TAC Xenta©

TAC Xenta 104-A

Handbook

TAC Xenta®

TAC Xenta 104-A

Handbook

Contents

1 Documentation and Terminology

1.1 Documentation

Enclosed Documentation

TAC Xenta 104 is delivered with an installation instruction:

- Installation instruction, TAC Xenta 104, part number 0FL-3935.

Other Documentation

There is additional information about TAC Xenta 104 in the following documents:

- Data sheet for TAC Xenta 104, part number 0-003-1821
- Data sheet for ZS 101–ZS 105, part number 0-003-1661.
- Data sheet for STR100–STR107, part number 0-003-2304.
- Data sheet for STR150, part number 0-003-2306.
- Data sheet for STR350/351, part number 0-003-2310-0
- TAC Xenta Network Guide, part number 0-004-7460.
- TAC Xenta OP Handbook, part number 0-004-7506.

All the above mentioned documents can be found on the internet at www.tac.com or can be ordered from your nearest TAC service point.

1.2 Terminology

This handbook contains some abbreviations and terms, which are specific for the zone controller's applications and network communication. The most common terms are explained in Table 1.1, "Terminology".

Table 1.1: Terminology

neuron	A communication processor with built-in protocol
node	A communication unit on the network
SNVT	Standard Network Variable Type
nvixxx	Variable that gets its value from another unit on the network
nvoxxx	Variable that is sent to another unit on the network
ncixxx	Configuration parameter; variable that gets its value from another unit on the network and keeps it during a power failure
service pin	Function that can be used during installation on the network
wink	A confirmation that the connection to a controller via the network is working (a LED is lit for appr. 20 seconds)
LNS	LonWork® Network Services. System tool for installation, configuration and maintenance of LonWorks network

2 Zone Controller TAC Xenta 104

2.1 General

The TAC Xenta® 104-A is a zone controller intended for roof top unit, small AHU, and unit ventilator applications which have heating, cooling, and economizer functions. The controller maintains a constant zone temperature by sequenced control of the heating, cooling, and OA/RA dampers. By using a discharge air temperature sensor, the discharge and zone temperatures may be controlled in cascade if the TAC Xenta 104-A configuration properties are set accordingly.

Cascade control also allows minimum and maximum limiting of the discharge air temperature. The fan On/Off is controlled by a 24 VAC isolated relay contact. The fan mode may be selected to operate continuous during the Occupied mode, or cycle with heating or cooling demand from the zone.

The Controller's Basic Functions

The controller has a number of built-in functions that are designed to handle normal control situations. There are two operating modes to choose from (occupied and unoccupied) and five application modes (heating only, cooling only, auto changeover, fan only and off).

The zone temperature is measured using a permanent thermistor sensor or a temperature node connected to the network. Setpoint calculations are made in line with defined methods. Fan control during the comfort mode can be either continuous or cycling with heating or cooling functions. The economizer will only function in the cooling or auto changeover modes. If the outdoor air is useful for cooling, the economizer will use it and provide energy savings and prevent damper hunting when cooling is cycling on and off.

For a detailed functional description of all the basic please see Chapter 5.2, "The Controller's Basic Functions", on page 38.

More About Functions

Apart from the controller's basic functions, there are a number of other functions for controlling the climate in the zone; these are described in detail in Chapter 5.3, "More About Functions", on page 43. Additional external functions that can be connected are also described in this chapter, these include window contact sensor and occupancy sensor.

Communication

The controller can work either as a stand-alone unit, without being connected to a network during operation, or be a part of a larger system with several other units such as TAC Xenta 300/400 and other zone controllers in the TAC Xenta family.

TAC Vista is an excellent tool for reading variables as well as a configuration tool for commissioning and/or operation purposes. When TAC Vista is not part of the system, reading and configuration of variables can be made from the operating panel TAC Xenta OP, version 3.11 or later.

The controller is LonMark® approved and communicates on a LonTalk® TP/FT-10 network via a twisted-pair, unpolarized cable. If you want to know more about the LonWorks® technology visit www.echelon.com or www.lonmark.org.

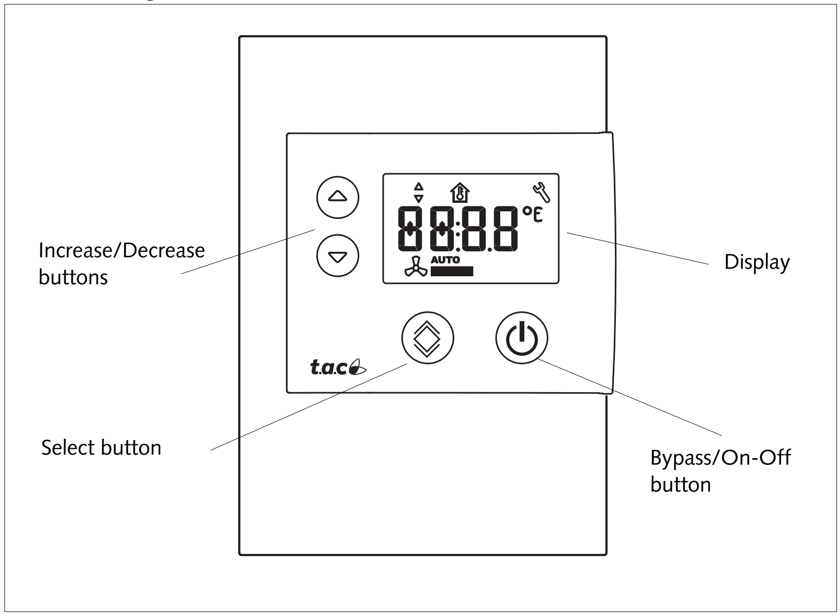
2.2 Wall Modules

A temperature sensor must be mounted within in the zone to be controlled. In the STR series of wall modules the temperature sensor is combined with various types of user interface. Several STR models can be used with the TAC Xenta 104-A; the choice is determined by the desired functionality and user interface.

- STR350/351. Wall unit with temperature sensor and LCD display. Extensive functionality for zone control. Communicates with the controller over LonWorks.
- STR150. Wall unit with temperature sensor and LCD display. Incorporates the most common functions for zone control. One-way serial communication with the controller.
- STR100-104. Wall module with temperature sensor and controls for the most common zone control functions. STR100-104 signals are hard-wired to TAC Xenta 104-A I/O.

2.2.1 STR350/351

STR350/351 communicates over LonWorks. LonWorks is used for all data exchanges between the room unit and the controller.



STR350/351 has the following functionality when used with TAC Xenta 104-A:

- **Temperature sensor.** Use either the built in thermistor element or any other temperature sensor available on the LonWorks network
- **Actual temperature display.** The actual zone temperature can be displayed on the LCD. It can also be hidden if preferred.
- **Temperature setpoint display.** The temperature setpoint can be displayed, either as an absolute value or as an offset.
- **Temperature setpoint adjustment.** The temperature setpoint can be adjusted, either as an absolute value or as an offset.
- **Bypass or on/off button.** The bypass function forces the controller to comfort mode for a configurable period of time. The same button can also be used as an on/off button.
- **Mode Indicator.** An On/Off symbol in the LCD indicates the mode of the control.

See STR350/351 configuration and data sheets for more details about the technical characteristics listed above, additional functions and configuration details.

Use the LNS plug-in to configure STR350/351.

2.2.2 STR150

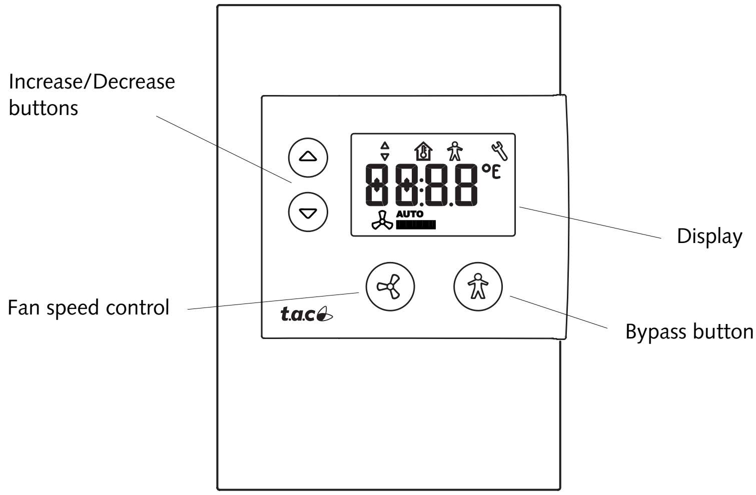


Fig. 2.1: Wall module STR150

STR150 is connected to TAC Xenta 104-A using two or three wires; the third wire is used if mode indication in the LCD is required. On the other two wires information is sent from the wall unit to the controller:

- **Zone temperature.** The temperature sensed by the thermistor element.
- **Temperature setpoint.** The temperature setpoint is displayed as an absolute temperature, but transmitted as an offset to the configured reference temperature.
- **Bypass button.** The bypass button forces the controller to comfort mode for a fixed period of time (2h).

The mode indication signaled on the third wire is connected to the symbol of a man in the LCD:

- Comfort mode (On) is indicated by a steady symbol
- Economy (Standby) mode is indicated by a flashing symbol.
- If the symbol is not shown (off) the zone is unoccupied.

There is no communication from the controller to the unit. This means that if a setpoint is changed using TAC Vista, the new value cannot be displayed on STR150.

STR150 is configured using the buttons and display on the unit. See STR150 configuration and data sheets for details.

2.2.3 STR100-104

STR100-104 is a series of room units that connect to the I/O terminals of TAC Xenta 104-A. The functionality of the various models are shown in the Table 2.1, "STR100-104 functionality".

Table 2.1: STR100-104 functionality

Model	Temp Sensor	Mode Indicator	Setpoint Adjustment	Bypass Button
STR100	X			
STR101	X	X		
STR102	X	X	X	
STR103	X	X		X
STR104	X	X	X	X

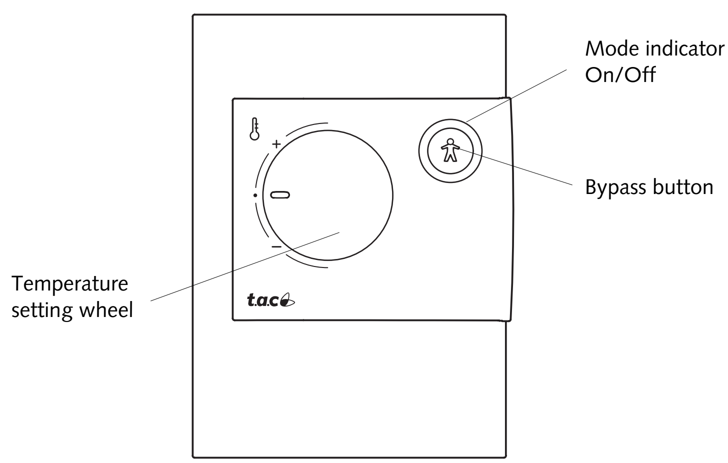


Fig. 2.2: Wall module STR104 as an example

Note! The TAC Xenta OP is normally connected directly to the controller, not the wall module. The TAC Xenta 101-VF has a TAC Xenta OP access connecter (type RJ-10) on the controller instead of dedicated terminals for the wall module.

Depending on model the following functionality may also be present:

- **Temperature Sensor.** All models have a 1.8Kohms@25°C thermistor element.
- **Temperature Adjustment.** The temperature setpoint can be adjusted. Using the plastic keys on the rear of the core panel the adjustment range can be set.
- **Mode Indicator.** The green LED indicates the control mode:
    - Comfort mode (On) is indicated by a steady green light

  - If the LED is off the zone is unoccupied.
- **Bypass button.** The bypass button forces the controller to comfort mode for fixed period of time (2h).

Refer to STR100-107 data sheet and installation sheet for details.

2.2.4 Wall Module Configuration

Wall Module Choice

STR150 is enabled by *nciAppOptions* bit 14:

- 0 = ZS, STR100-104 or STR350/351 (default)
- 1 = STR150

This can be set using the LonMaker Xenta100 plug-ins in Toolpack version 2.01 or higher, or by means of TAC Xenta OP.

Initial Start Up Status

- SpaceTemp in the application is set to +20.00 Celsius (This can not be read in the *nviSpaceTemp*, however it can be read in *nvoSpaceTemp*)
- Fan is set to Fan Auto

TAC Xenta can now accept for data from the STR module.

If no room temperature readings are received within 10 minutes, the SpaceTemp in the application is set to “invalid”. This is shown as “invalid” in nvoSpaceTemp.

When the first update is received then the 10-minute limit is changed to 5 minutes.

Unless there is a restart, the Offset + Fan values are not cleared and the last value is valid.

Fore more information on how to configure and engineer the STR series of wall modules see respective product documents.

2.2.5 General

The controller is suitable for a variety of applications such as RTU (Roof Top Units), small Unit Ventilators and small AHU (Air Handling Units).

Cooling control is achieved by one or two cooling stages in sequence based on zone temperature from the wall module.

Heating control is achieved by one or two heating stages based on zone temperature or as an alternative tri-state valve control based on discharge air temperature.

For economizer control a sensor is connected in the mixed- or discharge air stream depending of application.

A fan is controlled according to configuration settings.

Different configuration options can be chosen to fit both networked and stand-alone applications.

The TAC Xenta 104 controller incorporates several features:

- a fan status switch to stop the heating and cooling functions, can be connected.
- an auxiliary alarm sensor can be connected.
- the fan can be configured to run continous or cycle on a call for heating or cooling.
- A discharge air temperature sensor can be connected for controlling the discharge air temperature and the zone temperature in cascade.

2.2.6 HVAC Controller, Network Installation

In networked applications a SNVT supplies the out-door air temperature for economizer and compressor lockout functions.

For economizer control a sensor is connected in the mixed air stream in both two stage and tri-state modes.

For detailed description about networked applications, please see Chapter 5.3.5, “Networked Applications”, on page 46.

In stand-alone applications the outdoor air temperature for economizer and compressor lockout functions is supplied by a physical input.

For economizer control a sensor is connected in the discharge air stream in both two stage and tri-state modes.

For detailed description about stand-alone applications, please see Chapter 5.3.6, “Stand-alone Applications”, on page 47.

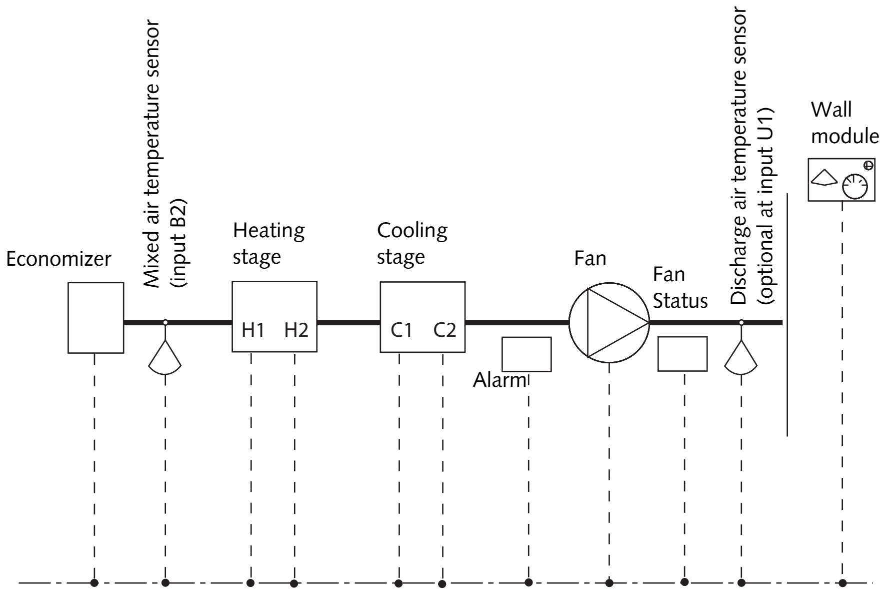


Fig. 2.3: RTU application for HVAC controller network installation

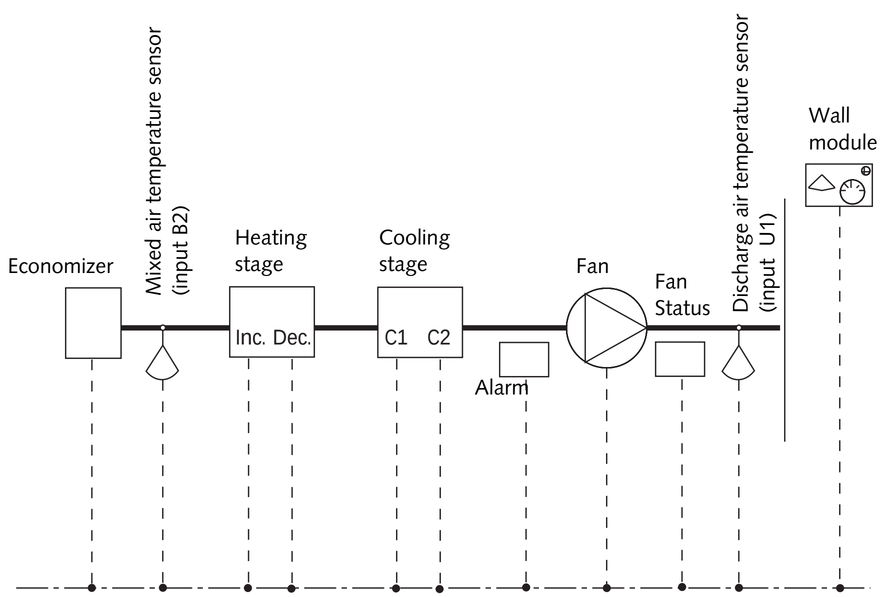


Fig. 2.4: AHU or Unit Ventilator applications for HVAC controller network installation

2.2.7 HVAC Controller, Stand-alone Installation

In stand-alone applications the outdoor air temperature for economizer and compressor lockout functions is supplied by a physical input.

For economizer control a sensor is connected in the discharge air stream in both two stage and tri-state modes.

For detailed description about stand-alone applications, please see Chapter 5.3.6, “Stand-alone Applications”, on page 47.

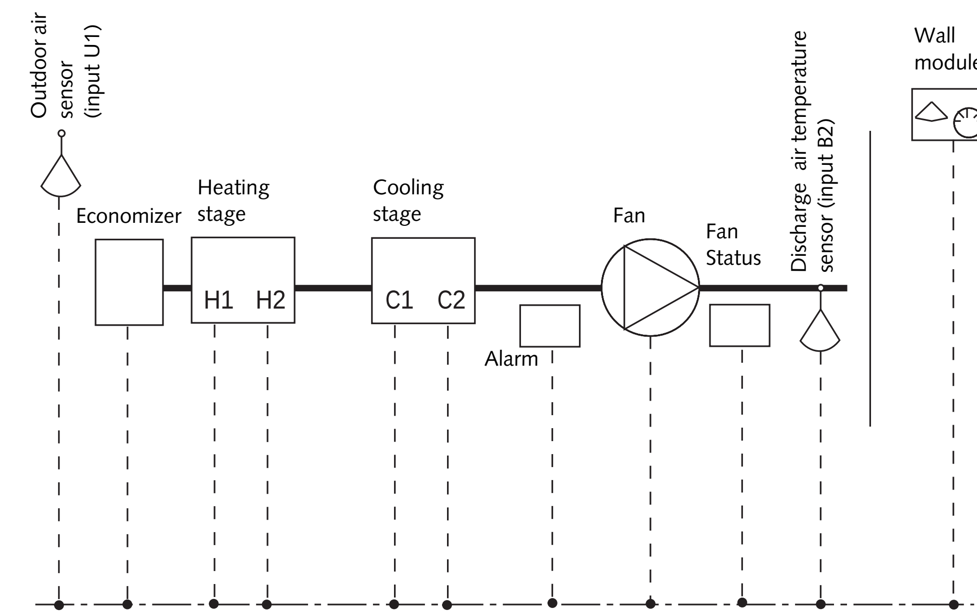


Fig. 2.5: RTU application for HVAC controller, stand-alone

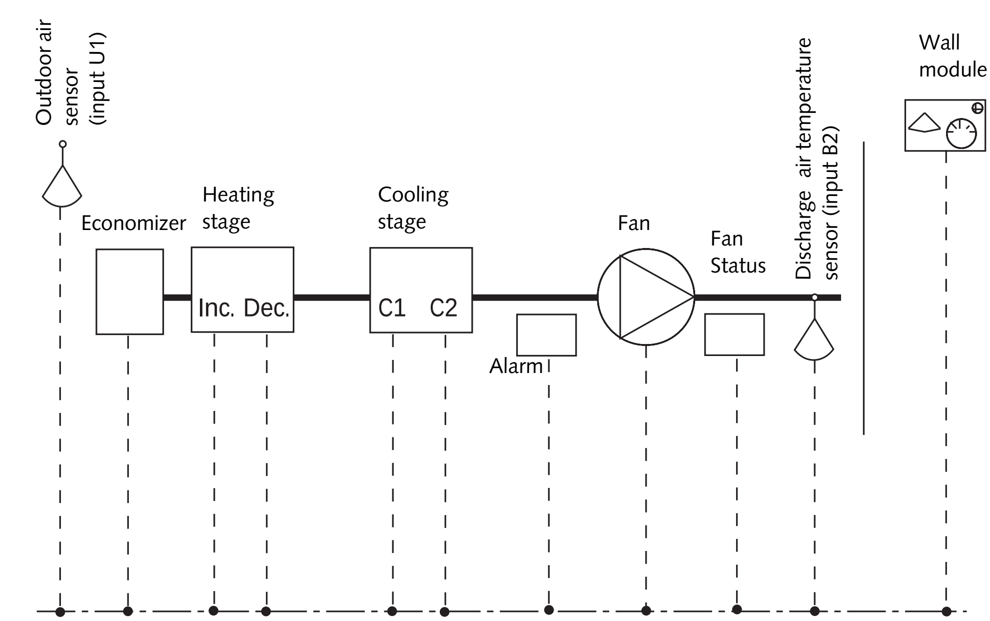


Fig. 2.6: AHU or Unit Ventilator application for HVAC controller, stand-alone

3 Installation

3.1 Mechanical Installation

3.1.1 Fitting

The TAC Xenta 104-A can either be snapped onto a DIN rail (Fig. 3.1) or fixed to a level surface with two screws. (Fig. 3.2).

Fastening the controller onto a DIN rail:

1. Place the controller on the top of the rail as shown by arrow 1.
2. Twist the controller downwards until it snaps onto the rail as shown by arrow 2.
3. To remove use place a screwdriver to locate the lock on the bottom of the controller and pull down. Lift the controller diagonally upwards and off the rail.

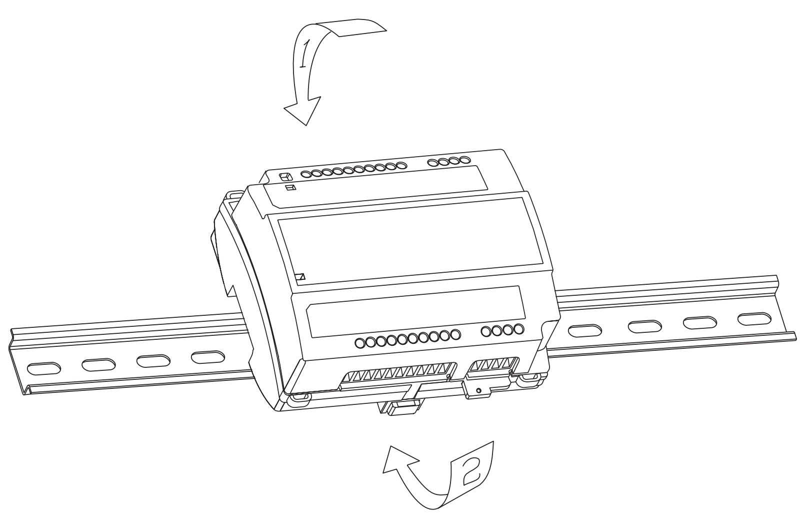


Fig. 3.1: TAC Xenta 104-A fixed on a DIN rail

Fixing the controller to a level surface:

Use the two sockets provided for fixing the controller; the maximum screw size is M4 or ST 3,5 (Ø 0.15"). The head of the screw should not exceed 7,5 mm (0.3") in diameter.

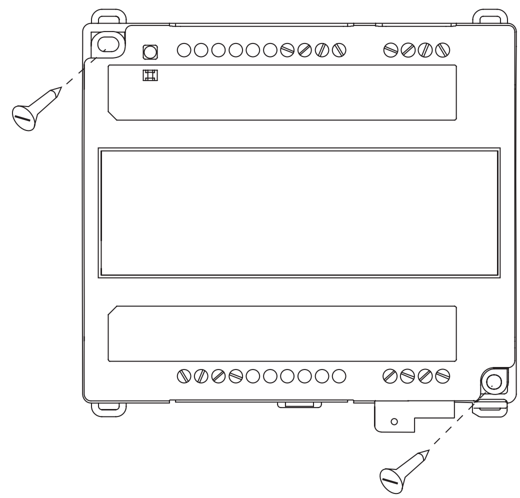


Fig. 3.2: TAC Xenta 104-A fixed to a level surface

3.2 Electrical Installation

3.2.1 General

1. Each controller or group of controllers must use max. 6 A fuses.
2. Avoid hanging or loose cables by using clamps to secure them to the controller.
3. A switch to cut off the power supply to the controller or compete unit must be easily accessible.
4. Connect U1 and M with a jumper when not used.
5. When several Xenta controllers receive power from a common transformer, it is important that all Gs are connected to each other and that all G0s are connected to each other. They must not be interchanged. An important exception: G0 on the wall module should not be connected with the other G0's. Instead it should be connected to the terminal OP on the controller. At the transformer, G0 should be connected to protective earth. This is to get an grounding point for interference diversion.
6. To ensure that the specified measuring accuracy is achieved, the two M terminals must be connected to the wall module.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Safety Standard

Transformers supplying the controller must comply to the safety standard EN 60 742 or any other relevant safety standard for ELV, 24 V AC. ETL listing: UL 3111-1, first edition and CAN/CSA C22.2 No. 1010.1-92. When connecting equipment that has an independent power supply, the power supply must also comply with this norm.

Cable Lengths

For information on communication cable lengths, see TAC Xenta Network Guide, part number 0-004-7460. For all other cables, maximum length is 30 m (100 feet) and min. area is 0,7 mm^2 (AWG-19).

The Wall Modules

The STR100-104 is primarily intended for use with the Xenta 104-A. For more information about how to connect and configure wall modules, please refer to the documentation for each respective product.

Connection Terminals

The designation of the connection terminals can be seen in two places on the controller: on the edge of the printed circuit board, and on the label on the front of the controller.

Table 3.1: Connection Terminals

Termin.	Design.	Function	Type
1	C1	TP/FT-10 communication channel	-
2	C2	TP/FT-10 communication channel	-
3	X3	Alarm (option)	Digital input
4	M	Measurement neutral	-
5	X2	Fan status	Digital input
6	B2	Discharge/mixed air temperature sensor	Thermistor input
7	M	Measurement neutral	-
8	U1	OA/discharge air temperature sensor	Thermistor input
9	D1	LED on wall module	Digital output
10	M	Measurement neutral	-
11	X1	Bypass button on wall module	Digital input
12	R1	Setpoint offset dial on wall module	10 kΩ linear potentiometer
13	M	Measurement neutral	-
14	B1	Room temperature sensor	Thermistor input
15	G	24 V AC (G)	Input
16	G0	24 V AC (G0)	Input
17[a]	OP	24 V AC supply for TAC Xenta OP	-
18	G	24 V AC supply for TAC Xenta OP	-
19	V1	Heating actuator: increase	Triac output
20	VC1	24 V AC (G) supply for V1, V2	-
21	V2	Heating actuator: decrease	Triac output
22	V3	Cooling stage 1	1st stage output
23	VC2	24 V AC (G) supply for V3, V4	-
24	V4	Cooling stage 2	2nd stage output
25	M	Measurement neutral	-
26	YI	Economizer actuator	Analog output
27	K1	Fan relay	Relay output
28	KC1	Fan relay	Relay output

a. Connected to G0 on the wall module. Do **not** connect to G0 on the controller.

3.2.2 Wiring of TAC Xenta 104 as Typical RTU or HVAC Unit

Read Chapter 3.2.1, “General”, on page 20 before you connect the cables as shown in the wiring diagram in Fig. 3.3.

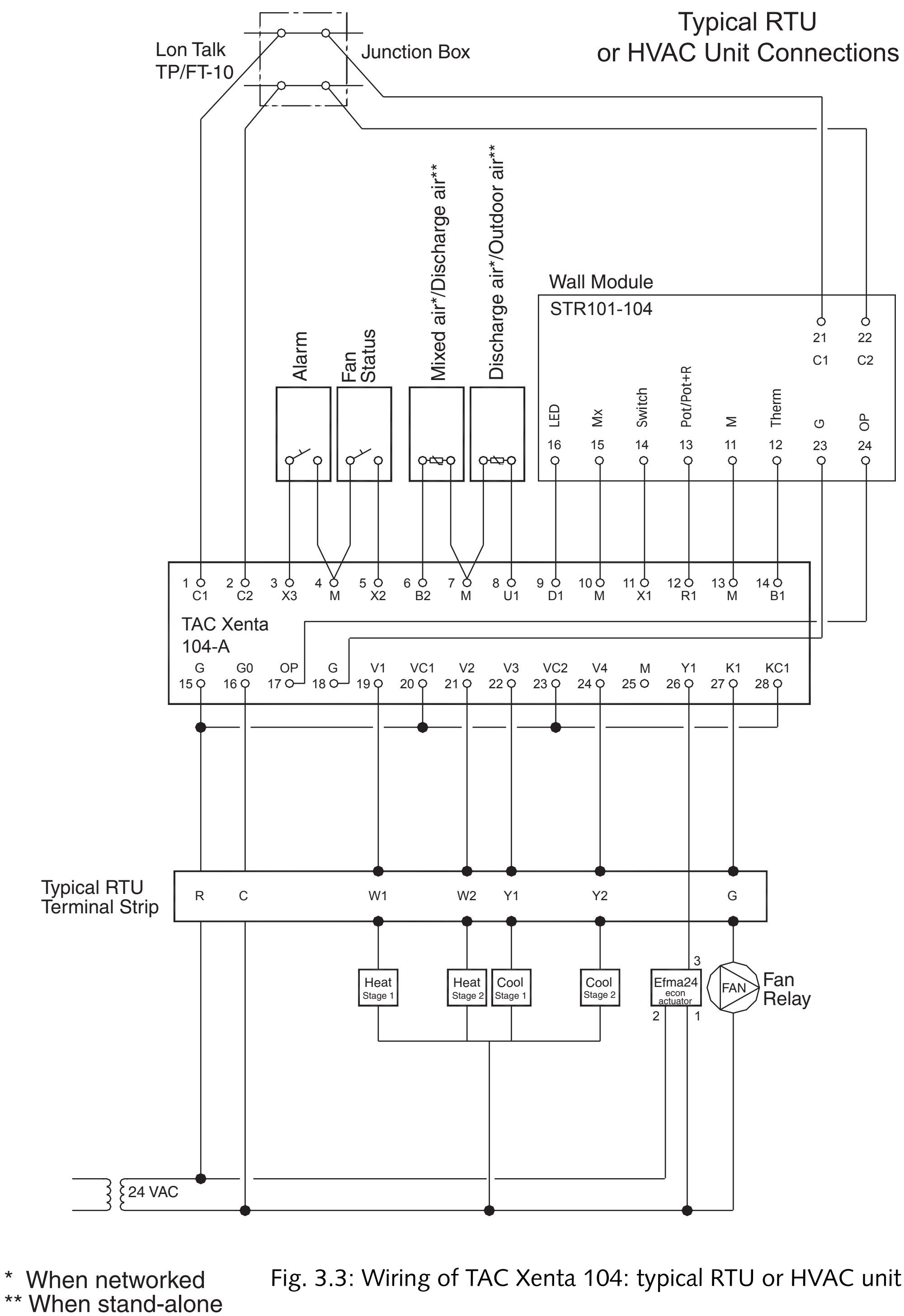
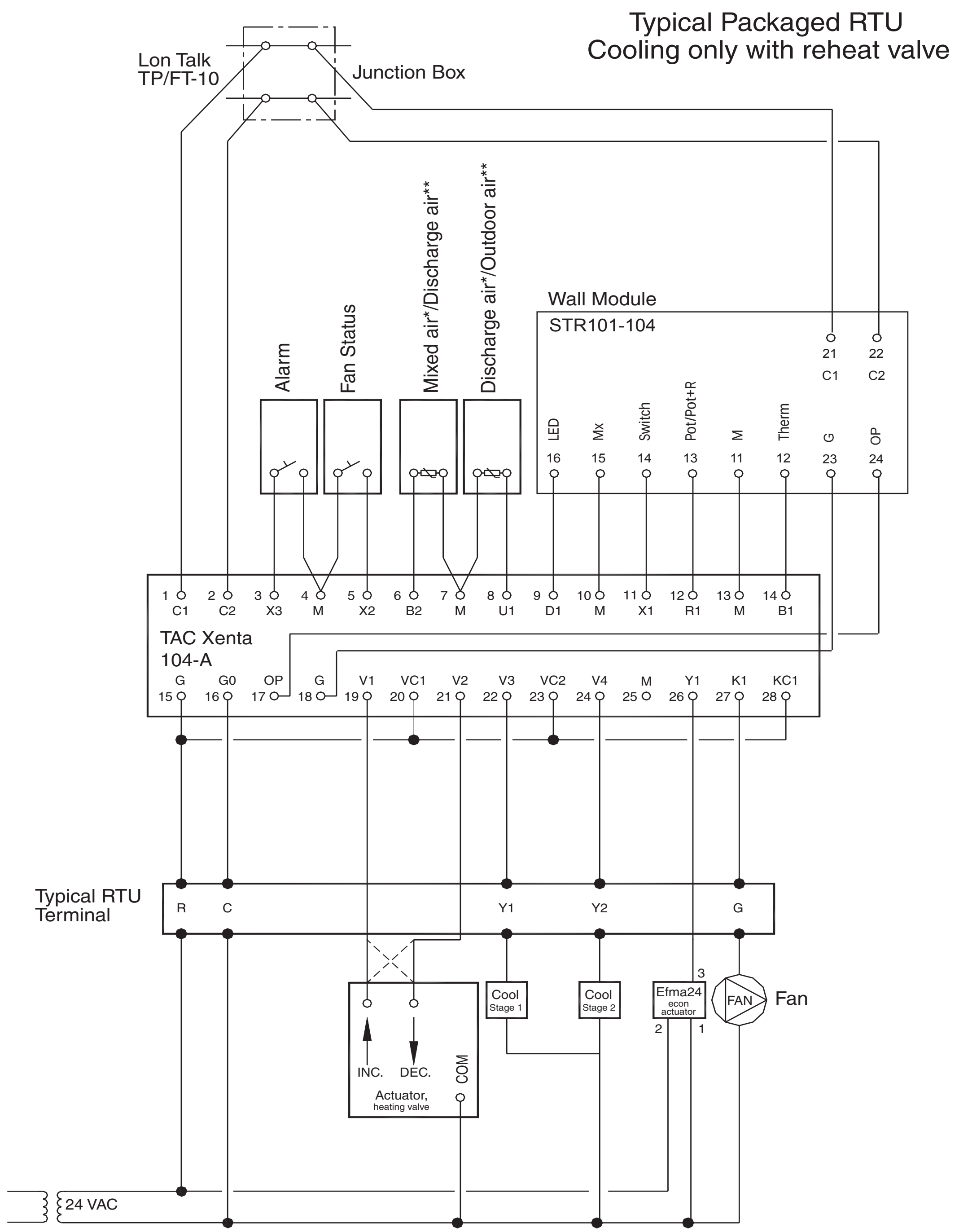


Fig. 3.3: Wiring of TAC Xenta 104: typical RTU or HVAC unit

3.2.3 Wiring of TAC Xenta 104 as Typical Packaged RTU

Read section Chapter 3.2.1, “General”, on page 20 before you connect the cablesas shown in the wiring diagram in Fig. 3.4.

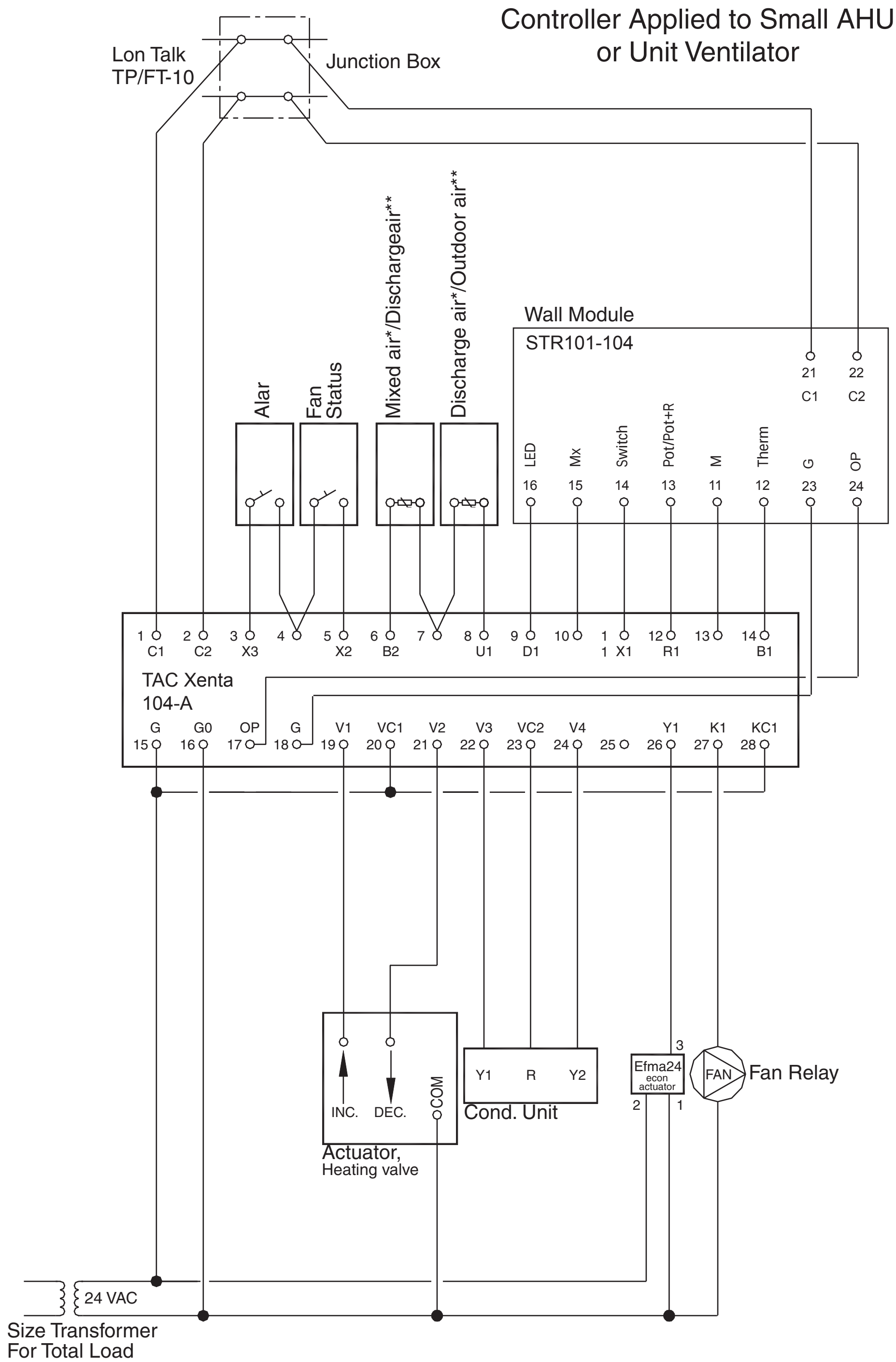


* When networked
** When stand-alone

Fig. 3.4: Wiring of TAC Xenta 104: typical packaged RTU

3.2.4 Wiring of TAC Xenta 104 as Controller Applied to Small AHU

Read section 3.2.1 “General” before you connect the cables as shown in the wiring diagram in Fig. 3.5.



* When networked
** When stand-alone

Fig. 3.5: Wiring of TAC Xenta 104: controller applied to small AHU

3.2.5 Connecting to STR150

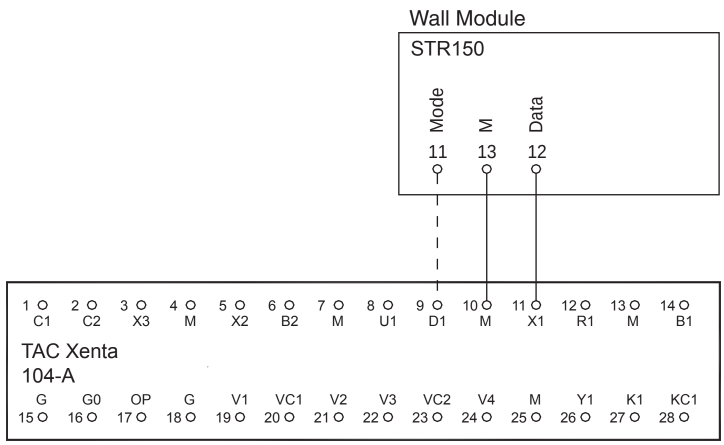


Fig. 3.6: Connecting to STR150

3.3 Commissioning

3.3.1 General

Once the mechanical and electrical installations have been completed the controller can be commissioned. This means:

- Installing the controller on the network, setting the node status and giving it an address.
- Setting the controller's configuration parameters.
- Bind network variables.
- Test the functions.

Before commissioning a complete zone system, read the “TAC Xenta - Zone Systems Guideline”.

The TAC Xenta OP can be used to set the basic parameters. Use a network management tool or TAC Vista for commissioning the controller on the network.

How to use the TAC Xenta 100 as a stand-alone unit:

1 Use TAC Xenta OP to set the node status to "Configured".

2 Use TAC Xenta OP to set the basic parameters.

3 Use TAC Xenta OP to set all other parameters and variables.

Commissioning can also be achieved using a network management tool.

3.3.2 Node Status

The node status indicates which network configuration or program mode the controller is in. The node status can be changed using TAC Vista (version 3.1 or later) and the network management tool. TAC Xenta OP can also be used on some occasions. The controller can be in these states:

Unconfigured

The controller is not configured when it leaves the factory. Neither the program nor the network communication are running. The service light emitting diode is flashing.

The controller must be configured before it can operate in a network (on line) see below.

You cannot set configuration parameters or network variables in this state.

Configured, Online

Use the TAC Xenta OP, TAC Vista or a network management tool to change the status to configured. When this has been done, the program and the network communication will be fully operational. The service LED is off. This is the normal state for a controller when it is operating.

The controller will use the address given by the tool during configuration. As TAC Xenta OP cannot be used to set an address, all controllers are given a default address. Therefore all controllers get default addresses. This means that TAC Xenta 100 can only be used as a standalone controller and cannot be used in a network.

The parameters and variables can now be set.

Configured, Soft Online

A network management tool is needed for this operation. The controller is programed and configured for a network, but the program and communications are idle. The light emitting diode is off. If the controller is reset, it will go into configured, online.

Configured, Hard Online

A network management tool is needed for this operation. The controller is programed and configured for a network, but the program and communications are idle. The light emitting diode is off. If the controller is reset, it will remain in this state.

Without a Program and Not Configured

This states indicates that there is something wrong with the controller. No program can be detected. The light emitting diode is lit.

3.3.3 Configuration Parameters (nci's)

TAC Xenta 100 has a number of configuration parameters that can be used to set the parameters of the controller. See Chapter 4, "Configuration Parameters", on page 31. There are also network variables to control the controller during when it is operating.

Use the commissioning protocol in Appendix B to write down your settings when commissioning. Chapter 8, "Communication", on page 57 contains information about all parameters and variables, such as their index, accepted values, normal values. Detailed descriptions of the parameters and variables can be found in Chapter 4, "Configuration Parameters", on page 31, in Chapter 5, "Functional Description", on page 37 and in Chapter 6, "Trouble-shooting", on page 51.

3.3.4 Network Installation

For network installation, you need either a network management tool (LNS based or not) or TAC Vista. Examples of network management tools are MetraVision and ICELAN-G. Here you find brief information on how this is made.

The installation has two steps:

1. Feed information about the controllers' unique neuron-ID into the network management tool's data base.
2. Allow the network management tool to install the controller on the network. The controller will automatically be given an address.

There are two ways to feed the neuron-ID into the data base:

1. Manually feed the neuron-ID into the network management tool. To make this easier you can use a bar code reader to read the detachable ID-neuron label that is attached to every controller. It can be a good idea to collect these labels when you make the basic configuration, and stick them to a form, drawing or similar. There is a form for this purpose in the manual "TAC Xenta, Guidelines for zone applications" .
2. Use the service pin function. You can only do this when the controller is connected to the network. There is a service pin key in a hole in the upper left hand corner of the controller by terminal C1. Push the key to instruct the controller to send out its neuron-ID. The network management tool can then read the neuron-ID from the network and save it in its data base.

Fore more information see "TAC Xenta, Guidelines for zone applications".

3.3.5 Network Variable Binding

The binding method is determined by the type of network management tool to be used. Detailed information can be found in the tool's documentation. A description of how network variables are bound with Metra Vision can be found in the "TAC Xenta Network manual".

Binding network variables is not an issue when the controller is used in a stand-alone operation.

3.3.6 Function Test

Check that the controller works as intended.

All the controller’s functions are described in Chapter 5, “Functional Description”, on page 37.

Trouble-shooting is described in Chapter 6, “Trouble-shooting”, on page 51.

4 Configuration Parameters

All communication with the controller is made using network variables.

- *nci's* are used to configure the controller. *nci's* are normally set during commissioning, and are not altered during normal operation (the parameters are stored in a special memory, and can be changed a maximum of 10 000 times).
- *nvi's* control the controller during operation,
- *nvo's* are output variables, which the controller sends out on the network.

Chapter 8, "Communication", on page 57 contains detailed information about accepted values and normal values for all parameters. All configuration parameters have default values on delivery.

4.1 Basic Parameters

nciAppOptions

These parameters are used to set selectable functions in the controller. The parameter consists of 16 bits, where each bit represents one function choice. The bits 10 through 13 are not used. When you look at *nciAppOptions* with TAC Xenta OP, bit 0 is shown to the left.

Table 4.1: The function of different bits in *nciAppOptions*.

Bit no.	Function	
Bit 0		Not used
Bit 1		Not used
Bit 2	0	2-stage heating
	1	Tri-state heating
Bit 3	0	Fan cycling on room temperature
	1	Continuous fan
Bit 4	0	Read outdoor temperature (U1)
	1	Read SNVT *nviOutsideTemp*
Bit 5	0	Read outdoor or discharge temperature. Econo Lockout using *nviOutsideTemp* (Deg).
	1	Read enthalpy value. Econo Lockout using *nviOutsideTemp* (Ent).
Bit 6 - 13		Not used
Bit 14	0	ZS, STR101-104 or STR350/351wall modules
	1	STR150 wall module with display
Bit 15		Reserved for production test. Should not be altered!

Bit 6 through bit 13 are not used.

4.2 Other Configuration Parameters

The controller's other configuration parameters are listed below together with a short description. See also Chapter 8, “Communication”, on page 57.

Index	Name	Description
0	*nciLocation*	Location label
18	*nciSetpoints*	Occupancy temperature setpoints
19	*nciSpaceTempLow*	Low limit of zone temperature
20	*nciSpaceTempHigh*	High limit of zone temperature
21	*nciSpaceTempOfst*	Offset of zone temperature
22	*nciGainEcon*	Gain for economizer controller
23	*nciItimeEcon*	Integral time economizer controller
24	*nciGainHeat*	Gain for heating controller
25	*nciItimeHeat*	Integral time heating controller
26	*nciGainCool*	Gain for cooling controller
27	*nciItimeCool*	Integral time cooling controller
28	*nciClgLocStpt*	Cooling lock-out setpoint
29	*nciEcoLocStptDeg*	Economizer lock-out setpoint degrees
30	*nciEcoLocStptEnt*	Economizer lock-out setpoint enthalpy
31	*nciEconoMin*	Minimum position economizer
32	*nciHeatActStTime*	Stroke time for heating actuator
33	*nciShrtCycleTime*	Minimum compressor intervals
34	*nciMixAirTempLow*	Low limit of temperature for mixed air
35	*nciDischAirMin*	Min. limit discharge air
36	*nciDischAirMax*	Max. limit discharge air
37	*nciInstallType*	Source for network configuration
38	*nciSndHrtBt*	Send heartbeat
39	*nciRcvHrtBt*	Receive heartbeat

nciLocation

nciLocation is used to make a label for the actual place where the controller is installed. In the operating panel, this parameter is shown as the first variable.

nciSetpoints

nciSetpoints is used to set the setpoint temperatures for heating and cooling in the different operation modes: occupied and off mode (see section Chapter 5.2.1, “Operation Modes”, on page 38 and Chapter 5.2.4, “Setpoint Calculation”, on page 40).

nciSpaceTempLow, nciSpaceTempHigh

nciSpaceTempLow and *nciSpaceTempHigh* are used to set an alarm setpoint, lowest and highest zone temperatures. Default value 50/86 °F (10/30 °C).

nciSpaceTempOfst

nciSpaceTempOfst is used to adjust the reading from the temperature sensor or *nviSpaceTemp*. Default value 0.

nciGainEcon, nciGainHeat, nciGainCool

nciGainEcon, *nciGainHeat* and *nciGainCool* are used for setting the gain for the economizer and heating/cooling controllers. Default value 25.

nciItimeEcon, nciItimeHeat, nciItimeCool

nciItimeEcon, nciItimeHeat and *nciItimeCool* are used to sett the I-time for the economizer and heating/cooling controllers. Default value 900 s (15 min).

nciClgLocStpt

nciClgLocStpt is used to set the cooling lock-out setpoint.

nciEcoLocStptDeg, nciEcoLocStptEnt

nciEcoLocStptDeg and *nciEcoLocStptEnt* contains the lock-out setpoints for the economizer, in degrees and enthalpy. Default values 64 °F / 0 (18 °C / 0).

nciEconoMin

nciEconoMin contains the minimum position for the economizer damper. Default value 0%.

nciHeatActStTime

nciHeatActStTime is set according to the stroke time of the actuator.

nciShrtCycleTime

nciShrtCycleTime is used to set a minimum allowed time between compressor run sessions.

nciMixAirTempLow

Alarm setpoint for low mixed air temp. Default value 46 °F (8 °C).

nciDischAirMin, nciDischAirMax

nciDischAirMin and *nciDischAirMax* are used to set the allowed maximum/minimum temperatures. Effective in cascade tri-state control as well as two stage (see Chapter 5.3.2, “Cooling”, on page 44). Default values 50/95 °F (10/35 °C).

nciInstallType

nciInstallType is only used during free-standing operation and is set to show that the node itself should define its address (see Chapter 8.5.3, “The Node Object’s Configuration Parameters (nci)”, on page 60).

nciSndHrtBt

nciSndHrtBt is used to decide how often the *nvo’s*, which are sent out on the network regularly, should be sent (see Chapter 8.3, “Monitoring Network Variables, Heartbeat”, on page 58).

nciRcvHrtBt

nciRcvHrtBt is used to decide the maximum time there can be between updating the nvi’s, for which the controller expects continuous updating (see Chapter 8.3, “Monitoring Network Variables, Heartbeat”, on page 58).

5 Functional Description

5.1 General

The controller's function is determined by its node status (Chapter 3.3.2, "Node Status", on page 27), operations (Chapter 5.2.1, "Operation Modes", on page 38) and the methods used to force the controller (Chapter 5.2.2, "Application and Emergency Modes", on page 39) for well-adapted zone temperature control.

The controller measures the zone temperature, the outside or mixed air temperature and uses various methods to calculate setpoints. Apart from the basic functions the controller can also use a variety of methods to control the climate in the zone. These are described in Chapter 5.3, "More About Functions", on page 43.

Each section in this chapter ends with information about how network variables are used in the current control situation. If you need details about the network variables' characteristics, such as default values and accepted values see Chapter 8, "Communication", on page 57.

5.2 The Controller's Basic Functions

5.2.1 Operation Modes

The controller has three operation modes:

- Occupied
- Bypass
- Unoccupied

The operation mode is controlled by *nviManOccCmd*, but is also influenced by the bypass button on the wall module. The relationship between operation modes is shown in Table 5.1, "The relationship between desired operation, bypass timer and current operation mode." The controller's values during stand-alone operation are also shown.

Table 5.1: The relationship between desired operation, bypass timer and current operation mode.

Desired operation *nviManOccCmd*	**Bypass timer**[a]	***nvoEffectOccup***
Occupied OC_OCCUPIED		OC_OCCUPIED
Unoccupied OC_UNOCCUPIED	Enabled	OC_BYPASS
	At a stand-still	OC_UNOCCUPIED
Stand-alone OC_NUL		OC_OCCUPIED

a. Activated by the bypass button on the wall module

Occupied Mode

Occupied Mode is default mode that is to say when someone is in the zone the controller should ensure that the climate in the room is comfortable. The controller is in this mode when *nviManOccCmd* = OC_OCCUPIED (or OC_NUL after a power down).

The LED on the wall module is lit with a steady red light and the setpoint knob on the wall module can be used to make manual settings. The setpoints used are found in *nciSetpoints* (can be modified).

The fan is on continously or during heating/cooling.

Bypass Mode

Change temporarily from unoccupied to occupied mode using the bypass button on the wall module.

Press the bypass key on the wall module to start the bypass timer and turn the controller into bypass mode. The bypass timer runs for two hours then the controller changes operation mode according to Table 5.1, "The relationship between desired operation, bypass timer and current operation mode.". The bypass mode acts as the occupied mode during two hours. Both setpoints and alarms operate as in occupied mode.

Unoccupied Mode

When the zone is not used for a longer period of time, the controller can be set in unoccupied mode. The controller is in this mode when *nviManOccCmd* = OC_UNOCCUPIED.

The light emitting diode on the wall module is out, and the fan is off, if there is no demand for heating or cooling. In such cases, the fan is running. The setpoint knob is blocked, but the bypass button is not. The setpoints used are found in *nciSetpoints*, unoccupied mode.

Index	Variable name	Description
1	*nvoEffectOccup*	Actual occupancy output
14	*nviManOccCmd*	Occupancy scheduler input
18	*nciSetpoints*	Occupancy temperature setpoints

5.2.2 Application and Emergency Modes

TAC Xenta 104-A is designed to control both heating, cooling, economizing, and to automatically change from heating to cooling as necessary..

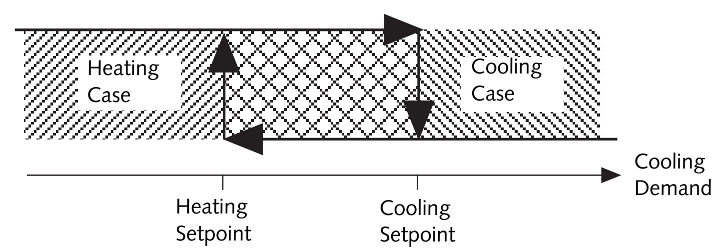


Fig. 5.1: Changeover between heating and cooling cases

You can force the controller to heat only or cool only, just as you can force it to neither heat nor cool, and to run the fan only. This is achieved using *nviApplicMode*, see Table 5.2, “The relation between nviApplicMode and forcing.”.

Table 5.2: The relation between *nviApplicMode* and forcing.

nviApplicMode	**Mode**	**Description**
HVAC_AUTO	Automatic (no forcing)	The controller automatically changes over between heating and cooling
HVAC_HEAT	Heating only	The controller can only heat. The cooling setpoint is neglected.
HVAC_COOL	Cooling only	The controller can only cool. The heating setpoint is neglected.
HVAC_FAN_ONLY	Fan only	The controller neither cools nor heats. The fan is running constantly.
HVAC_OFF	Off	The controller neither cools nor heats. The fan is at a stand-still.

Emergency Mode

In some situations, the damper has to be forced fully opened or closed. This is done with *nviEmergCmd*. The heating and fan control are disabled in emergency mode. The emergency mode has higher priority than all the other modes.

Table 5.3: The relation between *nviEmergCmd* and forcing.

nviEmergCmd	**Description**
EMERG_NORMAL	Normal control
EMERG_SMOKE_PURGE	Fully open damper (100%)
EMERG_SHUTDOWN	Fully closed damper (0%)

Index	**Variable name**	**Description**
10	*nviApplicMode*	Application mode input
11	*nviEmergCmd*	Emergency command input

5.2.3 Measuring Zone Temperature

You can measure the zone temperature either with a permanent thermistor sensor (usually the wall module) or with a LonTalk temperature sensor node connected to *nviSpaceTemp*. If *nviSpaceTemp* has a valid value the controller will use it, if it doesn't the thermistor value will be used. The thermistor value (or a value from the network) can be adjusted by *nciSpaceTempOfst* having received a value; the value is added to the thermistor value. The value the controller uses is also put out on *nvoSpaceTemp*. If neither value is valid, *nvoSpaceTemp* will receive the off value.

nvoSpaceTemp is sent when it has changed by at least 0.1°C.

Table 5.4: Measuring Zone Temperature

Index	**Variable name**	**Description**
6	*nvoSpaceTemp*	Zone temperature output
12	*nviSpaceTemp*	Zone temperature input
21	*nciSpaceTempOfst*	Zone temperature sensor adjustment

5.2.4 Setpoint Calculation

Zone Temperature Setpoints

nciSetpoints define four temperature setpoints; heating setpoint occupied mode, cooling setpoint occupied mode, heating setpoint unoccupied mode and cooling setpoint unoccupied mode.

The smallest accepted deviation between the heating and cooling setpoints is 0.5 °C, and the heating setpoints must be lower than the cooling setpoints. If the heating setpoints are higher or equal to the cooling setpoints, the controller resets the heating setpoint to 0,5 °C lower than the cooling setpoint. Table 5.5, “The setpoints in nciSetpoints” shows accepted values and default values for the four temperature setpoints in *nciSetpoints*.

The setpoints for occupied mode are basic setpoints, which can be changed with *nviSetpoint*, *nviSetPntOffset* and the setpoint knob. The unoccupied mode setpoints are always valid.

Table 5.5: The setpoints in *nciSetpoints*

Setpoint	*Min.*	*Max.*	*Normal*
Cooling setpoint occupied	*10 °C*	*35 °C*	*24 °C*
Heating setpoint occupied	*10 °C*[a]	*35 °C*	*22 °C*
Cooling setpoint unoccupied	*10 °C*	*35 °C*	*28 °C*
Heating setpoint unoccupied	*10 °C*[a]	*35 °C*	*16 °C*

a. If the cooling setpoint is 10 °C, the heating setpoint is set to 9,5 °C.

Calculation

The current setpoint, *nvoEffectSetpt*, depends on the current operation mode, *nvoUnitStatus*, the desired operation mode, *nviApplicMode*, and *nviSetpoint*, *nviSetpntOffset*, *nciSetpoints* and a possible local setpoint adjustment via the wall module.

nviSetpoint is used to allow the temperature setpoints in occupied mode to be changed via the network. If there is a valid value on *nviSetpoint*, the controller uses this value as a new basic setpoint when calculating effective setpoints. Heating and cooling setpoints will thus be half of the deadband ((Occupied Heat – Occupied Cool)/2) apart from *nviSetpoint*.

nviSetPntOffset can be seen as a setpoint adjustment from a wall module connected to the network. Its value is added to setpoints for occupied mode.

Index	Variable name	Description
2	*nvoUnitStatus*	Unit status output
5	*nvoEffectSetpt*	Actual setpoint output
10	*nviApplicMode*	Application mode input
13	*nviSetPoint*	Temperature setpoint input
14	*nviSetPntOffset*	Setpoint offset input
18	*nciSetpoints*	Occupancy temperature setpoints

5.2.5 Control Sequence with TAC Xenta 104-A

Without Economizer

The zone temperature is controlled by one or two stages, which either heats or cools. The fan is normally only on during heating or cooling, but can also be configured to run continously. Figure 5.2 shows the control sequence:

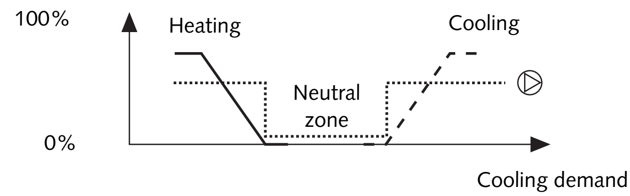


Fig. 5.2: Control sequence for TAC Xenta 104-A without economizer

With Economizer

The zone temperature is controlled by a combination of one or two stages of heating and cooling aided by an economizer.

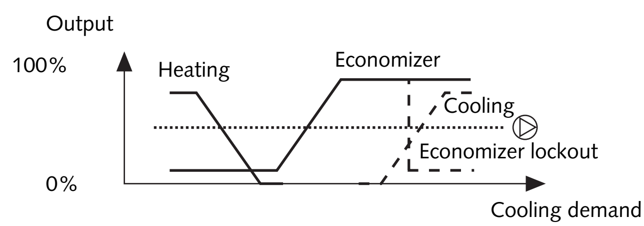


Fig. 5.3: Control sequence for TAC Xenta 104-A with economizer

5.2.6 Fan Control

The fan can be in two different modes, chosen in bit 3 of *nciAppOptions*:

Continuous Operation

The fan is on continuously during occupied and bypass modes.

Cycling with Heating/Cooling

When fan configuration is set for cycling, the fan will be off until the zone temperature controller calls for heating or cooling and the zone temperature and effective setpoint deviates more than 0.5 °C. The fan will be turned off when the deviation is less than 0.2 °C.

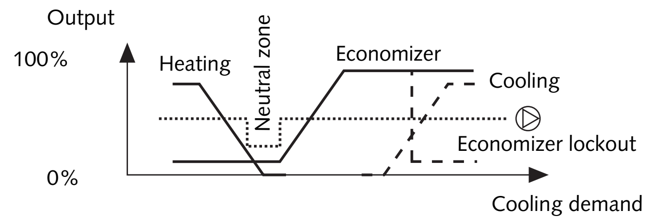


Fig. 5.4: Control sequence for TAC Xenta 104-A with economizer

Index	Variable name	Description
17	*nciAppOptions*	Application options

5.3 More About Functions

5.3.1 Heating

General

When the zone temperature falls below the present heating setpoint, heating outputs will be staged On in sequence. If tri-state heating is selected, the increase output will begin to pulse On to open the tri-state heating valve. When the heating setpoint is satisfied, the two stage heating outputs will sequence off. If tri-state heating is selected, the decrease output will begin to pulse On to close the tri-state heating valve. When the zone temperature rises above the present cooling setpoint, cascade mixed air temperature control will modulate the economizer damper if the economizer is enabled via the floating lockout setpoint. When the economizer reaches 100%, or if the economizer is locked out, the two cooling outputs will be staged On in sequence. This cooling sequence is reversed as the room temperature falls below the cooling setpoint.

Staged Heating Control

The heating outputs are controlled by a PI regulator that looks at room temperature as its input. If heating is allowed it will sequence on the two outputs. The heating outputs do not have a fixed delay set point. The timing and delay function is a result of the PI regulator.

Tri-state Heating Control

The heating outputs can be configured as tri-state control for controlling a heating valve in Unit Ventilator or small AHU applications. When tri-state is selected and the outdoor temp. is supplied as an NV (in a networked system), the heating controller looks at the sensor connected to terminal U1.

When used as a stand alone controller (U1 used for outdoor air), the heating controller instead looks at the sensor connected to terminal B2 and uses this value for heating as well as economizer control.

If a thermal actuator is used for heating and some modulation is desired then it must be connected to the increase output. Also the P and I band must be set very low to cause the output to be operating as soon as a need for heat exists. When heating demand is 100% the output will be on continually.

Lockout

The heating control is locked out on a loss of fan proof. If tri-state heating control is selected, tri-state valve control remains enabled for heating coil protection.

Heating controller	
Type:	PI
Gain:	0-32,75; normal value: 25
I-time:	0-60 minutes; normal 15 minutes
Dead band:	0,2 °C
Run time:	5-600 s; normal 165 s
Control interval:	15 s

5.3.2 Cooling

Control

The cooling outputs are controlled by a PI regulator that uses room temperature as its input. If cooling is allowed and outdoor temperature is above cooling lockout setpoint it will sequence on the two outputs. The outputs have an adjustable anti-cycle timer for short cycle protection. An NV is available to read on the network to indicate the percent of cooling called for by the cooling regulator. The PI regulator tuning parameters can be adjusted via the TAC Xenta OP or an NV.

Night Free Cooling Mode

This can be accomplished by sending the opertaing mode “cooling only”, then sending an NV for reduced room temperature set-points, and sending an NV for cooling lockout.

Lockout

If the outdoor temperature sensor is connected and configured it will be used to determine cooling lockout. Cooling is locked out on a loss of fan proof.

Cooling controller	
Type:	PI
Gain:	0-32.75; normal value: 25
I-time:	0-60 minutes; normal 15 minutes
Dead band:	0.2 °C
Run time:	5-600 s; normal 165 s
Control interval:	15 s

5.3.3 Economizer

Control

The economizer will only function in the cooling or Auto changeover modes. The economizer will stay at the minimum position setpoint while heating in occupied or bypass mode. In unoccupied mode, the damer is closed. The economizer output is controlled via a PI regulator that normally uses the sensor connected to B2 as its input.

The economizer is active during cooling. There is a built in software lock to hold the economizer at 100% outdoor air position if the outdoor air is useful for cooling when any stage of mechanical cooling is on. This will provide maximum energy savings and prevent economizer damper hunting when the mechanical cooling is cycling on and off.

Lockout

There are three economizer lockout options. First, if the outdoor temperature sensor is connected and configured it will be used to determine economizer lockout. Second, if the outdoor sensor is not connected, an NV must be sent to give the controller the outdoor air temperature. Third, an enthalpy NV may be sent to the controller and an enthalpy lockout setpoint used to determine economizer operation. The economizer is also locked out on a loss of fan proof.

When the economizer reaches 100%, or if the economizer is locked out, the two cooling outputs will be staged On in sequence. This cooling sequence is reversed as the room temperature falls below the cooling setpoint.

A minimum economizer damper position is set to maintain minimum ventilation requirements.

5.3.4 Cascade Control

Cascade temperature control allows the zone temperature setpoint deviation to establish an inversely reset discharge and/or mixed air temperature setpoint decrease and vice versa. The minimum and maximum discharge and/or mixed air temperature setpoints can be adjusted using configuration parameters. Economizer and tri-state heating control are always based on cascade control.

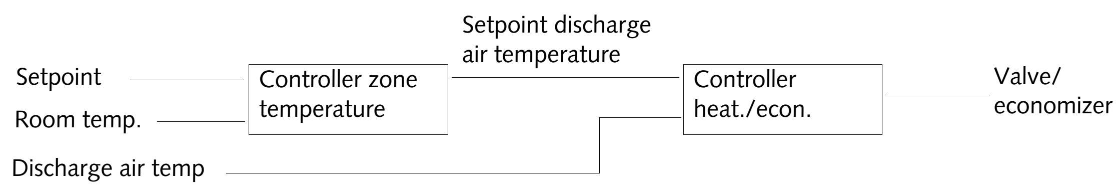


Fig. 5.5: Principal diagram cascade control

Zone temperature controller	
Type:	PI
Gain:	0-32,75; normal value: 25
I-time:	0-60 minutes; normal 15 minutes
Dead band:	0,2 °C
Control interval:	15 s

Index	Variable name	Description
7	*nvoDischAirTemp*	Discharge air temperature output
24	*nciAppOptions*	Application options
29	*nciDischAirMax*	Max. limit discharge air
30	*nciDischAirMin*	Min. limit discharge air

5.3.5 Networked Applications

In networked applications the outdoor air temperature is fed to the controller by *nviOutsideTemp*. Configuration variable *nciAppOptions* bit 4 set to 1. The outdoor temperature controls the economizer and compressor lockout functions.

The input B2 is connected to a sensor in the mixed air stream for economizer control. The temperature value is presented in *nvoDischMixTemp*.

Cooling control by stage 1 and stage 2 in sequence always use roomtemperature (input B1) as real value and controls against *nvoEffectSetpt*.

Two Stage-application (RTU)

Economizer control uses mixed air temperature (input B2) as real value and controls against setpoint from the cascade controller (set-value discharge air).

Heating control uses roomtemperature (input B1) as real value and controls against *nvoEffectSetpt*.

The input U1 can, if desired, be used for monitoring discharge air temperature in *nvoDischAirTemp* but no controlling functions will depend on this input.

Tri-State-application (Small Unit Ventilator- or Small AHU)

Economizer control uses mixed air temperature (input B2) as real value. Controls against setpoint from the cascade controller.

The input U1 should in this case be connected to a discharge air sensor. The value will be presented in *nvoDischAirTemp*. Heating control uses discharge air temperature as real value and controls against setpoint from the cascade controller.

5.3.6 Stand-alone Applications

In stand-alone applications the input U1 is used for measuring outdoor air temperature. This is selected by *nciAppOptions* bit 4 set to 0. The purpose is to control the economizer and compressor lockout functions. The outdoor temperature can be monitored (from software version 1.01 onwards) in *nvoDischAirTemp*.

Cooling control by stage 1 and stage 2 in sequence is always using roomtemperature (input B1) as real value and controls against *nvoEffectSetpt*.

Two Stage- application (RTU)

The input B2 is used for a discharge air sensor and can be monitored in *nvoDischMixTemp*. It supplies real value for the economizer loop and controls against setpoint from the cascade controller (set-value discharge air).Heating control uses roomtemperature (input B1) as real value and controls against nvoEffectSetpt.

Tri-State- application (Small Unit Ventilator- or Small AHU)

The input B2 is used for a discharge air sensor and will be used as real value for economizer control against setpoint from the cascade controller. The temperature value can be monitored in *nvoDischMixTemp*.

Heating control also uses discharge air temperature (input B2) as real value and controls against setpoint from the cascade controller.

5.3.7 Sensor Options

If the controller is networked, the sensor connected to terminal B2 should be used as a mixed air sensor for economizer control and a sensor connected to U1 should be used as a discharge air sensor if set up for tri-state heating control. Then an NV for outdoor air temperature has to be used.

If a controller is set up as a stand-alone RTU control, then the sensor connected to terminal U1 must be outdoor air temperature. This is used for economizer and compressor lockout. The sensor connected to terminal B2 is used for discharge air temperature.

If set up as a stand-alone small Unit Ventilator controller (tri-state), the sensor connected to terminal B2 must be installed in the discharge air stream since it will in this case be used as real value for both heating and economizer control.

If the controller is set-up using an NV for outdoor air temperature, the discharge air temperature can be monitored and displayed at the TAC Xenta OP (*nvoDischAirTemp*), TAC Vista® or bound to a NV in a TAC Xenta 300 or TAC Xenta 400.

This will allow you to provide a fully functional RTU control system either stand-alone or networked. In a network system you can display both the mixed and discharge air temperature for monitoring and diagnostics.

Index	Variable name	Description
7	*nvoDischAirTemp*	Discharge air temperature
24	*nciAppOptions*	Application options

5.3.8 Auxiliary Alarm Contact

TAC Xenta 104-A has an option for connecting an auxiliary alarm contact to input X3. An alarm is activated when the contact has been active for more than 3 minutes. See *nvoAlarmStatus*, bit 3 (Table 5.6, “nvoAlarmStatus”).

5.3.9 Fan Status Contact

To insure the function of the fan while heating and cooling, a fan status contact can be connected to input X2. An alarm is activated when there is no fan proof for more than 5 minutes while the fan is running. See *nvoAlarmStatus*, bit 0 (Table 5.6, “nvoAlarmStatus”). The alarm is activated also if the the fan proof signal is present for more than 5 minutes when the fan is supposed not to be running.

5.3.10 Alarm

When TAC Xenta 104-A reports alarms to a monitoring systemit it is achieved using the network variable *nvoAlarmStatus*. The variable has 16 bits, which corresponds to different alarm situations.

Table 5.6: nvoAlarmStatus

Bit no	Alarm	Cuts out when...	Is reset when...
0	Fan failure	No fan proof for more than 5 min. while running (all modes).	Fan proof retains
1	High zone temperature	The zone temp. is higher than the value in *nciSpaceTempHigh* for more than 60 min (all modes).	The controller no longer detects the state.
2	Low zone temperature	The zone temp. is lower than the value in *nciSpaceTempLow* for more than 60 min (all modes).	The controller no longer detects the state.
3	Auxiliary alarm	Alarm contact (X3) is active for more than 3 min.	The controller no longer detects the state.
4	Low discharge air temperature	The mixed air temp. is lower than the value in *nciMixAirTempLow* for more than 5 min.	The controller no longer detects the state.
10	Start not bound *nvi:s*	Power on.	When the first not bound network variables are received.
11	Adaptation of thermistor	Internal writing error in the controller memory.	The controller must be replaced.
12	Bound network variables not received	Bound network variables have not been received within set time. *nciRcvHrtBt*	When network variables have been received.
13	Not valid value on input	An input network variable gets outside its accepted values.	The variable gets an accepted value.
14	No application program	No valid application program.	The application program is loaded. Contact the nearest TAC service point.
15	Cannot write to EEPROM	The controller is faulty.	The controller must be replaced.

Index	Variable name	Description
4	*nvoAlarmStatus*	Alarm status output
19	*nciSpaceTempLow*	Low limit of zone temperature
20	*nciSpaceTempHigh*	High limit of zone temperature
34	*nciMixAirTempLow*	Low limit of mixed air temperature
39	*nciRcvHrtBt*	Receive heartbeat

6 Trouble-shooting

6.1 General

The TAC Xenta 104-A is a very reliable controller. However if problems do occur use the trouble-shooting tips in this chapter. If you need further help, please contact your nearest TAC service point.

6.2 Inputs and Outputs (nvi/nvo's)

The most important variables for information on the current status of the controller during operation, are the *nvo's* and the *nvi's*.

You can use these to check the controller's operation and remedy any faults or disturbances.

A list and short description of all the *nvi's* and the *nvo's* can be found below. In chapter 8, you can find comprehensive information about all variables' index, variable name, function, accepted values, normal values etc.

Index	Name	Description
1	*nvoEffectOccup*	Effective occupancy output
2	*nvoUnitStatus*	Unit status output
3	*nvoTerminalLoad*	Heating/cooling demand output. Positive value=cooling, negative value=heating
4	*nvoAlarmStatus*	Alarm status output (Table 5.6, "nvoAlarmStatus")
5	*nvoEffectSetpt*	Effective setpoint output
6	*nvoSpaceTemp*	Zone temperature output, also on input B1
7	*nvoDischAirTemp*	Discharge air temperature output, on input U1
8	*nvoDischMixTemp*	Mixed air temperature output, on input B2
9	*nviManOccCmd*	Occupancy scheduler input, choice of mode
10	*nviApplicMode*	Application options input (forcing the controller)
11	*nviEmergCmd*	Emergency command input
12	*nviSpaceTemp*	Zone temperature input, replaces input B1 at a valid value
13	*nviSetpoint*	Temperature setpoint input, which at a valid value, recalculates *nciSetpoints*
14	*nviSetpntOffset*	Setpoint offset
15	*nviOutsideTemp*	Outside temperature input, replaces input U1 at a valid value
16	*nviEnthalpy*	Outside enthalpy value for economizer lockout

6.3 Trouble-shooting Guide

What affects...	**Check...**
Operation?	• Bypass timer on wall module (X1). If you have pressed the bypass key, it takes 2 hours before the time expires. • How the content in *nvoEffectOccup* can be affected. See Chapter 5.2.1, “Operation Modes”, on page 38 on operation modes. • Order via network, *nviManOccCmd*.
Operation mode? (Forcing of controller)	• Chosen settings in *nciAppOptions* • Order via network, *nviApplicMode* • Outputs heating/cooling, *nvoUnitStatus, nvoTerminalLoad*, which are affected by normal control.
Control setpoint?	• Current operation mode, *nvoEffectOccup* • Current unit status, *nvoUnitStatus* • Set basic setpoints, *nciSetpoints* together with *nviSetpoint*. A not valid value in *nviSetpoint* gives the basic setpoints. See Chapter 5.2.4, “Setpoint Calculation”, on page 40. • *nviSetpntOffset* and/or the setpoint knob on the wall module. Results in +/- influence.
Read temperature?	• Physical reading (B1) or similar network variable, *nviSpaceTemp*. A valid value on the network overrides a physical reading. *nciSpaceTempOfst* can displace the value.
Read discharge air/ mixed air temperature?	• Only physical input (B2). This input can be used for several different sensor options (see Chapter 5.3.5, “Networked Applications”, on page 46). For cascade control according to choice with *nciAppOptions* , see Chapter 5.3.4, “Cascade Control”, on page 46.
That an alarm is set?	• Current values in *nciSpaceTempHigh* and *nciSpaceTempLow.*
The LED on the wall module?	• That the controller receives power when the LED is out. • The controller when the service LED is lit. This indicates that the controller does not work correctly and should be replaced. • The controller when the service LED is hit for 15 seconds and the goes out. This is not a fault, but an indication that the controller answers a “wink” command from the network. • Current operation.

7 Technical Data

7.1 Technical Data

Power

Supply voltage:		
TAC Xenta 104-A 24 V AC	–10% +20%	50–60 Hz
Power consumption:		
Controller with TAC Xenta OP		4 VA
Actuator supply		max. 12 VA
Digital outputs		max. 4×19 VA = 76 VA
Total		max. 92 VA

Ambient temperature:

Operation	–13 °F – +122 °F (–25 °C – +50 °C)
Storage	–13 °F – +122 °F (–25 °C – +50 °C)
Humidity	max. 90% RH, non-condensating

Enclosure

Material	ABS/PC-plastic
Protection	IP 30
Color	gray/red
Dimensions	126×122×50 mm (4.96"x4.80"x2")
Weight	0,4 kg (0.88 lb)

Inputs/Outputs

Inputs X2–X3 for fan status and alarm sensor:	
Voltage open contact	23 V DC ± 1 V DC
Current closed contact	4 mA
Min. pulse width	15 s
Outputs V1–V4, for heating/cooling (triac):	
Type of actuator	increase/decrease
Min. output voltage	supply voltage – 1,5 V
Max. load	0,8 A
Relay output for fan on-off control, K1 and KC1:	
Max. voltage	24 V AC
Max. load	2 A
Input for bypass button on wall module, X1:	
Min. pulse width	250 ms
Inputs for zone temperature and discharge/mixed air temperature sensors, B1,B2 and U1:	
Thermistor type NTC	1800 W at 25 °C (77 °F)
Measuring range	+14 °F – +122 °F (–10 °C – +50 °C
Accuracy	±0.4 °F (±0,2 °C)
Input setpoint adjustment on wall module, R1:	
Type	10 kW linear potentiometer
Adjustment range	±9 °F (±5 °C)
Accuracy	±0,2 °F (±0,1 °C)

Application program:

Cycle time	15 s

LED (light emitting diode) colour:

Power	green
Service	red

Compatibility:

Standard conforms to	LonMark® Interoperability Guidelines and LonMark Functional Profile: RTU Controller
Network protocol	LonTalk®
Channel	TP/FT-10, 78 kbps
Neuron® type 3150®	10 MHz

Standards/Norms:

Emission	EN 50081-1
Immunity	EN 50082-1
Safety	EN 61010-1
ETL listing UL 3111-1	first edition CAN/CSA C22.2 No. 1010.1-92
Flammability integrated materials	UL 94 V-0
CE mark	complies with requirements

Part number:

TAC Xenta 104-A	0-073-0591
Terminal kit, TAC Xenta 100	0-073-0914
Diskett with external interface files (XIF) for TAC Xenta 100 series	0-008-5582

7.2 Dimensions

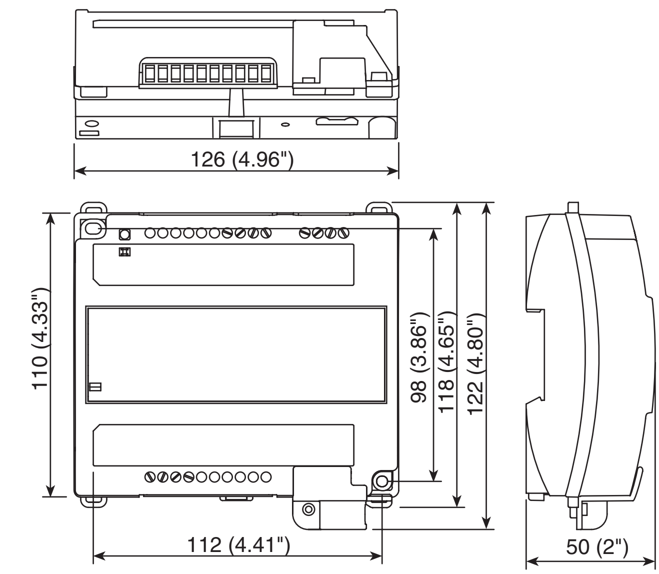


Fig. 7.1: Dimensions for TAC Xenta 104

8 Communication

8.1 General

The controller consists of two LonMark objects: the node object and the controller object. These objects are monitored using the network variables *nviRequest* and *nvoStatus*.

The network variable *nciLocation* is used when configuring the basic parameters to give a detailed description of the actual place where the controller is fitted. The variable receives an arbitrary string of signs and dividers as long as the string is no longer than 30 signs. You can program a specific location label for example.

TAMF.main.floor3.room343/RC40

A LNS based network management tool uses *nciLocation* when a data base needs to be recreated. The monitoring of an installed network is made by the LNS tool reading *nciLocation*, and then using the information to give the node a subsystem name and a unit name. The string should therefore consist of a name and a search path for the subsystem, followed by a slash and the unit name, i.e.

system.subsystem[.subsystem...]/unit name

8.2 Default Settings and Power on

For all network variables the following settings are valid:

- Number of sent messages per time unit: NONE
- Service type: NOT CONFIRMED if not stated otherwise
- Access check: NO, possible to configure: YES.
- Polled: NO for all nvo and nci, YES for all nvi (starting up)
- Synchronized: NO
- Change/update only when the controller is not active on the network; flags = NO
- Restart of TAC Xenta 104 after change; flags = YES

All network variables have the same index as they have in the menu tree in the operator panel TAC Xenta OP. They represent the order in which they have been declared in the system program; as the order is important for the variables' self documentatory string. The variables are of a standard type or so called SNVT The values that each SNVT can receive are listed in the tables in this chapter. Apart from SNVT, there are also standard configuration parameters (SCPT) and parameter types for user configuration (UCPT). To learn more about which SNVT/SCPT/UCPT there are and the values they can receive, please see the “The SNVT Master List and Programmer's Guide” on www.lonmark.org.

At power on, all variables for inputs and outputs (*nvi* and *nvo*) receive their default values. On a restart, as the configuration parameters (*nci*) retain their earlier set values. After a restart, every *nvi’s* will send a request to all *nvo’s* they are bound to (a poll).

8.3 Monitoring Network Variables, Heartbeat

In TAC Xenta 104-A there is a function, called Heartbeat, which can be configured to monitor input and output variables on the network.

In the overviews in this chapter, you can see whether the variable is monitored with Heartbeat in the column Hb.

Inputs

Some of the inputs in TAC Xenta 104-A are monitored in a way that the variable must receive values within a certain time for it to be regarded as valid. If no value is received within this time, the variable will return to its default value. An alarm will also be enabled, bit 12 in *nvoAlarmStatus*.

Which outputs are monitored in this way, you find in the list of network variables in Chapter 8.6.1, “The Controller Object’s Inputs (nvi)”, on page 62.

The time is set with the variable *nciRcvHrtBt*. Its default value is 0.0, which means that no monitoring is performed.

Outputs

The bound outputs are normally sent out when they are changed. Most outputs in TAC Xenta 104-A are monitored, so even if the values are not changed, they are sent out at even intervals.

Which outputs are monitored in this way, you find in the list of network variables in Chapter 8.6.2, “The Controller Object’s Outputs (nvo)”, on page 63.

The time is set with the variable *nciSndHrtBt*. Its normal value is 0.0, which means that no monitoring is performed.

8.4 Not Accepted Values

All *nvo’s* are limited to their accepted values, an all nvi’s detect whether the incoming value is within the accepted limits. If the value is not accepted, the controller activates bit 13 in the variable for alarm handling, nvoAlarmStatus. For a nvi, the controller uses the off value, which is also counted as an accepted value.

8.5 The Node Object

The variables in the node object (Fig. 8.1) are divided into three categories:

- Mandatory (M)
- Optional (O)
- Configuration properties (C)

The category “Mandatory” contains all compulsory variables[1], “Optional” contains selectable variables, and ”Configuration properties” contains the configuration parameters.

Note! The network variables’ indeces are not the same as the figure in “nv” in the figure.

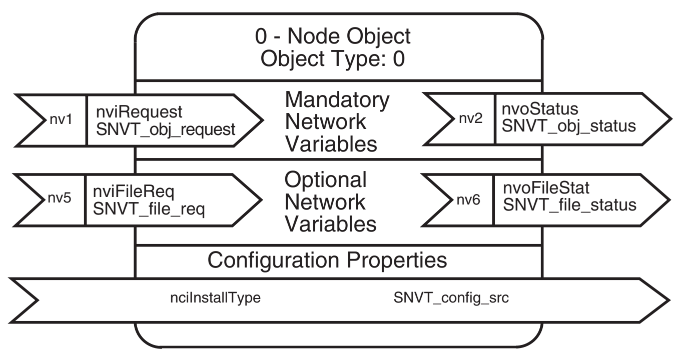


Fig. 8.1: The node object

1. According to LonMark standardised function profil for RTU controllers

8.5.1 The Node Object's Inputs (nvi)

Table 8.1: The Node Object's Inputs (nvi)

Index	Variable	Hb[a]	SNVT	Accepted values (Service type)	Default value	Description (self doc. string)
40	nviRequest	No	SNVT_obj_request	0=RQ_NORMAL 2=RQ_UPDATE_STATUS 5=RQ_REPORT_MASK	RQ_NUL (Confirmed)	Object request @0|1
42	nviFileReq	No	SNVT_file_req	see "SNVT Master List"	FR_NUL (Confirmed)	File request @0|5

a. Hb=Heartbeat

8.5.2 The Node Object's Outputs (nvo)

Table 8.2: The Node Object's Outputs (nvo)

Index	Variable	Hb[a]	SNVT	Accepted values (Service type)	Default value	Description (self doc. string)
41	nvoStatus	No	SNVT_obj_status	invalid_id (0..1) invalid_request(0..1)	Alla = 0 (Confirmed)	Object status @0|2
48	nvoFileStat	Yes	SNVT_file_status	see "SNVT Master List"	FS_NUL (Confirmed)	File status @0|6

a. Hb=Heartbeat

8.5.3 The Node Object's Configuration Parameters (nci)

Table 8.3: The Node Object's Configuration Parameters (nci)

Index	Variable	Hb[a]	SNVT SCPT/UCPT	Accepted values	Default value	Description (self doc. string)
37	nciInstallType	No	SNVT_config_src SNVT_nwrk_config (25)	0=CFG_LOCAL 1=CFG_EXTERNAL CFG_NUL	0=CFG_LOCAL	Network configu-ration source &0,,0\x80,25

a. Hb=Heartbeat

8.6 The Controller Object

The variables in the controller object (Fig. 8.2) are divided into four categories:

- Mandatory (M)
- Optional (O)
- Configuration properties (C)
- Manufacturer Defined Section (MDS)

The category "Mandatory" contains all compulsory variables[1], "Optional" contains selectable variables, "Configuration properties"

1. According to LonMark standardised function profile for RTU controllers

contains configuration parameters, and “Manufacturer Defined Section” includes all other variables that make the controller’s functions possible (Fig. 8.2).

Note!
The network variables’ indexes are not the same as the “nv- figure” in the diagram below.

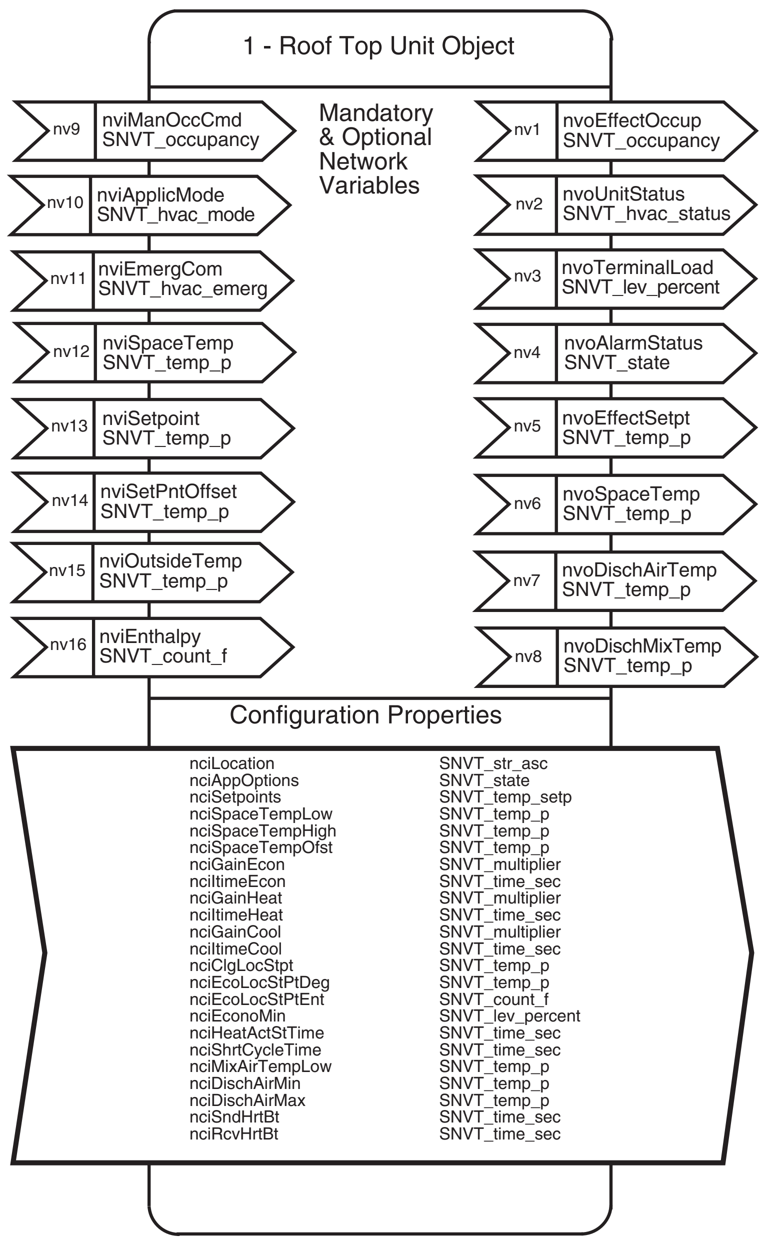


Fig. 8.2: The controller object

8.6.1 The Controller Object's Inputs (nvi)

Table 8.4: The Controller Object's Inputs (nvi)

Index	Variable	Hb[a]	SNVT	Accepted values	Default value	Description (Self doc. string)
9	*nviManOccCmd*	No	SNVT_occupancy	0=OC_OCCUPIED 1=OC_UNOCCUPIED 3=OC_STANDBY other values=OC_NUL 255=OC_NUL	OC_NUL	Occupancy scheduler input @1|6
10	*nviApplicMode*	Yes	SNVT_hvac_mode	0=HVAC_AUTO 1=HVAC_HEAT 3=HVAC_COOL 6=HVAC_OFF 9=HVAC_FAN_ONLY;all other values are interpretated as HVAC_AUTO	HVAC_AUTO	Application mode input @1|5
11	*nviEmergCmd*	No	SNVT_hvac_emerg	0=EMERG_NORMAL 1=EMERG_PURGE 2=EMERG_SHUTDOWN 3=EMERG_PRESSURIZE 4=EMERG_DEPRESSURIZE, all others=EMERG_NORMAL	EMERG_ NORMAL	Emergency command input @1|15
12	*nviSpaceTemp*	Yes	SNVT_temp_p	–10 °C to 50 °C, 327,67 °C[b]	327,67 °C[b]	Zone temperature input @1|1
13	*nviSetpoint*	No	SNVT_temp_p	10 °C to 35 °C, 327, 67 °C[b]	327,67 °C[b]	Temperature setpoint input @1|2
14	*nviSetpntOffset*	Yes	SNVT_temp_p	–10 °C to 10 °C	0 °C	Setpoint offset input @1|7
15	*nviOutsideTemp*	Yes	SNVT_temp_p	–10 °C to 50 °C, 327,67 °C[b]	327,67 °C[b]	Outside temperature input @1|8
16	*nviEnthalpy*	Yes	SNVT_count_f	0 to 1^{38}	0	Enthalpy input @1#6

a. Hb=Heartbeat

b. Off value

8.6.2 The Controller Object's Outputs (nvo)

Table 8.5: The Controller Object's Outputs (nvo)

Index	Variable	Hb[a]	SNVT	Accepted values	Default value	Description (Self doc. string)
1	*nvoEffectOccup*	Yes	SNVT_occupancy	0=OC_OCCUPIED 1=OC_UNOCCUPIED 2=OC_BYPASS 3=OC_STANDBY 255=OC_NUL	OC_OCCUPIED	Actual occupancy output, @1#1
2	*nvoUnitStatus*	Yes	SNVT_hvac_statusmode heat_output_primary heat_output_secondary cool_output econ_output fan_output in_alarm	1=HVAC_HEAT 3=HVAC_COOL 9=HVAC_FAN_ONLY 6=HVAC_OFF 0% to 100% 163,83%[(b)] 163,83%[(b)] 0% to 100% 163,83%[(b)] 163,83%[(b)] 0% to 100%, 163,83%[(b)] 255[(b)]	HVAC_HEAT 163,83%[(b)] 163,83%[(b)] 163,83%[(b)] 163,83%[(b)]	Unit status, output, @1|4
3	*nvoTerminalLoad*	Yes	SNVT_lev_percent	–163,84% to 163,84%	0%	Heat./cool. demand output, @1#2
4	*nvoAlarmStatus*	No	SNVT_state	16 bits, 0=normal, 1 = alarm	00000000 00000000	Alarm status, output, @1#3
5	*nvoEffectSetpt*	Yes	SNVT_temp_p	10 °C to 35 °C 327,67 °C[(b)]	327,67 °C[(b)]	Effective setpoint output,@1|10
6	*nvoSpaceTemp*	Yes	SNVT_temp_p	–10 °C to 50 °C, 327,67 °C[(b)]	327,67 °C[(b)]	Zone temp. output @1|3
7	*nvoDischAirTemp*	No	SNVT_temp_p	–10 °C to 50 °C, 327,67 °C[(b)]	327,67 °C[(b)]	Discharge air temp. output,@1#4
8	*nvoDischMixTemp*	No	SNVT_temp_p	–10 °C to 50 °C, 327,67 °C[(b)]	327,67 °C[(b)]	Mixed air temp. output,@1#5

a. Hb=Heartbeat

b. Off value

8.6.3 The Controller Object's Configuration Parameters (nci)

Table 8.6: The Controller Object's Configuration Parameters (nci)

Index	Variable	Hb[a]	SNVT SCPT/UCPT	Accepted values	Default value	Description (Self doc. string)
0	*nciLocation*	No	SNVT_str_asc SCPT_location (17)	31 ASCII signs	All = 0	Location label &1,1,0\x80,17
17	*nciAppOptions*	No	SNVT_state UCPT (1)	16 bits, 0–1	00000000 00000000	Application options &1,1,3\x8A,1
18	*nciSetpoints*	No	SNVT_temp_setpt SCPTsetPnts (60)	10 °C to 35 °C (50 °F to 95 °F)	occ cool = 24 °C (75 °F) (stby cool = 24°C (75 °F)) unoc cool = 28°C (82 °F) occ heat = 22°C (72 °F) (stby heat = 22°C (72 °F)) unoc heat = 16°C (61 °F)	Occupancy temperature set-points &1,1,0\x80,60, 10:35|10:35|10:35| 10:35|10:35|10:35
19	*nciSpaceTempLow*	No	SNVT_temp_p UCPT (17)	0 °C to 20 °C (32 °F to 68 °F)	10 °C (50°F)	Low lim. of zone temp. &1,1,3\x80,17,0:20
20	*nciSpaceTempHigh*	No	SNVT_temp_p UCPT (17)	0 °C to 40 °C (32 °F to 104 °F)	30 °C (86°F)	High lim. of zone temp. &1,1,3\x80,29,0:40
21	*nciSpaceTempOfst*	No	SNVT_temp_p UCPT (16)	+0–10 (°C) +0–18 (°F)	0 (°C,°F)	Offset zone temp. &1,1,3\x80,20,0:40
22	*nciGainEcon*	No	SNVT_multiplier UCPT (2)	0 to 32,7675	25	Gain for economizer &1,1,3\x80,30
23	*nciItimeEcon*	No	SNVT_time_sec UCPT (3)	0 s to 3600 s (60 minutes)	900 s (15 minutes)	Integral time for economizer &1,1,3\x80,31,0:3600
24	*nciGainHeat*	No	SNVT_multiplier	0 to 32,7675 UCPT (2)	25	Gain for heating controller, &1,1,3\x80,2
25	*nciItimeHeat*	No	SNVT_time_sec UCPT (3)	0 s to 3600 s (60 minutes)	900 s (15 minutes)	Integral time heating controller &1,1,3\x80,3,0:3600
26	*nciGainCool*	No	SNVT_multiplier UCPT (5)	0 to 32,7675	25	Gain for cooling controller. &1,1,3\x80,5
27	*nciItimeCool*	No	SNVT_time_sec UCPT (6)	0 s to 3600 s (60 minutes)	900 s (15 minutes)	Integral time cooling controller &1,1,3\x80,6,0:3600
28	*nciClgLocStpt*	No	SNVT_temp_p UCPT (24)	-50 °C to 50 °C (-58 °F to 122 °F)	10 °C (50°F)	&1,1,3\x80,24,-50.0: 50.0
29	*nciEcoLocStptDeg*	No	SNVT_temp_p UCPT (25)	-50 °C to 50 °C (-58 °F to 122 °F)	18 °C (64°F)	Setpoints degrees for econo-mizer, &1,1,3\x80,25,- 50.0:50.0
30	*nciEcoLocStptEnt*	No	SNVT_count_f UCPT (32)	0 to 138	0	Enthalpy setpoints for econ., &1,1,3\x80,32
31	*nciEconoMin*	No	SNVT_lev_percent UCPT (26)	0% to 100%	0%	Economizer minimum &1,1,3\x80,26,0:100
32	*nciHeatActStTime*	No	SNVT_time_sec UCPT (4)	5 s to 600 s (10 minutes)	165 s	Stroke time for heating actua-tor &1,1,3\x80,4,5:600
33	*nciShrtCycleTime*	No	SNVT_time_sec UCPT (27)	0 s to 3600 s (60 minutes)	900 s	Short cycle time &1,1,3\x80,27,0:3600
34	*nciMixAirTempLow*	No	SNVT_temp_p	-10 °C to 50 °C (14 °F to 122 °F)	8°C (46°F)	&1,1,3\x80,28,-10.0:50.0
35	*nciDischAirMin*	No	SNVT_temp_p UCPT (19)	0 °C to 40 °C (32 °F to 104 °F)	10 °C (50°F)	Min. limit disch. air &1,1,3\x80,19,0:40
36	*nciDischAirMax*	No	SNVT_temp_p UCPT (18)	0 °C to 40 °C (32 °F to 104 °F)	35 °C (95°F)	Max. limit disch. air &1,1,3\x80,18,0:40
38	*nciSndHrtBt*	Yes	SNVT_time_sec SCPTmaxSend Time (49)	5,0 s to 6553,4 s 0,0 s = disabled	0,0 s (disabled)	Send heartbeat &2,1.2.3.5.6,0\x8A,49
39	*nciRcvHrtBt*	No	SNVT_time_sec SCPTmaxRcvTime (48)	0,0 s to 6553,4 s 0,0 s = disabled	0,0 s (disabled)	Receive heartbeat &2,10.12.14.15,0\ x8A,48

a. Hb=Heartbeat

Appendix

A Commissioning Protocol

A Commissioning Protocol

This protocol can be used when commissioning the TAC Xenta 104-A controller. Note that the indices are listed in numerical order, not in the order they are used during commissioning. To find information about accepted values, see the tables in Chapter 8, “Communication”, on page 57.

Table A.1: Commissioning Protocol

Index	Function	Variable	Default value	Set value	Note
0	Config. location label	*nciLocation*	0		
9	Occupancy scheduler input	*nviManOccCmd*	OC_NUL		
10	Application mode input	*nviApplicMode*	0=Auto		
11	Emergency command input	*nviEmergCmd*	EMERG_ NORMAL		
12	Zone temperature input	*nviSpaceTemp*	327,67 °C		
13	Temperature setpoint input	*nviSetPoint*	327,67 °C		
14	Setpoint offset input	*nviSetpntOffset*	0 °C		
15	Outside temperature input	*nviOutsideTemp*	327,67 °C		
16	Enthalpy input	*nviEnthalpy*			
17	Config. application options	*nciAppOptions*	00000000		
18	Config. occup. temp. set-points	*nciSetpoints*			
	(Cooling setpoint comfort	*occupied_cool*	24 °C, 75 °F)		
	(Cooling setpoint economy	*standby_cool*	24 °C, 75 °F)		
	(Cooling setpoint off	*unoccupied_cool*	28 °C, 82 °F)		
	(Heating setpoint comfort	*occupied_heat*	22 °C, 72 °F)		
	(Heating setpoint economy	*standby_heat*	22 °C, 72 °F)		
	(Heating setpoint off	*unoccupied_heat*	16 °C, 61 °F)		
19	Config. min. low limit zone temp.	*nciSpaceTempLow*	10 °C (50 °F)		
20	Config. min. high limit zone temp.	*nciSpaceTempHigh*	30 °C (86 °F)		

Table A.1: Commissioning Protocol

Index	Function	Variable	Default value	Set value	Note
21	Config. zone temp. sensor adj.	*nciSpaceTempOfst*	0,0 °C		
22	Config. gain for economizer	*nciGainEcon*	25		
23	Config. integral time economizer	*nciItimeEcon*	900 s		
24	Config. gain for heating contr.	*nciGainHeat*	25		
25	Config. integral time heat. contr.	*nciItimeHeat*	900 s		
26	Config. gain for cooling contr.	*nciGainCool*	25		
27	Config. integral time cool. contr.	*nciItimeCool*	900 s		
28	Config. setpoint cooling lockout	*nciClgLocStpt*	10 °C (50 °F)		
29	Config. econ. setpoint, degrees	*nciEcoLocStptDeg*	18 °C (64 °F)		
30	Config. econ. setpoint, enthalpy	*nciEcoLocStptEnt*	0		
31	Config. economizer minimum	*nciEconoMin*	0		
32	Config. stroke time heat. actuator	*nciHeatActStTime*	165 s		
33	Config. short cycle protection	*nciShrtCycleTime*	900 s		
34	Config. low limit mixed air temp.	*nciMixAirTempLow*	35 °C (95 °F)		
35	Config. min. limit discharge air	*nciDischAirMin*	10 °C (50 °F)		
36	Config. max. limit discharge air	*nciDischAirMax*	35 °C (95 °F)		
37	Config. network conf. source	*nciInstallType*	0=LOCAL		
38	Config. send heartbeat	*nciSndHrtBt*	0,0 s		
39	Config. receive heartbeat	*nciRcvHrtBt*	0,0 s		
40	Object request input	*nviRequest*	RQ_NUL		
42	File request input	*nviFileReq*	FR_NUL		

Index