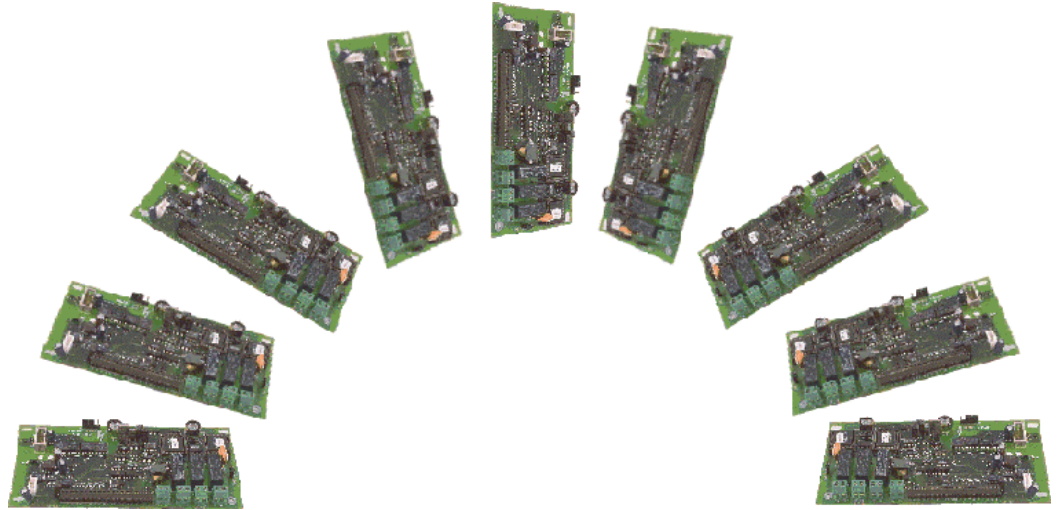


VACON
CX/CXL/CXS
FREQUENCY CONVERTERS



LONWORKS® Option Board

USER'S MANUAL

Subject to changes without

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1. INTRODUCTION

1.1 General

Vacon frequency converters can be connected to LONWORKS® network by using CX203OPT option board. The converter can then be controlled, monitored and programmed from the LONWORKS® network. Vacon CX LONWORKS® option board follows Variable Speed Motor Drive Profile.

The used I/O can also be extended with the LONWORKS® option board:

- 4 digital inputs (standard signals)
- 4 digital outputs (standard signals)
- Termistor input (can be directly connected into the motor termistors for overtemperature trip)
- Encoder input

The interface board should be installed into the external option enclosure outside the frequency converter.

1.2 About this manual

The purpose of this manual is to provide you with the information on how to install and set up your Vacon CX LONWORKS® Option Board for communication over a LONWORKS® network. For more specific information on installation and operation of Vacon CX refer to the VACON CX/CXL/CXS Frequency Converter User's Manual and Vacon CX/CXL Fieldbus Application User's Manual.

This manual assumes that you are familiar with Vacon CX frequency converters and using LONWORKS® Option Board with a Vacon CX frequency converter containing application with fieldbus support. It is also assumed that you are familiar with LONWORKS® and its installation procedures and tools.

1.3 Safety Precautions

Before doing any installation, read carefully all warnings and safety instructions in VACON CX/CXL/CXS Frequency Converter User's Manual.



Internal components and circuit boards (except the isolated I/O terminals) are at mains potential when Vacon CX is connected to the mains. This voltage is extremely dangerous and may cause death or severe injury if you come in contact with it.

The control I/O terminals are isolated from the mains potential, but the I/Os (if jumper X9 is in OFF-position) may have dangerous voltage connected even if the power is off the Vacon CX.

2. SPECIFICATIONS

Bus interface connections	Channel	FTT-10A Free Topology transceiver
	Transfer cable	Twisted pair
I/O -control connections	Digital input (4 pcs)	24 V ($\pm 15\%$), $R_i = 5\text{ k}\Omega$
	Digital output (4 pcs)	Open collector output, 50 mA/48 V
	Termistor input (1 pcs)	$R_{\text{trip}} = 4.7\text{ k}\Omega$
	Encoder input (3 pcs)	24 V ($\pm 30\text{ V}$): "0" $\leq 10\text{ V}$, "1" $\geq 18\text{ V}$, $R_i = 3.3\text{ k}\Omega$ 5 V ($\pm 10\text{ V}$): "0" $\leq 2\text{ V}$, "1" $\geq 3\text{ V}$, $R_i = 330\ \Omega$
	Aux. voltage	24 V ($\pm 20\%$), max 50 mA
Safety		Fulfills EN50178 standard

Table 2-1. Specifications

The control connections are isolated from the mains potential and the I/O ground is connected to the frame of the device via a 1-M Ω resistor and 4.7-nF capacitor*. The control I/O ground can be connected also directly to the frame by changing the position of the jumper X9 (GND ON/OFF) to ON-position. Digital inputs are isolated from the I/O ground.

* Default value (X9 is GND OFF- position)

3. LonWorks®

3.1 Overview

LONWORKS® technology has been developed by Echelon Corporation. LONWORKS® network is used in applications like industry and building automation, controlling household electronics, medical instrumentation and many others. The target of the LONWORKS® network is to provide a common vendor independent communication network for intelligent devices.

In a LONWORKS® network, no central control or master-slave architecture is needed. Nodes on a network communicate with each other using LonTalk® protocol. Interoperable nodes use Standard Network Variable Types (SNVT) for communicating over the network. The definition of an SNVT includes units, a range, and an increment. Vacon LONWORKS® uses only Standard Network Variable Types for the data types.

All network variables are either input (data is coming from the network to the device) or output (data is sent to the network from the device) network variables. When network variables on different nodes on the network have been bound together by an installation tool, passing of data is automatic between the right nodes. Only the same type of network variables can be bound together, so it is very important to have compatible interfaces.

3.2 Physical media and wiring

LONWORKS® networks can be implemented on many different physical media. Vacon CX 203OPT option board is equipped with an FTT-10A transceiver supporting the Free Topology transformer coupled network, which allows the network wire to be connected as bus, star, loop or mixed way. Communication speed with this media is 78kBits/s. The FTT-10A transceiver is compatible with Echelon's LPT-10 Link Power Transceiver, and these transceivers can communicate with each other on a single twisted pair cable.

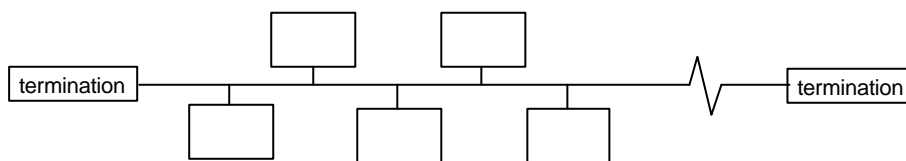


Figure 3-1 Doubly Terminated Bus Topology

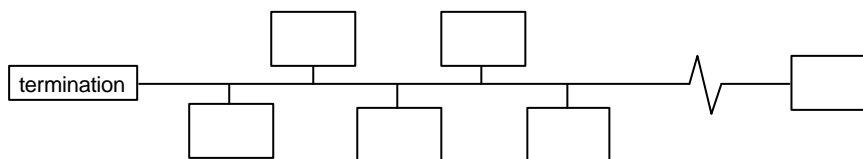


Figure 3-2 Singly Terminated Bus Topology

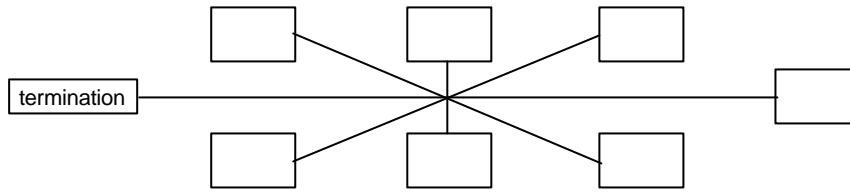


Figure 3-3 Star Topology

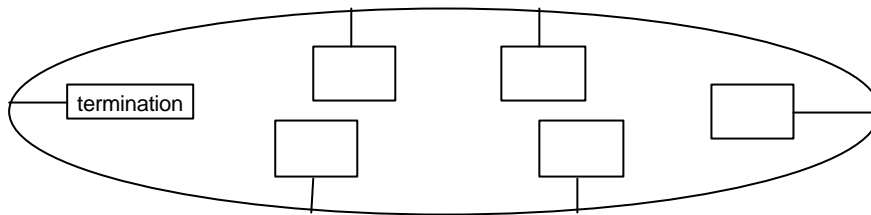


Figure 3-4 Loop Topology

Up to 64 FTT-10 transceiver nodes are allowed per network segment, the individual segments can be connected together by a router. See tables 3-1 for recommended cable types and cable lengths for FTT-10. Even if unshielded cable types are recommended to be used with this type of transceiver, it is still highly recommended to use only shielded cables with frequency converters. Attention should be paid to proper grounding of the shield to ensure bus operation, grounding of the shield should be done on both ends of the cable.

Cable type	Max. doubly terminated bus length	Max. free topology wire length	Max. node-to-node distance
Belden 85102 (unshielded)	2700 m	500 m	500 m
Belden 8471 (unshielded)	2700 m	500 m	400 m
Level IV, 22AWG (unshielded)	1400 m	500 m	400 m
JY (St) Y 2x2x0.8mm (shielded)	900 m	500 m	320 m

Table 3-1 FTT-10 wiring

3.3 Bus termination

The FTT-10 network segment requires termination for proper data transmission performance. A total termination impedance of approximately 52.3Ω is required.

In a free topology segment, only one termination is required and may be placed anywhere on the free topology segment. In a doubly terminated bus topology, two terminations are required, one at each end of the bus.

The Vacon CX 203OPT option board is equipped with termination resistors, which can be selected with jumper X6. If the jumper is in 'ST' position, single termination is selected and if it is in 'DT' position, double termination is selected. If termination is not done in this node the jumper should be removed or positioned so that it is connected to one pin only.

3.4 Service button and LED

Every LONWORKS® device has a service button, which is needed during network installation. Pressing the button causes the node to send its unique ID number to the network. Because the Vacon CX LONWORKS® Option Board is located in normal use under the frequency converter's cover, the service button operation can be utilized by changing the value of a service button parameter from 0 to 1 or vice versa on the Vacon CX operating panel. Location of the service button parameter depends on the used Vacon CX's application.

Each LONWORKS® device should also have a service LED on it. The LED shows the operating state of the device by blinking. On Vacon CX, the operating state can be seen on the operating panel as actual value 22. See table 3-2 for coding of the states.

Node State	State Code	Service LED
Applicationless and Unconfigured	3	On
Unconfigured	2	Flashing
Configured	4	Off

Table 3-2 Service LED states

4. INSTALLATION

Before doing any commissioning read carefully the safety instructions in the " VACON CX/CXL/CXS Frequency Converter User's Manual " chapter Safety. Check that you have got all the LONWORKS® kit parts: Repeater board on mounting board, power cable (black terminal), data cable (blue terminal) and LONWORKS® board in the separate option enclosure. The repeater board with the mounting board can be installed into the already existing place of the option board inside the frequency converter (see figure 4-1).

A	Remove the control panel and the jumper X4 from the control board. Install the jumper which you removed from terminal X4 of the control board, on terminal X9 of the Fieldbus board in the ON or OFF position.
B	Connect the power cable to the control board terminal X5 and the data cable to terminal X14. The power cable can also be connected to terminal X6, if the power cable from the power board is connected to terminal X5.
C	Put the data and power cables through the holes in the mounting board.
D	Install the mounting board on the standoffs by the larger holes and "push" it into the right position in the slots on the standoffs . Check that the mounting board is stable and secure it with a screw to the lower left standoff. If you have difficulties to place the board, slightly bend the regulator A4 and capacitor C59 of the control board.
E	Connect the power cable to terminal X1 of the Repeater board and the data cable to terminal X2.
F	Connect the cable coming out of the option enclosure to terminal X3 of the repeater board. Find the closest grounding terminal on the frequency converter and strip the cable so that you can ground the shield under the grounding terminal.
G	After this install the control panel back on its place.
H	If you use a 5-V encoder input, install the jumper in terminal X7 (see figure 5-1) of the LONWORKS® board.

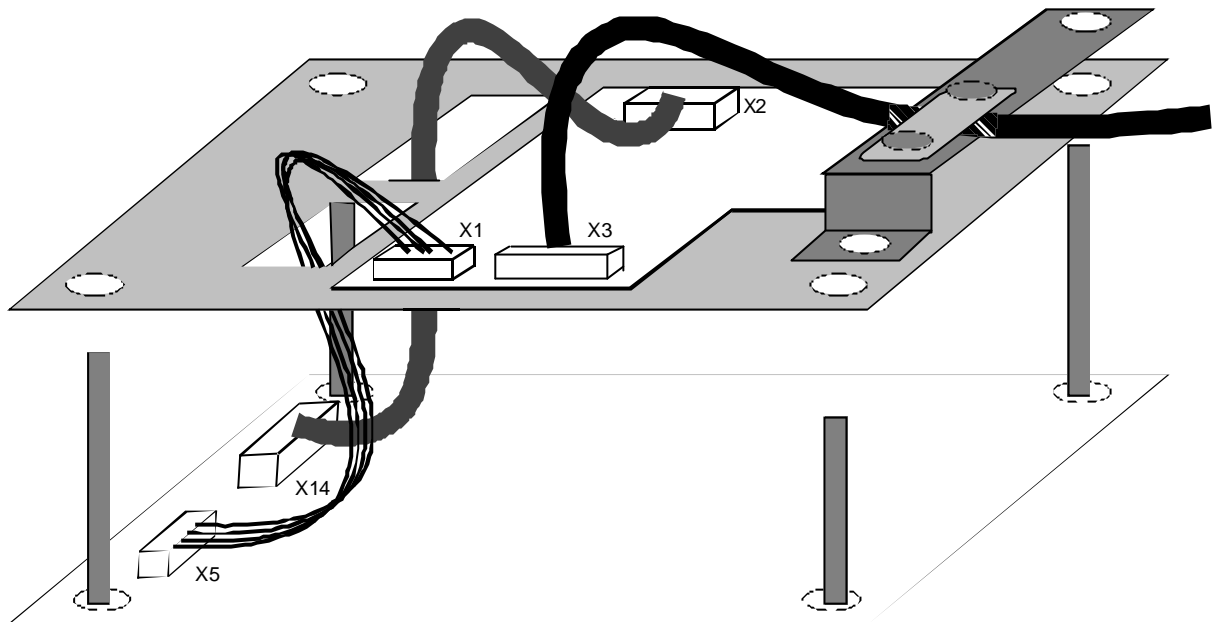


Figure 4-1. Repeater board on mounting board installed on top of the control board

5. CONNECTIONS

5.1 Board layout

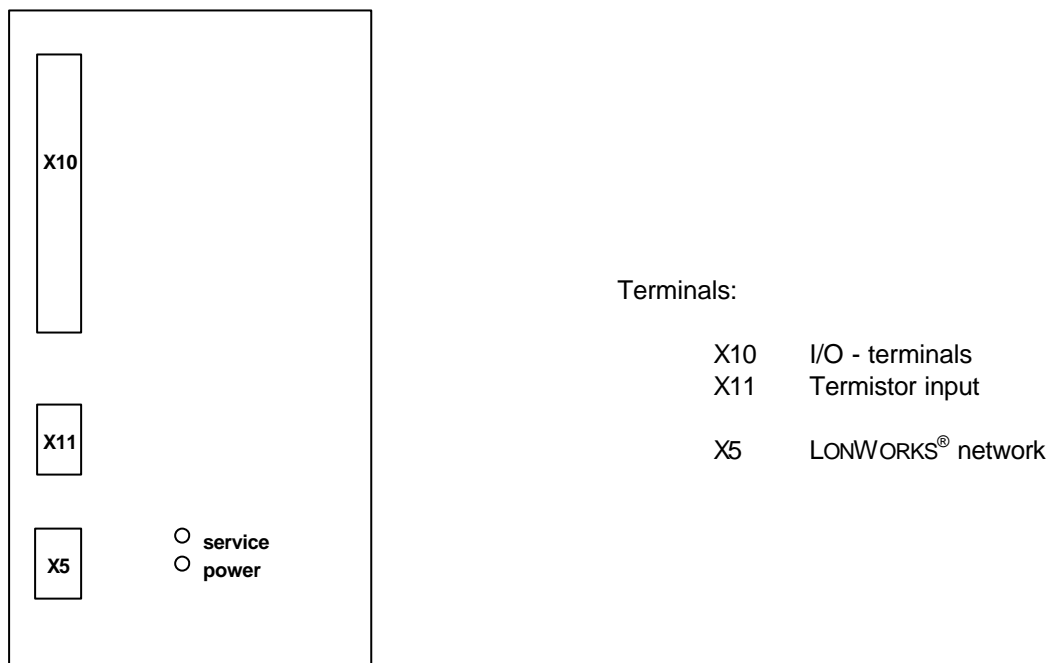


Figure 5-1. LONWORKS® option board

Diagnostic LED:

- power Supply Voltage, Green.
Power led is active if the interface board has supply voltage.
- service Neuron's service pin, Green.
See table 3-2. for the operation of this led.

5.2 I/O-control connections

Terminal	Signal	Description	
301	DID1	Programmable: External fault OR Select of Active Control Source	Contact open = no fault Contact closed = fault Contact open = VACON IO-terminal Contact closed = Fieldbus
302	DID2	Run disable	Contact open = start of motor enabled Contact closed = start of motor disabled
303	DIE3	Acceler. / Decel. time selection	Contact open = time 1 selected Contact closed = time 2 selected
304	DIE4	Jogging speed selection	Contact open = no action Contact closed = jogging speed
305	COMD	Common for DID1-DID2	Connect to GND or +24 V
306	+24 V	Control voltage output	Voltage for switches, etc. max. 0.05 A
307	COME	Common for DIE3-DIE4	Connect to GND or +24 V
308	GND	I/O ground	Ground for reference and controls
309	DID5A+	Pulse input A (differential input)	
310	DID5A-		
311	DID6B+	Pulse input B (differential input)	90 degrees phase shift compared to pulse input A
312	DID6B-		
313	DID7Z+	Pulse input Z (differential input)	one pulse per one revolution
314	DID7Z-		
315	GND	I/O ground	Ground for reference and controls
316	DOD1	Open collector output 1	READY
317	DOD2	Open collector output 2	RUN
318	DOD3	Open collector output 3	FAULT
319	DOD4	Open collector output 4	FIELDBUS CONTROL
320	GND	I/O ground	Ground for reference and controls
327	TI+	Termistor input	
328	TI-		
329	NET1	LONWORKS® network	
330	NET2		

Figure 5-2. Control connections

NOTE! Termistor input(terminals 327 and 328) must be shorted if not used.

READY = ON, when mains voltage has been applied and Vacon CX is ready to operate

RUN = ON, when the motor is running

FAULT = ON, if a fault occurs

6. COMMISSIONING

Check first commissioning of the frequency converter in the VACON CX/CXL/CXS Frequency Converter User's Manual (Chapter 8.)

Commissioning of the LONWORKS® option board:

1. Check that Multi-purpose Control Application II (or e.g. Fieldbus Application) is selected. Parameter P0.1 = 0
2. Change service pin parameter value from 0 to 1 or vice versa. Check if your Network Management Tool receives a service pin message from Vacon CX.

Start-up test:

FREQUENCY CONVERTER APPLICATION

1. Check that the control panel is not the active control source.
(See CX/CXL/CXS frequency converter User's manual, Chapter 7.)
2. Set parameter "Fieldbus control select" to value 1(On).

NETWORK MANAGEMENT SOFTWARE

1. Write value 100.0 1 to nviDrvSpeedStpt.
2. Frequency converter status is RUN and output frequency $1.00 * nviDrvSpeedScale$
3. Write value 0 0 to nviDrvSpeedStpt.
4. Frequency converter status is STOP

If nvoDrvStats bit 3 = 1 Status of frequency converter is FAULT.

7. VACON LONWORKS® INTERFACE

7.1 Network Variables

The Vacon CX has a pre-defined set of network variables. These are divided into Network Input variables, Network Output variables and Network Configuration variables.

7.1.1 Network Input variables in the Vacon CX

Function	Variable Name	SNVT type	Min. Value	Max. Value
Driver speed setpoint	nviDrvSpeedStpt	SNVT_switch	0.0%	100.0%
			-1	1
Driver set point speed scaling	nviDrvSpeedScale	SNVT_lev_percent	-163.840%	163.830%
PI-control actual value	nviPIconAct	SNVT_lev_percent	0.00%	100.00%
Reset fault	nviRstFault	SNVT_lev_disc	n/a	Reset
Clear kWh trip counter	nviClrEnergy	SNVT_lev_disc	n/a	Clear
Any parameter	nviParIn	SNVT_count	0	65535 ^{*)}

Table 7-1 Network input variables

*) depends on the selected parameter

nviDrvSpeedStpt

This input network variable provides control and a low resolution speed setpoint

state	value	command
0	NA	Stop
1	0	0%
1	1 to 200	0.5 to 100%
1	201 to 255	100.0%
0xFF	NA	Auto

nviDrvSpeedScale

This network input variable provides scaling for nviDrvSpeedStpt. Negative values indicate a motor direction in reverse. For example, if the nviDrvSpeedStpt value is 50% and nviDrvSpeedScale -150%, then actual speed setpoint is -75%, or 0.75 times the nominal speed in the reverse direction.

nviPIconAct

This network input variable is used only with a PI-control application, which has fieldbus support. This variable is the actual value from the process to be controlled by frequency converter's PI-control.

nviRstFault

Setting a non-zero value for this variable will reset an active fault in Vacon CX. This variable will automatically go back to 0 value after the fault has been reset.

nviClrEnergy

Giving a non-zero value for this variable clears Vacon CX's resettable energy consumption counter.

nviParIn

This network input variable can be used to write a value to any of Vacon CX's parameters. Network configuration variable nciParInPt defines the parameter which will be written. If the value is changed via the network it is not saved in the frequency converter's non-volatile memory, unless bit 4 in nciEeprSave has been set to 1.

7.1.2 Network Output variables from the Vacon CX

Function	Variable Name	SNVT type	Min. Value	Max. Value
Drive speed feedback	nvoDrvSpeed	SNVT lev_percent	-163.840%	+163.830%
Actual motor current	nvoMtrCurnt	SNVT_amp	0.0A	3276.7A ^{**)}
Actual motor power	nvoMtrPwr	SNVT lev_percent	0.00%	163.83%
Status word	nvoDrvStats	SNVT_state	n/a	n/a
kWh trip counter	nvoDrvEnrgy	SNVT_elect_kwh	0kWh	65535kWh
Active fault code	nvoActFault	SNVT_count	0	41
Any parameter	nvoParOut	SNVT_count	0	65535 ^{*)}

Table 7-2 Network output variables

*) depends on the selected parameter
 **) depends on frequency converter nominal current

nvoDrvSpeed

This output network variable provides the speed of the drive as a percentage of the nominal speed.

nvoMtrCurnt

This network output variable's value is Vacon CX's output current. Configuration variable nciCurrDlta controls the propagation of this value to the network.

nvoMtrPwr

This network output variable's value is Vacon CX's output power in percent of its nominal power. Configuration variable nciPwrDelta controls the propagation of this value to the network.

nvoDrvStats

This network output variable represents the status of Vacon CX as a set of 16 boolean values.

Bit	Name	Description
0	Ready	0 = not ready, 1 = ready to start
1	Running	0 = stopped, 1 = running
2	Direction	0 = forward, 1 = reversed
3	Faulted	0 = OK, 1 = faulted
4	Not used	
5	Not used	
6	Not used	
7	Not used	
8	Fieldbus control	0 = external IO or panel, 1 = fieldbus control
9	Not used	
10	Not used	
11	Not used	
12	Not used	
13	Not used	
14	Not used	
15	Not used	

Table 7-3 Status word bits

nvoDrvEnergy

This network output variable's value is Vacon CX's resettable energy consumption counter. The maximum value for used SNVT is 65535 kWh, on the frequency converter the value can go much higher. If the counter exceeds the SNVT's maximum value, the network variable stays at its maximum. In such cases the real value can be seen on Vacon CX's operating panel. Configuration variable nciEnergyDlt controls the propagation of this value to the network.

nvoActFault

This network output variable's value is Vacon CX's active fault code. If the value is 0 the frequency converter has no fault. See the fault code list in Vacon CX/CXL/CXS Frequency Converter User's Manual for identifying the faults.

nvoParOut

This network output variable can be used to read the value of any Vacon CX parameter or variable. Network configuration variable nciParOutPt defines the parameter which will be read.

7.1.3 Network Configuration variables to the Vacon CX

Function	Variable Name	SNVT type
Maximum motor speed	nciMaxSpeed	SNVT_lev_percent
Minimum motor speed	nciMinSpeed	SNVT_lev_percent
Send heartbeat time	nciSndHrtBt	SNVT_time_sec
Nominal motor speed in RPM	nciNmI Speed	SNVT_rpm
Nominal motor frequency	nciNmI Freq	SNVT_freq_hz
Minimum ramp up time	nciRampUpTm	SNVT_time_sec
Minimum ramp down time	nciRampDownTm	SNVT_time_sec
Default value for nviDrvSpeedScale	nciDrvSpeedScale	SNVT_lev_percent
Receive heartbeat time	nciRcvHrtBt	SNVT_time_sec
Amount of change in actual speed value before it is sent	nciSpeedDelta	SNVT_lev_percent
Amount of change in motor current before it is sent	nciCurrDlta	SNVT_amp
Amount of change in motor power before it is sent	nciPwrDelta	SNVT_lev_percent
Amount of change in kWh before it is sent	nciEnrgyDlt	SNVT_elec_kwh
Amount of change in output parameter before it is sent	nciParDelta	SNVT_count
Input parameter's address	nciParInPt	SNVT_count
Output parameter's address	nciParOutPt	SNVT_count
Save the parameter changes from Lon to drive's eeprom	nciEeprSave	SNVT_state

Table 7-4 Network configuration variables

nciMaxSpeed

This configuration property is used to define the maximum speed of a motor. The value is entered as a percentage of nominal speed in RPM, as defined by the Nominal Speed (nciNmI Speed) configuration value. The value of the maximum speed must be validated against the value of the minimum speed as follows:

$$-163.840 \leq \text{minimum speed} \leq \text{maximum speed} \leq 163.830$$

If the value is changed via the network it is not saved in the frequency converter's non-volatile memory, unless bit 1 in nciEeprSave has been set to 1.

nciMinSpeed

This configuration property is used to define the minimum speed of the motor. The value is entered as a percentage of nominal speed in RPM, as defined by the Nominal Speed (nciNmlSpeed) configuration value. The value of the minimum speed must be validated against the value of the maximum speed as follows:

$$-163.840 \leq \text{minimum speed} \leq \text{maximum speed} \leq 163.830$$

If the value is changed via the network it is not saved in the frequency converter's non-volatile memory, unless bit 0 in nciEeprSave has been set to 1.

nciSndHrtBt

This configuration property defines the maximum period of time that expires before Drive Speed Feedback (nvoDrvSpeed) value will automatically be updated. When this network configuration variable is set to 0, the automatic update is disabled. The valid range is 0.0 to 6,553.4 sec (0.1 sec).

nciNmlSpeed

This configuration property is used to provide the nominal speed of the motor in RPM. This value is necessary to determine the minimum and maximum speed for the motor, based on the configuration properties nciMinSpeed, nciMaxSpeed (entered as percent of nominal speed). If the value is changed via the network it is not saved in the frequency converter's non-volatile memory, unless bit 5 in nciEeprSave has been set to 1.

nciNmlFreq

This configuration property is used to provide the nominal frequency for the motor. If the value is changed via the network it is not saved in the frequency converter's non-volatile memory, unless bit 4 in nciEeprSave has been set to 1.

nciRampUpTm

Defines the acceleration time for Vacon CX. If the value is changed via the network it is not saved in the frequency converter's non-volatile memory. The valid range is 0.0 to 6,553.4 sec (0.1 sec).

nciRampDownTm

Defines the deceleration time for Vacon CX. If the value is changed via the network it is not saved in the frequency converter's non-volatile memory. The valid range is 0.0 to 6,553.4 sec (0.1 sec).

nciDrvSpeedScale

This configuration property is used as the default value for nviDrvSpeedScale. This value will be adopted at power-up and in case of not receiving any input variable within the specified Receive Heartbeat time.

nciRcvHrtBt

The LONWORKS® Option Board will initiate bus-time-out activities when the max. receive time has expired without receiving an input network variable. Action taken by the frequency converter depends on the setting of the fieldbus fault response parameter. The communication watchdog function is disabled when this network configuration variable is set to 0. The valid range is 0.0 to 6,553.4 sec (0.1 sec).

nciSpeedDelta

This network configuration variable sets how much nvoDrvSpeed's value has to change before it is transmitted. When this network configuration variable is set to 0, nvoDrvSpeed is not transmitted, unless nciSndHrtBt is set.

nciCurrDlta

This network configuration variable sets how much nvoMtrCurnt's value has to change before it is transmitted. When this network configuration variable is set to 0, nvoMtrCurnt will not be transmitted.

nciPwrDelta

This network configuration variable sets how much nvoMtrPwr's value has to change before it is transmitted. When this network configuration variable is set to 0, nvoMtrPwr will not be transmitted.

nciEnrgyDlt

This network configuration variable sets how much nvoDrvEnrgy's value has to change before it is transmitted. When this network configuration variable is set to 0, nvoDrvEnrgy will not be transmitted.

nciParDelta

This network configuration variable sets how much nvoParOut's value has to change before it is transmitted. When this network configuration variable is set to 0, nvoParOut will not be transmitted.

nciParInPt

This network configuration variable sets the address of the parameter written by nviParIn. The address is formed of the group and the parameter number, defined by the application in the frequency converter. The group number is multiplied by 100 and the parameter number is added to it. For example parameter 3 in group 4 has the address 403.

nciParOutPt

This network configuration variable sets the address of the parameter or variable, which is read in nvoParOut. The address is formed of the group and the parameter number, defined by the application in the frequency converter. The group number is multiplied by 100 and the parameter number is added to it. Group number 0 is used for actual value variables.

nciEeprSave

This network configuration variable is a bit mask, which defines if some of the network input variables are written to Vacon CX's non-volatile memory, when changed from network. If a bit is set to 1, the corresponding variable will be saved.



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