M7410G

LINEAR VALVE ACTUATOR
WITH LON CAPABILITIES AND OPTIONAL PI-CONTROL

PRODUCT DATA

CONTENTS

LONMARK®
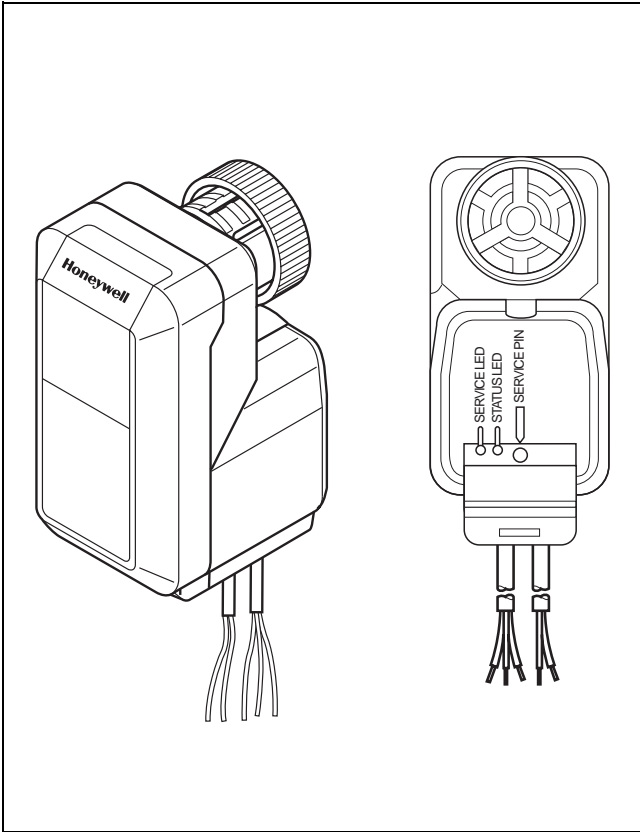
EN0B-0235 GE51R0802

Fig.1 M7410G Actuator

APPLICATION

The M7410G small linear actuator with LON capabilities is targeted for decentralized building structures and gives customers an effective new capability in energy management and product flexibility. The actuator works with standard SNVTs to provide interoperability with controllers based on LonWorks technology.

The M7410G actuator is specifically designed to provide LonMark capabilities together with the radiator and zone valve series of small linear valves and are used in fan coil units, induction units, small reheaters, recoolers and for zone control applications. They are employed in electronic temperature control systems using hot and / or cold water as the controlled medium.

The M7410G actuator is suitable for Honeywell Excel series controllers as well as for any other controllers based on LonWorks technology. Using standard Echelon configuration tools, the actuator can be configured with job specific settings.

The M7410G actuator is well suited for applications where space is limited and minimum power consumption is required. The actuator is both, attractive and robust in design.

The M7410G actuator is available in two variants, one standard variant and and a variant with additional PI-Controller. The PI-Controller variant allows the creation of a control loop independently of an Excel controller for use in small applications.

FEATURES

- **FTT10A communication**

- **Digital input may used for window or humidity switch**

- **The actuator is a flexible tool and LON is a flexible platform**

- **Simplifying complex HVAC plants**

- **Simple wiring**

- **Open products for third party integration**

- **Supplied with prewired connection cable**

- **Simple, standardized valve/actuator coupling**

- **No tools required for mounting**

- **Visual valve position indicator furnished with actuator**

- **Manual operation provided by the valve adjustment cap**

- **High-precision proportional valve actuator**

- **Standard network variables for ambient temperature, setpoint temperature, temperature offset, application mode (Heat / Cool), occupancy or valve position ensure easiest installation and proper operation (M7410G1032 / M7410G1040 / M7410G1057 only)**

- **Three actuators (M7410G1032 / M7410G1040 / M7410G1057) are equipped with an additional PI controller. The combination of actuator and PI controller in one device makes it easy and cheap to establish a hydronic or chilled ceiling room control loop**

DEVICE SPECIFICATIONS

Input voltage:	24 Vac ± 20 %, 50/60 Hz	
Power consumption:	1.4 VA	
Input signal:	SNVT_lev_percent 0-100%	
Control mode:	LON (FTT10A)	
Stroke:	2.5 - 4 mm	6.5 mm
Running time:	75 s at 50 Hz 63 s at 60 Hz	150s at 50 Hz 120s at 60 Hz
Stem force:	depending on type (see table)	
Protection standard:	IP 42	
Insulation class:	III	
Connection cable:	1.5 m	
Ambient operating temperature limits:	0 ... 55 °C	
Weight:	0.3 kg	
Suitable valves:	see table	
Manual operation:	see table	

OPERATION

The movement of the electric actuator is produced by a screw spindle which is driven in both directions by a synchronous motor through a set of gears. A magnetic clutch limits the torque of the gear assembly and the driving force of the actuator. The actuator is fixed to the valve body by means of a coupling ring requiring no tools for mounting. The actuator is maintenance-free and supplied completely with a ready-to-wire connecting cable.

VERSIONS

Order Number	PI-Controller	Force	Stroke	Compatible Valves
M7410G1008	-	90 N	3.5 mm	V100 (Thermostatic valves)
M7410G1032	●			V5822A4 / V5823A4
				V5832C4 / V5832A4
				V5833A4 / V5833C4
M7410G1016	-	180 N	6.5 mm	V5822A / V5832A
M7410G1040	●			V5823A / V5833A
				V5823C / V5833C
M7410G1024	-	300 N	6.5 mm	V5832B / V5833A
M7410G1057	●			V5872B / V5872D

PLUG-INS, XIF FILES AND DRF FILES

External interface files and the plug-ins (device ressource files included) can be downloaded at http://www.honeywell.de/plugin. For XIF-files take the link to the LonMark server.

Order Number	PlugIn Name	XIF-File	DRF-File
M7410G1008 / M7410G1016 / M7410G1024	ILONAS	ilona_s.xif	No
M7410G1032 / M7410G1040 / M7410G1057	ILONASPI	ilonaspi.xif	Yes

PLUG-INS

Plug-Ins give you the possibility to simplify start-up, maintenance, configuration and to reduce the installation effort.

XIF FILES

An External Interface File (XIF file) including the whole LON interface of the device can be used e.g. for offline configuration or binding of the device via a LON Tool.

For detailed description, please refer to the LNS-Plug-In Description chapter.

MOUNTING POSITION

The actuator may only be mounted beside or above the valve. Adjust the valve in the right position before mounting the actuator.
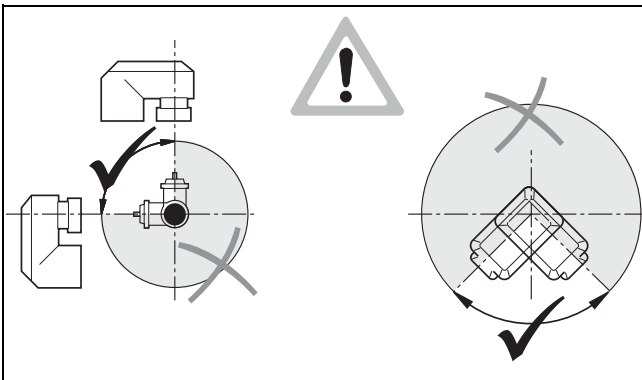

Fig.2 Mounting Positions

MOUNTING

Before the actuator is fixed to the valve, the adjustment cap must be removed (Fig. 2). Make sure that the actuator is in the open position (factory supplied position) before fixing the actuator to the valve body.
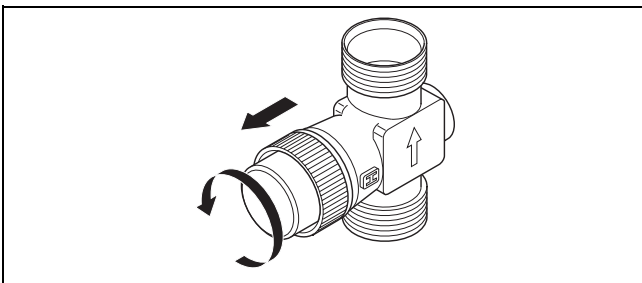
Fig. 3 Remove Protection Cap

The actuator must be mounted by hand. Don't use tools or additional forces, because actuator and valve may be damaged.

DRF- FILES

In case a LON network management tool is used, DRF files must be installed. Device Resource Files (DRF files) are needed to display special manufacturer defined network variables or configuration parameters correctly.

Fig. 4 Mounting the Actuator

ELECTRIC WIRING

The electrical installation must comply with the wiring diagram shown in Fig. 5 and Fig. 6.

Fig. 5 Electric Wiring

WIRING COLORS

Fig. 6 Wiring Colors

DIGITAL INPUT

Fig. 7 Digital Input

COMMISSIONING ADVICE

A functional check of the valve actuator can be carried out by changing the nviManActPos (SNVT_lev_percent).
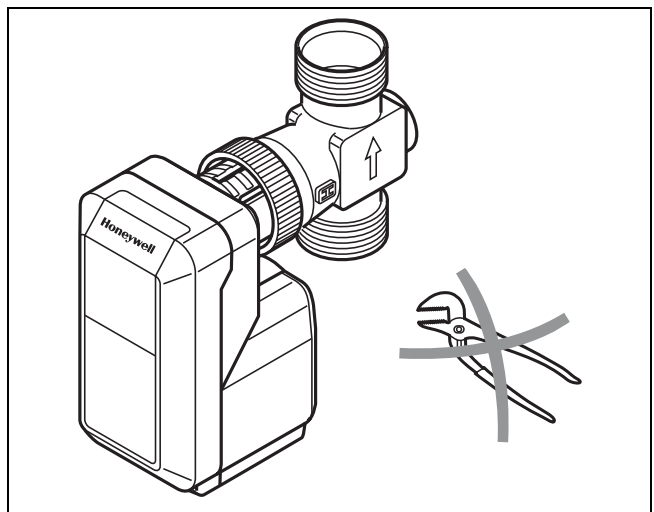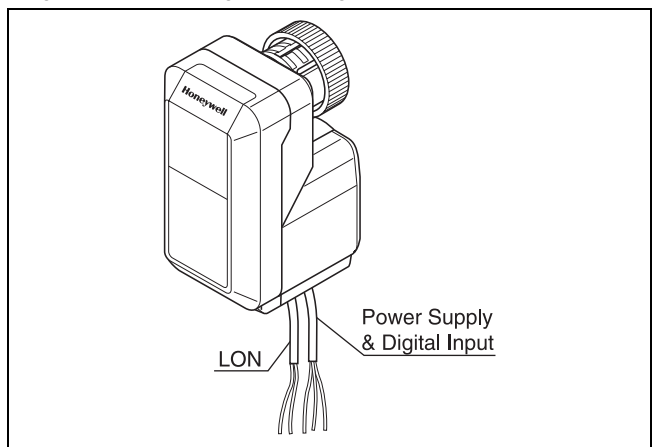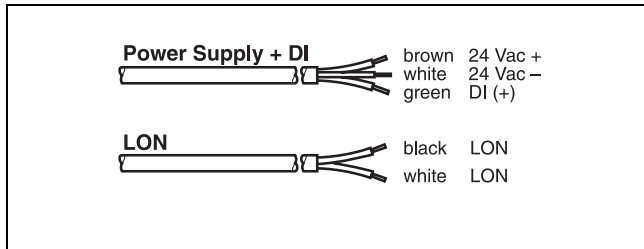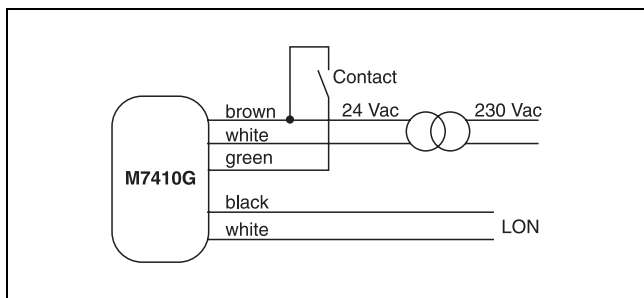The movement of the actuator stem (Fig. 7) indicates whether the valve is opening or closing. If the direction of travel is not correct, the configuration parameter nciDirRev (SNVT-state) can be used for changing the direction of action.
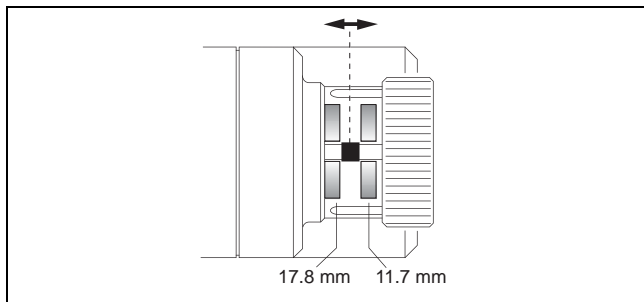
Fig. 8 Movement of the Actuator Stem

SERVICE LEDS AND SERVICE PIN DESCRIPTION

Service LED: Defined by Echelon firmware in the neuron chip (see table 1)

Status LED: Is blinking if wink was sent and indicates reverse or direct acting (see table 2 and diagram 1)

Service pin: Accessible under the cover and will be used to send the neuron ID over the network during the installation

Node state Service LED	hF01F Status code	Service LED	Pulse rate (Hz)
Applicationless and unconfigured	3	on	76
Unconfigured (but with an application)	2	Flashing	0.51
Configured, Hard Off-line	6	off	—
Configured	4	off	—

Table 1 Node States Service LED

Status LED	Blink Modes
Mode 1	1s on, 1s off, for 10 times - if a wink message was received
Mode 2	4s on, 1s off - direct acting and normal operation
Mode 3	4s off, 1s on - reverse acting and normal operation
Mode 4	continuously off - the device is in the offline-mode

Table 2 Blink Modes Status LED
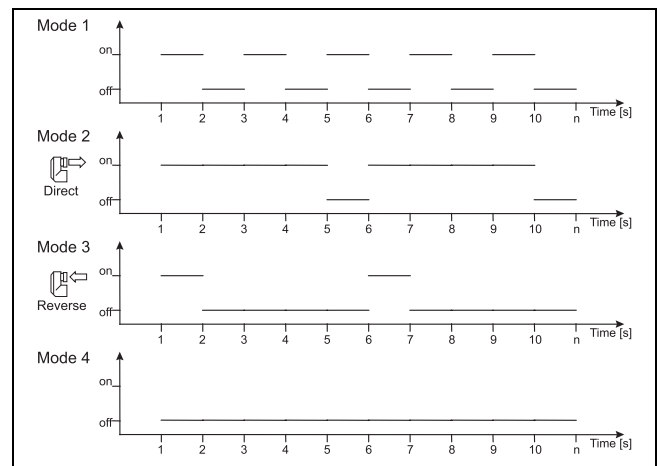
Diagram 1 Blink Modes Status LED

EN0B-0235 GE51R0802
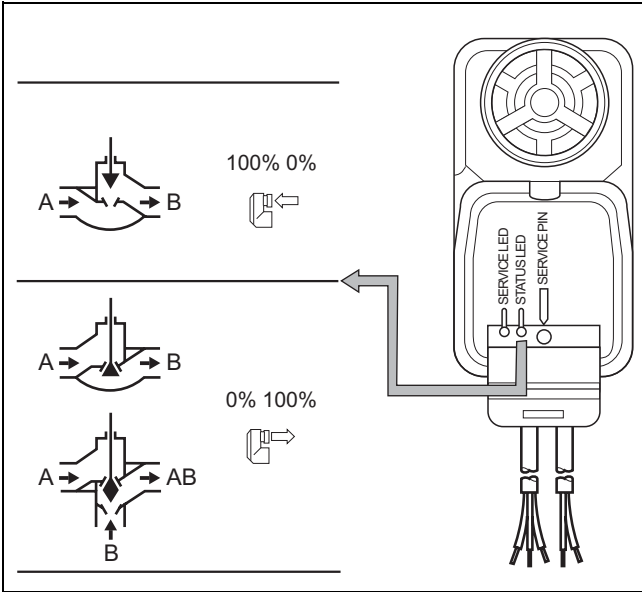
Fig. 9 Selecting Valve Type and Output Signal

DIMENSIONS (MM)
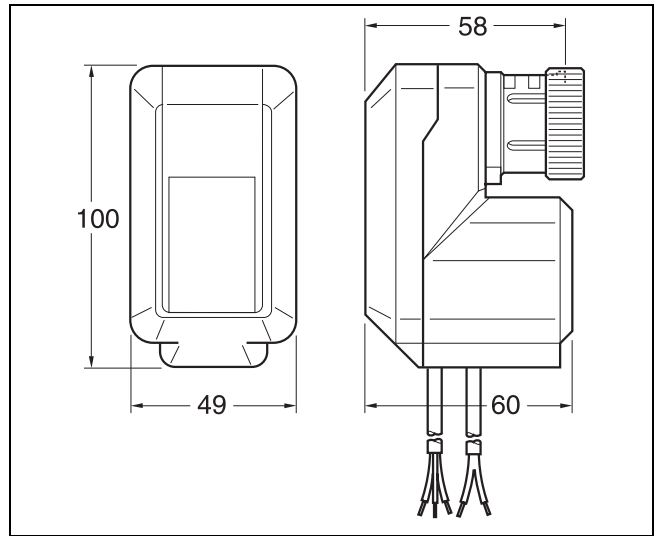
Fig. 10 Housing

LONMARK NETWORK INTERFACE

The Lon Network Interface for the two actuator variants (Standard and with PI-Controller) differs as follows:

	Actuator Type	
	Standard	**With PI-Controller**
LON Object	M7410G1008 M7410G1016 M7410G1024	M7410G1032 M7410G1040 M7410G1057
Actuator object	●	●
Controller object	-	●
Node object	-	●

ACTUATOR OBJECT

The actuator object supports the following network variables used for the communication and configuration

Fig.11 Actuator Object

DESCRIPTION OF USED SNVTS* AND SCPTS**

This table shows all used standard network variables and standard configuration parameters, their default values, a short description, the range and the send conditions and service of the outputs.

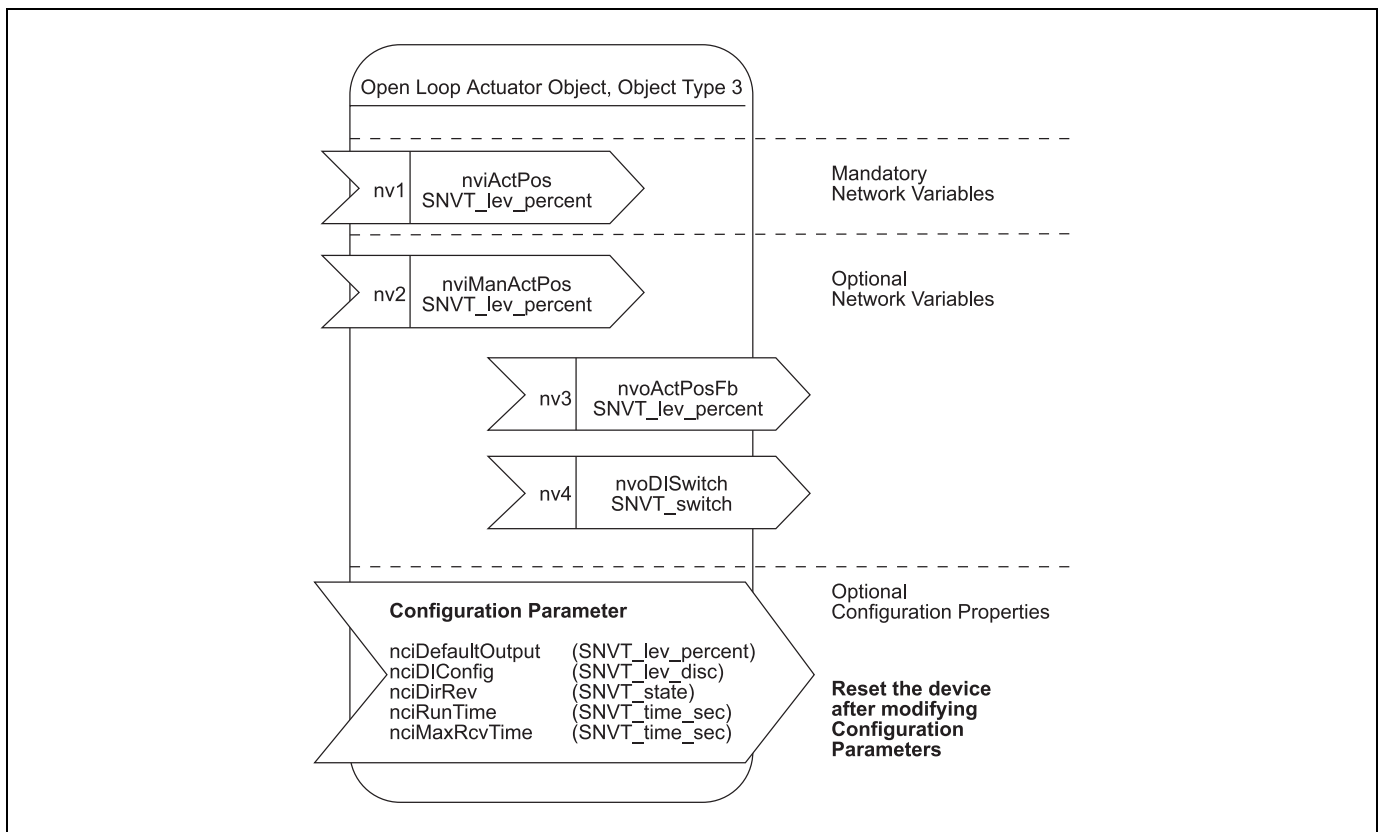| Standard Network Variable	Type {Range} {factory settings}	Adjustment of the different functionalities and the explanation of the shown values.	
Mandatory Network Variables		**Definition**	**Explanation**
nviActPos	SNVT_lev_percent {0...100 % ; 163.835} {163.835} = INVALID	**nviActPos = 163.835** [INVALID] ⇒ After Power-on or Reset ⇒ Controller is sending [INVALID]. The actuator will run to the safety position defined in [nciDefaultOutput]. ⇒ Watchdog has "detected"; Only possible if the watchdog was selected in [nciMaxRcvTime] and will correspond on the made selection in [nciDefaultOutput]. The actuator will run to the safety position defined in [nciDefaultOutput]. **nviActPos = 0% oder 100%** ⇒ Synchronization with full running time + 30%. The synchronization can be interrupted if new values are received. (excluding during synchronization after Power-on or Reset) **0% < nviActPos < 100%** ⇒ The actuator runs to the position received by the controller. (Exceptional case is after Power-on or Reset)	The actuating signal received from a controller defined in the range of 0-100% which defines the stroke position of the connected valve. Received values below 0% are calculated like 0% and values over 100% will be calculated with 100%. The only exception is the value 163.835 = [INVALID]. Is this value received, the actuator drives to the safety position which is defined in the [nciDefaultOutput]. The received values will be never overwritten by the software of the actuator. The variable [nviActPos] is only be used, if the variable with higher priority [nviManActPos] for manual operation is set to [INVALID] = 163.835. The cyclic received actuating signal can be supervised. In this case, the maximum timeframe for the cyclic received values can be defined in the configuration parameter [nciMaxRcvTime]. Is this timeframe passed, the actuator will be running to the safety position defined in the configuration parameter [nciDefaultOutput].
Optional Network Variables		**Definition**	**Explanation**
nvoActPosFb	SNVT_lev_percent {0...100 % ; 163.835} {163.835} = INVALID	**nvoActPosFb = 163.835** (INVALID) ⇒ After Power-on or Reset. ⇒ No defined stroke position feedback possible. **0% <= nvoActPosFb <= 100%** ⇒ The actual calculated position of the stem according to the time to stroke model.	This value shows the actual **calculated** stem position. **M7410G1008 / M7410G1016 / M7410G1024 For old version ILAS_V1** (stored in sd_string of device) nvoActPosFb will be updated cyclic every 0,5 sec, if it changes or not. The timing is hard coded and is not adjustable. So be careful about making bindings of many actuator feedback variables, e. g. to a controller for trending charts. If you have too many output variables bound to one device it could be overloaded. If you need this requirement than make a download of the new controller software revision ILAS_V2, which has a behavior as described below. To get the actual revision contact our Technical Assistance Center +49-7031-637-760.

 * SNVTs = Standard Network Variable Types
 ** SCPTs = Standard Configuration Parameter Types

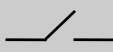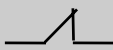| Optional Network Variables		Definition	Explanation
nvoActPosFb	SNVT_lev_percent {0...100 % ; 163.835} {163.835} = INVALID	**nvoActPosFb = 163.835** (INVALID) ⇒ After Power-on or Reset. ⇒ No defined stroke position feedback possible. **0% <= nvoActPosFb <= 100%** ⇒ The actual calculated position of the stem according to the time to stroke model. *IMPORTANT:* *If control signal requires 0 and 100 % respectively, then nvoActPosFb turns immediately to 0 and 100 % respectively.*	**M7410G1008 / M7410G1016 / M7410G1024** **For version ILAS_V2 or higher** (revision stored in sd_string of device) nvoActPosFb will be measured internally every 5 sec. If the value changes at the latest after 5 seconds the value will be updated. If the value does not change after 60 sec, the value will be send one time. **M7410G1032 / M7410G1040 / M7410G1057** nvoActPosFb will be measured internally every 5 seconds. If it changes permanently, the value will be send maximum every 5 seconds. After 15 minutes the value will be send one time if it has changed in between or not.
nviManActPos	SNVT_lev_percent {0...100 % ; 163.835} {163.835} = INVALID	**nviManActPos = 163.835** (INVALID) ⇒ After Power-on or Reset ⇒ Manual operation is switched off **nviManActPos = 0% or 100%** ⇒ Synchronization with full running time + 30%. The synchronization can be interrupted if new values are received. (excluding during synchronization after Power-on or Reset. **0% < nviManActPos < 100%** ⇒ The actuator is running to the manual set value. (Exceptional case is after Power-on or Reset)	The actuator can be operated manually. To have most accuracy a synchronization to the completely retract position has to be done. The watchdog [nciMaxRcvTime] is operating in the background (if selected). The manual operation has in each case a higher priority than the received actuating signal [nviActPos]. After changing the value for manual operation [nviManActPos] to [INVALID] the actuator is running according to the received values of [nviActPos]. Received values below 0% are calculated like 0% and values over 100% will be calculated with 100%. The only exception is the value 163.835 = [INVALID]. Is this value received, the actuator drives to the safety position which is defined in [nciDefaultOutput]. The received values are never overwritten by the software of the actuator.
nvoDISwitch	SNVT_switch Possible values 1. {0.0 , 0 } 2. {100.0 , 1} 3. {x, 0xFF=255=-1)}	The possible conditions can be selected by the configuration parameter [nciDIConfig]. A detailed description is made in the Selection of Digital Input Usage section.	Actual state of the sensor, connected to the digital input (e. g. window-contact or dewpoint-sensor). **M7410G1008 / M7410G1016 / M7410G1024** **For old version ILAS_V1** (stored in sd_string of device) nvoDIswitch will be updated cyclic every 3 sec if it changes or not. The timing is hard coded and is not adjustable. So be careful about making bindings of many digital input variables, e.g. to a controller for trending charts. If you have too many output variables bound to one device it could be overloaded. If you need this requirement than make a download of the new controller software revision ILAS_V2, which has a behavior as described below. To get the actual revision contact our Technical Assistance Center +49-7031-637-760. **For version ILAS_V2 or higher** (revision stored in sd_string of device) nvoDIswitch will be measured internally every 5 sec. If the value changes at the latest after 5 seconds the value will be updated. If the value doesn't changes after 60 sec the value will be send one time. **M7410G1032 / M7410G1040 / M7410G1057** nvoDIswitch will be measured internally every 5 seconds. If it changes, the value will be send at the latest after 5 seconds. After 15 minutes the value will be send one time if it has changed in between or not.

EN0B-0235 GE51R0802

Standard Configuration Parameters	SCPT Master List - Names from Echelon	Type {Range} {factory settings}	Adjustment of the different functionalities and the explanation of the shown values.	
			Definition	Explanation
nciDirRev	SCPTdirection	SNVT_state {Bits = 1 or 0} M7410G1008 /-16 /-24 {1111111111111111} M7410G1032 /-40 /-57 {1000000000000000}		Inverse the direction of action M7410G1008 / -16 / -24 1111111111111111= Direct 0000000000000000 = Reverse *M7410G1032 / -40 / -57* Bit 0 = 1 ⇒ Direct Bit 0 = 0 ⇒ Reverse
nciMaxRcvTime	SCPTmaxRcvTime	SNVT_time_sec {0...6553 sec} {0} Only integer values are accepted and numbers after a comma will be ignored.	Is no value [nviActPos], in a certain timeframe [nciMaxRcvTime] received, the actuator will run to the position defined in [nciDefaultOutput]. This is called a heartbeat control or watchdog function.	Watchdog for the Controller / Actuator supervision [nciMaxRcvTime] = 0 Watchdog is deactivated [nciMaxRcvTime] = for example 60 [sec] Watchdog expires, if for 60 seconds no new value is received on [nviActPos]. The actuator will run to the position, defined in the configuration parameter [nciDefaultOutput].
nciDefaultOutput	SCPTdefOutput	SNVT_lev_percent {0; 100 % ; 163.835} {163.835} = INVALID	This configuration parameter defines the condition what will happen if the timeframe [nciMaxRcvTime] of the watchdog is passed or if an undefined situation takes place. For example: The controller failed and no values are received. In this case the actuator can run to a safety position or stops immediately. The selection should be done according to the applications requirements.	Safety position in case of controller failure 100 % = Actuator will do a synchronization to 100 %, 100% running time +30% safety. 0 % = Actuator will do an synchronization to 0%, 100% running time +30% safety. [INVALID] = 163.835 = Actuator stops immediately All other values are the same as 163.835
nciDIconfig	SCPTinvrtOut	SNVT_lev_disc {ST_ON} {ST_OFF}	See Selection of Digital Input Usage section	Configuration of the digital input
nciRunTime	SCPTDriveTime	SNVT_time_sec {0...6553.5 sec} {6553.5} = INVALID	The selection of the running time will be done automatically. To adapt the valve stroke to the running time afterwards and to secure the accuracy for the time to stroke model this configuration parameter is used.	Possibility of overwriting the value for the running time, which is normally done automatically. This should only be done in case of adapting a different valve to the actuator. Setting nciRunTime to (INVALID) and resetting the node, the selection of runtime will be as factory setting. The running time is automatically selected and depending on the power supply frequency [50Hz/60Hz] which is measured by the hard-/software environment.

SELECTION OF DIGITAL INPUT USAGE

Configuration parameter (SCPT...nciDIconfig) Type: SNVT_lev_disc		Network variable (SNVT...nvoDIswitch) Type: SNVT_switch		Meaning	
		Value	State	User defined	DI not used or device offline or first 3 sec after Power-on/Reset/online
nciDIconfig =ST_OFF	switch closed	100.0	1	X	
	switch opened	0	0	x	
nciDIconfig = ST_ON	switch opened	100.0	1	X	
	switch closed	0	0	x	
nciDIconfig = ST_NUL (0xFF)		0	0xFF (=255=-1)		x

WATCHDOG FOR THE SUPERVISION OF THE ACTUATION SIGNAL

Activation of the watchdog-timer
Is the SCPT [nciMaxRcvTime] set to 0, the watchdog is generally switched off. To activate the watchdog, a value >0 has to be selected. This value has to be in the range of values. Values after a comma will be ignored.

Start of the watchdog-timer after Power-on
The watchdog-timer is starting after a first value was received by [nviActPos]. Up to that point, the actuator will stay in the defined safety position [nciDefaultOutput].

Watchdog-timer in case of manual operation.
Is the actuator working in the manual operation mode (nviManActPos ≠ INVALID) the watchdog-timer is working in the background. This means, if the controller fails, the watchdog-timer expires and after switching manual operation [nviManActPos] to [INVALID] the actuator is running to the safety position according to the definition in [nciDefaultOutput].

FACTORY SETTINGS

State of the Network and Configuration Parameters:

nviActPos	= 163.835 (INVALID)
nviManActPos	= 163.835 (INVALID)
nviActPosFb	= 163.835 (INVALID)
nvoDIswitch	= [0.0 -1]
	after initialization (3 sec.) = [0.0 0]
	(if there is no switch connected)
nciDefaultOutput	= 163.835 (INVALID)
nciDirRev	= 1111111111111111
	(for M7410G1008 / -16 / -24)
nciDirRev	= 1000000000000000
	(for M7410G1032 / -40 / -57)
nciMaxRcvTime	= 0.0 sec
nciDIconfig	= ST_OFF
nciRunTime	= 6553.5 (INVALID)

BEHAVIOR OF THE ACTUATOR AFTER POWER-ON / RESET / OFFLINE-ONLINE

The behavior of the motor is dependent on the configuration parameter *nciDefaultOutput.*

There are three possible states.

nciDefaultOutput	Behavior of the motor after Power-on / Reset
default: 163.835 = INVALID	The actuator makes no movement and waits. The first received value from the controller or manual will be saved as the actual position of the motor - no movement. The second received value will be compared to the first, and the motor runs to the new required position (and so on...).
0 %	The actuator synchronizes to the position referring to 0 % and runs then to the position according to the controller/ manual value, if one is received. If not, the actuator waits.
100 %	The actuator synchronizes to the position referring to 100 % and runs then to the position according to the controller/ manual value, if one is received. If not, the actuator waits.

INTERRUPTION OF THE SYNCHRONIZATION

The interruption of the synchronization after Power-on / Reset (nciDefaultOutput = 0 or 100 %) is not possible. Later synchronizations can be interrupted every time.

EN0B-0235 GE51R0802

WHAT HAPPENS AT OFFLINE-ONLINE MODE CHANGES

If the actuator is taken offline by a network management tool the application program of the device stops, and the following actions will be done before the offline mode takes place:

Online-Offline change

- The motor stops, if it is running
- The Status LED is taken off
- The network variable *nviActPosFb* will be set to INVALID (163.835), to show that the actuator is in a undefined situation
- The *state-value* of the network variable *nviDIswitch* will be set to INVALID (255 = 0xFF = -1), to show that the actuator is in a undefined situation.

Offline-Online change

- Application restart. Same situation as Power-on or Reset.

CONTROLLER OBJECT (ACTUATORS WITH PI-CONTROLLER ONLY)

The controller object supports the following network variables used for the communication and configuration
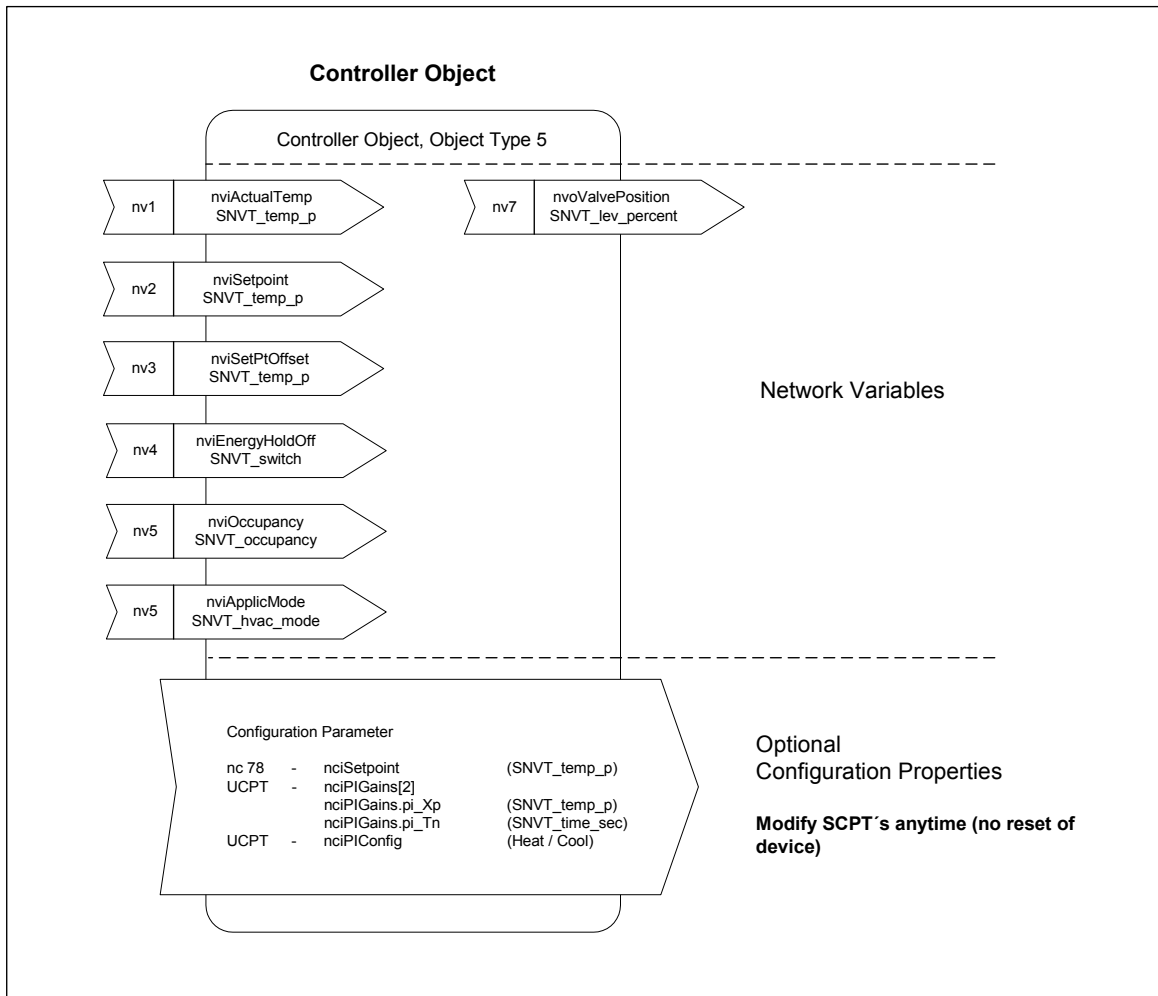

Fig.12 Controller Object

DESCRIPTION OF USED SNVTS AND SCPTS

This table shows all used standard network variables and standard configuration parameters, their default values, a short description, the range and the send conditions and service of the outputs.
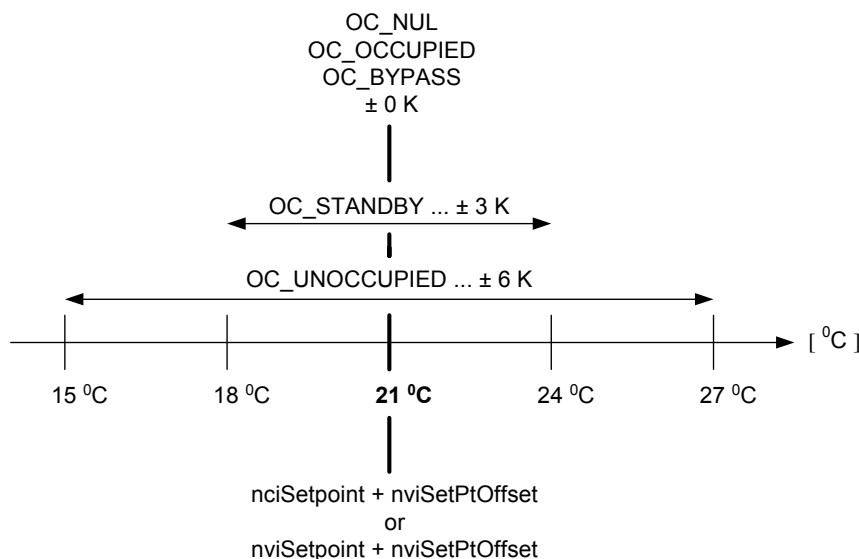
Standard Network Variable	Type {Range} {factory settings}	Adjustment of the different functionalities and the explanation of the shown values.	
Network Variables		Definition	Explanation
nviActualTemp	SNVT_temp_p {-163,80 to 163,80; 327,67} {327,67} = INVALID	**nviActualTemp = 327,67 [INVALID]** ⇒ after Power on or Reset. If nviActualTemp is INVALID than nvoValvePosition will be Invalid, too, cause no control loop is possible. not equal 327,67 [INVALID] ⇒ normal operation If nviActualTemp is not INVALID than normal operation is possible.	nviActualTemp includes the actual temperature delivered by an separate LON temperature sensor. Received values below –163,80°C are calculated like –163,80°C and values above 163,80°C will be calculated with 163,80°C. The only exception is the value 327,67 = [INVALID]. Is this value received, the output of the controller nvoValvePosition will be set to INVALID, too.
nviSetpoint	SNVT_temp_p {-157,80 to 157,80 [°C] 327,67} {327,67} = INVALID	**nviSetpoint = 327,67 [INVALID]** ⇒ after power on or reset. If nviSetpoint is INVALID the internal nciSetpoint will be used as the actual required temperature. **nviSetpoint not equal 327,67 [INVALID]** ⇒ normal operation If nviSetpoint is not INVALID than this parameter has higher priority than the setpoint adjusted in the SCPT nciSetpoint	Received values below –157,80°C are calculated like –157,80°C and values above 157,80°C will be calculated with 157,80°C. The only exception is the value 327,67 = [INVALID]. Is this value received, the internally setpoint [nciSetpoint] will be taken as the actual one. If the SNVT nviSetPtOffset is not INVALID than the required temperature will be evaluated like this. Setpoint = nviSetpoint + nviSetPtOffset
nviSetPtOffset	SNVT_temp_p {-157,80 to 157,80 [°C]; 327,67} {327,67} = INVALID	**nviSetPtOffset = 327,67 [INVALID]** ⇒ after Power on or Reset. If nviSetPtOffset is INVALID than it will be ignored. **nviSetpoint not equal 327,67 [INVALID]** ⇒ normal operation If nviSetptOffset is not INVALID it will be added to the actual valid setpoint	nviSetPtOffset works together with nviSetpoint or nciSetpoint and is part of the actual required temperature. Received values below –157,80°C are calculated like –157,80°C and values above 157,80°C will be calculated with 157,80°C. The only exception is the value 327,67 = [INVALID]. Is this value received, it will be ignored.
nviEnergyHoldOff	SNVT_switch Possible values: Value/State 1.) {0,0;0} 2.) {>0;1} {0,0;-1}	{ 0.0,0} the controller works in normal operation mode {100,1} the value nvoValvePosition will be overwritten with 0 %. So energy will be switched off. All other cases have the same meaning than {0.0,0}	Can be used for binding of a physical digital input, e.g. nvoDIswitch from the internal actuator object. So the energy could be saved if an open window or a dewpoint sensor detects a situation to switch off the energy = close the valve totally. This means no more heating in HEATING applications or no more cooling in COOLING applications
nviOccupancy	SNVT_occupancy {OC_OCCUPIED, OC_UNOCCUPIED, OC_BYPASS, OC_STANDBY, OC_NUL} {OC_NUL}	Description from LonMark 0 OC_OCCUPIED Area is occupied 1 OC_UNOCCUPIED Area is unoccupied 2 OC_BYPASS Area is temporarily occupied for the bypass period 3 OC_STANDBY Area is temporarily unoccupied 0xFF OC_NUL Value not available	For binding of an occupancy sensor. The state has influence on the setpoint to optimize the energy consumption. **Heating** If [OC_NUL] or [OCCUPIED] or [OC_BYPASS] 0 K substracted from setpoint If [OC_STANDBY] 3 K substracted from setpoint If [OC_UNOCCUPIED] 6 K substracted from setpoint

		Cooling
		If [OC_NUL] or [OCCUPIED] or [OC_BYPASS] 0 K added to setpoint
		If [OC_STANDBY] 3 K added to setpoint
		If [OC_UNOCCUPIED] 6 K added to setpoint
		K = Kelvin
nviApplicMode	SNVT_hvac_mode {HVAC_AUTO, HVAC_HEAT, HVAC_MRNG_WRMUP HVAC_COOL, HVAC_NIGHT_PURGE, HVAC_PRE_COOL, HVAC_OFF, HVAC_TEST, HVAC_EMERG_HEAT, HVAC_FAN_ONLY, HVAC_FREE_COOL, HVAC_ICE, HVAC_NUL} {HVAC_NUL}	Description from LonMark: 0 HVAC_AUTO 1 HVAC_HEAT 2 HVAC_MRNG_WRMUP 3 HVAC_COOL 4 HVAC_PRE_COOL 5 HVAC_NIGHT_PURGE 6 HVAC_PRE_COOL 7 HVAC_OFF 8 HVAC_TEST 9 HVAC_EMERG_HEAT 10 HVAC_FAN_ONLY 11 HVAC_FREE_COOL 12 HVAC_ICE 0xFF HVAC_NUL	If [HVAC_HEAT] than nciPiConfig will be overwritten and HEAT Application is active. If [HVAC_COOL] than nciPiConfig will be overwritten and COOL Application is active. If nviApplicMode is not [HVAC_HEAT] and not [HVAC_COOL] than the Application mode will be adjusted via nciPiConfig. ***IMPORTANT:*** *If application mode changes than the pi-controller will be reseted internally.*
nvoValvePosition	SNVT_lev_percent {0-100; 163,835} {163,835} = INVALID	**nvoValvePosition = 163,835 [INVALID]** ⇒ after Power on or Reset. PI-Controller cannot deliver a required actuator position If nvActualTemp is not INVALID ⇒ **nvoValvePosition = 0...100 %** Required Actuator / Valve position	nvoValvePosition includes the actual required valve position. This parameter could be bound with the SNVT nviActPos of the internal actuator object. ***IMPORTANT:*** *If nvoValvePosition changes it will be send at the latest within 5 seconds. After 15 minutes the value will be send one time if it has changed in between or not .*

RELATION BETWEEN NVIOCCUPANCY, NCISETPOINT, NVISETPOINT AND NVISETPTOFFSET

The adjusted value via nviOccupancy (0 K, 3K or 6K)

⇒ will be ADDED to the actual setpoint in COOLING MODE
⇒ will be SUBSTRACTED from the actual setpoint in HEATING MODE

OC_NUL
OC_OCCUPIED
OC_BYPASS
± 0 K

OC_STANDBY ... ± 3 K

OC_UNOCCUPIED ... ± 6 K

[^{0}C]

15 ^{0}C   18 ^{0}C   **21 ^{0}C**   24 ^{0}C   27 ^{0}C

nciSetpoint + nviSetPtOffset
or
nviSetpoint + nviSetPtOffset

Example 1:   *nviSetpoint   = INVALID, nciSetpoint = 21 °C, nviSetPtOffset = 5 K,*
nviOccupancy = OC_STANDBY, nciPiConfig = HEAT, nviApplicMode = INVALID

Actual Setpoint = nciSetpoint + nviSetPtOffset – occupancy_value

= 21°C + 5K – 3K = 23 °C

Example 2: *nviSetpoint = 23°C, nviSetPtOffset = -4 K, nviOccupancy = OC_UNOCCUPIED,*
nciPiConfig = COOL, nviApplicMode = INVALID

Actual Setpoint = nviSetpoint + nviSetPtOffset – occupancy_value

= 23°C – 4K + 6 K = 25°C

Standard Configuration parameter	SCPT Master List – names from Echelon or User defined Types	Type {Range} {factory settings}	Adjustment of the different functionalities and the explanation of the shown values.

nciPiConfig	UCPT_PiConfig	UNVT_PiConfig
		{
		    0 = HEAT;
		    1 = COOL;
		}
		
		{HEAT}
		
		If application mode changes than the pi-controller will be reseted internally.
			Decides if a heating or a cooling application should be controlled. nciPiConfig is only the decider if nviApplicMode is not set to HVAC_HEAT or HVAC_COOL. In this cases nviApplicMode decides if a heating or a cooling application is active.
			
			Regardless you have the HVAC mode HEAT or COOL , the internal frost protection function starts working if the actual temperature reaches the critical value < 6 ° C. In this case the value nvoValvePosition will be overriden with 100 % in heating mode and with 0 % in cooling mode. So there will be prevent damages caused by too low temperature. If a value of > 8 °C is reached the frost protection will be switched off again.

nciPiGains	UCPT_PiGains	UNVT_PiGains
		
		nciPiGains.pi_Xp [SNVT_tmp_p]
		{3 – 25 [K]}
		{4}
		
		nciPiGains.pi_Tn [SNVT_time_sec]
		{10 – 1000 [sec]}
		{300}
			nciPiGains.pi_Xp =
			        p value of pi controller
			
			nciPiGains.pi_Tn =
			        i value of pi controller in
			If the temperature deviation between setpoint and actual temperature is higher than 4,8 K the linearity of the P-portion gets lost and the P-Control is working in a limited range. In this case the I-Portion takes care for accurate controlling.

nciSetpoint	SCPTheatSetpt	SNVT_temp_p {-157,80 - 157,80 [°C]} {21°C}	The setpoint is the actual required temperature. If the SNVT nviSetPtOffset is not 0 than the required temperature will be evaluated like this. Setpoint = nciSetpoint + nviSetPtOffset Values below –157,80°C are calculated like –157,80°C and values above 157,80°C will be calculated with 157,80°C.

PRIORITIES OF THE DIFFERENT POSSIBLE SITUATIONS

Prio	Action	Occurs...	nvoValvePosition will be set to...
1	Frost Protection	...if the actual temperature runs below 6 ° C. Frost Protection mode is active till temperature rises above 8° C.	100 % if heating mode 0 % if cooling mode
2	Energy Off	...if nviEnergyHoldOff, which displays the state of a physical digital switch, turns to [value>0,state=1].	0 %
3	no control loop possible	...if nviActualTemp is [INVALID] than nvoValvePosition will be set to INVALID, too. If the bound internal Actuator (nviActPos) receives INVALID from nvoValvePosition it runs to the adjustable safety position. The safety position could be adjusted in the actuator object via variable nciDefaultOutput.	163,835 [INVALID]
4	Normal Operation	...if priorities 1-3 are not active. PI-Algorithm works. The actual required valve position will be evaluated.	the valve position evaluated by the PI-algorithm

FACTORY SETTINGS

State of the SNVTs/SCPTs (factory setting):

```
nviSetpoint            = 327,67 (INVALID)
nviSetptOffset         = 327,67 (INVALID)
nviActualTemp          = 327,67 (INVALID)
nviOccupancy           = OC_NUL
nviEnergyHoldOff       = {0,0;-1}
nviApplicMode          = HVAC_NUL
nvoValvePosition       = 163.835 (INVALID)

nciPiConfig            = HEAT
nciPiGains.pi_Xp       = 4
nciPiGains.pi_Tn       = 300
nciSetpoint            = 21 °C
```

BEHAVIOUR OF THE CONTROLLER AFTER POWER ON / RESET / OFFLINE-ONLINE

If power-on or reset or offline to online happens an application reset occurs.

Used PI-Algorithm

$$G(j\varpi) = \frac{100\%}{xp} \times \left(1 + \frac{1}{j\varpi \times T_N}\right)$$

Xp = Proportional band   *[nciPiGains.pi_Xp]*
T_N = Integral reset time   *[nciPiGains.pi_Tn]*

EN0B-0235 GE51R0802

NODE OBJECT (ACTUATORS WITH PI-CONTROLLER ONLY)

The node object is implemented to fullfill the LonMark guidelines, but it has no functionallity in this device.
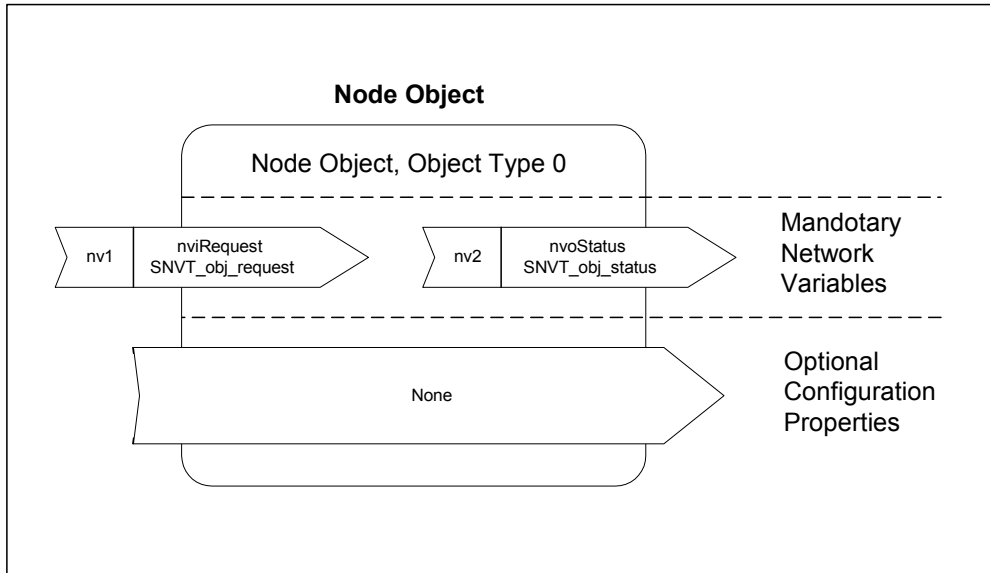
Fig.13 Node Object

LNS PLUG-IN DESCRIPTION

ACTUATOR OBJECT

DIAGNOSTIC AND TEST

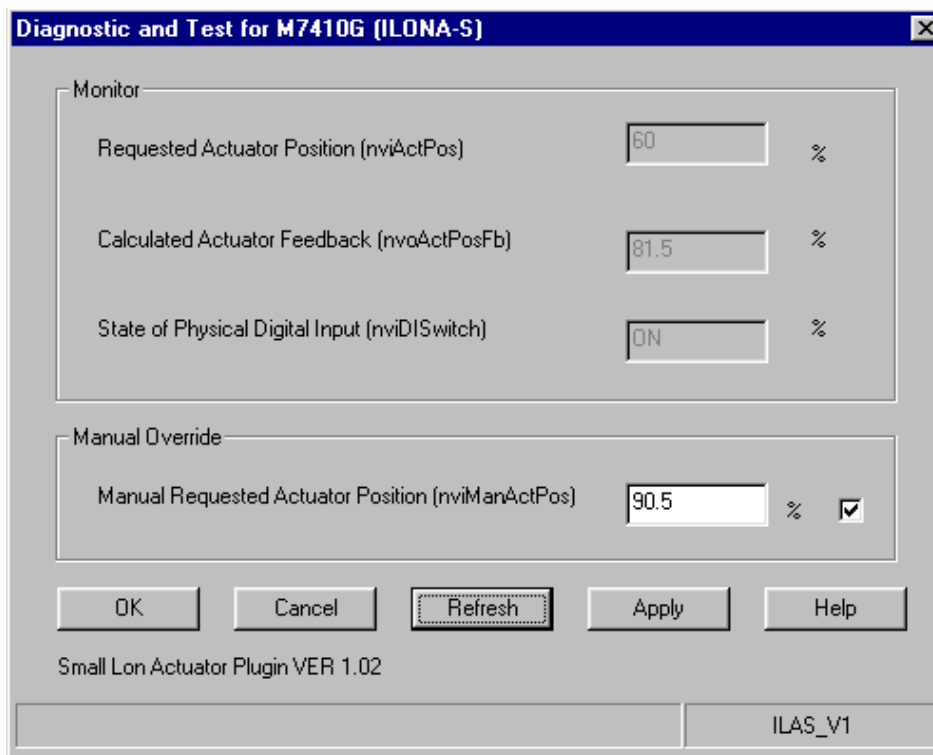The following descriptions apply to both actuator types (with / without PI-controller).

Fig.14 Diagnostic and Test Screen

There are two Plug-In versions available, one for each type of actuator (with / without PI-controller).

Monitor   Shows the current status of the actuator and of the physical digital input.

REQUESTED ACTUATOR POSITION (nviActPos)
Monitoring of the requested actuator position of the controller.
The range of nviActPos is 0...100 %. Received values below 0 % are calculated like 0 % and values above 100 % will be calculated like 100 %. The only exception is the value 163.835 % = [INVALID]. Is this value received the actuator drives to the safety positon adjusted in the Configuration dialog box.

100 % means synchronization to the 100 % - position with 130 % running of full motor runtime. The synchronization can be interrupted.
Special Case: power on / reset / offline-online.
The synchronization caused by nciDefaultOutput can not be interrupted.

0 % means synchronization to the 0 % - position with 130 % running of full motor runtime. The synchronization can be interrupted.
Special Case: power on / reset / offline-online.
The synchronization caused by nciDefaultOutput can not be interrupted.

CALCULATED ACTUATOR FEEDBACK (nvoActPosFb)
Monitoring of the actual calculated actuator position. It is important to know that the internal synchronous motor has no physical feedback sensor. The shown feedback is only a calculated value and should only be used for trend diagrams or to check motor movements. The correctness of this value is not guaranteed. The range of nviActPosFb is 0...100 %. (The invalid-string signalizes an undefined situation). For send timing description, please refer to "Description of used SNVTS* and SCPTS" section.

STATE OF PHYSICAL DIGITAL INPUT (nvoDIswitch)
Monitoring of the actual state of the sensor connected to the physical digital input. (e.g. window-contact or dewpoint-sensor). The possible conditions can be selected by the [Digital Input – Mode] – field on the Configuration - dialog box. The states of nvoDIswitch can be ON / OFF / INVALID. For send timing description, please refer to "Description of used SNVTS* and SCPTS" section.

Manual Override   Allows to operate the actuator manually.

MANUAL REQUESTED ACTUATOR POSITION (nviManActPos)
To operate the actuator manually, click check box and enter desired value:

The manual operation has in each case a higher priority than the received controller signal [nviActPos]. The range of nviManActPos is 0...100 %. Received values below 0 % are calculated like 0 % and values above 100 % will be calculated like 100 %.

100 % means synchronization to the 100 % - position with 130 % runningnof full motor runtime. The synchronization can be interrupted.
Special Case: power on / reset / offline-online.
The synchronization caused by nciDefaultOutput can not be interrupted.

0 % means synchronization to the 0 % - position with 130 % running of full motor runtime. The synchronization can be interrupted.
Special Case: power on / reset / offline-online.
The synchronization caused by nciDefaultOutput can not be interrupted.

To have most accuracy with the manual override a synchronization to the stem completely retract position has to be done.

After switching off the manual override the actuator is running according to the received controller values (nviActPos).

CONFIGURATION SCREEN

The following descriptions apply to both actuator types (with / without PI-controller).

Actuator Settings

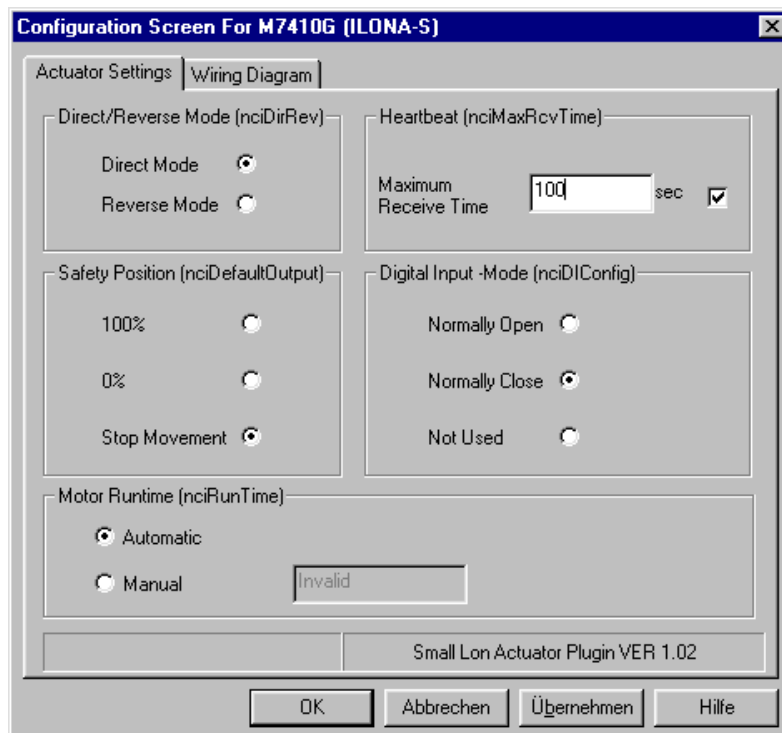Configures the functionality of the actuator and the physical digital input.

Fig.15 Configuration Screen

Direct / Reverse - Mode Inverses the direction of action
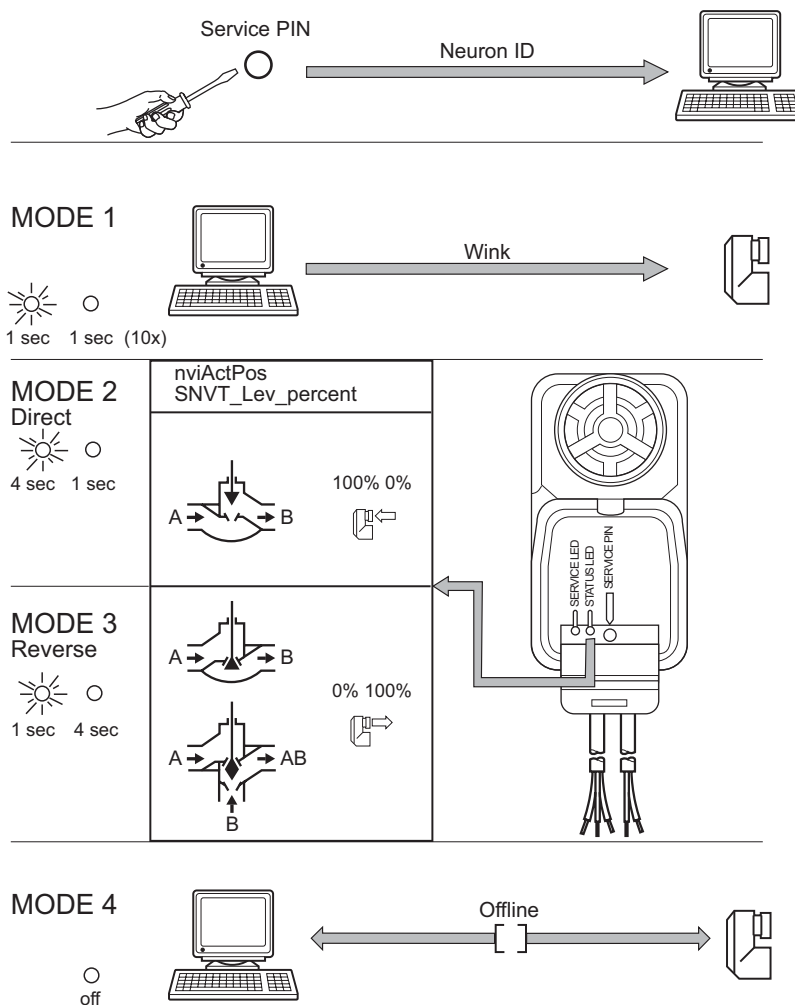(**nciDirRev**)

Fig.16 Modes

DIRECT_MODE
Requested actuator position = 0 %. Actuator runs to position "stem totally extract".
Requested actuator position = 100 %. Actuator runs to position "stem totally retract".
Status LED blinking: 4s on / 1 s off (Mode 2).

REVERSE_MODE
Requested actuator position = 0 %. Actuator runs to position stem totally retract.
Requested actuator position = 100 %. Actuator runs to position stem totally extract.
Status LED blinking: 1s on / 4 s off (Mode 3).

Heartbeat
(**nciMaxRcvTime**)

Heartbeat of the connected controller.

MAXIMUM RECEIVE TIME
Is no requested actuator position value (nviActPos) received in a certain timeframe
defined in the [Heartbeat] - field, the actuator will run to the position defined in the
[Safety Position] - field.

MAXIMUM RECEIVE TIME = 0 seconds. Heartbeat supervision = OFF

0 < MAXIMUM RECEIVE TIME <= 6553 seconds. Heartbeat supervision = ON and timeframe
adjusted.

Additional information
Only integer values are accepted and numbers after a comma will be ignored.

EN0B-0235 GE51R0802

Start of the heartbeat supervision after power on / reset / offline-online:
The heartbeat supervision starts after a first value was received by the controller (nviActPos). Up to that point, the actuator will stay in the defined safety position (nciDefaultOutput).
Heartbeat supervision in case of manual operation.
When the actuator is working in the manual operation mode ([nviManActPos] active), the heartbeat supervision is working in the backround. This means, if the controller fails, the timeframe is passed. Then the manual operation is switched off, and the actuator is running to the definition of the [Safety Position] - field.

Safety Position
Safety position of the actuator in case of controller failure, power on / reset / offline-(nciDefaultOutput) online or any other undefined situation.

Defines the condition what will happen if the timeframe defined in the [Heartbeat] - field is passed or if an undefined situation like power on / reset / offline-online occurs.

100 %
The actuator will do a synchronization to the 100 % - position with 130 % running of full motor runtime.
The synchronization can be interrupted.
Special Case: power on / reset / offline-online.
The synchronization can not be interrupted.

0 %
The actuator will do a synchronization to the 0 % - position with 130 % running of full motor runtime.
The synchronization can be interrupted.
Special Case: power on / reset / offline-online.
The synchronization can not be interrupted.

STOP_MOVEMENT
Actuator stops immediately.
Special Case: power on / reset / offline-online.
The Actuator makes no movement and waits. The first received value for the requested position from the controller or manual override will be saved as the actual position of the motor – no movement. The second received value will be compared to the first, and the motor runs to the new required position (and so on...).

Digital Input - Mode (nciDIswitch)
Configuration of the digital input.

Digital Input – Mode (nciDIswitch) [Configuration-dialog box]		State of Digital Input (nvoDIswitch) [Diagnostic and Test – dialog box]
NORMALLY OPEN	Switch closed	ON
	Switch opened	OFF
NORMALLY CLOSED	Switch opened	ON
	Switch closed	OFF
NOT USED	Switch ignored	INVALID*

* The invalid-string is shown the first three seconds after power on / reset / online - offline till the initialization of the actuator is finished too)

Motor Runtime
Possibility of overwriting the automatically detected motor runtime and to secure the (nciRunTime)accuracy for the time to stroke model. This should only be done in case of adapting a different valve to the actuator

AUTOMATIC
After power on / reset / offline-online the actuator automatically detects the motor runtime and software adapts the motor runtime to the 50 / 60 Hz mains frequency.

MANUAL
If the manual mode is activated it is possible to adjust another motor runtime (the values 0 and 6553,5 are not allowed).

General Information

The actuator automatically sends a service pin message after power on / reset / offline- online.

If the Actuator receives a wink message (executed by the network management tool) the status LED is blinking 10 times with a frequncy of one second and so the actuator could be located in the field.

ONLINE-OFFLINE change executed by the network management tool:

- The motor stops if it is running
- The status LED is taken off
- The calculated actuator feedback (nvoActPosFb) will be set to INVALID, to show that the actuator is in an undefined situation.
- The state of the physical digital input will be set to INVALID.

OFFLINE-ONLINE change executed by the network management tool:

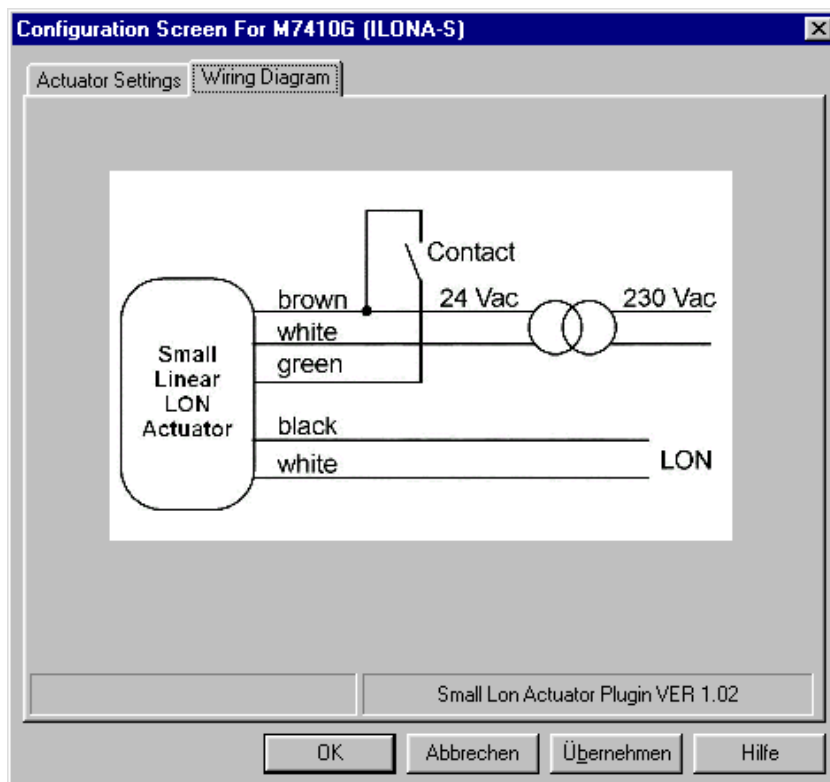- Application restart. Same situation as power-on / reset

Wiring Diagram

Diagram 2: Wiring

Wiring Colors

Power Supply + Digital Input	
Brown	24 Vac +
White	24 Vac -
Green	DI (+)

LON (E-Bus)	
Black	LON
White	LON

Input Voltage: Input Voltage for power supply
24 Vac ± 20 %, 50 / 60 Hz
LON (E-Bus): Connection of the LON Bus FTT-10A. The LON Bus is insensitive to polarity, eliminating wiring errors during installation.

Connection
Cable: 1,5 m

PI-CONTROLLER OBJECT

The PI-Controller Descriptions of the Plug-In only apply to the actuator types which have the PI-Controller integrated.
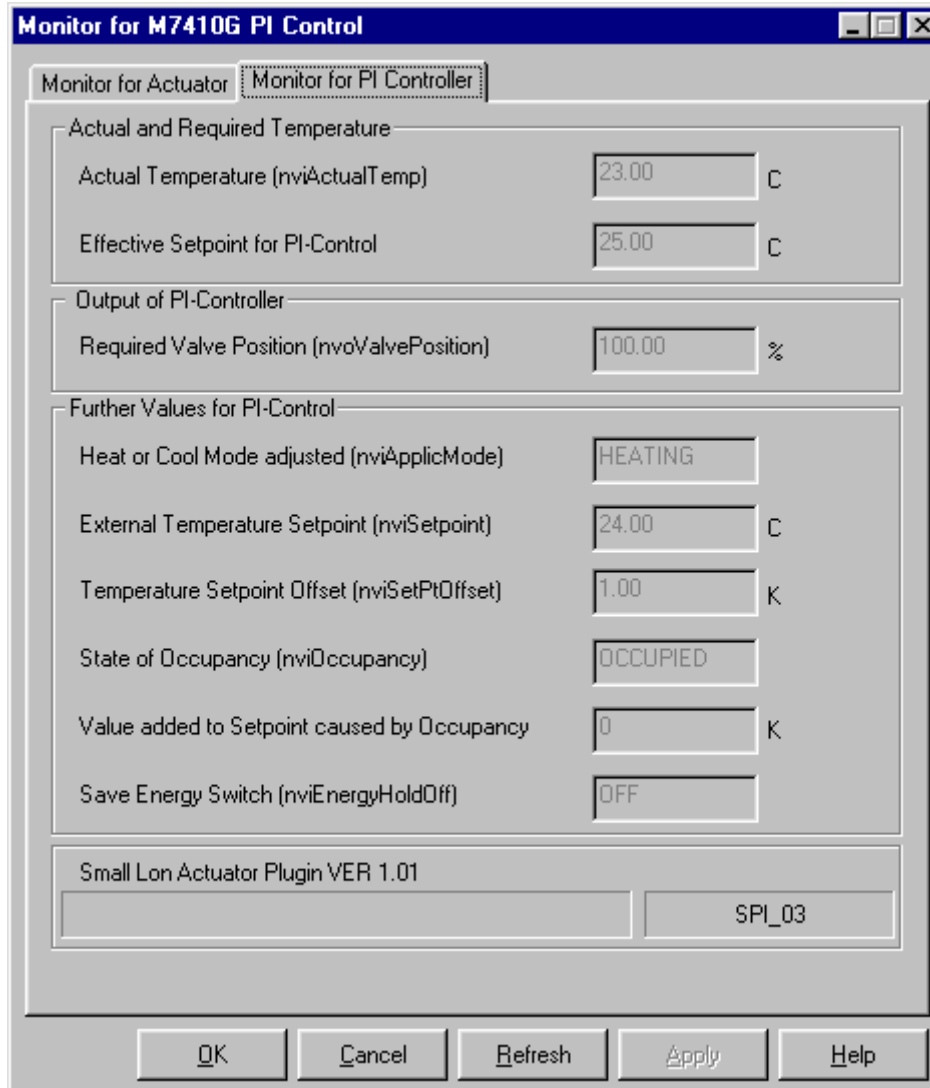
MONITORING

Fig.17 Monitoring Screen

Priority Table

Prio	Action	Occurs...	nvoValvePosition will be set to...
1	Frost Protection	...if the actual temperature runs below 6 °C. Frost Protection mode is active till temperature rises above 8 °C.	100 % if heating mode 0 % if cooling mode
2	Energy Off	...if nviEnergyHoldOff, which displays the state of a physical digital switch, turns to [ON].	0 %
3	no control loop possible	...if nviActualTemp is [INVALID] than nvoValvePosition will be set to INVALID, too.	INVALID (163,835)
4	Normal Operation	...if priorities 1-3 are not active. PI-Algorithm works. The actual required valve position will be evaluated.	the valve position evaluated by the PI-algorithm

Actual and Required Temperature

ACTUAL TEMPERATURE (nviActualTemp)
Shows the actual temperature received from a LON temperature sensor. For INVALID state refer to the priority table above (priority 3).

EFFECTIVE SETPOINT
The effective setpoint is the required temperature which depends on the

- Application Mode (nviApplicMode or nciPiConfig)
- the Setpoint (nviSetpoint or nciSetpoint)
- the Setpoint Offset (nviSetPtOffset)
- the Occupancy State (nviOccupancy)

Output of PI-Controller

REQUIRED VALVE POSITION (nvoValvePosition)
Shows the required valve position evaluated from the PI-controller.
For the different priorities refer to the priority table above.

Further Values for PI-Control

HEATING OR COOLING MODE ADJUSTED (nviApplicMode)
If the HEATING mode is adjusted via nviApplicMode, the internal configuration parameter nciPiConfig will be overridden and the controller works in the HEATING application mode.

If the COOLING mode is adjusted via nviApplicMode, the internal configuration parameter nciPiConfig will be overridden and the controller works in the COOLING application mode.

If the nviApplicMode edit field shows INVALID, the application mode will be adjusted via the internal configuration parameter nciPiConfig.

If the application mode changes between HEATING and COOLING, the PI-controller will be reset internally.

EXTERNAL TEMPERATURE SETPOINT (nviSetpoint)
Shows the temperature setpoint adjusted from the outside of the device. If this value is adjusted, the internal configuration parameter nciSetpoint will be overwritten. If nviSetpoint shows INVALID, the internal setpoint (nciSetpoint) is active.

TEMPERATURE SETPOINT OFFSET (nviSetPtOffset)
Shows the temperature offset adjusted from the outside of the device.

STATE OF OCCUPANCY (nviOccupancy)
Shows the actual occupancy state received from a occupancy sensor.
For description, see the table below.

Effective adjusted Application Mode	STATE OF OCCUPANCY	VALUE ADDED TO SETPOINT CAUSED BY OCCUPANCY
Heating	OCCUPIED	0
	BYPASS	
	INVALID	
	STANDBY	- 3
	UNOCCUPIED	- 6
Cooling	OCCUPIED	0
	BYPASS	
	INVALID	
	STANDBY	+ 3
	UNOCCUPIED	+ 6

VALUE ADDED TO SETPOINT CAUSED BY OCCUPANCY (nviOccupancy)
For description, see the table above.

SAVE ENERGY SWITCH (nviEnergyHoldOff)
For the behaviour of the controller if nviEnergyHoldOff turns to ON, refer to the priority table above (priority 2)

.

CONFIGURATION OF PI-CONTROLLER

If nviApplicMode is invalid
APPLICATION MODE (nciPiConfig)
Defines whether the controller should work in heating or cooling application mode. Internal configuration parameter nciPiConfig is only active, if external nviApplicMode is inactive (INVALID). If the application mode changes between HEATING and COOLING, the PI-controller will be reset internally.

Adjustment of PI-Control Parameters
PROPORTIONAL BAND (Xp)
Temperature deviation between the required temperature (effective setpoint) and the actual temperature (nviActualTemp), which causes the control output to modulate from 0 % to 100 % (nvoValvePosition).
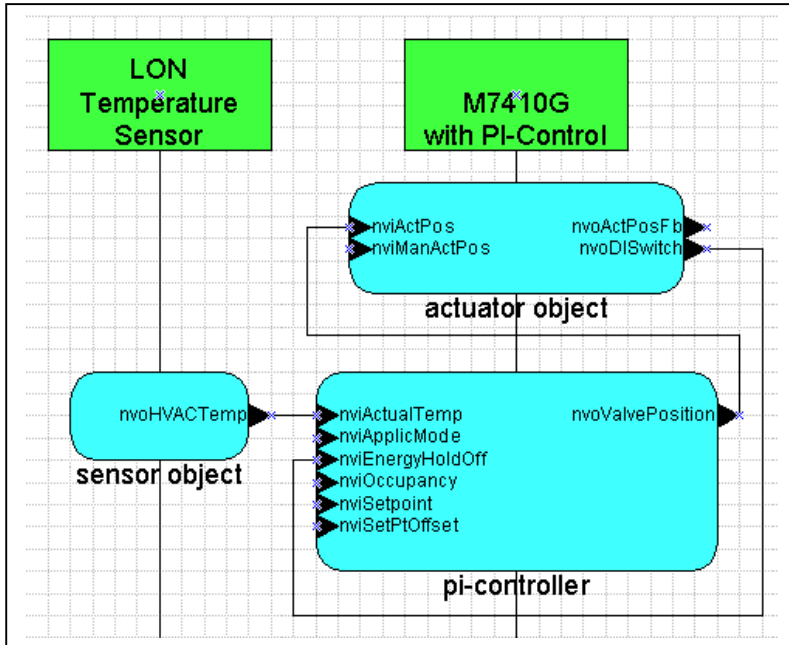
INTEGRAL RESET TIME (Tn)
Integral reset time of the PI-controller.

If nviSetpoint is invalid
INTERNAL SETPOINT (nciSetpoint)
Actual internal adjusted setpoint. This variable is only VALID if the external setpoint (nviSetpoint) is INVALID.

APPLICATION EXAMPLE FOR M7410G1032 / M7410G1040 / M7410G1057

The following picture shows the easiest way for a complete decentral temperature control loop with an additional Energy Hold Off signal from, e.g. a dewpoint sensor or a window contact.

Honeywell