MINio Programming and Operation Guide

General Information

Creating a MINio and Defining its Inputs

A MINio module must be created in the Module Directory before a MINio output can be programmed.

- Select the **Module Configuration** option in the executive module's Function Menu to access the Module Directory screen.
- Press **F3** to create a MINio module in the Module Directory and define its control inputs.
- Return to the Function Menu and select the **Load Control** option to access the Load Directory screen.
- Select an unassigned number and create the MINio load, entering its name in the Load Directory field next to that number.
- Select one of the following as the load type:

  — Digital Output Control (for a MINio digital output)
  — Analog Output Control (for a MINio analog output)

  The MINio contains six digital outputs and two analog outputs.

Controlling with Multiple Input Sensors

If multiple inputs are used to control a MINio's output point, the input types must all be the same. They can all be thermistor Type II inputs or IOM inputs or ETM inputs or MINio analog inputs, but they *cannot* be a combination of any of these. The types cannot be mixed..

Up to 32 inputs can be selected to control a single MINio output. These 32 inputs can be shared among the various control functions (primary setpoint control, control override, and control lockout), but the total number cannot exceed 32.

Distributed Input/Output *vs.* Distributed Control

The MINio is a distributed input/output (I/O) module. This means the control algorithms are executed within the executive module, and it commands MINio outputs to the desired positions. This reduces costs and allows downloadable enhancements and fixes, if necessary. With distributed I/O, each output will go to a definable default state if the module is in communications loss with the executive module.

The MINio should not be used for analog control applications that require very fast response or for applications that require stand-alone control (during communications loss) that goes beyond the user-defined default output states.

Monitoring Alarms on MINio Inputs

Several monitoring alarms can be defined for a MINio input point to handle multiple alarm conditions.

Timed Override Operation

Any of the eight MINio inputs can be defined as a timed override input. Any MINio output can be assigned to a timed override input that resides on any MINio in the system (within one executive module).

NOTE! There are no LEDs on the remote push buttons of the MINio inputs when they are used as timed overrides

Digital Output Control

Control Settings and Parameters

NOTE! The Control Logic Diagram for the Digital Output Control load type (Figure 1, at the end of this document) reveals the relative priorities of each of the control functions.

Program Operating Mode

The Program Operating Mode parameter offers the following options:

- **Run**: The output will control to the other parameters specified in the control settings.
- **Forced On/Forced Off**: The output will not follow the program parameters. It will go to the specified forced state.
- **NCL Controlled**: The output will be directly under the control of an NCL program and will not follow any of the commands specified in the control settings. In NCL, the MINio output control program statement is:

  Modoutput (mod, pt) = On or Modoutput(mod,pt) = Off

  In these statements, “mod” is the module address of the MINio, and “pt” is the output point number.

Output Relay Logic

This parameter offers the following options:

- **Normally Open**: The load is wired to the normally open contact of the MINio output.
- **Normally Closed**: The load is wired to the normally closed contact of the MINio output.

Control Input(s)

The use of control inputs is optional. If none is defined, the load will control to the other parameters.

If the load is to control to sensors, the user must define the control inputs to be used. Only analog inputs can be selected. To control the output with digital inputs, the Control Override parameter or the Control Lockout parameter should be used.

Virtual points can also be used as control inputs.

Control Input Direction

This parameter determines if the output will turn on at the setpoint plus one-half the setpoint differential or if it will turn on at the setpoint minus one-half the setpoint differential. The choices are the following:

- **Load On Below setpoint** (Typical application: a heating load)
- **Load On Above setpoint**: (Typical application: a cooling load)

Schedule On Setpoint

This parameter offers the following options:

- **Setpoint**: The setpoint to be used during the scheduled on periods should be entered.
- **Reset**: If this option is selected, ESS32 will prompt the user to select the sensor(s) to be used for the reset calculation.

Scheduled Off Setpoint

If the module is to control to a fixed setpoint during scheduled on time, ESS32 will prompt the user to enter the setpoint to be used during scheduled off time.

If the module is to control to a reset function, the user can select a scheduled off setpoint or a reset shift. The reset shift value will offset the reset calculation by the amount that the user specifies.

Setpoint Differential

The user should enter the amount of the differential. This will be split half above the setpoint and half below the setpoint.

Setpoint Range and Reset Range

If a reset calculation is used for the scheduled on setpoint, the user must enter the range of setpoints for the control input and the reset input and indicate how frequently the reset should be recalculated.

These ranges are used to calculate the actual setpoint based on a linear reset relationship.

Confirmed Status

This parameter can be used to confirm the operation of the controlled load using a digital feedback sensor (for example, an airflow sensor on a fan). The user must identify the sensor to be used for confirmation.

Confirmed Status Time Delay

This parameter allows the user to enter the minimum time delay to be used between turning the load on and sensing feedback from the confirmation sensor. If confirmation is not sensed within this period of time, the load will shut down, and an alarm will be generated.

If a confirmed status alarm occurs, the user can restart the load with a manual restart command (from the load monitoring screen)or wait until the beginning of the next scheduled on time when the module will automatically try to turn the load on.

Sensor Failure Control Mode

If the load is controlled by multiple inputs, it will automatically ignore failed sensors (open or shorted) and continue to control. If only one sensor is used or the last sensor fails, the load will go to this defined state (either on or off).

Minimum On Time

This parameter is used to enter the minimum amount of time that the load must run before it can turn off.

Minimum Off Time

This parameter is used to enter the minimum amount of time that the load must remain off before it can turn back on.

Duty Cycle Interval

If a duty cycle is used, this parameter is used to enter the cycle's combined total on and off times.

For the on time, the user should enter the length of the duty cycle's on time.

Outside Air Temp Lockout

The load's operation can be locked out above, below, inside, or outside a range of outside air temperatures.

Outside Air Temp Override

This parameter is used to specify the outside air temperature at which the load is forced on (whether during scheduled on or off time). The user can select above, below, inside, or outside a range of outside air temperature(s).

Control Override Input

This parameter is used to identify the sensors used to override the load. It can override (turn on) the load if the defined input exceeds the override setpoint. It takes a higher priority than the control input defined for the Control Inputs parameter. (Refer to the Logic Diagram for more information.)

Override Setpoint

This parameter is used to enter the setpoint that activates the control override function.

Control Lockout Input

This parameter is used to identify the sensors used to lockout (turn off) the load. It can lock out the load (during scheduled on or off time) if the defined setpoint exceeds the lockout setpoint. (Refer to the Logic Diagram to view the relative priority of the lockout function.)

Lockout Setpoint

This parameter is used to enter the setpoint that activates the lockout function.

Outdoor Light Lockout

The setpoint for this function varies based on the type of global outdoor light sensor that has been defined. If a digital global light sensor is used, the user should define **Active** or **Inactive** to respond to the light sensor being open or closed. If an analog global light sensor is used, the user should select **above** or **below**, and indicate the setpoint at which this load will turn off in response to outdoor light.

Demand Control

This parameter can be set to **Active** or **Inactive**.

If the user selects **Active**, ESS32 will prompt the user to enter the load into one of the demand control registers and define the maximum off and minimum on times to be applied if this load is shed in response to electrical demand.

Demand Setpoint Adjust

This parameter is used to specify the setpoint offset to which the control can drift during periods of demand shed.

Maximum Optimized Advance Time

This parameter is used to enter the maximum amount of time that the optimized start program is allowed to advance the start time before the scheduled on period.

Optimized Start

Optimized start is a function that automatically adjusts the scheduled on time of a load based on its historical rate of recovery when changing from scheduled off to scheduled on setpoints. The load will track and calculate the thermal rate of recovery (in minutes per degree) for the load.

If the load requires optimized start, the user should set this parameter to **Active**.

Initial Optimization Coefficient

This parameter is used to enter a value (in minutes per degree) that the load can use as its initial recovery rate. The MINio output will automatically fine-tune this value after it has learned the load's true recovery rate. The default value is 10 minutes per degree of recovery.

Phase Loss

If the user selects **Active**, this load will shut down if a global phase loss condition is transmitted by the executive module.

Schedule Extension

This parameter will work with any type of load, but it is generally used for lighting loads. For it to work properly, the user must set:

- The length of time for the schedule extension.

  This setting extends the scheduled on period by the amount specified. During this time, the override button is active and available to start a timed override.

- The minimum off time.

  This setting causes the lights to go off momentarily then turn back on as a warning that the lights are about to go out. The lights turn off for the duration of the minimum off time. When the lights turn back on, the schedule extension gives occupants sufficient time to initiate a timed override before the lights actually turn off.

At the end of a timed override, the lights will blink again to give occupants advanced warning that the lights are about to turn off.

Site Emergency

If this parameter is set to **Active**, this load will respond to a global site emergency condition transmitted by the executive module.

Network Emergency

This parameter is automatically activated if the load is affected by a monitoring/alarm point.

Site/Network Emergency Load State

This parameter is used to force this load on or off during a site or network emergency.

Timed Override Input

This parameter is used to identify a MINio input that has been previously designated as a timed override input.

The timed override only operates during the load's scheduled off time.

- During scheduled off time, if the timed override button on the designated MINio is pushed, there will be a delay before the load schedules on and the output responds. During this delay, additional pushing of the button will have no effect.

- When the load is in a timed override period, if the designated button is pushed, there will be a delay before the override is canceled and the output responds. During this delay, additional pushing of the button will have no effect.

Timed Override Period

This parameter is used to indicate the duration of the timed override.

Sequence Points

If the operation of this load is dependant upon the on or off state of other loads, the Sequence parameter must be **Active**. A MINio digital output can be sequenced to up to eight loads or virtual points, using either the following two sequence strategies:

- **Standard**: Allows the user to specify how many loads must be on or off for the sequence to be satisfied (allowing the load to turn on).
- **User-Defined**: Allows the user to list the specific on or off states that must exist for the sequence to be satisfied (allowing the load to turn on). The keyboard arrow keys and the spacebar can be used to toggle between the load's on/off states.

After the loads have been selected, the user can press **Esc** (escape).

Sequence On Delay

This parameter is used to specify the time delay that occurs before the load turns on after the sequence state is satisfied.

Sequence Off Delay

This parameter is used to specify the time delay that occurs before the load turns off after the sequence state is no longer satisfied.

Analog Output Control

General Information

For the Analog Output Control load type, several control functions can force the analog output to a specific voltage. If two or more of these functions are occurring at the same time, the one with the highest priority dictates what happens to the output voltage. The control functions are prioritized (from highest to lowest) as follows:

- Program Operating Mode
- Phase Loss
- Fault Position
- Outside Air Override
- Outside Air Lockout
- Sequence Off Position
- Control Setpoint

The MINio control algorithms are executed within the executive module. Therefore, the MINio analog outputs should not be used for any load that requires very fast response. The response time will vary, depending on the number of modules in the system. Control can be properly maintained by using an adequate sensor response time, as described below.

Control Settings and Parameters

Program Operating Mode

This parameter offers the following options:

- **Run**: The output will control to the other parameters specified in the control settings.
- **Forced**: This parameter is used to specify the voltage to which the output will be forced. It will stay at that voltage until the forced condition is ended.
- **NCL Controlled**: The output will be directly under the control of an NCL program and will not follow any of the commands specified in the control settings. In NCL, the MINio analog output control program statement is:

  Modoutput (mod, pt) = X . X

  In this statement, "mod" is the module address, "pt" is the output point number, and X .X is the desired voltage.

Output Control Range

This parameter is used to indicate the range and direction of the analog voltage output. For reverse-acting devices, the direction can be reversed. For example, if a device should open on a voltage drop, the range can be defined as 10 to 0 volts. This can be used to limit the upper or lower voltage limit (for example, to maintain a minimum position on a damper).

Control Input(s)

This parameter is used to identify the control inputs and virtual points to be used.

Control Input Direction

This parameter determines if the output will open at one-half the setpoint differential above the setpoint or at one-half the setpoint differential below the setpoint. The following options are offered:

- **Load on below setpoint** (Typical application: a hot water valve)
- **Load on above setpoint** (Typical application: a chilled water valve)

Schedule On Setpoint

This parameter offers the following options:

- **Setpoint**: The setpoint entered here is used during the scheduled on periods.
- **Reset**: If this option is selected, ESS32 prompts the user to select the sensor(s) used for the reset calculation.

Scheduled Off Setpoint

If the module controls to a fixed setpoint during scheduled on time, the user will be prompted to enter the setpoint to be used during scheduled off time.

If the module controls to a reset function, the user can select either a scheduled off setpoint or a reset shift. The reset shift value will offset the reset calculation by the amount that the user specifies.

Setpoint Differential

This parameter is used to indicate the amount of the differential. This will be split half above the setpoint and half below the setpoint. Inside the differential, the output voltage will not change.

Setpoint Range and Reset Range

If a reset calculation is used for the scheduled on setpoint, the user must enter the range of setpoints for the control input and the reset input and the how often the reset calculation is to be recalculated.

These ranges are used to calculate the actual setpoint based on a linear reset relationship.

Sensor Response Time

This parameter is used to indicate how long the output must wait before it is allowed to make another change after the MINio changes the output voltage.

This is to allow the system to respond fully and sense the first change before taking another control action. This prevents overshoot and/or undershoot of the setpoint.

Gain

This parameter determines how quickly the output ramps up or down to maintain setpoint. Ten pre-defined ranges are offered, with 1 being the slowest response and 10 the fastest. When all parameters (P, I, and D) are used, it responds to how far it is from setpoint (P), how long it has been away from setpoint (I), and how quickly it is moving toward or away from setpoint (D).

The user can custom-define the P, I and D parameters by selecting **12** and pressing **Ctrl** + **Enter** at the same time.

Phase Loss

If the parameter is set to **Active,** this load will shut down during a global phase loss condition transmitted by the executive module.

Fault Position

This parameter is used to select the voltage the output is to use if either of the following conditions occurs:

- Failure of all control sensors (Bad sensors are ignored if multiple sensors are used.)
- Module communications loss

Outside Air Temp Lockout

This parameter is used to force the output to go to a specific voltage when the outside air temperature is above, below, inside, or outside the specified range.

Outside Air Temp Lockout Position

This parameter is used to indicate the voltage the output is to use if the defined outside air temperature lockout setpoint is exceeded.

Outside Air Temp Override

This parameter is used to force the output to a specified voltage if the outside air temperature goes above, below, inside, or outside a range.

Outside Air Temp Override Position

This parameter is used to indicate the voltage that the output is to use when the defined outside air temperature override setpoint is exceeded.

Maximum Optimized Advance Time

The parameter is used to indicate the maximum amount of time that the optimized start program is allowed to advance the start time before the scheduled on period.

Optimized Start

Optimized start is a function that automatically adjusts the scheduled on time of a load based on its historical recovery rate when changing from scheduled off to scheduled on setpoints. The load tracks and calculates the thermal recovery rate (in minutes per degree) for the load.

If the load requires optimized start, this parameter should be set to **Active**.

Initial Optimization Coefficient

This parameter is used to enter a value (in minutes per degree) that the load is to use as its initial recovery rate. The MINio output will automatically fine-tune this value after it calculates the load's true recovery rate. The default value is 10 minutes per degree of recovery.

Site Emergency

This parameter should be set to **Active** if this load is to respond to a global site emergency condition transmitted by the executive module.

Network Emergency

This parameter is automatically activated if the load is affected by a monitoring alarm point.

Site/Network Emergency Load State

This parameter can force this load on or off during a site or network emergency.

Timed Override Input

This parameter is used to identify a MINio input that has been previously designated as a timed override input. The timed override only operates during the load's scheduled off time.

- During scheduled off time, if the designated input's override button is pushed, there will be a delay before the load schedules on and the output responds. During this delay, pushing the input's override button will have no effect.
- When the load is in a timed override period, if the designated input's override button is pushed, there will be a delay before the override is canceled and the output responds. During this delay, pushing the input's override button will have no effect.

Timed Override Period

This parameter is used to indicate the length of the timed override.

Sequence Points

If this load's operation is dependant upon the on or off state of other loads, Sequence must be **Active**. A MINio analog output can be sequenced to up to eight loads or virtual points, using either of the following sequence strategies:

- **Standard**: The user can define how many loads must be on or off for the sequence to be satisfied (allowing the load to turn on).
- **User-Defined**: The user can define the specific on or off states that must exist for the sequence to be satisfied (allowing the load to turn on). The keyboard arrow keys and the spacebar can be used to toggle between the load's on/off states.

Once the loads have been selected, the user can press **Esc** (escape) to exit the screen.

Sequence On Delay

This parameter is used to specify the time delay that occurs after the sequence state is satisfied.

Sequence Off Delay

This parameter is used to specify the time delay that occurs after the sequence state is no longer satisfied.

Sequence Off Position

If a sequence is used, the user should set this parameter to **Active** and indicate the voltage for the analog output if the sequence is not satisfied.

Digital Output Control Logic Diagram

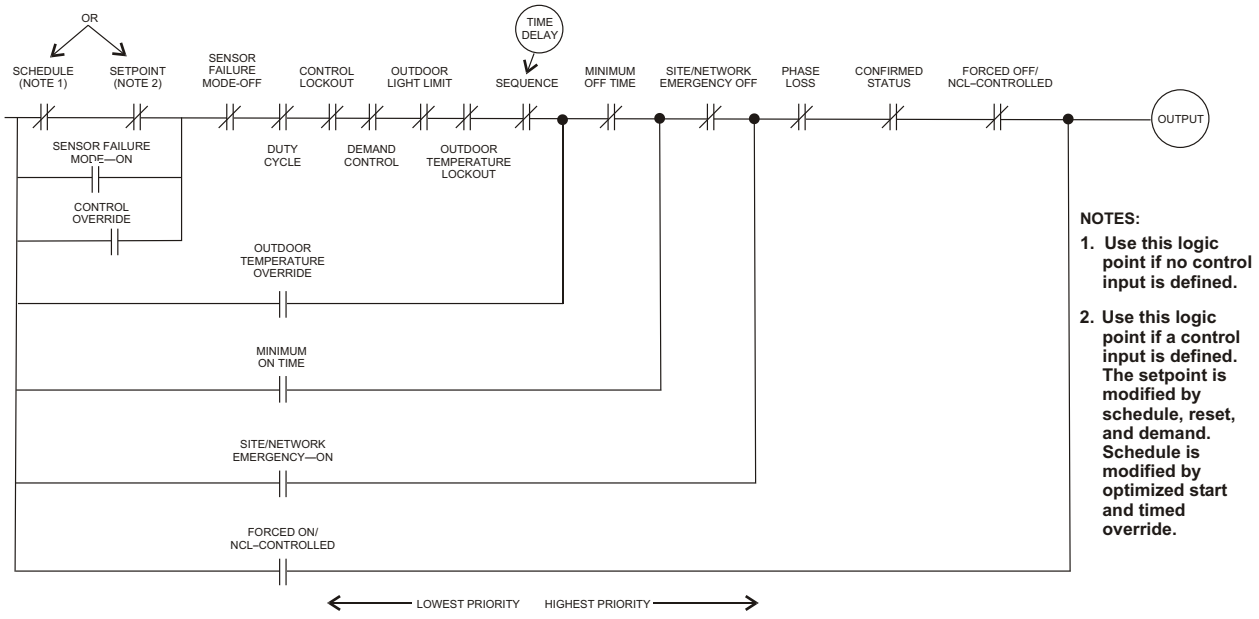

Figure 1. Digital Output Control Logic Diagram

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