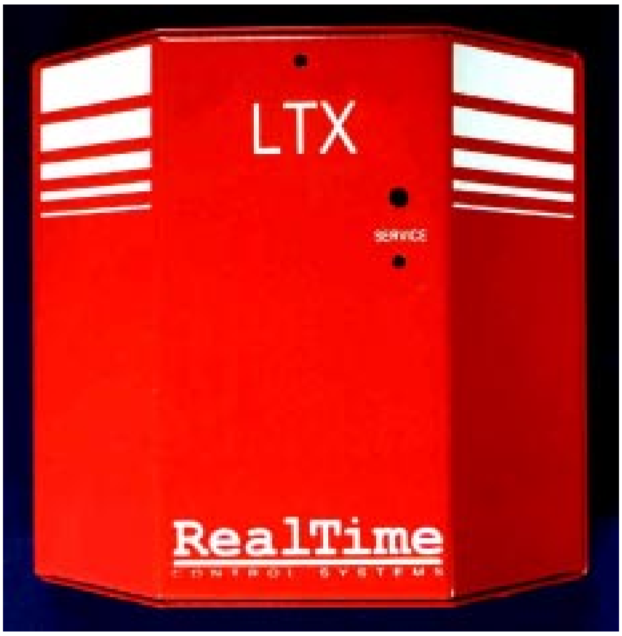
RealTime
CONTROL SYSTEMS

LTX-SC/T1 Datasheet

LTX-SC/T1 Site Controller

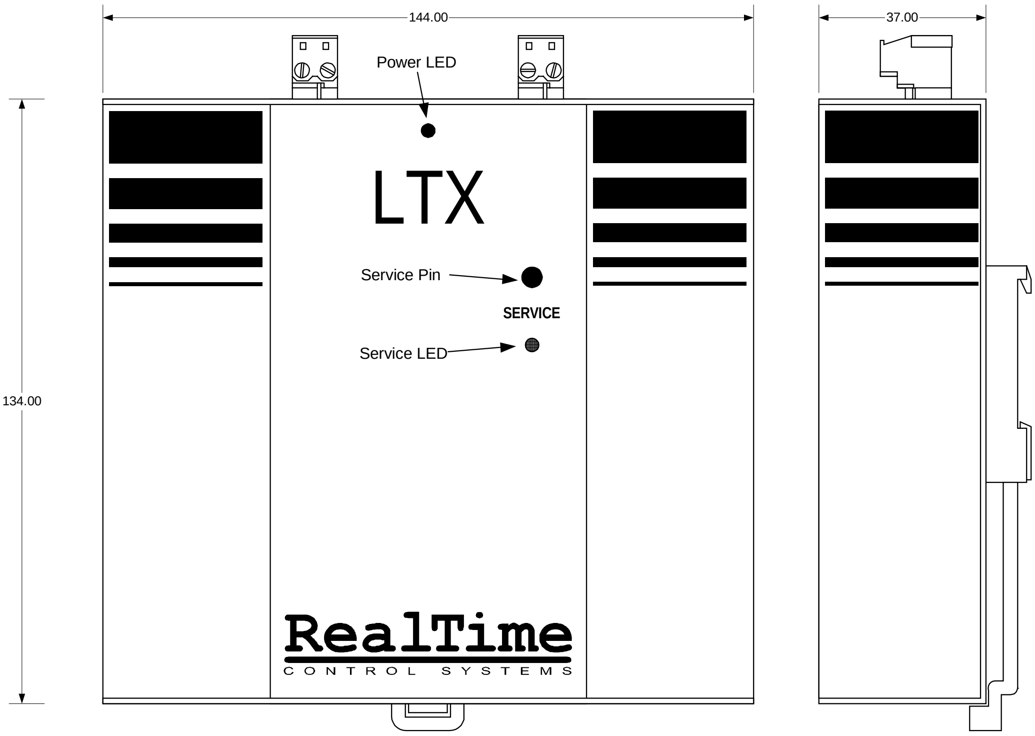


LTX-SC/T1 Iss1.01

Description

The RealTime LTX-SC Product Range is based around a LonWorks controller designed for control and monitoring of small to medium sites. A number of variants LTX are available for different applications. The controller provides all of the basic functionality required for a typical BMS solution including time-scheduling, data-logging and alarm reporting. The controller is based upon an open architecture which allows a variety of different systems to be integrated into the control system. The LTX-SC architecture provides a dial-in capability for remote supervision and maintenance.

The LTX-SC/T1 controller provides a complete control solution for sites with Toshiba air conditioning and Lonworks based DALI lighting controls. The controller provides all of the necessary scheduling control to control multiple groups of lighting and air-conditioning as well as interfacing with conventional I/O modules. Other third party devices can be added to the system for control of other systems. Multiple LTX-SC controllers can be used to control more complex systems.



Dimensions (mm)

1 Introduction

1.1 LTX-SC Features

Time Control

- Real-time clock with daylight savings functionality
- Comprehensive calendar functionality with standard and user configurable holidays
- Two Independent time-zones for scheduling occupancy and plant operation
- Time extend functionality for out-of-hours operation

Plant Control

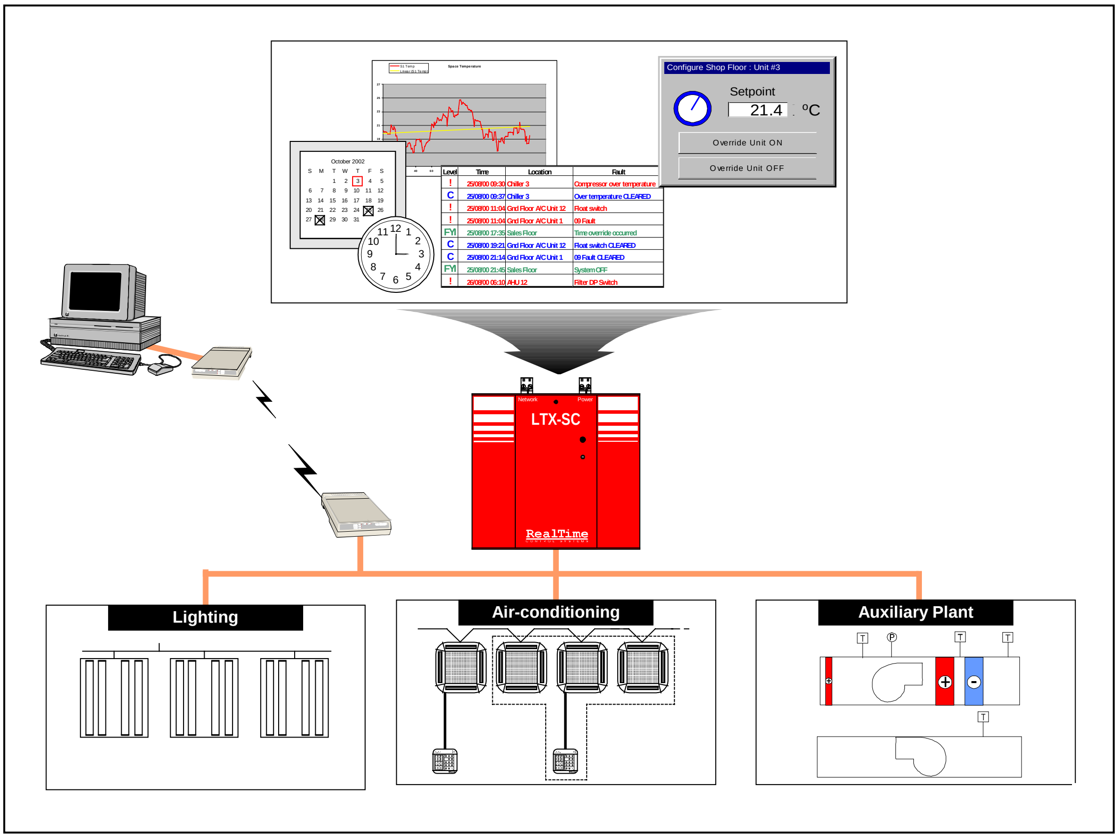
- Control for up to 16 air-conditioning units in 4 groups with separate user configurable operating conditions and scheduling.
- Control for up to 4 independent switched zones such as lighting and DHWS with compatibility with dimmable LonWorks lighting controls.
- Scalable control allowing additional hardware input and output points
- Fire-alarm functionality for placing all plant in alarm mode operation

Condition Monitoring

- Fault logging with history of the last 64 fault, recording all faults in Air-conditioning and Lighting systems
- 36 datalog channels including all temperatures from air-conditioning units and 4 auxiliary channels for external devices, with logging period from 1 minute to 4 hours.
- Event logging for recording significant events in site operation, with 64 event history

Remote Management

- Dial-in capability compatible with LNS based engineering and supervision software.
- PC Based LNS compatible configuration and supervisory software.



1.2 Description

The LTX-SC/T1 is designed for application in small and medium buildings that require core BMS functionality at low cost. The controller is one of the LTX-SC range of RealTime *Application Specific* controllers designed to meet specific application areas. This means that the controller contains functionality specifically tailored for particular solutions which would normally require significant amounts of control strategy programming and multiple devices to produce a complete control solution. The LTX-SC is based on a scalable architecture that allows multiple LTX-SC controllers for larger sites or more complex control requirements.

On the control side the LTX-SC performs scheduling of HVAC and lighting based around various occupancy conditions. Time and occupancy conditions can be transmitted from the LTX-SC to other LonWorks devices to allow more complex control systems to be created. Within the LTX-SC up to four control groups can be created for air-conditioning and lighting control as well as for other auxiliary devices. Additional items can be controlled by adding further control devices. The LTX-SC provides all of the necessary knobs to allow user adjustment of various plant parameters such as air-conditioning setpoints and lighting levels.

The two occupancy schedulers within the LTX combine clock and calendar functionality with inputs for site-enable, time extend and alarm inhibit to produce an occupancy schedule that allows a wide variety of different occupancy and operation profiles to be created, for example with standby and full occupancy states controlled by a combination of site enable and the standard occupancy time schedule.

At the supervisory level the LTX-SC provides a range of logs that allow maintenance and management personnel to locally or remotely monitor and diagnose problems in site operation. Datalogs and fault logs provide historical logs of plant behaviour and faults, whilst the event log provides a history of system operation.

1.2.1 Air Conditioning Control

The LTX-SC/T1 is capable of control and monitoring of up to 16 Toshiba RAV units without the need for hardwired points. In the majority of applications this is achieved through the use of a Toshiba LG1 interface, for certain applications it is necessary to use a RealTime LRC-LG interface. A single LTX interface can be configured to interface to one LG1 and one or more LRC-LG interfaces to allow control of different combinations of air-conditioners.

The interfaces required for connecting to different systems are shown in the following table of Toshiba products.

	RAS - xxx	RAV - Heatpump	RAV – Cooling only
R22 – Series 0 to 3	✘	*LRC-LG*	*LRC-LG*
R407C – Series 4	✘	*Toshiba LG1*	*LG1/LRC-LG**

*NOTE: Series 4 Cooling-Only *split* units do not have X-Y connections and are therefore not compatible with the LG1. However 'Cooling-only' units in VRF applications are actually 'heat-pump' indoor boards (with the –H) in the unit code, these *are* compatible with the LG1 as they have X-Y terminals.

The LTX-SC/T1 datasheet focuses on integration and control of the Toshiba LG1. For information about using the LRC-LG consult the datasheet available at *www.realtime-controls.co.uk*. **Note that temperature feedback is not available from the LRC-LG**.

The LTX-SC/T1 allows four independent groups of air-conditioners to be created. Each group has a set of operating conditions (setpoint, fanspeed etc.) that can be adjusted by the user. Each group can be controlled by one of the LTX occupancy schedulers that determine when the plant will run and implements occupancy extensions, standby and alarm modes. All fault codes from the units are monitored by the LTX and stored in the fault log. All temperatures readback from the units are stored in the data log. Group control also allows groups to be switched to local control during which all units in the group are slaved to a single keypad.

1.2.2 Lighting Control

The LTX-SC is designed to interface with LonWorks lighting controllers, and has been tested extensively with the Delmatic DELI lighting controller, a standard LonWorks based DALI lighting controller. Other controllers can be used providing they implement compatible network variables and functionality, please contact RealTime for advice. The LTX-SC has four independent lighting group controllers, each group can be bound to any number of DALI ballasts via DALI lighting controllers. Each group can be assigned to one of the LTX time schedulers and group profiles can be defined which specify dimming levels and behaviour during different operating modes. Lighting levels can be scheduled to ramp up and down during occupancy and smooth lighting transitions can be programmed for each state change. If lux sensors are employed the auxiliary data logging channels can be used to record lux variations (a type translator is required for this at present).

The LTX-SC monitors for ballast failure through a single network variable. Up to four compatible DALI lighting controllers can be bound to this input, ballast failures are then reported for each lamp group in the LTX fault log.

1.2.3 Additional Plant Control

The addition of one or more low cost LonWorks I/O modules or unitary controllers to the system allows a variety of additional plant to be controlled from the LTX. If external inputs for site-enable, time-extension and alarm inhibit are to be used then it is necessary to employ some form of I/O module. This also makes it possible to use additional inputs and outputs for further plant control. Scheduler states from the LTX can be used to enable items of plant as can outputs from the LTX group controllers. For selected I/O modules RealTime can supply special firmware that takes advantage of the scheduler state information, contact RealTime for further information.

Analogue inputs can be bound to the LTX datalogger auxiliary channels to record variations in e.g. space temperatures. Alternatively LonWorks based field sensors can also be bound to the datalogger.

The scheduler and group network variables can be used to bind to a wide variety of other Lonworks devices such as package AHU controllers and fan-coil controllers. Further control strategy can be added to the system through the use of additional controllers.

1.2.4 Remote Management

The addition of a modem or Ethernet interface to the network allows the system to be remotely managed and controlled. The PC based RealTime LTX Engineering Tool performs all of the necessary communications functions to allows any suitable equipped PC to connect to the system. The engineering tool allows complete access and control over all LTX functions including the fault log, data log and event log as well as all plant setpoints and modes. For further advise in designing and installing dial-up solutions please contact RealTime.

2 Functionality

The LTX consists of a number of function blocks with different types of functionality to allow a variety of different control configurations to be created. The complete functional profile is given in Section 3. The following sections describe the functionality of each type of function block.

2.1 Occupancy Scheduling

The core of the controller is the occupancy scheduling used to place the controlled plant in different modes dependent on various input states, time schedules and calendar states. Occupancy conditions are defined using the *SNVT_occupancy* enumerated type, this takes on four standard values defined as follows

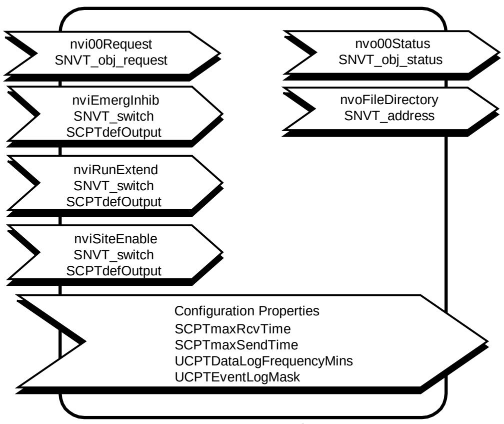
SNVT_occupancy Value	Description
OC_UNOCCUPIED	Site/zone is unoccupied
OC_STANDBY	Site/zone is in pre/post occupancy state such as pre-heat or cleaners mode
OC_OCCUPIED	Site/zone is occupied
OC_BYPASS	Site/zone is in an alarm condition

In practice the engineer can use these four states in any manner to operate plant in different modes depending on various conditions.

The two Scheduler function blocks each provide a *SNVT_occupancy* output that is then applied by the various plant control function blocks to determine the current operating conditions. The value of this occupancy state is determined from a number of sources as outlined in the following sections.

2.1.1 Node Object

The controller has three *SNVT_switch* inputs on the Node object which can be used to control the state of the system. The inputs do not have to be bound and each input has a *SCPTdefOutput* value that defines the default state. This value is also used if a timeout occurs on the input value. The *nviSiteEnable* input can be linked to any input that indicates when the site is occupied. The *nviRunExtend* input can be linked to any input that is used for manually extending site operation, for example by binding it to the output of the time-extension function block within the LTX controller. In the general case the two inputs can be used to define different operating states, each combination of inputs defining a different operating mode.



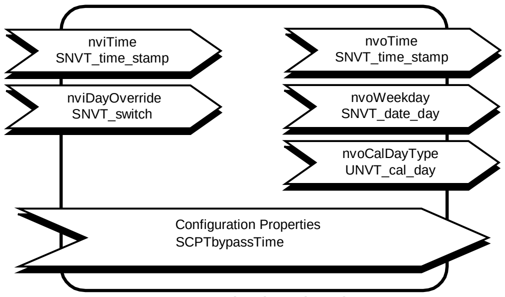
LTX-SC.Node

The *nviEmergInhibit* input is a special input that overrides the Schedulers to an output of OC_BYPASS regardless of what state the controller is in. This allows an input linked to the fire system to be used to place all plant into the required state for a fire-condition, i.e. disabling fans and switching off plant. The description of the scheduler below shows how these different inputs are incorporated.

The node object also has a number of global configuration values with various uses. Timeouts for inputs are defined by the global *SCPTmaxRcvTime*. If a timeout occurs on any of these inputs then they will be set to the default output value until a network update is received. This ensures that device or network failure will cause the controller to enter a well defined state. A heartbeat is also generated by a non-zero *SCPTmaxSendTime* which ensures that data is propagated on a regular basis even if it hasn't changed. In a distributed control application it is good practice to use max receive Timeouts and max send Heartbeats to maximise robustness. Hence if any particular control device is disabled the remaining plant should rapidly timeout and enter well defined default states. Typical values suggested are 10 seconds for *SCPTmaxSendTime* and 30 seconds for *SCPTmaxRcvTime*.

2.1.2 Clock/Calendar

The LTX-SC contains a fully functional real-time clock that is used for all time scheduling. The clock implements leap years and EU standard daylight savings, daylight savings adjustments are recorded in the event log. The time can be manually set from the *nviTime* input. This input can also be bound to a time-master so that in the case of multiple LTX controllers a single master controller is used as a time source. The current time is available on the *nvoTime* output. The current day of the week is also available from the *nvoWeekday* output.



LTX-SC.ClockCalendar

The calendar function allows holidays to be defined as well as defining special occupancy days. A set of standard UK holidays are included in the calendar and can be individually enabled or disabled, these holidays are shown in Table 1. to the right.

Holiday	Definition
Christmas Eve	24th December
Christmas Day	25th December
Boxing Day	26th December
New Years Eve	31st December
New Years Day	1st January
Easter Friday	Easter Sunday - 2
Easter Saturday	Easter Sunday - 1
Easter Sunday	See Calendar Act 1750
Easter Monday	Easter Sunday + 1
May Bank Holiday	First Monday in May
Spring Bank Holiday	Last Monday in May
August Bank Holiday	Last Monday in August

Table 1. *Standard Calendar Holidays*

Each standard holiday can be individually enabled and disabled using the LTX Engineering Tool.

When the LTX enters a holiday period the start and end of the holiday are recorded in the event log.

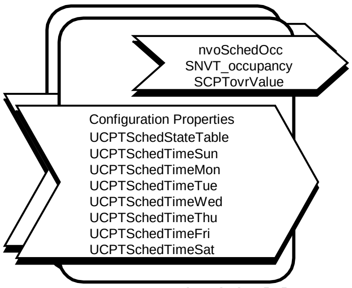
The calendar also has several types of entry that can be added. Three types of data entry are available; up to 31 *annual holiday dates* can be set which are yearly repeating holiday dates, 21 *single holiday dates* can be set for one-off holidays in a particular year and 21 *special occupancy* dates can be set which override standard holidays. Configuration of these is via the LTX Engineering Tool.

The input *nviDayOverride* allows calendar holidays to be overridden, for example to allow an external input to enable the system under special conditions when normally it would be held off by a holiday.

2.1.3 Schedulers

Core scheduling capabilities are provided by two independent scheduler objects which each produce a *SNVT_occupancy* output that is used to define the operating conditions of all controlled plant. Each scheduler has a standard 7 day week, with start and end times. The scheduler objects are the heart of the control system and combine information from the external state inputs on the Node object, the time and calendar information from the Clock/Calendar object as well as the local scheduler time and state configuration.

In each scheduler object a seven day occupancy profile is defined by seven user defined configuration parameters, one for each day of the week. Between the start and end times for the current day of the week the scheduler TIMEZONE is considered to be 'ON'.



LTX-SC.Scheduler[2]

The output of the scheduler, *nvoSchedOcc* is then determined by an eight entry scheduler state table defined by *UCPTSchedStateTable*. Each entry determines the output for a particular combination of *Node:nviSiteEnable*, *Node:nviRunExtend* and Scheduler:TIMEZONE. This allows a wide variety of different occupancy profiles to be created, some purely dependent on the scheduler TIMEZONE, some dependent on the node network variable inputs. Note that the *nviSiteEnable* and *nviRunExtend* inputs do not have to be performing the function suggested by their name, they can be used for any function where a change in the input determines a change in site operating state.

Below is an example table that illustrates the relationship between the three state variables and the state table output.

Index	***nviRunExtend***	***nviSiteEnable***	**TIMEZONE**	**Output Value**
0	0	0	0	OC_UNOCCUPIED
1	0	0	1	OC_UNOCCUPIED
2	0	1	0	OC_STANDBY
3	0	1	1	OC_OCCUPIED
4	1	0	0	OC_UNOCCUPIED
5	1	0	1	OC_UNOCCUPIED
6	1	1	0	OC_OCCUPIED
7	1	1	1	OC_OCCUPIED

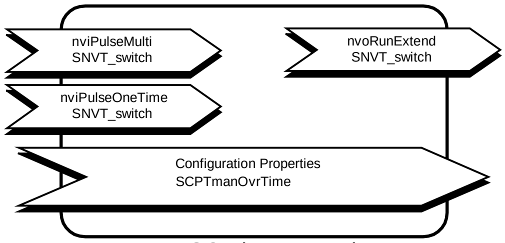
Table 2. *Example UCPTSchedStateTable configuration.*

In this example the scheduler is configured so that the site enable input places the site into OC_STANDBY state, and the site only moves into OC_OCCUPIED mode when the TIMEZONE becomes active. In addition the RunExtend input also places the site into OC_OCCUPIED state regardless of the time zone, but only if the site enable input is true. Hence the scheduler state table provides a method of combining the inputs in various different logical combinations to implement different control requirements.

The scheduler output state is not only determined by the scheduler state table, but also the current calendar day type and the *Node:nviEmergInhibit* input. In addition each of the scheduler objects implements the Lonmark OVERRIDE behaviour during which the output of the function block is defined by the network variable configuration parameter *SCPTovrValue*. The complete logic for determining the output is therefore:

```
if(Function Block is Overriden) then nvoSchedOcc = SCPTovrValue
else
        if(nviEmergInhibit=ON) then nvoSchedOcc = OC_BYPASS
        else
                if(Calendar Day =  HOLIDAY)  then nvoSchedOcc = OC_UNOCCUPIED
                else
                        nvoSchedOcc = SchedStateTable(nviRunExtend, nviSiteEnable, Time)
```

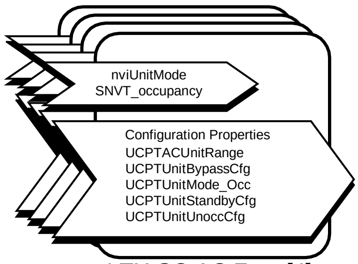
2.1.4 Time Extend



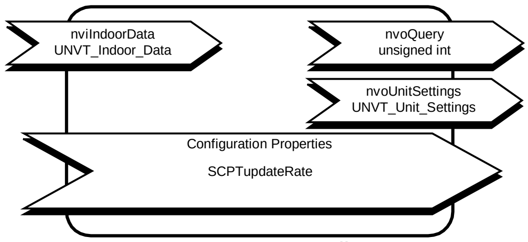
LTX-SC.Time Extend

The Time Extend function block provides the functionality for a timed override from a momentary input. The function block can be configured to produce a timed pulse lasting from 1 minute up to several days in length. Two inputs are available, nviPulseOneTime will ignore further inputs, nviPulseMulti will restart the timer. The output of this can be bound to the nviRunExtend input of the Node object in order to implement the extension functionality. The output can also be bound to suitable hardware output in order to provide extension indication, such as a lamp.

2.2 Air Conditioning Control



LTX-SC.AC Zone[4]



LTX-SC.LG1 Handler

The LTX-SC/T1 is designed to interface with a Toshiba LG1 interface or RealTime LRC-LG (see Section 1.2.1) and can monitor and control up to 16 air conditioning units in four separate groups.

The control of the LG1 interface is achieved using the LG1 Handler function block. This communicates with the LG1 via a limited set of network variables and performs all control and monitoring functions. The raw data transferred through this connection is visible through the LonMaker browser. The RealTime Engineering Tool also provides a view of all of the readback data from the LG1.

The three network variables on this function block must be bound to their complementary network variables on the LG1. Once the binding is performed all control is achieved through the *AC Zone* function blocks. For a standard application the following network variables should be bound

LTX-SC	Direction	LG1
nvoUnitSettings	⇨	*nviUnitSettings2*
nvoQuery	⇨	*nviQuery*
nviIndoorData	⇦	*nvoIndoorData*

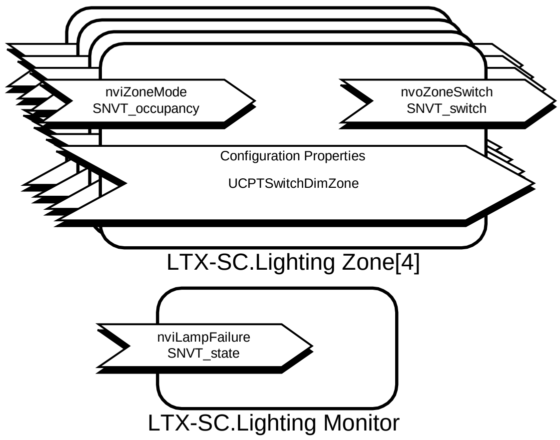
Note that the LG1 contains two Unit Settings network variables, only *nviUnitSettings2* should be bound.

Each AC Zone function block corresponds to one control zone. A single network variable *nviUnitMode* input of type *SNVT_occupancy* is used to control the state of each zone. This input is typically bound to one of the occupancy schedulers. Four configuration parameters within each AC Zone function block define the operating conditions under each of the four occupancy states. The primary operating conditions for a zone are defined for the OC_OCCUPIED state, in which the setpoint, fanspeed, mode, louver state, on/off and central/local operation are defined. For each for the other three modes it is possible to define separate on/off and setpoint states.

Zone groups are created for each function block by configuring the *UCPTACUnitRange* parameter. The configuration parameter contains the first and last unit address that is in that group, e.g. Group 1 is units 1 to 3, Group 2 is units 4 to 10. Hence unit addresses must be allocated as a continuous range to a single group. The range for each zone should not overlap with the other control groups. The RealTime engineering tool provides a simple interface for configuring these groups and setting up group operating conditions.

In operation the LG1 handler continuously monitors all units that are within defined groups. The readback data from these units is available through the Engineering Tool. Fault codes for each unit are monitored and fault conditions and clearances are reported to the Fault Log. The return air and heat-exchanger temperatures for each unit are recorded by the Data logger at the current logging rate.

2.3 Lighting Control



Four switched zones are available for switching plant as a function of *SNVT_occupancy*. The outputs of these function blocks are *SNVT_switch* values that can be used for either digital or analogue switching. The configuration parameter *UCPTSwitchDimZone* contains all of the necessary configuration for these function blocks. The RealTime Engineering Tool provides a user friendly interface for configuring these values.

The analogue value element of the *SNVT_switch* output is designed for control of dimmable lighting. The digital state element is designed for switching plant on and off.

For each *SNVT_occupancy* state a separate lighting level can be defined in the range 0 to 100%. A ramp rate can also be configured for each zone which controls the rate of change when the occupancy state changes. The ramp rate is configured in percent per second. E.g. for a ramp rate value of 2.5 the change from 0 to 100% would take 40 seconds. In the case of OC_BYPASS mode the ramp rate is ignored and the transition is instantaneous as this condition is used for emergency override states.

Each zone also has the facility to schedule a light level profile during occupancy. The OC_OCCUPIED state has a minimum and maximum light level value, together with a maximum light level time and selection of profile mode. The occupancy dimming mode can be set to occupancy maximum or minimum levels for commissioning purposes or for constant lighting level. If the profile is set to source from Scheduler 0 or Scheduler 1, then a dimming profile will be scheduled such that the level is occupancy minimum level at start and end of occupancy for the selected scheduler. The level will then ramp linearly so that it is at a maximum at the selected peak lighting level time. This allows a range of triangular profiles to be defined. If the maximum time is set to the start of occupancy then the level will start at the maximum level and ramp down to a minimum at the end of occupancy. The 'max' level can also be set to a value less than the 'min' level in which case an inverted profile will be generated.

The digital component of each switch zone can also be used, and can be used independently of the dimming zone so that a single switch zone can be used to control both a dimmed zone and a digitally switched zone. The digital state for each of the *SNVT_occupancy* states can be configured separately to allow this. For more advanced digital zone control see the digital switched zone in Section 2.4.

2.3.1 Lighting Faults

The Lighting monitoring function block has a single network variable *nviLampFailure*, a *SNVT_state* network variable that allows lamp and ballast failures for 16 groups to be reported. To facilitate larger systems it is possible to bind up to 4 lamp failure network variables to this input to allow the monitoring of up to 64 lighting groups. Any faults occuring in these systems are recorded in the fault log.

If more than one lighting controller is bound to the LTX-SC then the LTX engineering tool must be used to set up lighting groups. This allows the LTX-SC engineering tool to map lighting faults to the correct lighting controller. This must be performed while attached to the controller.

2.4 Digital Switching Control

The digital switching zone is not included in the LTX-SC-T1 but is available as firmware that can be loaded into selected dedicated I/O module bound to the LTX-SC. The digital switched zone is designed for general plant enable/disable scheduled on the *SNVT_occupancy* state. For each switch zone function block an on and off delay are configurable for each state change. The delays are not applied on transition to BYPASS mode.

Each digital switched object offers a hold-off feature to allow heating and cooling hold-offs. Each function block has an *SNVT_temp_*p input that can be bound to a temperature sensor (or other device through suitable translation). A hold-off temperature configuration parameter is used to define a hold-off level. A separate parameter defines the hold-off mode, currently either NO_HOLD_OFF, COOL_HOLD_OFF or HEAT_HOLD_OFF. In heat hold-off, if the input temperature is greater than the hold-off level then the zone output remains off regardless of the specified output. Cooling hold-off provides the opposite functionality. There is no default hystersis within the object however the on and off delays can be used to prevent the state oscillating around the hold-off point.

2.5 Historical Logs

The LTX-SC has a number of logging facilities that store historical information for use in maintenance and diagnostics. All of these logs are available through the LTX Engineering Tool. With the fault and event logs a number of user-interface features are available for filtering the log views.

2.5.1 Fault Logging

The fault logger monitors fault events that occur in the air-conditioning and lighting systems, a rolling history of the last 64 faults is stored within the LTX. Any fault code generated by the air-conditioning units is recorded in the fault log, as is any lamp or ballast failure recorded by the lighting controller. Each fault event log contains the system where the fault occurred, the fault code and the start and end times.

2.5.2 Event Logging

The event logger is similar to the fault logger but logs events for information purposes, as with the fault log the last 64 events are recorded within the LTX. This provides a history of events that have occurred in the controller such as changes in occupancy state and time extensions. The configuration parameter *Node:UCPTEventLogMask* determines which events are recorded. This filter is configured through the LTX engineering tool.

2.5.3 Datalogging

The datalogger has 36 logging channels, each containing the last 128 data values. A single global parameter *Node:UCPTDataLogFrequencyMins* determines the frequency with which logging is performed, ranging from 1 minute logging to 4 hour logging. The datalogs are viewed using the LTX engineering tool.

The first 32 channels are currently dedicated to the logging of temperature data from the air-conditioning units. The first 16 channels record the return air temperature from each unit and the next 16 channels record the heat-exchanger temperatures from each unit. The remaining four channels are auxiliary channels with *SNVT_temp_p* network variable inputs that can be bound to external field devices.

3 LonWorks Engineering

System engineering consists of several stages, most of which can be performed off site. Initial engineering is performed using a standard graphical LonWorks engineering tool (LonMaker for Windows is recommended). Once the binding relationships between network variables and devices has been created then much of the device configuration can be performed either using the LonMaker browser or the RealTime engineering tool. In most cases the RealTime Engineering Tool provides an easier interface for setting the configuration.

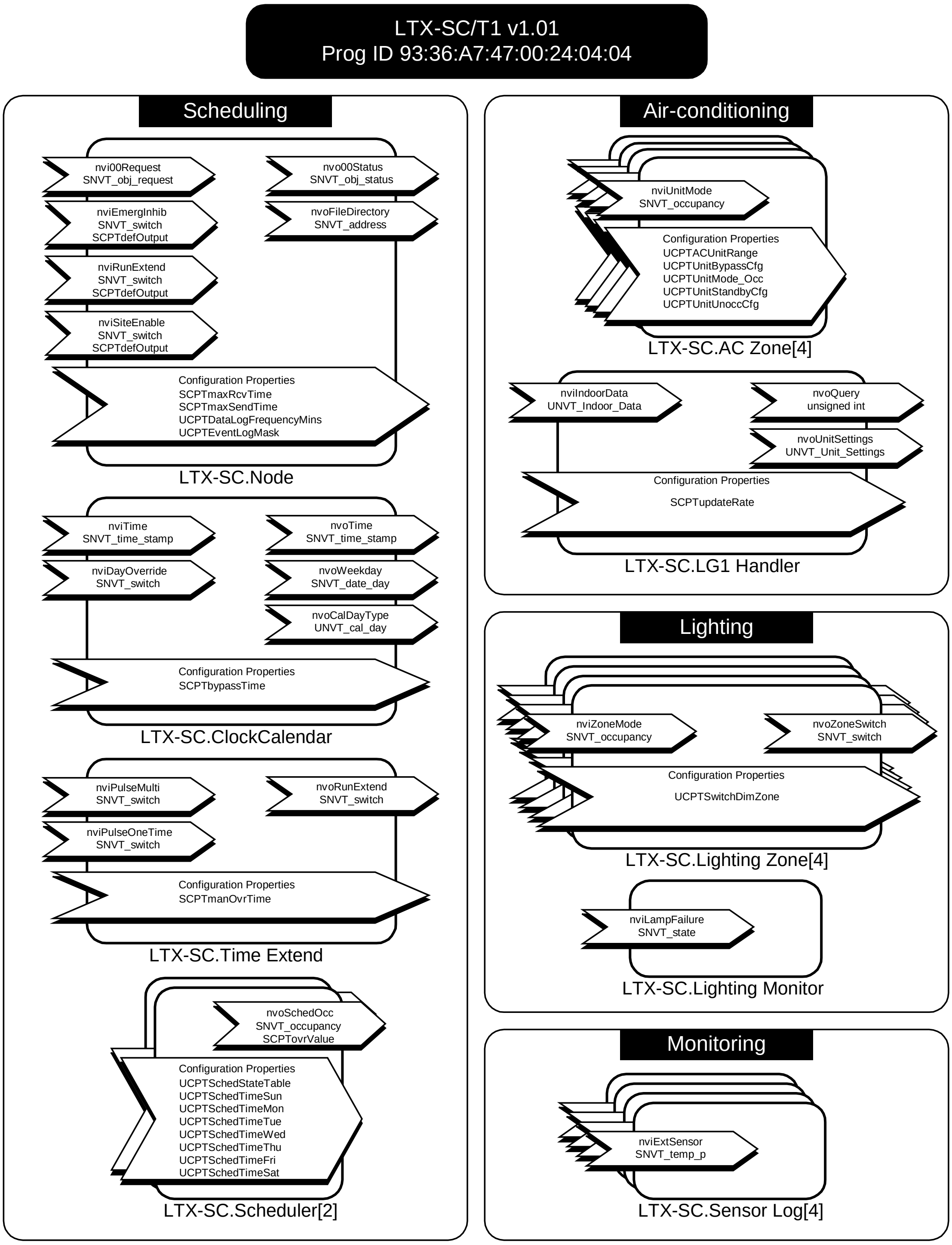
All functionality defined by configuration parameters in the LTX can be configured off-site. However there are a small number of features (extended date functionality and lighting controller mappings) which at present can only be configured when attached to the device, i.e. after the device has been commissioned.

A Note On LonWorks Object Indexing

There is an unfortunate problem in LonWorks relating to the indexing of function blocks and network variables. When there are multiple network variables they are written as an array such as nvoVal[3], meaning that there are three nvoVals. Programmers like to count from zero so the network variables are named as nvoVal[0], nvoVal[1] and nvoVal[2]. The rest of the world likes to count from *one*, because it seems logical to refer to the *first,* the *second* and the *third* nvoVal, but not the *zeroth* nvoVal. The problem is that when working with LonWorks devices there are inconsistencies where some objects are numbered from zero and sometimes from 1. This can and does cause problems, especially when an array of function blocks each contains an identical network variable, the function blocks can often end up being numbered from one whilst their corresponding network variables are numbered from zero.

The network variable names cannot be renamed, the function blocks can. It is suggested that the engineer avoids any numbering system that simply numbers function blocks, i.e. Scheduler 1 and Scheduler 2 have network variables nvoSchedOcc[0] and nvoSchedOcc[1], which is sure to cause confusion, instead it is desirable to use functional names for the objects that avoid numbering. It is possible to use zero based indexes for function blocks provided that the end-user will not see the objects.

3.1 LTX-SC/T1 Functional Profile

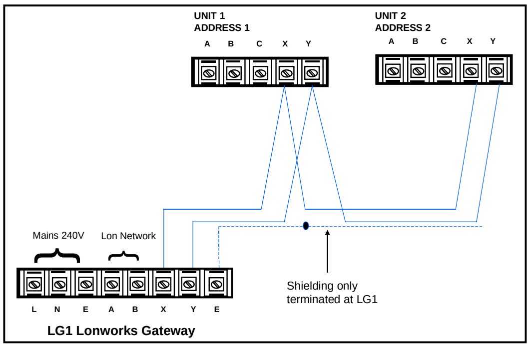


LTX-SC/T1 Iss1.01

4 Toshiba Installation and Commissioning

1) All units (if possible) should be placed on the X-Y network. B-C Slave wiring should NOT be used

2) The X-Y network should be wired as a daisy chain from the panel where the LG1 is located to each unit. Multiple cables should not be run out from the panel, refer to Toshiba instructions for more details.



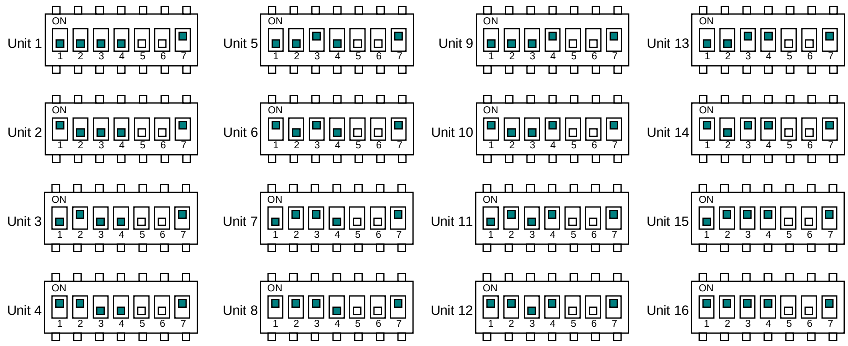
3) If more than 16 units are installed, then the units should be divided into groups of 16 or less and each group wired and addressed seperately. An LG1 interface (and LTX) is required for every 16 units

4) If remote controllers are used, they should only by wired to the MASTER via ABC, The slave BC connection should NOT be installed if the slaves are on the X-Y network. Slave control is performed by the BMS.

5) All units on X-Y network should be setup with SW01 rotary switch set to 1. All units are 'masters' on the X-Y. Slave groups are created in software. SW02 should be set to the unit number using the following dip switch settings. **Note that the indoor board must be re-powered for this addressing to take effect.**

1) Set Rotary switch SW01 to 1

2) Set SW02 according to the following settings.



6) To commission the system, instead of using a remote controller the network should be commissioned using a Central Controller available from Toshiba. This works on the X-Y network and will confirm that the unit addresses are set up correctly. It allows units to be individually run and shows the fault code status for each unit.

7) **Once the system is commissioned , the X-Y network cable can be simply transferred from the central controller to the Toshiba LG1.** Refer to the Toshiba LG1 installation instructions for further details of X-Y network wiring and DIP switch settings for address allocation.

5 Summary of Toshiba Fault Codes

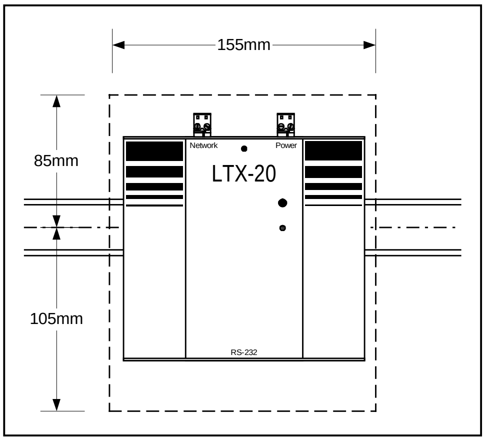
Below is a brief summary of the Alarm codes that can be generate by the Toshiba units. Refer to the Toshiba Service manual for more detailed explanations of the codes.

Hex Code	Fault	Critical	Decimal Code
00	No indoor unit connected	✘	0
04	No communication on 1-2-3 terminals	✓	4
08	Reverse temperature change	✘	8
09	Frost or no-temp change	✘	9
0B	Indoor unit float switch	✘	11
0C	Indoor temperature sensor TA	✓	12
0D	Indoor heat-exchanger sensor TC	✓	13
12	Indoor microprocessor fault	✓	18
14	Refer to outdoor unit (Super Multi)	✓	20
15	Refer to Multi Controller	✓	21
18	Refer to outdoor unit (TE Sensor Fault)	✓	24
19	Refer to outdoor unit (TL/TD Sensor Fault)	✓	25
1C	Refer to outdoor unit (Super Multi)	✓	28
1D	Refer to outdoor unit (Super Multi)	✓	29
1E	Refer to outdoor unit (High discharge temp)	✓	30
1F	Refer to outdoor unit (Super Multi)	✓	31
21	Refer to outdoor unit (High pressure switch)	✓	33
99	Lost communications with indoor unit	✓	153
B7	Group Fault Code	✓*	183
FF	No Fault	-	255

* B7 Fault code indicates a fault in one or more slaves attached on the A-B-C network of a master. By default it is assumed that B7 *could* be critical. LTX alarm options defined by R(G) allow B7 faults to be classified as non-critical if so desired.

NOTE: There only difference between decimal and hexadecimal is the way the number is displayed. When viewing fault codes from the LG1 the data may be formatted in either hexadecimal or decimal format, depending on what viewing method is used. To maintain compatibility with established fault code methods these codes should always be formatted and displayed in *hexadecimal*.

6 Installation Instructions



The LTX is installed as follows

1) Mount the LTX on a standard symmetric DIN rail. A clearance of 85mm above and 105mm below the DIN rail centreline should be allowed and 155mm horizontal clearance. See the figure to the right.

2) Connect the LTX Power connector (black) to a 1.5VA 24Vdc supply. The connection is polarity independent. Do not power the device up.

3) Connect the LonWorks network to the LTX connector labelled 'Network' (orange) using unshielded twisted pair; the connection is polarity independent. Multiple devices can be daisy-chained.

4) Daisy-chain the LonWorks connection from the LTX to a pair of screw-terminals mounted on the DIN rail adjacent to the LTX. This is for engineering purposes and allows easy access to the network.

5) Add a network terminator to the LonWorks network if specified.

7 Troubleshooting Guide

Problem	Cause	Actions/Checks
Unit in 99 Fault	Unit not responding to queries	Check X-Y network Installed correctly Check indoor boards addressed correctly Check Rotary switch SW01 set to 1. Check for duplicated unit addresses on SW02 Check units re-powered after re addressing
All Heat Exchanger temperatures are a constant value 72°C	This is a modular multi-system. HE temperatures are not returned in this case and are shown as 72°C	No action
Unit readback settings are different from those sent by LTX	Unit not able to achieve required operating conditions	Check if louver activation is called for on a unit without louvers – or the louver jumper CN21 has been removed Heating is being called on a cooling only unit. The unit has a local hold-off device such as a Toshiba T2 Check Rotary switch SW01 set to 1.

8 Technical Specification

Electrical

Supply	24V DC unisolated
Power	1.5VA
Processor	Echelon 3150
Clock Speed	10 MHz
External Memory	32kb PROM, 24kb SRAM
LON Network	FTT-10A Transceiver, Free topology network

Mechanical

Dimensions	H138 x W146 x D38 without DIN clip H144 x W146 x D48 with DIN clip
Mounting	Quick release standard DIN rail
Clearance around DIN rail	Minimum 85mm above and 105mm below DIN rail centreline
Casing Material	Casing – Powder coated 18 gauge steel to RAL 3020
Weight	250g
Power and LON **Connectors**	Two part rising clamp 0.5mm" to 2.5mm" cross sectional area cable

Environmental

Temperature	
Storage	-10oC to 50oC
Operation	0oC to 50oC
Humidity	0-90% RH non-condensing
Protection	IP30
EMC Emissions	EN50081-1
EMC Immunity	EN50082-1

Sales Office

RealTime Control Systems Ltd
Park House
Greenhill Crescent
Watford, UK
WD18 8PH

Tel : +44 (0)1923 233384
Fax: +44 (0)1923 233385
Email: sales@realtime-controls.co.uk

Future updates of this datasheet available from http://www.realtime-controls.co.uk