Installation, Operation and Maintenance Manual
MDE 262 Rev. 3
January 2023

Biffi ICON3000

LonWorks Bus Module

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NOTICE

Biffi Italia has taken every care in collecting and verifying the documentation contained in this Installation, Operation and Maintenance Manual. The information herein contained are reserved property of Biffi Italia.

Section 1: Introduction to LonWorks® Protocol

LonWorks is a complete platform for implementing control network systems created by Echelon Corporation. LonWorks has been approved as ANSI/EIA-709.1 and as ISO/IEC 14908, Parts 1, 2, 3, and 4 Standards.

Devices in a LonWorks network communicate using LonTalk®, the standardized language of the network. LonTalk consists of a series of underlying protocols that allow intelligent communication among various devices on a network. The protocol provides a set of services that allow the application program in a device to send and receive messages from other devices over the network without needing to know the topology of the network or the names, addresses or functions of other devices. Support for network management services allow for remote network management tools to interact with devices over the network, including reconfiguration of network addresses and parameters, downloading of application programs, reporting of network problems and start/stop/reset of device application programs. LonTalk – and thus LonWorks networks – can be implemented over basically any medium, including power lines, twisted pair, radio frequency (RF), infrared (IR), coaxial cable and fibre optics.

A control network is a group of “nodes”, each with one or more sensors or actuators, plus localized computational capability, that communicate over one or more media, using a standard protocol to control and monitor application. Communication among the nodes may be peer-to-peer (distributed control) or master-slave (centralized control); in either case, intelligence in the nodes permits the distribution of processing loads. If the control functions are also distributed, both system performance and reliability can be dramatically enhanced.

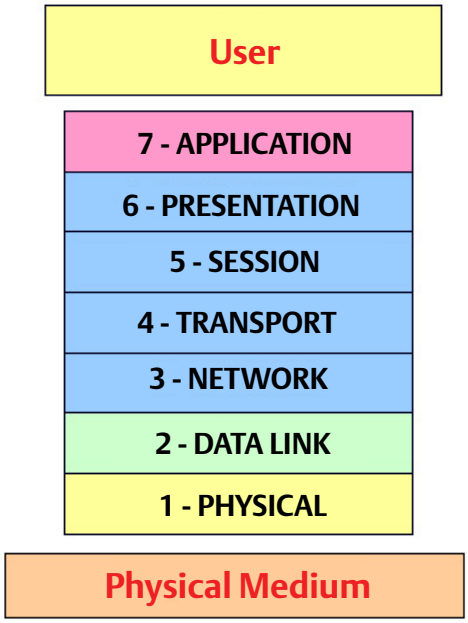
LonWorks networks really describe a complete solution to the problem of control systems.

Protocols are generally designed to follow the ISO standard “Open Systems Interconnection Reference Model”, which encompasses a full set of protocol features, and classifies them according to seven functional categories referred to as “layers”. Thus the “seven layer ISO-OSI model”.

The LonTalk protocol implements all seven layers of the ISO-OSI model and the entire LonTalk protocol stack is contained in the Neuron chip that is a complete system on a chip.

The Neuron is comprised of multiple CPUs, memory, I/O, communications port, firmware, and operating system. Features include media access, transaction acknowledgement and peer-to-peer communication, and more advanced services such as sender authentication, priority transmissions, duplicate message detection, automatic retries, client-server support, unicast/multicast/broadcast addressing and error detection and recovery. Reliable delivery is provided by using end-to-end acknowledgements made possible by the use of a seven layer OSI stack, 16-bit cyclical redundancy checks and in the case of certain transceivers, the use of error correction algorithms.

An integral part of the protocol used in LonWorks® networks is its unique media access technique, termed “predictive persistent CSMA, with optional priority and collision detection”. It provides linear response to offered traffic load, predictable response time for heavily loaded networks, and consistent performance independent of network size.



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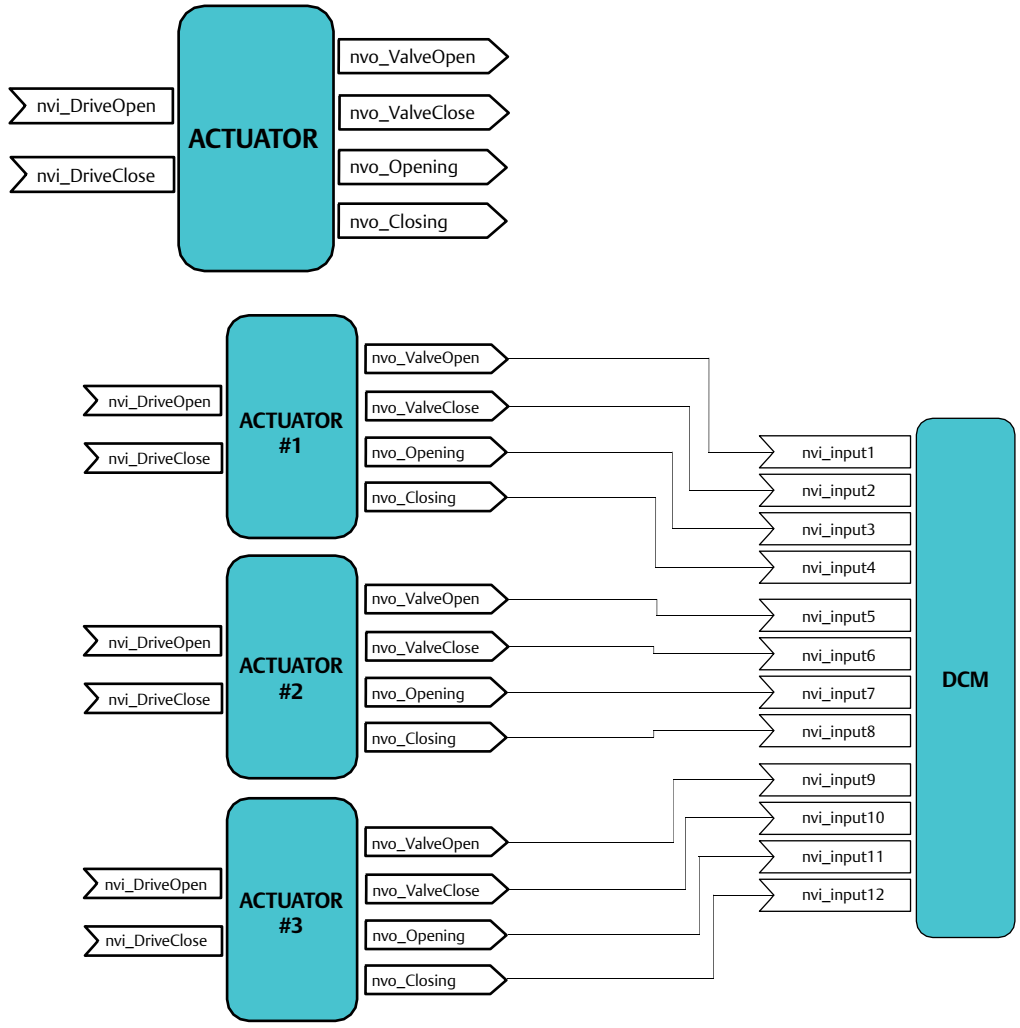
Interoperability is achieved by the introduction of the Standard Network Variable Type (SNVT): each node implements a set of communication objects that are defined according to the standardized data type SNVT.

The configuration of a LonWorks® network consists of the establishing of virtual connections among input and output communication objects belonging to the same SNVT type (binding).

During the normal functioning, every time an output changes state, the variation is immediately propagated to the correspondent input element.

Figure 1



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1.1 Nodes Addressing

LonTalk® protocol supports networks with segments using different media. A **channel** is a physical transport media for packets. A LonWorks® network is composed of one or more channels. The LonWorks devices that are physically connected to a channel can be reached by a variety of different addressing mechanisms.

Each device is identified by a unique Neuron-ID code that is a 48-bit code assigned to the Neuron chip microprocessor during the manufacturing. The ID is typically used as a network address during the installation and the node configuration.

The identifier that is assigned to the device during the configuration is based on three components:

- **Domain:** it corresponds to the entire network. A single node can be a member of up to two domains
- **Subnet:** a subnet is a logical grouping of nodes form one or more channels. There may be up to 255 subnets per domain
- **Node:** there may be up to 127 nodes per subnet

The addressing space available for a single domain is 255 x 127 = 32.385.

1.2 Message Services

The LonTalk protocol offers four basic type of message services.

ACKD: End-to-end acknowledged service, where a message is sent to a node or to a group of nodes and individual acknowledgements are expected from each receiver. If the acknowledgements are not received, the sender times out and retries the transaction.

REQUEST: Request/response service, where a message is sent to a node or to a group of nodes and individual responses are expected from each receiver.

UNACKD_RPT: Unacknowledged repeated. A message is sent to a node or to a group of nodes multiple times and no response is expected.

UNACKD: Unacknowledged. A message is sent once to a node or to a group of nodes time and no response is expected.

Section 2: LonWorks® Implementation in ICON3000

2.1 Fieldbus Media

This section is based on the following documents:

- LonWorks FTT-10 Free Topology Transceiver User's Guide - Version 6 - Echelon Corporation
- LonMark Layers 1-6 Interoperability Guidelines - Version 3.0 - LonMark Interoperability Association
- LonWorks Engineering Bulletin - Junction Box and Wiring Guideline for Twisted Pair LonWorks Networks - November 2001

ICON3000 implements LonWorks protocol using the FT 5000 Smart Transceiver with FT-X3 Communications Transformer that are the components that drives the communication function.

The characteristics of the FT 5000 Smart Transceiver are stated in the Echelon literature and can be summarized as follows:

- Communication speed is set at 78 Kbps;
- The communication channel cable must be separate from the high voltage cables;
- Up to 64 FT 5000 Smart Transceivers can be connected in a network segment; and
- The network segment length depends on the network topology and on the cable selected.

The LonWorks interface module can also be installed in the ICON3000v2 actuator.

The ICON3000v2 actuator can be recognized because when it is switched on, the name "ICON3000v2" appears on the local screen, as shown in Figure 2.

Figure 2

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Table 1. Doubly Terminated Bus Topology Specification

	Maximum Bus Length	Max Stub from Bus to Node
BELDEN 85102, 16 AWG	2,700 meters	3 meters
BELDEN 8471, 16 AWG	2,700 meters	3 meters
Level IV, 22 AWG	1,400 meters	3 meters
TIA Category 5	900 meters	3 meters

Table 2. Free Topology Specification

	Maximum Bus Length	Max Stub from Bus to Node
BELDEN 85102, 16 AWG	500 meters	500 meters
BELDEN 8471, 16 AWG	400 meters	500 meters
Level IV, 22 AWG	400 meters	500 meters
TIA Category 5	250 meters	450 meters

NOTE:
If the total bus length exceeds the maximum length indicated in the tables above, or if the total number of nodes is more than 64, it is necessary to split the network in several network segments connected by standard physical layer repeaters.

2.1.1 Specification for 16 AWG/1.3 mm – Twisted Pair Cable

Stranded pair (19 x 29), tinned copper.

Table 3. Doubly Terminated Bus Topology Specification

	Min.	Type	Max.	Unit	Condition
DC resistance, each conductor	14.0	14.7	15.5	ohm/km	20 °C for ASTM D 4566
DC resistance, unbalanced	-	-	5%	-	20 °C for ASTM D 4566
Mutual capacitance	-	-	55.9	nF/km	for ASTM D 4566
Characteristic impedance	92	100	108	ohm	64 kHz to 1 MHz for ASTM D 4566
Attenuation					
20 KHz	-	-	1.3	dB/km	20 °C for ASTM D 4566
64 KHz	-	-	1.9	-	-
78 KHz	-	-	2.2	-	-
156 KHz	-	-	3.0	-	-
256 KHz	-	-	4.8	-	-
512 KHz	-	-	8.1	-	-
772 KHz	-	-	11.3	-	-
1000 KHz	-	-	13.7	-	-
Propagation delay	-	-	5.6	ns/m	78 KHz

The following Belden cables are indicated in the Echelon literature as compliant to the 16 AWG/1.3 mm – twisted pair cable specification:

BELDEN 8471 Tinned copper, PVC insulated, twisted pair, Chrome PVC jacket
BELDEN 85102 Tinned copper, Tefzel insulated. Clear Tefzel jacket. 300 V RMS 150 °C

Other selected producers are indicated in the Echelon document:

LonWorks® Engineering Bulletin - Junction Box and Wiring Guideline for Twisted Pair LonWorks Networks - November 2001

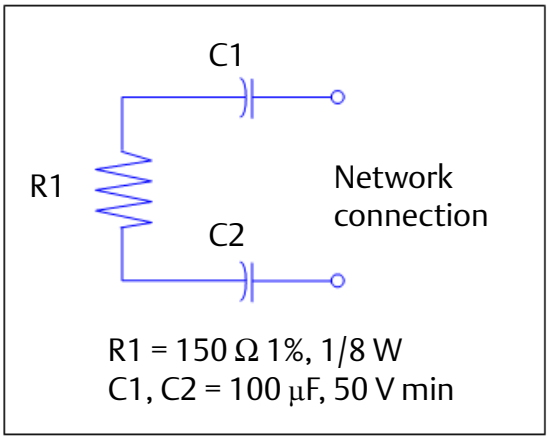
2.1.2 Bus Communication Topology

A **Doubly Terminated Bus Topology** achieves the longest bus length and in this case the line must be terminated on both ends by a termination circuit.

The terminator is a simple RC circuit, defined by the LonWorks® protocol specifications and shown in Figure 3.

The terminators are necessary to avoid the propagation of echoes (reflections) that can be generated due to the high transmission speed (78 Kbps) and the network cable length.

Figure 3 Doubly Terminated Bus Topology - Twisted Pair Termination Circuit



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Section 3: ICON3000 LonWorks® Interface

This document describes the characteristics of the LonWorks DE7761 and DE9475 fieldbus communication cards.

The LonWorks DE7761 is applicable to ICON3000 actuators.

The LonWorks DE9475 is applicable to ICON3000v2 actuators.

Figures 4 and 5 show the positioning of the signals and control switches available for the user.

Figure 4 DE7761 LonWorks Interface Module for ICON3000 Actuator

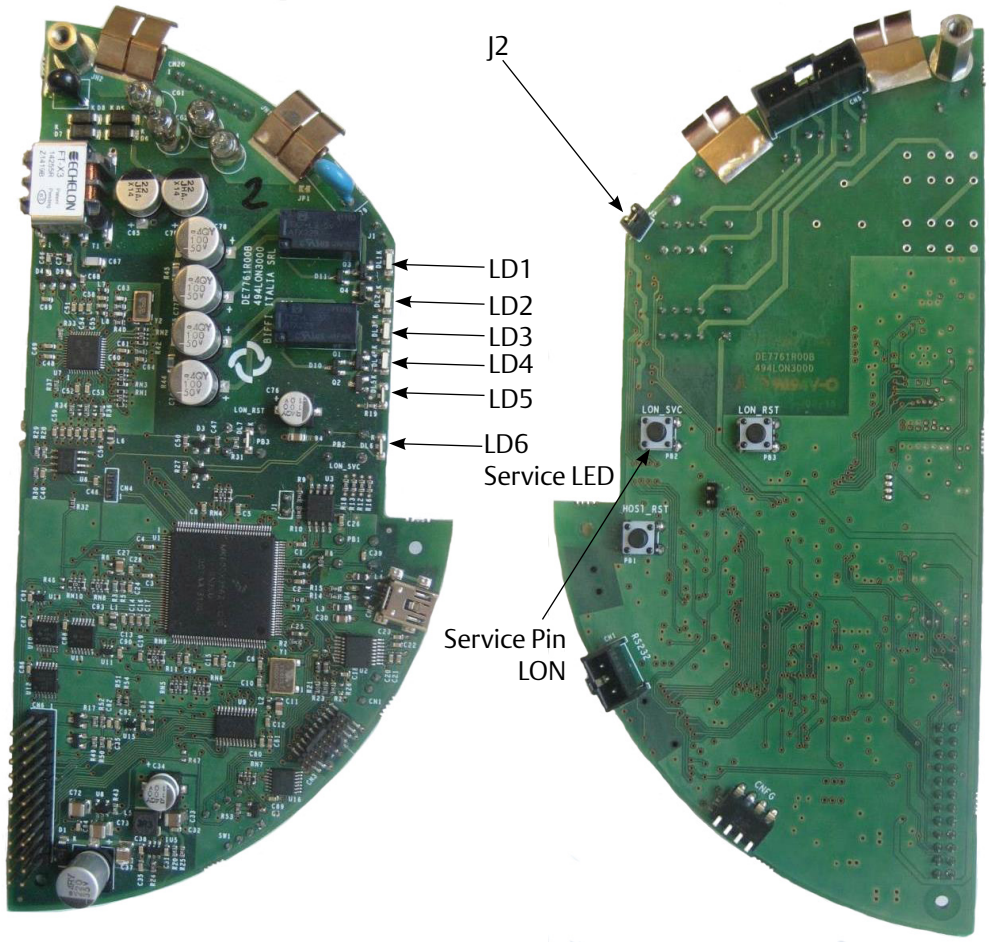

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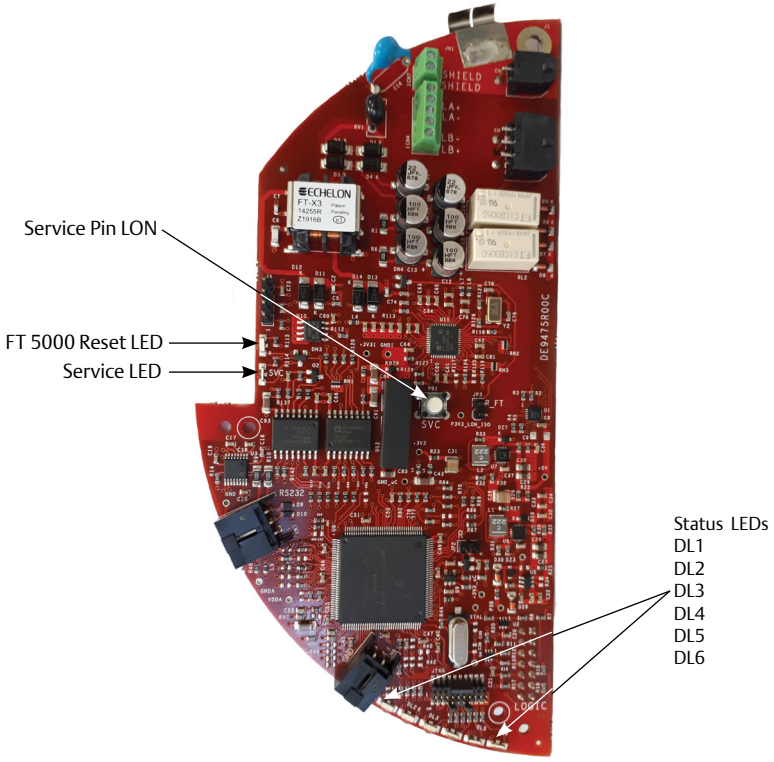
Figure 5 DE9475 LonWorks® Interface Module for ICON3000v2 Actuator



3.1 Network Wiring

The ICON3000 actuator can be installed in the LonWorks network by the twisted pair cable connected to the screw terminals in the terminal board.

Details of the cable are available in Section 2.1.1.

Typically, the actuators in a LonWorks network are connected in a bus structure.

Figure 6

LonWorks input data line (indicated as Side B) is connected to terminals A1-A2 (polarity insensitive); in case of shielded cable the shield is connected to terminal A3.

LonWorks output data line (indicated as Side A) is connected to terminals A4-A5 (polarity insensitive); in case of shielded cable the shield is connected to terminal A6.

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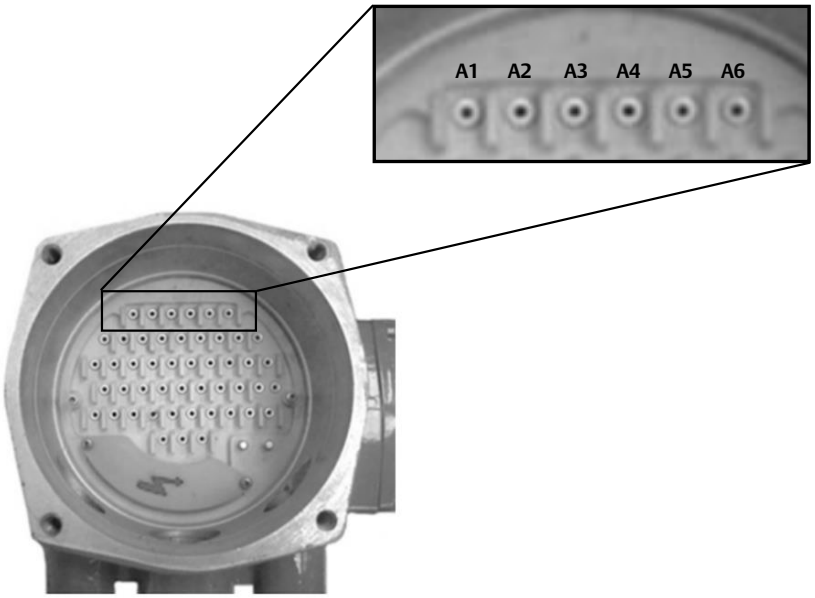
Figure 7



The data lines should be kept separated from all other cables. They should be laid in separate, conductive and earthed electrical conduits.

3.2 Status LEDs

3.2.1 LD1-LD5: Status LED on DE7761 Board for ICON3000 Actuator

Five LEDs represent the current operating status of the board. The LEDs are powered when jumper J2 is closed.

Table 4.

LED	CONTEXT		
	Wink Command	Power Up	Normal Functioning
LD1	All LEDs blink for 7 s	The LEDs light up in sequence to indicate the data reading phase from the main board	Bus side A (net output) ON – connected to network OFF – connected to terminator
LD2			Bus side B (net input) ON – connected to network OFF – connected to terminator
LD3			Reserved
LD4		Reserved	Reserved
LD5	LED is ON when the card is powered		

3.2.2 LD1-LD6: Status LED on DE9457 Board for ICON3000v2 Actuator

Six LEDs are mounted on the DE9457 LonWorks® interface to give the following indications for Field service.

Table 5.

LED	Wink Command	Power Up	Normal Functioning
DL1 (Red)	-	The LED is power ON to indicate the data reading phase from the main board	Alarm active: ON when the interface detects one or more hardware issue OFF when the interface can work correctly
DL2 (Red)	The LEDs blink for 7 s	Application running: BLINK when the interface application is running correctly Fixed ON or OFF when the application is not running correctly	
DL3 (Red)		Slave State: BLINK when the interface communicates with base card Fixed ON or OFF when the communication between base card and interface is locked	
DL4 (Green)		Bus side B (net input): ON – connected to network OFF – connected to terminator	
DL5 (Green)		Bus side A (net input): ON – connected to network OFF – connected to terminator	
DL6 (Green)	Power On: ON when interface module is correctly powered from base card		

3.3 LD6: Service LED

The Service LED is controlled directly by the microprocessor that manages the LonWorks communications and gives indications about the status of the node.

The different LED indications are shown in Table 6.

Figure 8

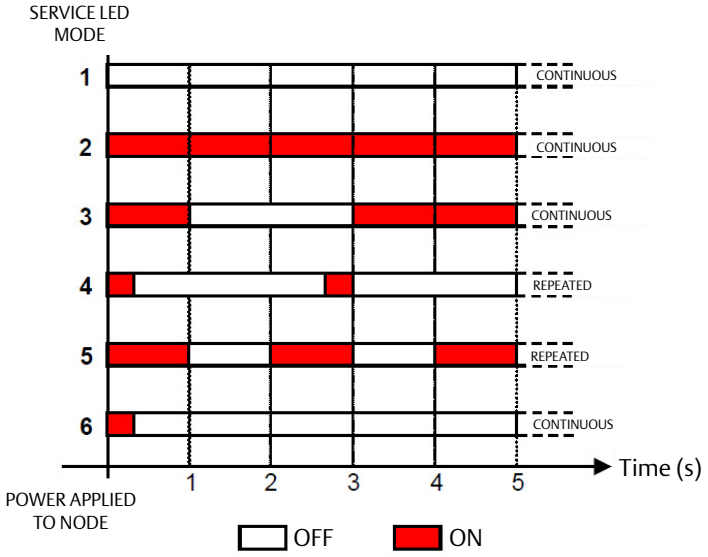


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Table 6.

Mode	Context	Description
1	Power up	Bad node hardware
2	Power up	Bad node hardware
3	Power up/Reset	Node is applicationless May be caused by the Neuron Chip firmware when a mismatch occurs on application checksum Node needs to be re-programmed flashing firmware code
4	Anytime	Watchdog timer reset occurring Possible corrupt EEPROM or communication problem with ICON3000 base card
5	Anytime	Node is unconfigured but has an application This is the condition that results after the on-board procedure to return to factory default is not completed successfully A new configuration from a LonWorks® configuration tool restores the node
6	Anytime	Node is configured and running normally

3.4 Local Procedures

3.4.1 FDI Control Menu

The LonWorks interface of ICON3000 is equipped with the FDI circuit that drives the LonWorks line terminations.

The line terminations on board of the ICON3000 are supposed to be managed only by the DCM2 Master Station because they are part of the distributed control system algorithm that the DCM2 implements to control the communication line integrity.

Applications that do not include DCM2 must avoid the control of FDI circuits by using the network variable nv#57 nviFdiCmd.

At the power on the terminations are released and return to the default state.

The Local operator can enter in the ICON3000 menu to verify the FDI settings and set the default values indicated between “( )”.

3.4.1.1 FDI Control Menu for ICON3000 Actuator

Restore procedures:

- Move the local selector to OFF and then press simultaneously OPEN and STOP
- **LANGUAGE:** Select the language and press YES
- **VIEW MODE:** Press NO
- Enter the password
- **SETUP MODE:** Press YES
- **ACTUATOR SETUP:** Press YES
- Press NO to scroll the list of available routines until:
- **FDI CONTROL:** Press YES
  - **NODE TYPE (SLAVE):** Press YES if it is correct, or press NO to change
  - **ADDRESS MODE (SUBNET):** Press YES if it is correct, or press NO to change
  - **LOOP TIME (250):** Press YES if it is correct, or press NO to change
- **CONTROL MODE:** Press YES to change or press NO to skip to RELAY routine
  - **FDI ENABLE ALL:** Press NO
  - **FDI DISABLE ALL:** Press YES
- **RELAY:** Press YES to change or NO to return to FDI CONTROL
  - **NETWORK A (ON NET):** Press YES if it is correct, or press NO to change
  - **NETWORK B (ON NET):** Press YES if it is correct, or press NO to change

View procedures:

- Move the local selector to OFF and then press simultaneously OPEN and STOP
- **LANGUAGE:** Select the language and press YES
- **VIEW MODE:** Press YES
- Press NO to scroll the list of available routines until:
- **FDI CONTROL:** Press YES
- Press YES to scroll the current values of FDI CONTROL parameters

3.4.1.2 FDI Control Menu for ICON3000v2 Actuator

Restore procedures:

- Move the local selector to OFF and then press simultaneously OPEN and STOP
- **LANGUAGE:** Select the language and press YES
- **VIEW MODE:** Press NO
- Enter the password
- **SETUP MODE:** Press YES
- **ACTUATOR SETUP:** Press YES
- Press NO to scroll the list of available routines until:
- **FDI CONTROL:** Press YES
  - **NODE TYPE (SLAVE):** Press YES if it is correct, or press NO to change
  - **ADDRESS MODE (SUBNET):** Press YES if it is correct, or press NO to change
  - **LOOP TIME (250):** Press YES if it is correct, or press NO to change
- **CONTROL:** Press YES to change or press NO to skip to RELAY routine
  - **FDI ENABLE ALL:** Press NO
  - **FDI DISABLE ALL:** Press YES
- **RELAY:** Press YES to change or NO to return to FDI CONTROL
  - **NETWORK A (ON NET):** Press YES if it is correct, or press NO to change
  - **NETWORK B (ON NET):** Press YES if it is correct, or press NO to change
- **CLEAR NODE:** Press YES to perform the clear of LonWorks® interface NvRam, press NO to skip routine
  - **CONFIRM:** Press YES to confirm the clear of LonWorks interface NvRam, press NO to skip routine. The “Clear Node” routine deletes all the information stored in LonWorks interface card and report it to its factory default state

View procedures:

- Move the local selector to OFF and then press simultaneously OPEN and STOP
- **LANGUAGE:** Select the language and press YES
- **VIEW MODE:** Press YES
- Press NO to scroll the list of available routines until:
- **FDI CONTROL:** Press YES
- Press YES to scroll the current values of FDI CONTROL parameters

3.4.2 Positioner Menu

The positioner function is available only on the modulating actuators and it is enabled when the network variable nv#31 nviInchingMode has been set to the value ST_ON.

The value 0 of position request (nv#6 SetPoint), received from the LonWorks® bus, corresponds to the request R% = 0% = valve fully closed, and the value 100 corresponds to the request R% = 100% = valve fully open.

The ICON3000 compares the current position % of the actuator with the position request R%, received from the bus, and if the difference is greater than the dead band, the actuator is driven to reach the new requested position. The following options can be configured via either bus or local operator interface:

- **Dead band:** configurable from 0.1% to 25.5% of the maximum position error (difference between the position request % and current position %). The configured value should be great enough to avoid “hunting” effect of the actuator.

⚠ WARNING

If the dead band value set by the operator is not compatible with the position resolution that the ICON3000 can obtain by the mechanical chain of the actuator, the ICON3000 will use as dead band value the best resolution possible.

- **Motion inhibit time:** it allows to adjust the length of the delay time between two cycles of the motor. It can be configured from 1 to 255 s and allows to set the maximum number of start/hour of electrical motor.

Configuration procedures:

- Move the local selector to OFF and then press simultaneously OPEN and STOP
- **LANGUAGE:** Select the language and press YES
- **VIEW MODE:** Press NO
- Enter the password.
- **SETUP MODE:** Press YES
- **ACTUATOR SETUP:** Press YES
- Press NO to scroll the list of available routines until:
- **POSITIONER:** Press YES
  - **DEAD BAND (xx):** Acceptable value from 0.1 to 25.5%; press YES if it is correct, or press NO to change
  - **MOTION INHIBIT TIME (xx):** Acceptable value from 1 to 255 s; press YES if it is correct, or press NO to change

View procedures:

- Move the local selector to OFF and then press simultaneously OPEN and STOP
- **LANGUAGE:** Select the language and press YES
- **VIEW MODE:** Press YES
- Press NO to scroll the list of available routines until:
- **POSITIONER:** Press YES
- Press YES to scroll the current values of POSITIONER parameters

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3.4.3 Node Report Menu

It is possible to access the significant info related to the LonWorks® interface from the local operator interface.

- Move the local selector to OFF or REMOTE
- Press YES or NO according to the current context to scroll the list of available routines until:
- NODE REPORT press YES
- Press YES to scroll the current values of NODE REPORT parameters:
  - **NEURON ID** — 6-byte unique identifier assigned by the manufacturer of the Neuron Chip
  - **XMIT ERROR** — **Transmit Error:** Number of CRC errors detected during packet reception
  - **TRANS. TIMEOUT** — **Transaction Timeout:** Number of times that the node failed to receive expected responses
  - **RCV. TRANS. FULL** — **Received Transaction Full:** Number of time that an incoming packet was discarded
  - **LOST MSG** — **Lost Messages:** Number of time that an incoming packet was discarded due to slow processing
  - **MISSED MSG** — **Missed Messages:** Number of time that an incoming packet was discarded due to excess traffic.
  - **RESET CAUSE** — Code of the last reset cause:
    0 Clear
    1 Power up
    2 External reset
    12 Watchdog
    20 Software reset
  - **NODE STATE** — Code of the current node state:
    2 Unconfigured
    3 Applicationless
    4 Configured on-line
    6 Configured, hard off-line
    12 Configured, soft off-line
    140 Configured, bypass off-line
  - **ERROR LOG** — Code of the last error detected:
    0 No error
  - **MODEL NUMBER** — Set to 32
  - **BUS CARD REPORT (ICON3000v2 only)** — By this routine, it is possible to show the 64 characters identification string relevant to the LonWorks interface card. Press YES to view the card report.

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—	**NODE RESET?**	Press YES to reset the LonWorks® interface
—	**CLEAR STATUS ?**	Press YES to clear the error counters
—	**SERVICE PIN (ICON3000v2 only)**	Press YES to send the Service pin message over the LonWorks network
—	**PP/MB REC COUNTER**	Current communication errors of the internal data line between the logic board and the LonWorks interface card. It is cleared if the communication resumes.
—	**PP/MB GEN COUNTER**	Total communication errors of the internal data line between the logic board and the LonWorks interface card since the last power up

3.4.4 Service Pin Message

This function forces the LonWorks interface to send on the networks its service pin message.

- Move the local selector to REMOTE
- Press STOP

The ICON3000v2 can also access this function from the Node Report menu.

Section 4: ICON3000 LonWorks® Communication Profile

ICON3000 actuator equipped with LonWorks interface card is able communicate a wide set of data for a complete control and managing.

This section lists all the communication objects implemented in ICON3000 with a brief explanation.

4.1 Actuator Runtime Input Variables

These communication objects are the commands to the actuator.

Table 7.

nv no.	nv name	nv type	Units	Min.	Max.	Comments
0	nviDriveOpen	SNVT_lev_disc	-	ST_OFF	ST_ON	OPEN command will be initiated on a transition from ST_OFF to ST_ON
1	nviDriveClose	SNVT_lev_disc	-	ST_OFF	ST_ON	CLOSE command will be initiated on a transition from ST_OFF to ST_ON
2	nviStop	SNVT_lev_disc	-	ST_OFF	ST_ON	STOP command will be initiated on a transition from ST_OFF to ST_ON
3	nviOP_IntLck	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON = Open Interlock active ST_OFF = Normal operation enabled
4	nviCL_IntlLck	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON = Close Interlock active ST_OFF = Normal operation enabled
5	nviESD	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON = Emergency Shut Down ST_OFF = Normal operation
6	nviSetpoint	nviSetpoint SNVT_lev_percent	%	0.0	100.0	Setpoint input (active when nv#31 nviInchingMode is set to ST_ON)

4.2 Actuator Output Variables

These communication objects are the current state of the actuator.

Table 8.

nv no.	nv name	nv type	Units	Min.	Max.	Comments
7	nvoValveOpen	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON when valve fully open, else ST_OFF
8	nvoValveClosed	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON when valve fully closed, else ST_OFF
9	nvoOpening	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON when valve opening, else ST_OFF
10	nvoClosing	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON when valve closing, else ST_OFF
11	nvoMonitorRelay	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON when monitor relay closed, else ST_OFF

nv no.	nv name	nv type	Units	Min.	Max.	Comments
12	nvoAlarmActive	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON if any of the alarm conditions is present, else ST_OFF
13	nvoPosition	SNVT_lev_percent	%	0.0	100.0	Current valve position in % of full position
14	nvoTorque	SNVT_lev_percent	%	-150.0	150.0	Current valve torque in %
15	nvoActuatorState	SNVT_state	-	-	-	See Table 9
16	nvoWarning	SNVT_state	-	-	-	Warnings See Table 10
17	nvoAlarm	SNVT_state	-	-	-	Alarms See Table 11

Table 9. Actuator State

Bit Number	Value
Bit 0	Reserved
Bit 1	Reserved
Bit 2	Reserved
Bit 3	Reserved
Bit 4	Reserved
Bit 5	Reserved
Bit 6	Relay B connected to the Network
Bit 7	Relay A connected to the Network
Bit 8	Reserved
Bit 9	Reserved
Bit 10	Reserved
Bit 11	ESD Command in progress
Bit 12	ICON on Local Configuration mode
Bit 13	Local selector on REMOTE
Bit 14	Local selector on LOCAL
Bit 15	Local selector on OFF

Table 10. Actuator Warning

Bit Number	Value
Bit 0	STOP depressed during remote
Bit 1	Reserved
Bit 2	High torque in closing
Bit 3	High torque in opening
Bit 4	High electronic card temperature
Bit 5	Reserved
Bit 6	Reserved
Bit 7	Reserved
Bit 8	Reserved
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Reserved
Bit 12	Reserved
Bit 13	Reserved
Bit 14	Reserved
Bit 15	Reserved

Table 11. Actuator Alarm

Bit Number	Value
Bit 0	Incorrect pushbutton coding
Bit 1	Reserved
Bit 2	Max. Torque in closing
Bit 3	Max. Torque in opening
Bit 4	Reserved
Bit 5	Phase loss
Bit 6	K1 contactor failure
Bit 7	K2 contactor failure
Bit 8	Motor overheating
Bit 9	Motor stalled
Bit 10	Reserved
Bit 11	Position sensor failure
Bit 12	Power failure
Bit 13	Reserved
Bit 14	Reserved
Bit 15	Internal communication error

4.3 Actuator Setup and Configuration Variables

These data are related to the actuator behavior.

Table 12.

nv no.	nv name	nv type	Units	Min.	Max.	Default value	Comments
18	nviHeartbeat	SNVT_time_sec	s	0.0	999.0	1.0	Heartbeat value for all output nv's 0.0 = Heartbeat disabled
19	nviPosSensitivty	SNVT_lev_percent	%	0.0	100.0	1.0	Position sensitivity in %
20	nviTrqSensitivty	SNVT_lev_percent	%	0.0	100.0	5.0	Torque sensitivity in %
21	nviESDAction	SNVT_hvac_overid	-	HVO_OFF	HVO_NUL	HVO_OFF	Action to take when an ESD condition occurs See Table 13
22	nviESDTrqAlrmOvr	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_OFF	ST_ON = ESD torque alarm override ST_OFF = No override
23	nviCloseOnPos	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON	ST_ON = Close on Position ST_OFF = Close on Torque
24	nviOpenOnPos	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON	ST_ON = Open on Position ST_OFF = Open on Torque
25	nviTorqueBand	SNVT_lev_percent	%	0.0	8.0	4.0	Torque band, defines the vicinity of the extreme position where a torque end of travel can occur
26	nviCWToClose	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_ON	ST_ON = Clockwise to Close ST_OFF = Counterclockwise to Close
27	nviHighTurn	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_OFF	Not used in ICON3000
28	nviFixPhaseError	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_OFF	Not used in ICON3000
29	nviClampPosition	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_OFF	Not used in ICON3000
30	nviDisplayPos	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_OFF	Not used in ICON3000
31	nviInchingMode	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_OFF	ST_ON = Inching remote control mode ST_OFF = On/Off remote control mode

nv no.	nv name	nv type	Units	Min.	Max.	Default Value	Comments
32	nviDeadband	SNVT_lev_percent	%	0.1	10.0	10.0	Deadband, used in inching mode
33	nviFeedbackDelay	SNVT_time_f	s	1.0	60.0	1.0	Feedback Delay (delay between interventions time, used in inching mode only)
34	nviReversalTime	SNVT_time_f	s	1.0	10.0	0.5	Reversal Time (delay between two movements with different direction)
35	nviJammedValveT	SNVT_time_f	s	2.0	100.0	2.0	Jammed Valve Timeout
36	nviTimerControl	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_OFF	ST_OFF (0) = Timer not active ST_LOW (1) = Timer active when closing only ST_MED (2) = Timer active when opening only ST_HIGH (3), ST_ON (4) = Timer active in both directions
37	nviTimerOnTime	SNVT_time_f	s	1.0	10.0	1.0	Timer ON Time
38	nviTimerOffTime	SNVT_time_f	s	1.0	100.0	10.0	Timer OFF Time
39	nviTmr StrtPosOpn	SNVT_lev_percent	%	0.0	100.0	100.0	Timer stop position, opening direction
40	nviTmrStrtPosCls	SNVT_lev_percent	%	0.0	100.0	100.0	Timer start position, closing direction
41	nviTrqLim Opening	SNVT_lev_percent	%	0.0	100.0	75.0	Torque limit value, opening direction. Exceeding this value will trigger an alarm
42	nviTrqLimClosing	SNVT_lev_percent	%	0.0	100.0	75.0	Torque limit value, closing direction. Exceeding this value will trigger an alarm
43	nviTrqAlrmBypass	SNVT_lev_percent	%	1.0	8.0	5.0	Torque alarm bypass distance, in % of full range from both ends
44	nviCalPosition	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_OFF	Not used in ICON3000
45	nviReset	SNVT_lev_disc	-	ST_OFF	ST_ON	ST_OFF	ST_ON = force a new reading of data from base card ST_MED = force factory default ST_OFF = No action

Table 13. ESD Configuration

Value of nviESDAction.state	ESD Action
0: HVO_OFF	Not Active
1: HVO_POSITION	Go to the position specified in nviESDAction.percent
2: HVO_FLOW_VALUE	Not used
3: HVO_FLOW_PERCENT	Not used
4: HVO_OPEN	Open valve
5: HVO_CLOSE	Close valve
6: HVO_MINIMUM	Not used
7: HVO_MAXIMUM	Not used
8: 0xFE: (invalid)	Stay put
0xFF: HVO_NUL	Stay put

4.4 Maintenance Variables

These data are related to the actuator maintenance.

Table 14.

nv no.	nv name	nv type	Units	Min.	Max.	Default Value	Comments
46	nviComissDate	SNVT_time_stamp	-	-	-	-	Date of the field installation
47	nviMaintDate	SNVT_time_stamp	-	-	-	-	Date of the next scheduled maintenance intervention
48	nvoPeakTorque	SNVT_lev_percent	%	-150.0	150.0	0	Peak torque recorded during last stroke
49	nvoPeakTorquePos	SNVT_lev_percent	%	0.0	100.0	0	Position at which peak torque was recorded
50	nvoAverageTorque	SNVT_lev_percent	%	-150.0	150.0	0	Average normal torque
51	nvoCycleCounter	SNVT_count_f	-	0.0	224-1	-	Number of combined Contactor Cycles

4.5 Factory Commissioning Variables (Read Only)

These data are related to the actuator maintenance.

Table 15.

nv no.	nv name	nv type	Comments
52	nviActuatorSize	struct	Actuator size, 24 characters
53	nviSerialNumber	struct	Serial number, 16 characters
54	nviMotorSupply	struct	Motor supply, 16 characters
55	nviNamePlate	struct	Nameplate. See Table 16
56	nviCalTorque	unsigned	Not used in ICON3000

Table 16. Actuator Nameplate

Bit	Field Name	Field Type	Comments
0-3	HardwareRev	char[4]	Hardware revision, 4 characters
4-7	SoftwareRev	char[4]	Software revision, 4 characters
8-11	NominalTorque	float_type	Nominal Torque
12-15	ActuatorRPM	float_type	Actuator RPM
16-22	ConfigTime	SNVT_time_stamp	Date of Factory Commissioning
23	IsThreePhase	boolean	0= Single Phase 1= Three Phase

4.6 Fault Detection Function Configuration

These data are related to the control of the FDI circuits that drive the line termination circuits implemented on the LonWorks® interface.

⚠ WARNING

These data are reserved for DCM2 Master Station that implements a function to controls the integrity of the communication cable.

Table 17.

nv no.	nv name	nv type	Comments
57	nviFdiCmd	SNVT_count	FDI Command: see Table 18
58	nviFdiConfig	struct	FDI Configuration: see Table 19

Table 18. FDI Command

Value	Command	Description
1	Disable	Disables FDI algorithms for the particular node and resets the node's relays to their default state
2	Enable	Enables FDI algorithms for the particular node and awaits proper communication to trigger the FDI system
3	Disable All	Relays a Disable Command to all nodes connected to the network
4	Enable All	Relays an Enable Command to all nodes connected to the network
5	Connect Network A	Manual switch side A from terminator to network
6	Disconnect Network A	Manual switch side A from network to terminator
7	Connect Network B	Manual connect to Network B
8	Disconnect Network B	Manual disconnect from Network B

Table 19. FDI Configuration

Field Name	Field Type	Value	Description
Node Id	integer	0	Passive node
		1	Master Node connected to Network A
		2	Master Node connected to Network B
AddrMode	integer	1	All the nodes in the network make a simple loop
		2	Reserved
		3	The nodes in the network are grouped in different loops
		4	Reserved
TimerInt	unsigned long	-	This parameter controls the speed of the fault detection process and is expressed in time units referred to the internal clock. A lower value increases the network traffic by the FDI nodes, while a higher value decreases network traffic. Typical values fall in the range of 200 to 400.

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