptFb	SNVT_lev_percent	Reports the speed setpoint as a percentage of nciNmIFreq
nv15	nvoSpdCmd	SNVT_lev_percent	Reports the speed command as a percentage of nciNmIFreq regardless of command source
nv16	nvoPIDFb	SNVT_lev_percent	Reports the PID feedback as a percentage of nciNmIFreq
nv17	nvoDrvBus	SNVT_volt	Reports DC Bus voltage
nv18	nvoReadParamVal	SNVT_count	Reports value of requested parameter
nv19	nviDrvFltRst	SNVT_switch	Resets a drive fault
nv20	nvoRunStp	SNVT_switch	Reports the Run/Stop status of the drive
nv21	nvoDrvFlt	SNVT_switch	Reports drive fault condition
nv22	nvoDrvParamErr	SNVT_count	Reports parameter access error
nv23	nvoDrvTemp	SNVT_temp	Reports drive temperature
nv24	nvoDrvEnergyKwh	SNVT_elec_kwh	Reports cumulative energy in kWh
nv25	nvoDrvEnergyMwh	SNVT_elec_kwh	Reports cumulative energy in mWh

◆ 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 user, programming, technical and parameter access manuals must be considered when interpreting a reported value. For example, a read of b2-04, DC Injection Time at Stop, which reports 100 in *nvoReadParamVal* is actually a setting of 1.00 sec, since the increment for this parameter is 0.01 seconds.

◆ Configurable Network Traffic

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

◆ 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.

◆ 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.

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*): Each behavior is described in additional detail below.

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

Note: Communication must be established and then lost for these features to function as described

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 must be added (consult factory).

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

◆ 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.

◆ 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'.

◆ 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'.

◆ 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.

Chapter 3 Troubleshooting

This chapter is a basic troubleshooting guide. For detailed information on the drive refer to the appropriate drive user, programming and/or technical manual. Detailed information on LONWORKS can be obtained from www.echelon.com.

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Introduction

The following is a short guide to troubleshooting the *LONWORKS Option* installation. It highlights some of the most common issues faced when diagnosing and correcting issues associated with the startup and operation of a drive with a industrial network. While most of the information is centered on the application of the drive, the guidelines presented are applicable to most LONWORKS networks.

Diagnosis of network fault issues typically fall into three categories: installation, wiring and cabling, and network configuration. Installation and wiring will be discussed below to help resolve common problems associated in LONWORKS network troubleshooting. Refer to the documentation that accompanied the controller for information on system setup.

Troubleshooting Check List

- 1:** The drive operates correctly without the *LONWORKS Option* installed. This includes running the drive from the operator keypad. Check that the drive responds to commands and faults as the application requires.
- 2:** Check that the *LONWORKS Option* is correctly installed on the drive. That all connectors are firmly seated and that the option card hold down is on top of the *LONWORKS Option*, not underneath it.
- 3:** Check that the communications cable plug end has been firmly seated in connector J1 on the *LONWORKS Option*, and that the cable has been properly connected to the drive's terminal assembly.
- 4:** Check that the termination switch on the drive's terminal assembly is in the ON position.
- 5:** Check that the communications cable is not routed near any high voltage or current wires.
- 6:** Check that the LONWORKS network cable has been correctly and securely connected to the *LONWORKS Option*.
- 7:** Check that the drive communications, command and control parameters are set correctly.
- 8:** Check that the *LONWORKS Option* has established communication with the drive and that neither the "CALL" message nor any fault message is displayed on the drive operator.
- 9:** Check that the *LONWORKS Option* is connected to a noise free ground. Verify the state of the ground connection with an oscilloscope. Make sure that the correct equipment is used and that it does not induce noise into the network. A Z-Lead probe attachment for the oscilloscope is recommended. Also, when using line powered equipment, differential probes must be used in order to avoid introducing imbalances onto the network. If a noise free ground cannot be found, leave the *LONWORKS Option* ground connection unconnected.
- 10:** If a safety interlock is used with the drive, verify that the safety interlock is wired properly and that the controlling multi-function input parameter is programmed correctly.
- 11:** Verify that the LEDs on the *LONWORKS Option* are in their correct state.
- 11:** Check that all other devices on the network are connected properly.
- 12:** Check that the network is correctly terminated for the topology used.
- 13:** Check that the node has been correctly configured. Refer to the documentation that was supplied with the LONWORKS controller for information on node commissioning and configuration. The External Interface File (E7_LW.XIF) and the Device Resource Files (E7_LW.TYP, E7_LW.ENU, E7_LW.FPT, and E7_LW.FMT) may be found on the CD supplied with the drive or downloaded from www.drives.com.

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LEDs

◆ POWER LED

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.

◆ SERVICE

Figure 3.1 – SERVICE LED Behavior 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.

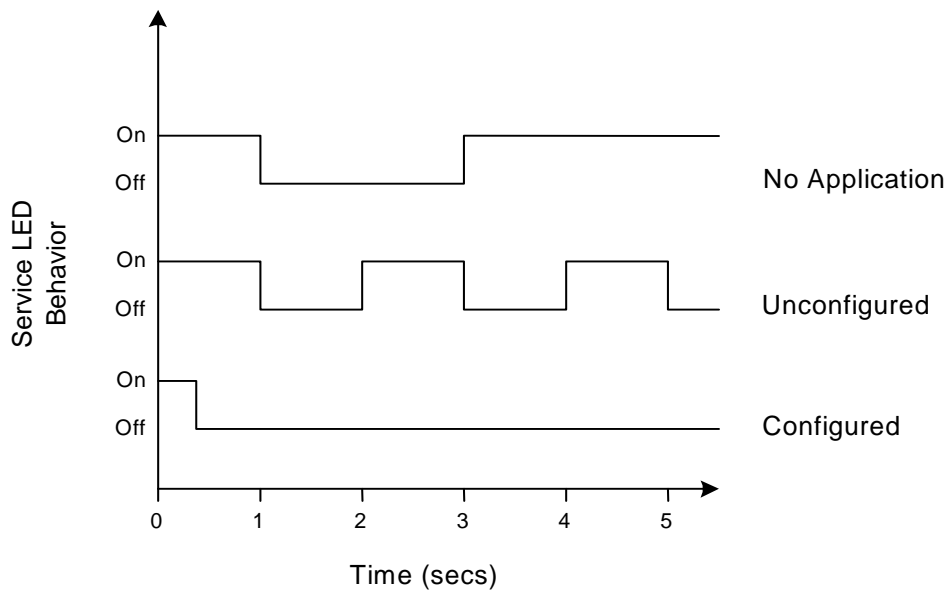


Figure 3.1 - SERVICE LED Behavior

If some other type of behavior is noted, attempt to return the node to its unconfigured state as described previously. If this cannot be accomplished, there may be a problem with the node hardware.

◆ 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 previously.
- 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.

◆ 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 previously.
- 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.

◆ 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 previously.
- During normal operation, this LED is lit if a cable loss is detected. Once communication has been re-established, this LED will be off.

Installing The *LONWORKS Option*

This section provides a brief check of the proper installation of the *LONWORKS Option*.

◆ Drive Operates Correctly Without The *LONWORKS Option* Installed

Before installing any drive option, **verify that the drive functions properly without the option installed**. Refer to the appropriate drive user, programming and/or technical manual for information on the proper installation and operation of the drive.

◆ The *LONWORKS Option* Is Properly Installed

- Verify that the option card hold down on the drive had been removed prior to the installation of the *LONWORKS Option*.
- Verify that the connection between 2CN on the *LONWORKS Option* is securely connected to and firmly seated on the 2CN connector on the drive control board and that all stand-offs are locked in their associated mounting holes.

◆ The *LONWORKS Option* Is Properly Connected to the Drive

- A noise free ground is essential to the proper and stable operation of the network. Verify that the *LONWORKS Option* is properly connected to a noise free ground. If a noise free ground cannot be found, leave the *LONWORKS Option* ungrounded.
- Verify that the communication cable is properly and firmly seated on the J1 connector on the *LONWORKS Option*.
- Select the appropriate connection diagram below. Verify:
 - that the **purple** wire is connected to the **R+** terminal on the drive's terminal assembly,
 - that the **yellow** wire is connected to the **R-** terminal on the drive's terminal assembly,
 - that the **orange** wire is connected to the **S+** terminal on the drive's terminal assembly,
 - that the **blue** wire is connected to the **S-** terminal on the drive's terminal assembly.
- Verify that the termination switch on the drive terminal assembly is in the **ON** position.

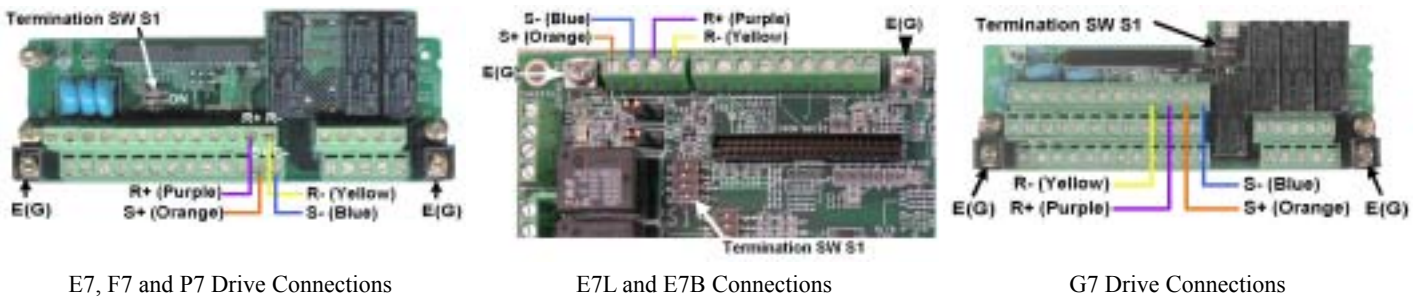


Figure 3.2 – Drive Connections

◆ Network Cable Is Connected Correctly

- Connect the *LONWORKS* network cable to the *LONWORKS Option*. Refer to the figure below for connection details.

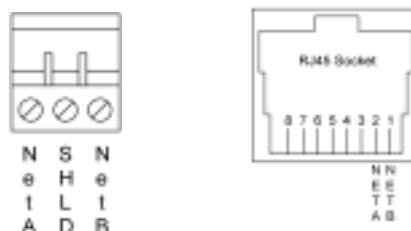


Figure 3.3 – LONWORKS Network Connections

◆ Drive Parameters are Set Correctly

The *LONWORKS Option* communicates with the drive via RS485. It is necessary to set the drive communications parameters to match those of the *LONWORKS Option*.

Table 3.1 – Drive Parameter Settings				
Parameter	Function	Data	+/- Limits - Description	Default
A1-01	Access Level	0	Operator	2
		1	User	
		2	Advanced (LONWORKS)	
H5-01	Serial Communications Address	1F	0 – 1Fh (0 – 31 dec)	1Fh
H5-02	Serial Baud Rate Select	0	1200 baud	3
		1	2400 baud	
		2	4800 baud	
		3	9600 baud (LONWORKS)	
		4	19200 baud	
H5-03	Serial Parity Select	0	None (LONWORKS)	0
		1	Even parity	
		2	Odd parity	
H5-06	Transmit Wait	5	5 – 65ms	5
H5-07	RTS Control Select	0	Disabled (LONWORKS)	0
		1	Enabled	
H5-08	Protocol Select	0	MODBUS (LONWORKS)	0
		1	N2 (Metasys) (E7, E7L and E7B only)	
		2	P1 (APOGEE) (E7, E7L and E7B only)	

It is also necessary to set the control parameters to the application requirements.

Table 3.2 – Control Parameters				
Parameter	Function	Value	Description	Default
b1-01	Frequency Reference Source	0	Operator Keypad	0
		1	External Terminals	
		2	Serial Communications (LONWORKS)	
		3	Option PCB	
		4	Pulse input (Available on F7 and G7 drives only)	
b1-02	Run/Stop Command Source	0	Operator keypad	0
		1	Terminals	
		2	Serial Communications (LONWORKS)	
		3	Option PCB	
F6-01	Stopping Method for Communications Error	0	Ramp to Stop	1
		1	Coast to Stop	
		2	Emergency Stop (Decel time set by C1-09)	
		3	Operation Continues	
F6-02	External Fault Detection	0	Always detect	0
		1	Detect During Operation	
F6-03	Stopping Method for External Fault	0	Ramp to Stop	1
		1	Coast to Stop	
		2	Emergency Stop (Decel time set by C1-09)	
		3	Operation Continues	

Cables and Wiring

Standard network wiring practices should be followed.

- Do not route any network wires close to high voltage or high current wires. It is recommended that network wiring be in its own conduit or trough. It may, however, be routed with low voltage DC wires.
- If the network must cross high voltage or current wires, the network must cross perpendicular to the high voltage or current wires.
- If a clean, noise free ground cannot be found locally to the device, route a ground wire of sufficient size to each device. Remember to provide a single point ground to avoid ground loops.
- Follow all local electrical codes.

◆ Network Cables

Choose the correct cable for the application and network configuration. For more information on cables and cabling refer to “*Junction Box and Wiring Guidelines for Twisted Pair LONWORKS Networks*” Echelon engineering bulletin #005-0023-01. It may be downloaded from www.echelon.com.

Table 3.3 BUS Topology Specifications	
Cable	Maximum bus length(Meters)
Belden 85102	2700
Belden 8471	2700
Level IV, 22AWG	1400
JY(St) Y 2x2x0.8	900
TIA Category 5	900

Note: A doubly-terminated bus may have stubs of up to 3 meters from the bus to each device.

Table 3.4 Free Topology Specifications		
Cable	Maximum device-to-device distance (Meters)	Maximum total Wire length(Meters)
Belden 85102	500	500
Belden 8471	400	500
Level IV, 22AWG	400	500
JY(St) Y 2x2x0.8	320	500
TIA Category 5	250	450

◆ Shield Grounds

Shields can be a prime source of noise in any network. The general rule is to ground the shield at the signal source. Depending on the type of noise and the quality of the ground plane, it may be advisable to ground the shield at each device and/or at both ends of the network segment. If there is noise on the network or intermittent short term communication failures, removing the shield from the device connection is usually one of the first methods used restore communications stability. Also, if there is a disparity in the ground planes between devices, it is preferable to disconnect the shield from the device connection. The shield must still remain contiguous even if removed from a device connector.

Table 3.5 – Shield Ground	
Device	Description
R	470kΩ, 5%, ¼W
C1	0.1µF, 10%, Metalized polyester, ≥100V

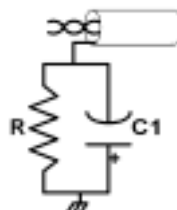


Figure 3.4 Shield ground

◆ Network Termination

Determine the topology of the network. In a BUS topology, there is a definite beginning and end to the network. In a Free topology only the either the beginning or end of the network can be determined. Refer to the diagrams below for examples of BUS and Free topologies.

Network termination consists of a resistor and two capacitors as shown in the figure below. Note the polarity of the capacitors. Refer to the “*FT 3120/FT3150 Smart Transceiver Data Book*” for more information on network termination. It be downloaded from www.echelon.com.

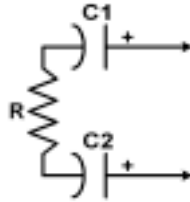


Figure 3.5 – LONWORKS Network Termination

■ BUS topology

BUS topology requires termination resistors at the beginning and end of the network.

Table 3.5 – BUS Topology Terminator Device Values	
Device	Description
R	105Ω, 1%, ¼W
C1 and C2	100μF, ≥50V (typically aluminum-electrolytic)

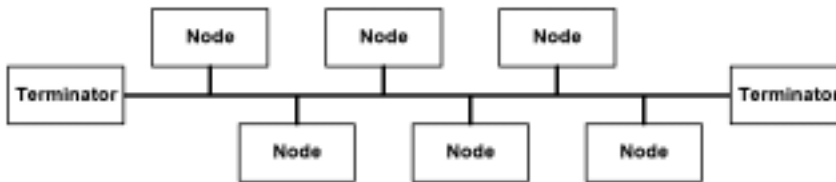


Figure 3.6 – LONWORKS BUS Network Topology

■ Free topology

Free topology network requires only one terminator.

Table 3.6 - Free Topology Terminator Device Values	
Device	Description
R	52.3Ω, 1%, ¼W
C1 and C2	100μF, ≥50V (typically aluminum-electrolytic)

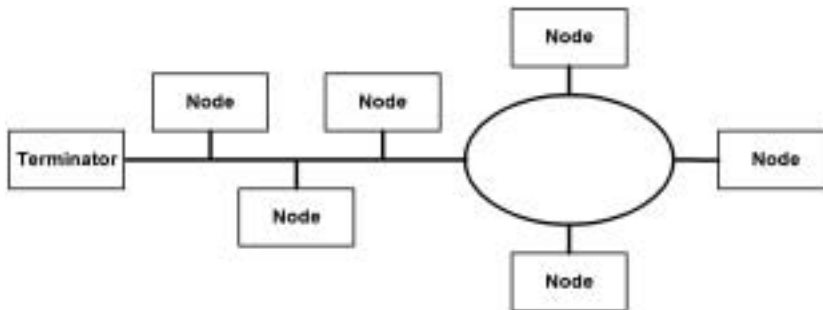


Figure 3.7 – LONWORKS Free Network Topology

LONWORKS[®] Option



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