SeaChange

Distributor Module | Data Sheet M3

# Secondary Circuit Controller
## with Temperature Control

## Main Features

Controls a Secondary LPHW or Chilled Water Circuit - Pump and Valve Control

Variable Temperature (VT) or Constant Temperature (CT) Control

Weather Compensation option for Heating Circuits

Collates Demand Signals from Multiple Zones


## Summary Features

### General

The SeaChange Secondary Circuit Controller provides control of LPHW or Chilled Water secondary circuits. These may be VT or CT circuits which are coupled to the primary circuit by valves and pump sets or other plant, and require individual control. These circuits may feed Radiator Zones, Air Handling Units, Fan Coil Units, DHW systems or other types of load; ideally all of the associated loads will be controlled by SeaChange 'Consumer' Modules (for instance, Zone Controllers or AHU Controllers).

Configuration parameters can be set to allow operation to match the plant control requirements. A full table of configuration and monitoring parameters is detailed later in this data sheet.

A table of available product versions is shown on the back page and inside back page.

### Demand Control

The Secondary Circuit Controller is known as a *Distributor Module* ; it receives Heating or Cooling Demand signals from its *Consumer Modules*. It collates the demand signals and calculates a setpoint which is then passed back as a Demand to a SeaChange *Provider Module* controlling a primary source of energy (eg. Boilers or Chillers). In this way, the primary plant will run only when a demand for it's services exists.

### Intelligent Demand Filtering

The Secondary Circuit Controller has Intelligent Demand Filtering and can be set to produce a Demand for heating or cooling only when certain criteria are met, e.g. when at least 5 Fan Coils of the 50 on a circuit are demanding Cooling - this would prevent a large Chiller from running when only 1 Fan Coil was demanding cooling energy.

### Temperature Control

The Secondary Circuit Controller provides temperature control of the Secondary Circuit allowing Primary and Secondary Circuits to run at different temperatures. The temperature setpoint used is calculated by the Secondary Circuit Controller according to its type;

1) **VTC**, **V**ariable **T**emperature **C**ompensated uses a combination of Zone Demands and Outside Temperature to calculate its setpoint.

2) **VTU**, **V**ariable **T**emperature **U**ncompensated uses only Zone Demands to calculate its setpoint.

3) **CTU**, **C**onstant **T**emperature **U**ncompensated works to a fixed setpoint.

Different *Output Driver* types can be used for different types of valve; Raise/Lower, Time Proportioning and Staged Drivers are available. The accompanying secondary pump can be switched using the Occupation Switch output C.

An Analogue Output variant can control a 0 - 10Vdc valve and a pump via an external relay module.

For CT Circuits where the Primary and Secondary temperatures are the same (i.e. no valve is used) then the CTU Controller can be used for pump control only. No temperature sensor is necessary in this case, but it may be fitted for monitoring purposes.

A Pump Changeover variant of the Secondary Circuit Controller is available to control a CT twin pump set directly, where no valve is required. This product is described in the separate data sheet M4.

# Features

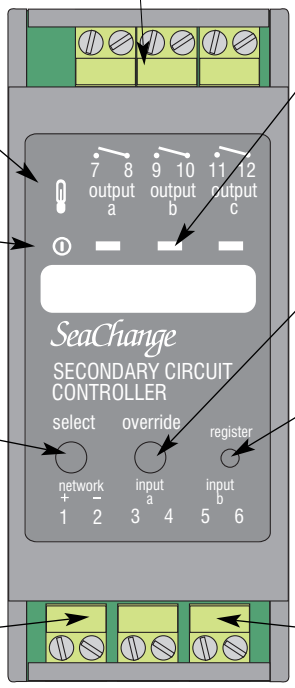
**Temperature Indicator**
indicates how far the controlled temperature is from setpoint.
Green = close to setpoint.
Amber = above setpoint.
Red = below setpoint.
Flashes in Setup mode and when Alarm present.
See SeaChange Design Guide

**Status Lamp**
indicates that the Controller is in Occupancy mode if lit steadily, also indicates that controller is in Configuration Mode (slow flashing) or Override Mode (see Manual Override section).

**Select**
is used during commissioning to allow a Zone Controller to display the Engineering Parameters of this controller, and to set the Timing Characteristics of the outputs.

**Connections**
for network. Belden 8205 Twisted pair, unscreened cable is required (or exact equivalent).

**Connections**
for triac or 0 -10 Vdc outputs controlling actuator and plant.
See back page for details




**Output Status Lamps**
indicates current status of the three triac outputs or level of the two 0 -10 Vdc outputs.

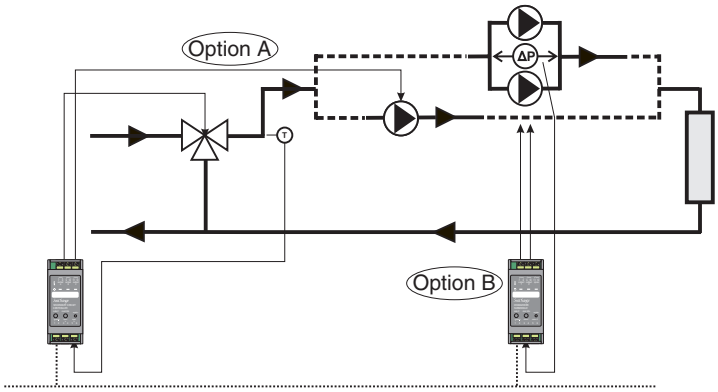
**Override**
is used to change from Normal to Override mode. Override mode will allow the plant to run without demand signals from the Zone Controllers, which is useful for plant maintenance purposes (see Detailed Features section).

**Registration Button**
is used during the commissioning process to build logical links between controllers

**Terminals**
are all of two-part construction to facilitate wiring connections.

**Connections**
for flow temperature sensor, VFC and optional return sensor. Twisted pair, unscreened cable is required.

# Typical Applications




**Heating Secondary Circuit with Raise/Lower valve for Temperature Control**
Zone Trim + Weather Compensation (*)
VTC / DIN / 3T / 105
Zone Trim only (*)
VTU / DIN / 3T / 105
CT Circuit
CTU / DIN / 3T / 105

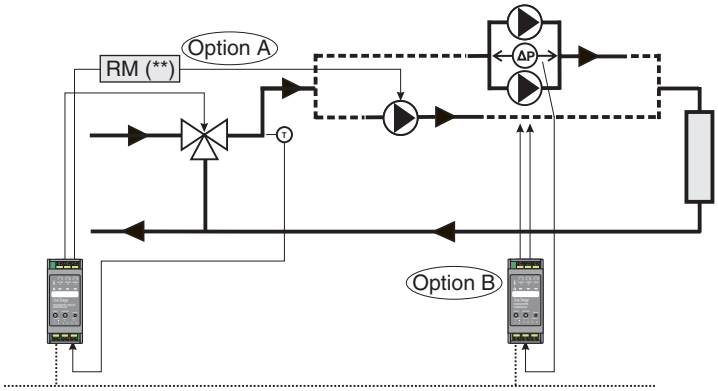
**Option A : Single Pump**
Use Occupation Switch output C

**Option B : Pump Pair**
PCO / DIN / 3T / 004

(*) Zone influence must use at least one Zone Controller in the space - see Detailed Features

# Typical Applications






## Heating Secondary Circuit with 0 - 10Vdc valve for Temperature Control

Zone Trim + Weather Compensation (*)
VTC / DIN / AOP / 721
Zone Trim only (*)
VTU / DIN / AOP / 721
CT Circuit
CTU / DIN / AOP / 721

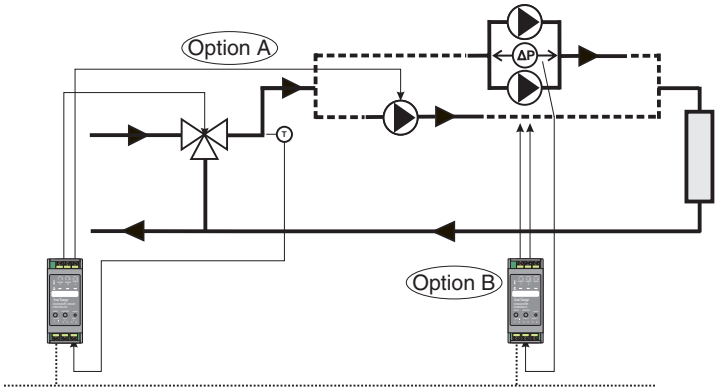
### Option A : Single Pump

Use Occupation Switch output B + RM(**)

### Option B : Pump Pair

PCO / DIN / 3T / 004

(*) Zone influence must use at least one Zone Controller in the space - see Detailed Features
(**) Sontay IO-RM1-12DC relay module required to switch pump from 0-10Vdc output




## Chilled Water Circuit with Raise/Lower valve for Temperature Control

Zone Trim varies VT temperature (*)
VTU / DIN / 3T / 205
CT Circuit
CTU / DIN / 3T / 205

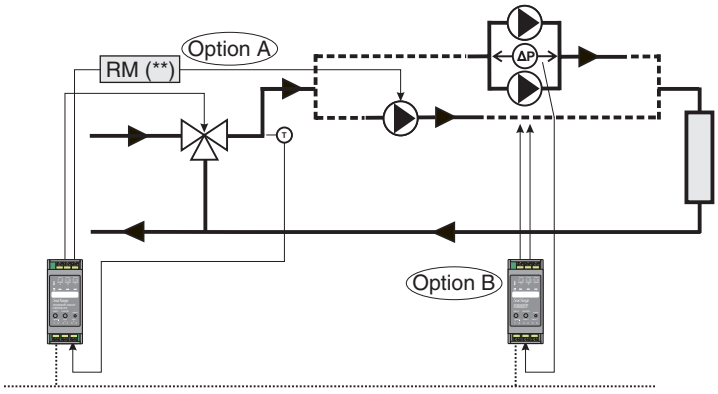
### Option A : Single Pump

Use Occupation Switch output C

### Option B : Pump Pair

PCO / DIN / 3T / 007

(*) Zone influence must use at least one Zone Controller in the space - see Detailed Features




## Chilled Water Circuit with 0 - 10Vdc valve for Temperature Control

Zone Trim varies VT temperature (*)
VTU / DIN / AOP / 821
CT Circuit
CTU / DIN / AOP / 821

### Option A : Single Pump

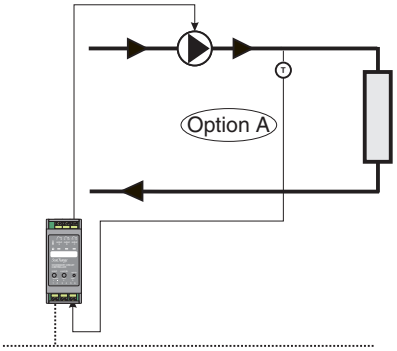
Use Occupation Switch output B + RM(**)

### Option B : Pump Pair

PCO / DIN / 3T / 007

(*) Zone influence must use at least one Zone Controller in the space - see Detailed Features
(**) Sontay IO-RM1-12DC relay module required to switch pump from 0-10Vdc output

# Typical Applications




**Heating or Chilled Water Circuit with no Temperature Control, single pump**
Heating CT Circuit
CTU / DIN / 3T / 105
Cooling CT Circuit
CTU / DIN / 3T / 205

**Option A : Monitoring sensor**
Sensor input for monitoring only.
Use **CMDE** = 0. See Operation With No Sensor Fitted section.

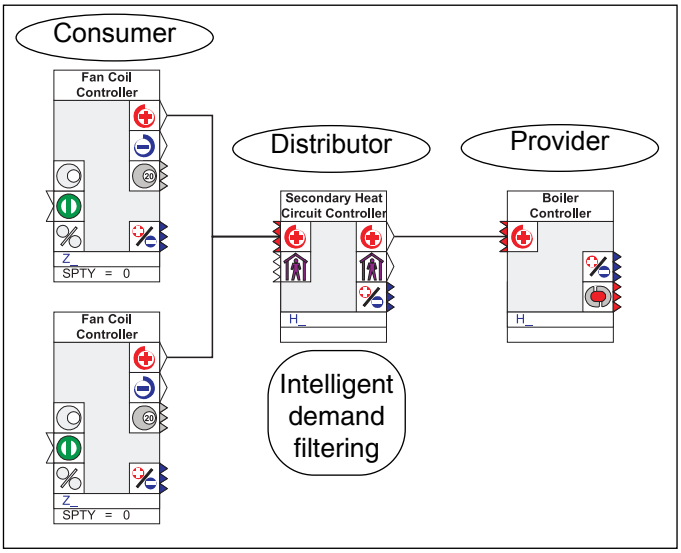
# Detailed Features

## Occupation State of the Secondary Circuit

The Secondary Circuit controller has no internal Occupation Time Schedules; instead it determines whether it is working in an Occupied Mode (controlling to its Occupied Setpoint) or Unoccupied Mode (pumps off, controlling to its Non-Occupied Setpoint) by 3 methods:

### A) Occupancy determined by Zone energy demands

In this mode the Secondary Circuit controller determines whether it is working in an Occupied or Non-Occupied mode depending on the Heating or Cooling Demand Signals it receives from the Consumer Modules registered to it.




The occupied or non-occupied state of the controller is determined by the settings of minimum demand **MIND**, minimum average demand **MNAV** and minimum number occupied **MNOC**. These parameters can be used singly or together. They are particularly useful when many Consumers are being fed from one large primary plant, and it is undesirable to allow this plant to run below a certain minimum load.

**MIND minimum demand**

The highest Demand signal from the Consumer Modules is compared with the Minimum Demand parameter **MIND** and if greater the Controller is put into occupied mode. Once occupied the Demand signal from the Consumers must drop below half the **MIND** setting to become non-occupied.

**MNAV minimum average demand**

The average Demand signal from the Consumer Modules is compared with this value and if greater the Controller is put into occupied mode. Once occupied the average Demand signal from the Consumers must drop below half the **MNAV** setting to become non-occupied. The average value is used to prevent a small demand from a single zone activating the controller.

**MNOC minimum number of occupied zones**

The number of zones occupied is compared with this value and if greater the Controller is put into occupied mode. Once occupied the number of occupied zones needs to fall below half the MNOC setting to become non-occupied.

To disable a particular test set the parameter to zero. If all three parameters are zero the Controller will become occupied if any Consumer Module is occupied.

If more than one test is in action (not zero) then the occupancy state is determined by ANDing the result of each test.

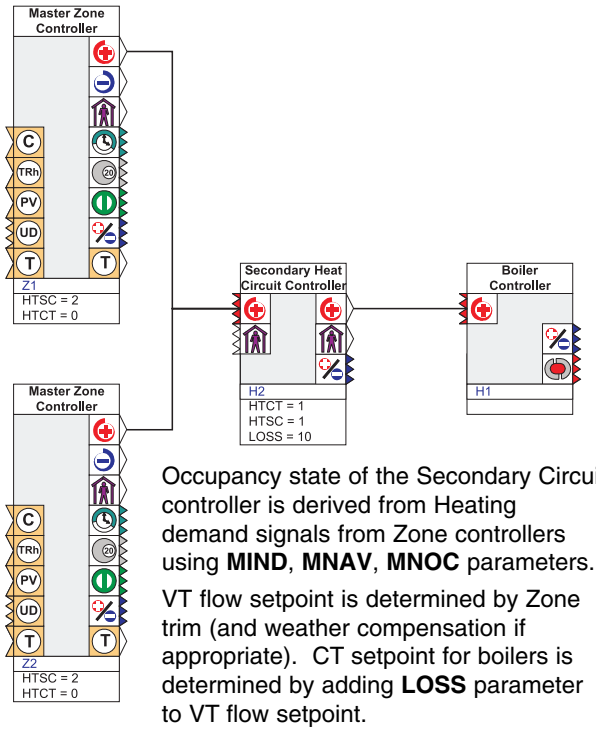
For example, if the settings are:

**MIND 50, MNAV 20, MNOC 5**

The Controller will become occupied when the highest Consumer Demand is greater than 50% and the average Demand is greater than 20% and at least 5 consumers are occupied.

Note if no temperature sensor is fitted then the controller operates in driver mode, passing on the highest or average demand (depending on the setting of **SPTY**) to the output stages **but only whilst Occupied**.

**Heating VT Circuit with 2 subzones, weather compensation and zone influence**



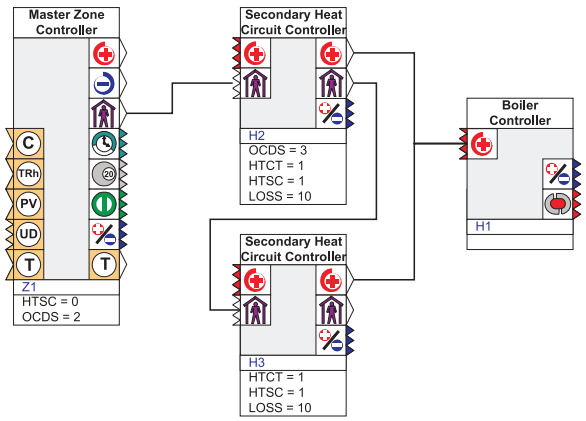

Occupancy state of the Secondary Circuit controller is derived from Heating demand signals from Zone controllers using **MIND**, **MNAV**, **MNOC** parameters.

VT flow setpoint is determined by Zone trim (and weather compensation if appropriate). CT setpoint for boilers is determined by adding **LOSS** parameter to VT flow setpoint.

## B) Occupancy determined by Occupancy Demand signals from another controller

In this mode the Secondary Circuit controller will enter the Occupied mode if any of the controllers Interconnected to it via Occupancy Demand enters Occupancy themselves.

**2 VT heating zones with weather compensation only - no zone influence**




Occupancy state of both Secondary Circuit controllers is determined by occupancy status of Zone controller. Zone heating demands are ignored. VT flow setpoint is determined by weather compensation only. CT setpoint is calculated by adding **LOSS** parameter to VT flow setpoint.

## C) Occupancy determined by external Volt-Free contact

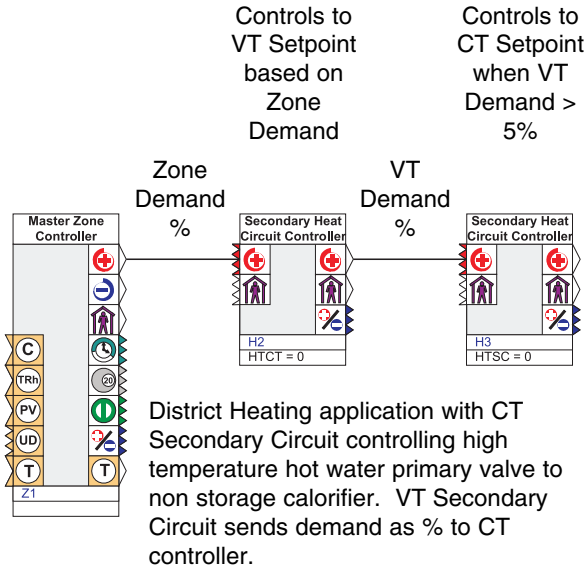
Occupancy state of the Secondary Circuit controller can be influenced by an external VFC input.

Some secondary CT Circuits contain loads that are not controlled by SeaChange modules; because the SeaChange system is inherently demand driven, it is important that the energy requirements of all loads is accounted for, otherwise loads may not receive Hot or Chilled Water services when they need them.

To accommodate legacy systems with existing controls, the Secondary Circuit Controller can be driven into an Occupied State by applying a Volt Free Contact to terminals “3-4”. If the parameter **INMD** is set to 3, a contact closure will force the Controller into Occupation. **INMD** = 1 is an “AND” function and **INMD** = 2 is an “OR” function with the functions described in A) and B) above, so a mixture of SeaChange Consumer or Distributor module loads and non-SeaChange loads can be accommodated.

## Demand Control

The Setpoint used by the Secondary Circuit Controller to control its own valve is also used as a Demand signal which needs to be sent to the module controlling the Primary energy feeding the Secondary Circuit. This is usually a Provider Module (e.g. Boiler or Chiller Controller) but could also be another Distributor Module (i.e. Secondary Circuit Controller) in which case the demand is sent as a % rather than a setpoint, and **HTCT** should be set to 0.




District Heating application with CT Secondary Circuit controlling high temperature hot water primary valve to non storage calorifier. VT Secondary Circuit sends demand as % to CT controller.

# Temperature Control

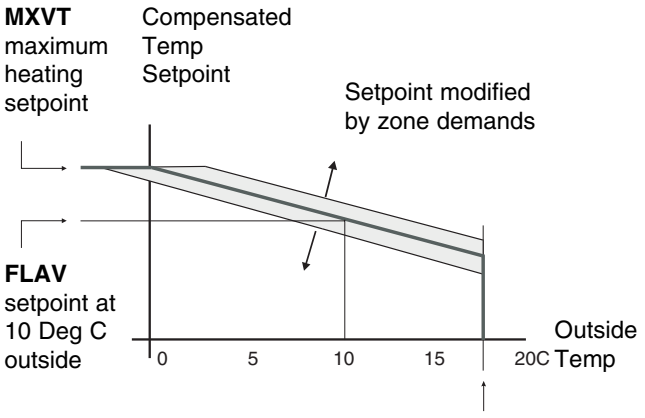
## A) VTC - Variable Temperature with Weather Compensation (heating only)

The VTC version of the Secondary Circuit controller controls water temperature for the VT circuit according to a Weather Compensated setpoint; this is further modified by demand signals from the Zone Controllers to produce the Heating setpoint. The current setpoint can be monitored by parameter **REQD**.

## Zone Trim and Adaption

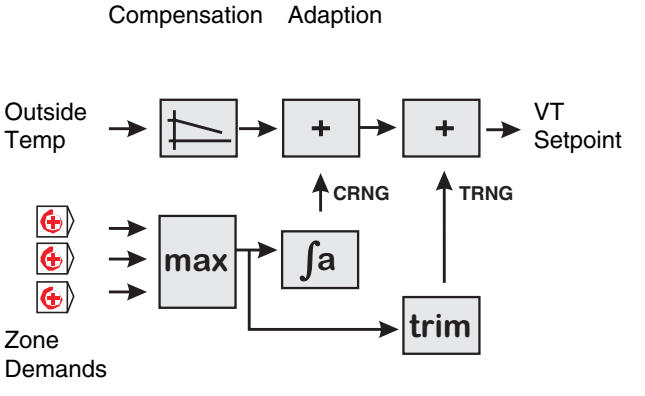
Zone Controllers (or other Consumer Modules) produce demand signals varying between -100% (full cooling) and +100% (full heating). The VTC Controller adapts the Weather Compensation to "learn" the building's characteristic by keeping the highest-demanding Zone device at a +50% demand level during occupancy.

If the demand level is above or below 50%, the Weather Compensated setpoint is modified by two effects in the Fuzzy Logic Control loop; the trim effect will rapidly raise or lower the setpoint to take care of short-term changes in load.




**Weather Compensation and Adaption in VTC Controller**

The adaptive effect will additionally raise or lower the setpoint if the "error" from the 50% level is sustained over a long period, which represents the control system "learning" the thermal characteristic of the building.




**Setpoint Calculation in VTC Controller**

The effects of these adaptations can be limited; the maximum excursion from the Weather Compensated setpoint caused by their effects can be set on two Configuration Parameters: **TRNG** sets the maximum trim effect, and **CRNG** sets the maximum influence of the adaptive effect.

These setpoint calculations remain active when the Controller is in an Occupied state (see **Occupation State**, earlier in this document). At all other times, it will control to its non-occupied setpoint, **FRSP**.

## Pump Control and Demand

The Default settings of **MIND**, **MNAV** and **MNOC** will cause the heating to shut down when all Zones are satisfied. This is best practise for energy efficiency; however, if space temperature sensors are badly sited or not representative of the entire zone temperature, it may be necessary to disable this feature. If it is desired for the Heating pump to run at all times during any Zone's Occupancy period, then **MIND**, **MNAV** and **MNOC** should all be set to zero; energy losses due to unnecessary circulation of water or overheating of parts of the zone may result, however.

## Other Features

**FLAV** defines the unadapted Weather Compensated setpoint at 10 Deg C outside temperature

**MAXF** is a limit to heating flow temperature (useful for limiting the flow temperature in underfloor heating applications), and also defines the Weather Compensated setpoint at 0 Deg C Outside temperature.

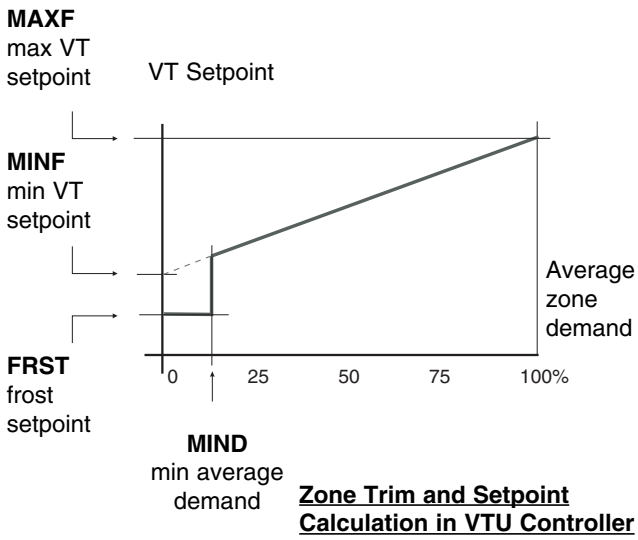
**SMRT** defines a summer cutoff temperature; when the outside temperature exceeds this value, the Controller will be forced into non-Occupancy.

## B) VTU - Variable Temperature with no Weather Compensation

The VTU Controller controls water temperature for the VT circuit according to a setpoint which is adjusted by demand signals from the Zone Controllers (or other Consumer Modules) registered to it.

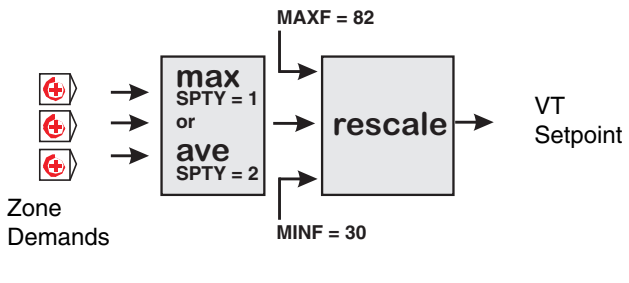
### Zone Trim

The maximum demand from all of the Zone Controllers registered to the Secondary Circuit Controller is used to rescale the setpoint for the VT temperature between **MAXF** and **MINF**. Thus if the maximum demand from the Zones is 100%, the VT setpoint will be set to **MAXF**; if the maximum demand is low, just a few percent, the setpoint will reduce to approach **MINF**. Cooling versions work in an inverted sense.




**Zone Trim and Setpoint Calculation in VTU Controller**

If the parameter **SPTY** is changed from its default value of 1 to 2, this will cause the average value of Zone Demands to be used instead of the maximum.




**Setpoint Calculation in VTU Controller**

These setpoint calculations remain active when the Controller is in an Occupied state (see **Occupation State**, earlier in this document). At all other times, it will control to its non-occupied setpoint, **FRSP** (or **NOSP** for Cooling versions).

### Pump Control and Demand

The Default settings of **MIND**, **MNAV** and **MNOC** will cause the Secondary Circuit to shut down when all Loads are satisfied. This is best practise for energy efficiency; however, if space temperature sensors are badly sited or not representative of the entire zone temperature, it may be necessary to disable this feature. If it is desired for the Secondary Circuit pump to run at all times during any Consumer Module's Occupancy period, then **MIND**, **MNAV** and **MNOC** should all be set to zero; energy losses due to unnecessary circulation of water or overheating/cooling of the space may result, however.

## C) CTU - Constant Temperature

The CTU Controller controls to a Constant Temperature Setpoint, set on parameter **MAXF** (**MINF** is not used in this application) when the Controller is in an Occupied state (see **Occupation State**, earlier in this document).

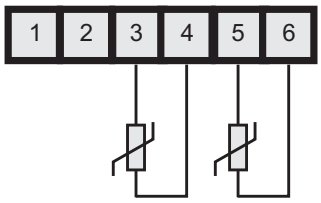
At all other times, it will control to its non-occupied setpoint, **FRSP** (or **NOSP** for Cooling versions).

The Default settings of **MIND**, **MNAV** and **MNOC** will cause the Secondary Circuit to shut down when all Loads are satisfied. This is best practise for energy efficiency; however, if space temperature sensors are badly sited or not representative of the entire zone temperature, it may be necessary to disable this feature. If it is desired for the Secondary Circuit pump to run at all times during any Consumer Module's Occupancy period, then **MIND**, **MNAV** and **MNOC** should all be set to zero; energy losses due to unnecessary circulation of water or overheating/cooling of the space may result, however.

## Temperature Sensors and Inputs

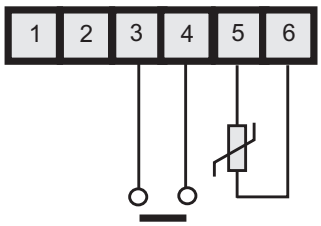
Depending on the application, one or more sensors can be used for temperature control. The standard flow temperature sensor is connected to input **'temp b'** on terminals 5 and 6. The optional input **'temp a'** on terminals 3 and 4 can either be used for a return temperature sensor or alternatively a VFC input. The behaviour of the two inputs are configured by parameters **SACT** and **INMD**.

**Flow Sensor and Optional Sensor**



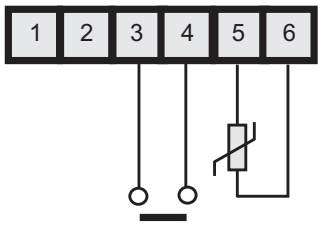

| | |
|---|---|
| Input 3-4 | Optional Sensor |
| Input 5-6 | Flow Sensor |
| **INMD** = 0 | |
| **SACT** = 0 | Control on Flow sensor only<br>Optional sensor for monitoring |
| **SACT** = 1 | Control on average of two sensors |
| **SACT** = 2 | Control on maximum of two sensors |
| **SACT** = 3 | Control on minimum of two sensors |

**Flow Sensor and external Control Status input**




| | |
|---|---|
| Input 3-4 | External occupancy VFC input |
| Input 5-6 | Flow Sensor |
| **SACT** = 0 | |
| **INMD** = 1 | Occupancy determined by own occupancy state **AND** external i/p<br>Use for Interlock with high limit stat |
| **INMD** = 2 | Occupancy determined by Time Schedule **OR** external i/p<br>Use for external occupancy override |
| **INMD** = 3 | External occupancy signal only<br>Use for external timeclock control where no Zone Controller used |

**Flow Sensor and external Alarm Monitor input**




| | |
|---|---|
| Input 3-4 | External monitor / alarm VFC input |
| Input 5-6 | Flow Sensor |
| **SACT** = 0 | |
| **INMD** = 4 | Monitor Input if **ALRM** = 0<br>Alarm Input if **ALRM** > 0 |
| **INMD** = 5 | Pump readback monitor<br>Generates alarm if no status readback from pump (via DP switch etc ) within 30 secs (set **ALRM** > 0) |
| **ALST** = 0 | 0 = Alarm State, 1 = Normal |
| **ALST** = 1 | 0 = Normal, 1 = Alarm State |

### Sensor calibration

The resultant control sensor value (flow sensor input alone, or flow and return sensors combined as set by **SACT**) can be adjusted by calibration parameter **SCAL**.

### Operation with no sensor fitted

Like many SeaChange Modules, the Secondary Circuit Controller can work with or without a Temperature Sensor; the act of connecting the sensor (or not) determines in which mode the Controller will work.

With a sensor connected, the Controller will use its internal Fuzzy Logic control loop to control its outputs according to the appropriate setpoint. This is called Closed Loop control.

If no sensor is fitted (or the sensor is disconnected) the Controller will effectively bypass its control loop, and the Zone Demands (either Maximum, or Average Demand according to the value of **SPTY**) will be used to drive the valve directly (thus if the Zone Demand is 70%, the valve will be driven to 70% open). This is called Open Loop control.

Sometimes, Open Loop operation is required but the sensor is needed for monitoring (for instance, if the Secondary Circuit Controller was being used to enable a Chiller with its own temperature controls, then the Controller's own control loop would need to be disabled). In these cases, setting parameter **CMDE** = 0 will disable the control loop, allowing Open Loop operation, whilst leaving the sensor connected for monitoring purposes.

## Submodules

The Secondary Circuit controller can have up to 2 actuator or changeover submodules registered to it, and also up to 8 condensation sensors sharing a common address.

### Condensation Sensor

Intelligent condensation sensors can be registered to cooling versions of the Secondary Circuit controller. The state of the condensation sensors can be monitored on input I4 and if the alarm mode is set, can be used to generate alarms. Up to 8 sensors can be registered, sharing the same cloned address.

When the sensor detects that condensation is present, the cooling demand is progressively reduced to zero. Cooling control recovers a few minutes after condensation is no longer present.

## Frost Protection

The Heating versions of Secondary Circuit Controller have their own Frost Protection Setpoint, **FRSP**, which if violated, will cause the Controller to run its pump and send demand signals to its Heat provider (Cooling versions have a similar over-temperature setpoint **NOSP**). Additionally, if the Boiler Controller (which is responsible for global Frost Protection in a Seachange system) enters Frost Protect mode, the Secondary Circuit Controller will run its pump and open its valve to 50% to allow water circulation using **FRPT**.

## Pump Control Interlock

**Twin Pumpsets (using Changeover Submodule)**

The Secondary Circuit Controller outputs can be interlocked with the status of pumps controlled by a Changeover submodule.

When the interlock pump switch **ILKP** = 1 the Secondary Circuit controller ensures that flow has been established by the Changeover Submodule before allowing any of its outputs to be energised. Setting **ILKP** = 1 will automatically set **ALRM** to 1 or higher.

If subsequently both pumps fail, the Secondary Circuit Controller will shut down and generate a **PMPF** pump failure alarm. The Secondary Circuit controller will remain disabled until the Secondary Circuit Controller Override button is pushed, or **ILKP** is reset.

When the established flow switch **ESTF** = 1, the Secondary Circuit Controller will wait for pumps to run for the minimum on time before outputs are energised.

**Single Pump (using Occupation Output)**

When a single pump is driven from the occupation output, **INMD** = 5 and **ALRM** = 2 or 3, the control outputs are disabled if the pump readback signal goes into alarm. The pump remains disabled until the readback signal is fixed, the Override button is pushed or the **ALRM** parameter is set to zero.

**Single Pump (Continued)**

The pump (occupation output) can also be set to delay its start after the heating/cooling outputs have started, or to run on after they have shut down, using the configuration parameters **HDLY** and **CDLY**. A negative value will start the pump the defined number of minutes after the heating/cooling drivers have been enabled; a positive value will cause the pump to run on after the heating/cooling drivers shut down. This feature does not apply to the operation of Changeover Submodules which have their own run on feature built in.

The interlock features can be particularly useful when controlling packaged chillers.

## Alarm Handling

The Secondary Circuit Controller may be set to ignore alarm conditions, report them to a SeaChange Doorway Supervisor (either locally connected to the system, or via an autodialling modem), or to both report alarms and take some control action. The **ALRM** parameter is used to select the desired Alarm Mode.

The Secondary Circuit Controller generates an alarm if the sensor fails and also if the external alarm input is used. The sense of the alarm input can be set by parameter **ALST**.

The Secondary Circuit Controller may be set to respond to the **STOP** System Stop Alarm which is generated by another Controller; this can be used to shut down the entire control system, or parts of it, if a particularly critical event occurs. See Boiler Controller datasheets B1 or B2 for more details about the System Stop Alarm.

Alarm codes as they appear at Doorway Supervisor and InSite tool:

**NOAL** No Alarms.
All alarm conditions cleared in this Module.

**SENF** Sensor Failed.

**EXTN** External alarm generated by VFC input.

**CNDF** Condensation Failure.

**PMPF** Pump Fail (readback alarm) generated by VFC input (**INMD** = 5) or registered PCO Submodule.

**STOP** System **STOP** alarm received.
All outputs shut down if **ALRM** = 3 or 4.

## Local Indication of Alarms

Alarms are indicated by red flashing of the Temperature Indicator (Thermometer) LED, if the alarm results in a control action (e.g. shutting down the pump/valve). If **ALRM** is set to 0 (ignore alarms) or 1 (report alarms to supervisor only) then no control action will be taken, and the thermometer LED will not flash.

# Commissioning

## Setup Mode : Timing Characteristics of Output Channels

It is possible to set the stroke time (for Raise/ Lower type Actuators) and the minimum on/off time (for Time Proportion type Actuators) using pushbuttons.

*Raise/Lower Types - Setting Stroke Time*

**1 Hold down Select until Temp lamp flashes**

Temperature indicator will flash red at one second intervals.
Release select button; output B will energise to close valve.

**2 When valve is closed press Select**

Temperature indicator will flash green and output A will energise to open valve. The controller is now measuring the stroke time.

**3 When the valve is open press Select**

Flashing will stop and stroke time is now set and stored in non-volatile memory. This time will be retained until the procedure is repeated.

**Note**: if a Stroke Time of less than 30 secs is set using pushbuttons then the setup process is aborted. Temp indicator flashes amber rapidly for 5 secs indicating an invalid period. This allows checking of wiring without affecting Stroke Time setup. Stroke Times less than 30 secs can be entered manually via Zone Controller or InSite tool.

*TP Types - Setting Minimum Time On/Off*

**1 Hold down Select until Temp lamp flashes**

Temperature indicator will flash green at one second intervals and relay A will energise. Release select button.

**2 When minimum on/off time has elapsed, press select**

Flashing will stop and this time will be set and stored in non-volatile memory. This time will be retained until the procedure is repeated. Note that the full TP period will be 10 times this value.

The times can also be viewed and changed using parameters **HPRD** (heating) and **CPRD** (cooling).

## Manual Override

Allows the outputs to be exercised during commissioning and maintenance activities. Holding the *override* button pressed until the Status Lamp flashes green will cause the controller to be switched from automatic control to *Override Mode*. Subsequent pressings of the manual override button will cycle through the available Override modes.

**1) Hold down Override until Status lamp flashes**

Controller changes to Override Mode and becomes Occupied, controlling to current Occupied Setpoint.

**2) Press Override again**

Controller changes to Manual Mode and output is set to 100% heating.
Temperature lamp shows red.

**3) Press Override again**

Controller changes to Manual Mode and output is set to 100% cooling.
Temperature lamp shows amber.

**4) Press Override again**

Controller cancels Manual Override and reverts to automatic control.

As this feature does not time out, care should be exercised to ensure the module is returned to the automatic mode on completion of the commissioning or maintenance activities.

Occupancy Override can also be achieved via Doorway and InSite; using **AUTO** and **OVRD** monitoring parameters. The status lamp indication shows a different sequence.

**Override from Off to ON :**

Status lamp flashes long ON, short Off

**Override from ON to Off :**

Status lamp flashes long Off, short ON

See our 'Design Guide' publication for details of the Override features.

## Registration

*Registration* is the simple process by which logical connections are made between Controllers in a SeaChange system; it is done during commissioning and involves pressing buttons on the Controllers in a specific sequence.

For further details of the registration process, see our 'Design Guide' publication.

**Address Allocation and System Housekeeping**

Like all SeaChange Controllers, the Secondary Circuit controller must be registered with other modules in order to create a working system. During the Registration procedure, the address of each Controller is allocated by the module that contains *System Housekeeping*. Check that you have an appropriate System Housekeeping Module; see our 'Design Guide' publication.

## Interconnects

The Secondary Circuit controller may receive signals from a Zone Controller or other Consumer module, either by Zone Energy Demand or Zone Occupancy Demand signals (see Occupation State section). It may also send signals to other modules (e.g. a Pump Changeover submodule when the controller's secondary circuit has a twin pump set)

These Interconnects are put in place by Registration; again, see our 'Design Guide' publication.

# Configuration Parameters - Heating Types

M3

| Label | Doorway InSite Code | Description | Units | Default Value | Range |
|---|---|---|---|---|---|
| FRSP | C1 | Frost Protection / Non Occupied Setpoint | Deg C | 10 | 2 to 15 |
| MAXF | C2 | Maximum Flow Setpoint (VTC and VTU) / CT Setpoint (CTU) | Deg C | 82 | 5 to 100 |
| MINF | C3 | Minimum Flow Setpoint | Deg C | 30 | 1 to 100 |
| FLAV | C4 | Flow Temperature for 10°C outside temperature (VTC only) | Deg C | 50 | 20 to 100 |
| SACT | C5 | Sensor Action<br>0: Use 'temp b' sensor for control and optionally use 'temp a' sensor for monitoring or VFC using INMD<br>1: Use average of valid sensor values (INMD = 0)<br>2: Use maximum of valid sensor values (INMD = 0)<br>3: Use minimum of valid sensor values (INMD = 0) | | 0 | 0 to 3 |
| SCAL | C6 | Sensor Calibration | Deg C | 0 | -10 to +10 |
| SPTY | C7 | Setpoint Type | - | 0 | 0 to 3 |
| | | for **CTU** | - | 0 | - |
| | | 0: Constant temperature setpoint (value set in MAXF) | | | |
| | | for **VTU** | - | 1 | - |
| | | 1: Setpoint varies linearly based on Maximum Demand Signal from Consumers | | | |
| | | 2: Setpoint varies linearly based on Average Demand Signal from Consumers | | | |
| | | for **VTC** | - | 3 | - |
| | | 3: Weather Compensated with Zone demand Compensation | | | |
| INMD | C8 | Input Mode for input terminals 3 and 4 'temp a'<br>0: Additional temperature input for max, min, ave using SACT<br>1: External occupation (input linked = Occupied) AND with internal Occupation<br>2: External occupation (input linked = Occupied) OR with internal Occupation<br>3: External Occupation signal only<br>4: Alarm input<br>5: Pump alarm | - | 0 | 0 to 5 |
| MIND | C9 | Minimum Demand | % | 5 | 0 to 100 |
| MNAV | C10 | Minimum Average Demand | % | 0 | 0 to 100 |
| MNOC | C11 | Minimum number of Occupied Zones | - | 0 | 0 to 200 |
| MNDV | C12 | Minimum demand for driver, affects control of Fan or Pump | % | 5 | 0 to 100 |
| LOSS | C13 | Flow Loss added to setpoint and sent to Heat Provider | Deg C | 10 | 0 to 20 |
| TRNG | C14 | Maximum trim effect on heating setpoint (VTC only) | Deg C | 10 | 0 to 20 |
| CRNG | C15 | Maximum adaptive effect on heating setpoint (VTC only) | Deg C | 10 | 0 to 20 |
| SMRT | C16 | Summer outside temperature setpoint to inhibit heating | Deg C | 20 | 10 to 30 |
| HPRD | C17 | Heating Driver Stroke/Minimum On Time | secs/10 | 18 | 1 to 240 |
| HDLY | C18 | Heating Interlock Delay<br>Negative value opens valve before pump starts<br>Positive value runs pump on after valve shuts down | mins | 5 | -30 to 30 |
| FPRD | C19 | Not used in this application | secs/10 | 12 | 1 to 240 |
| FRPT | C20 | Frost Protection Mode<br>0: No action<br>1: Open heating valve 50%<br>2: Open heating valve and run pump | | 2 | 0 to 2 |
| MANL | C21 | Manual Level, set by Doorway or InSite | % | 0 | -100 to 100 |
| CMDE | C22 | Control Mode<br>0: Control loop disabled, demand passed direct to outputs<br>1: Normal control | - | 1 | 0 to 1 |
| ALRM | C23 | Alarm Mode<br>0: Ignore alarms<br>1: Report all alarms to Doorway/InSite, no control action, no flashing Temp indicator<br>2: Report all alarms, shut down all outputs on local alarm<br>3: Report all alarms, shut down on STOP alarm or local alarm<br>4: Report all alarms, shut down on STOP alarm only | - | 0 | 0 to 4 |
| ALST | C24 | Alarm report sense<br>0: Alarm if input = 0, pump running if input = 1<br>1: Alarm if input = 1, pump running if input = 0 | - | 1 | 0 to 1 |
| HTSC | C25 | Heat Source | - | 1 | 0 to 8255 |
| OCDS | C26 | Occupation Destination | - | 0 | 0 to 8255 |
| HTCT | C27 | Heating Demand sent as CT<br>0: HTSC interconnects to Secondary Circuit, demand sent %<br>1: HTSC interconnects to Boiler, demand sent as CT temp | - | 1 | 0 to 1 |
| COMP | C28 | Adaption offset for weather compensated setpoint | Deg C | 0 | -50 to 50 |

Parameter details were correct at product software revision 4C1. Details of current version can be seen on website.

# M3 Monitoring Parameters - Heating Types

| Label | Doorway / InSite Code | Description | Units | Default Value | Range |
|---|---|---|---|---|---|
| EXTI | I1 (C30) | External Input (function depends on **INMD** setting) | - | - | 0 to 1 |
| OCC | I2 (C31) | Occupied | - | - | 0 to 1 |
| SHOF | I4 (C33) | Summer Heating Inhibit | - | - | 0 to 1 |
| COOL | I5 (C34) | Cooling Mode | - | - | 0 to 1 |
| RLYA | I6 (C35) | Triac A Status (for 3T types only) | - | - | 0 to 1 |
| RLYB | I7 (C36) | Triac B Status (for 3T types only) | - | - | 0 to 1 |
| RLYC | I8 (C37) | Triac C Status (for 3T types only) | - | - | 0 to 1 |
| AUTO | W1 (C38) | Automatic/Manual Status | - | - | 0 to 1 |
| OVRD | W2 (C39) | Override | - | - | 0 to 1 |
| ILKP | W3 (C40) | Interlock Pump (PCO submodule) | - | - | 0 to 1 |
| ESTF | W4 (C41) | Establish Flow (PCO submodule) | - | - | 0 to 1 |
| HAND | W5 (C42) | Manual Hand; use with MANL to set output level | - | 0 | 0 to 1 |
| POT | W6 (C43) | not used in this application | - | 0 | 0 to 1 |
| SERV | W7 (C44) | Service Pin Message (to Doorway and InSite, self resetting) | - | - | 0 to 1 |
| CGST | W8 (C45) | Configuration Mode Status | - | - | 0 to 1 |
| HTMP | S1* (C50) | Heated Water Temperature | Deg C | - | - |
| DMND | S2* (C51) | Control Demand | % | - | - |
| REQD | S3 (C52) | Current Setpoint | Deg C | - | - |
| ZDMD | S4 (C53) | Highest demand from zones | % | - | - |
| AVDM | S5 (C54) | Average demand from zones | % | - | - |
| NOCC | S6 (C55) | Number of zones Occupied | - | - | - |
| FLOW | S7 (C56) | Flow Temperature | Deg C | - | - |
| RTRN | S8 (C57) | Return Temperature | Deg C | - | - |
| MAXF | K1 (C60) | Maximum Flow Setpoint (for VTU, VTC and CTU) | Deg C | 82 | 10 to 100 |
| MINF | K2 (C61) | Minimum Flow Setpoint (for VTU and VTC only) | Deg C | 30 | 5 to 100 |
| FLAV | K3 (C62) | Flow Temperature Setpoint for 10C outside (for VTC only) | Deg C | 50 | 10 to 100 |
| FRSP | K4 (C63) | Non Occupied (Frost) Setpoint | Deg C | 10 | 5 to30 |
| MXVA | K5 (C163) | Maximum Voltage output a (for AOP types only) | Vdc | 10 | 0 to 10 |
| MNVA | K6 (C164) | Minimum Voltage output a (for AOP types only) | Vdc | 0 | 0 to 10 |
| MXVB | K7 (C165) | Maximum Voltage output b (for AOP types only) | Vdc | 10 | 0 to 10 |
| MNVB | K8 (C166) | Minimum Voltage output b (for AOP types only) | Vdc | 0 | 0 to 10 |
| | | Engineering Parameters; only accessible via Doorway and InSite | | | |
| NOAL | C90 | No Alarms; all alarms cleared when set to 1 | - | - | 0 or 1 |
| SENF | C91 | Sensor Failed (when set to 1) | - | - | 0 or 1 |
| EXTN | C92 | Volt-Free Contact alarm (when set to 1) | - | - | 0 or 1 |
| CNDF | C93 | Condensation detected (for cooling types only) | - | - | 0 or 1 |
| PMPF | C94 | Pump Failed (when set to 1) | - | - | 0 or 1 |
| STOP | C95 | STOP alarm received (when set to 1) | - | - | 0 or 1 |
| DI A | C180 | Input 3-4 digital status | - | - | 0 or 1 |
| DI B | C181 | Input 5-6 digital status | - | - | 0 or 1 |

* 24 hour plots available for these values by default
Plotting interval and plotted variable changeable via Doorway or InSite

Parameter details were correct at product software revision 4C1. Details of current version can be seen on website.

# Configuration Parameters - Cooling Types

M3

| Label | Doorway InSite Code | Description | Units | Default Value | Range |
|---|---|---|---|---|---|
| NOSP | C1 | Non Occupied Setpoint | Deg C | 40 | 10 to 50 |
| MAXF | C2 | Maximum Flow Setpoint | Deg C | 16 | 5 to 100 |
| MINF | C3 | Minimum Flow Setpoint | Deg C | 11 | 1 to 100 |
| SACT | C4 | Sensor Action<br>0: Use 'temp b' sensor for control and optionally use 'temp a' sensor for monitoring or VFC using INMD<br>1: Use average of valid sensor values (INMD = 0)<br>2: Use maximum of valid sensor values (INMD = 0)<br>3: Use minimum of valid sensor values (INMD = 0) | | 0 | 0 to 3 |
| SCAL | C5 | Sensor Calibration | Deg C | 0 | -10 to +10 |
| SPTY | C6 | Setpoint Type | - | 0 | 0 to 2 |
| | | for **CTU** | - | 0 | - |
| | | 0: Constant temperature setpoint (value set in MAXF) | | | |
| | | for **VTU** | - | 1 | - |
| | | 1: Setpoint varies linearly based on Maximum Demand Signal from Consumers | | | |
| | | 2: Setpoint varies linearly based on Average Demand Signal from Consumers | | | |
| INMD | C7 | Input Mode for input terminals 3 and 4 'temp a'<br>0: Additional temperature input for max, min, ave using SACT<br>1: External occupation (input linked = Occupied) AND with internal Occupation<br>2: External occupation (input linked = Occupied) OR with internal Occupation<br>3: External Occupation signal only<br>4: Alarm input<br>5: Pump alarm | - | 0 | 0 to 5 |
| MIND | C8 | Minimum Demand | % | 5 | 0 to 100 |
| MNAV | C9 | Minimum Average Demand | % | 0 | 0 to 100 |
| MNOC | C10 | Minimum number of Occupied Zones | - | 0 | 0 to 200 |
| MNDV | C11 | Minimum demand for driver, affects control of Fan or Pump | % | 5 | 0 to 100 |
| GAIN | C12 | Flow Gain subtracted from setpoint and sent to Cooling Provider | Deg C | 2 | 0 to 25 |
| CPRD | C13 | Cooling Driver Stroke/Minimum On Time | secs/10 | 18 | 1 to 240 |
| CDLY | C14 | Cooling Interlock Delay<br>Negative value opens valve before pump starts<br>Positive value runs pump on after valve shuts down | mins | 5 | -60 to 60 |
| FPRD | C15 | Not used in this application | secs/10 | 12 | 1 to 240 |
| FRPT | C16 | Frost Protection Mode<br>0: No action<br>1: Open valve 50%<br>2: Open valve and run pump | | 0 | 0 to 2 |
| MANL | C17 | Manual Level, set by Doorway or InSite | % | 0 | -100 to 100 |
| CMDE | C18 | Control Mode<br>0: Control loop disabled, demand passed direct to outputs<br>1: Normal control | - | 1 | 0 to 1 |
| ALRM | C19 | Alarm Mode<br>0: Ignore alarms<br>1: Report all alarms to Doorway/InSite, no control action, no flashing Temp indicator<br>2: Report all alarms, shut down all outputs on local alarm<br>3: Report all alarms, shut down on STOP alarm or local alarm<br>4: Report all alarms, shut down on STOP alarm only | - | 0 | 0 to 4 |
| ALST | C20 | Alarm report sense<br>0: Alarm if input = 0 (contact open), pump running if input = 1 (closed)<br>1: Alarm if input = 1 (contact closed), pump running if input = 0 (open) | - | 1 | 0 to 1 |
| CLSC | C21 | Cool Source | - | 0 | 0 to 8255 |
| OCDS | C22 | Occupation Destination | - | 0 | 0 to 8255 |
| CLCT | C23 | Cooling Demand sent as CT<br>0: CLSC interconnects to Secondary Circuit, demand sent as %<br>1: CLSC interconnects to Chiller, demand sent as CT temp | - | 1 | 0 to 1 |

Parameter details were correct at product software revision 4C1. Details of current version can be seen on website.

# M3 Monitoring Parameters - Cooling Types

| Label | Doorway / InSite Code | Description | Units | Default Value | Range |
|---|---|---|---|---|---|
| EXTI | I1 (C30) | External Input (function depends on **INMD** setting) | - | - | 0 to 1 |
| OCC | I2 (C31) | Occupied | - | - | 0 to 1 |
| COND | I4 (C33) | Condensation Alarm | - | - | 0 to 1 |
| COOL | I5 (C34) | Cooling Mode | - | - | 0 to 1 |
| RLYA | I6 (C35) | Triac A Status (for 3T types only) | - | - | 0 to 1 |
| RLYB | I7 (C36) | Triac B Status (for 3T types only) | - | - | 0 to 1 |
| RLYC | I8 (C37) | Triac C Status (for 3T types only) | - | - | 0 to 1 |
| AUTO | W1 (C38) | Automatic/Manual Status | - | - | 0 to 1 |
| OVRD | W2 (C39) | Override | - | - | 0 to 1 |
| ILKP | W3 (C40) | Interlock Pump (PCO submodule) | - | - | 0 to 1 |
| ESTF | W4 (C41) | Establish Flow (PCO submodule) | - | - | 0 to 1 |
| HAND | W5 (C42) | Manual Hand; use with MANL to set output level | - | 0 | 0 to 1 |
| POT | W6 (C43) | not used in this application | - | 0 | 0 to 1 |
| SERV | W7 (C44) | Service Pin Message (to Doorway and InSite, self resetting) | - | - | 0 to 1 |
| CGST | W8 (C45) | Configuration Mode Status | - | - | 0 to 1 |
| CTMP | S1* (C50) | Chilled Water Temperature | Deg C | - | - |
| DMND | S2* (C51) | Control Demand | % | - | - |
| REQD | S3 (C52) | Current Setpoint | Deg C | - | - |
| ZDMD | S4 (C53) | Highest demand from zones | % | - | - |
| AVDM | S5 (C54) | Average demand from zones | % | - | - |
| NOCC | S6 (C55) | Number of zones Occupied | - | - | - |
| FLOW | S7 (C56) | Flow Temperature | Deg C | - | - |
| RTRN | S8 (C57) | Return Temperature | Deg C | - | - |
| MAXF | K1 (C60) | Maximum Flow Setpoint (for VTU and CTU) | Deg C | 16 | 10 to 100 |
| MINF | K2 (C61) | Minimum Flow Setpoint (for VTU only) | Deg C | 11 | 5 to 100 |
| MXVA | K3 (C163) | Maximum Voltage output a (for AOP types only) | Vdc | 10 | 0 to 10 |
| MNVA | K4 (C164) | Minimum Voltage output a (for AOP types only) | Vdc | 0 | 0 to 10 |
| MXVB | K5 (C165) | Maximum Voltage output b (for AOP types only) | Vdc | 10 | 0 to 10 |
| MNVB | K6 (C166) | Minimum Voltage output b (for AOP types only) | Vdc | 0 | 0 to 10 |
| | | Engineering Parameters; only accessible via Doorway and InSite | | | |
| NOAL | C90 | No Alarms; all alarms cleared when set to 1 | - | - | 0 or 1 |
| SENF | C91 | Sensor Failed (when set to 1) | - | - | 0 or 1 |
| EXTN | C92 | Volt-Free Contact alarm (when set to 1) | - | - | 0 or 1 |
| CNDF | C93 | Condensation detected (when set to 1) | - | - | 0 or 1 |
| PMPF | C94 | Pump Failed (when set to 1) | - | - | 0 or 1 |
| STOP | C95 | STOP alarm received (when set to 1) | - | - | 0 or 1 |
| DI A | C180 | Input 3-4 digital status | - | - | 0 or 1 |
| DI B | C181 | Input 5-6 digital status | - | - | 0 or 1 |

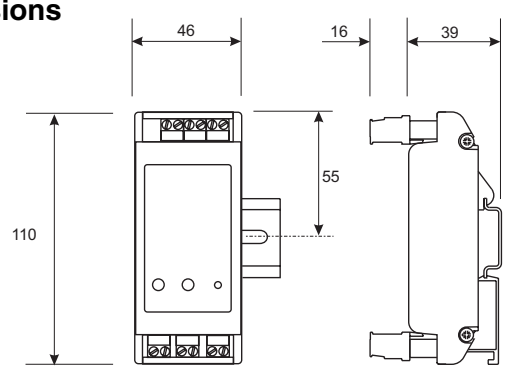
* 24 hour plots available for these values by default
Plotting interval and plotted variable changeable via Doorway or InSite

Parameter details were correct at product software revision 4C1. Details of current version can be seen on website.

# Specification - Analogue Outputs

M3

## Dimensions




all dimensions in mm

## Electrical

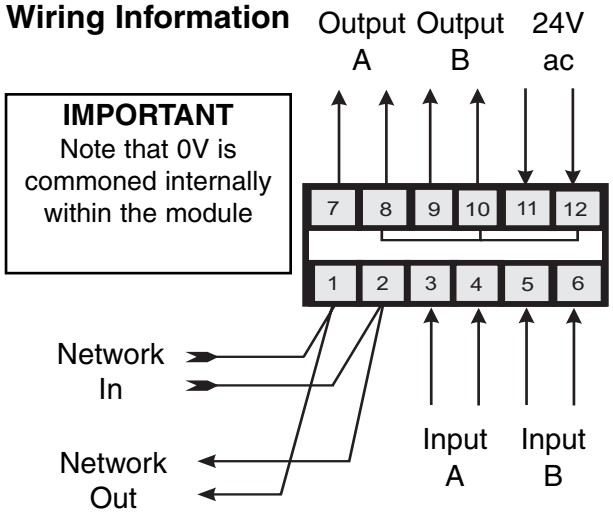
| | |
|---|---|
| Inputs | 2 Thermistors or 1 Thermistor + 1 VFC |
| Outputs | 2 x 0 - 10Vdc |
| Consumption | 7mA from network<br>50mA from external 24Vac supply |

## Physical

| | |
|---|---|
| Weight | 0.15 kg |
| Cover Material | PC/ABS alloy Self extinguishing to UL 94 V0/1.60 |
| Base Material | Polyamide 6.6 Self extinguishing to UL 94 VO |
| Colour | Dark Grey to Pantone 425 |

CE Conformant product

## Wiring Information




See below for output configuration

**IMPORTANT**
Note that 0V is commoned internally within the module

**IMPORTANT**
Incorrect polarity connections to 0-10Vdc may cause damage to module

**IMPORTANT**
All network and input cable from temperature sensors or VFC to be unscreened, twisted pair cable, 20AWG - Belden 8205 or direct equivalent

See below for input configuration

If inputs are not being used, leave open circuit

## Options and Product Codes

Secondary Circuit Controller Module - Analogue Outputs

**VTC / DIN / AOP / [*driver option*]**

**VTU / DIN / AOP / [*driver option*]**

**CTU / DIN / AOP / [*driver option*]**

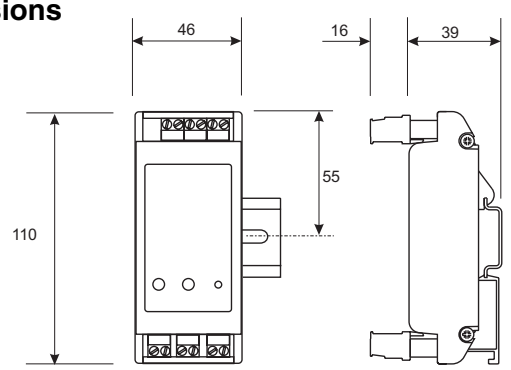
**Output driver options** for Heating version (Heat Source) and Cooling version (Cool source)

| Heating Option | Cooling Option | Output A | Output B | Output C |
|---|---|---|---|---|
| AOP / 721 | AOP / 821 | 0 -100% demand = 0 - 10Vdc | Occupation Switch or optimum start switch<br>Use Sontay IO-RM1-12DC module to drive pump | Not available |

| Input Configuration | Input A | Input B |
|---|---|---|
| | Return Sensor (optional)<br>or VFC status / alarm / occupancy | Flow Sensor |

# M3 Specification - Digital Outputs

## Dimensions




all dimensions in mm

## Electrical

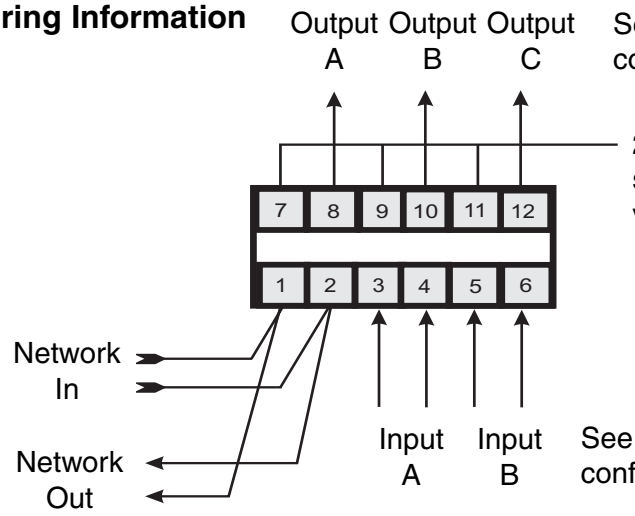
| | |
|---|---|
| Inputs | 2 Thermistors or 1 Thermistor + 1 VFC |
| Outputs | 3 Triacs - 1A at 230V |
| Consumption | 25mA from network |

## Physical

| | |
|---|---|
| Weight | 0.15 kg |
| Cover Material | PC/ABS alloy Self extinguishing to UL 94 V0/1.60 |
| Base Material | Polyamide 6.6 Self extinguishing to UL 94 VO |
| Colour | Dark Grey to Pantone 425 |

CE Conformant product

## Wiring Information




See below for output configuration

250Vac maximum supply voltage. dc voltage not suitable

**IMPORTANT**
All network and input cable from temperature sensors or VFC to be unscreened, twisted pair cable, 20AWG - Belden 8205 or direct equivalent

See below for input configuration

If inputs are not being used, leave open circuit

## Options and Product Codes

Secondary Circuit Controller Module - Triac Outputs

**VTC / DIN / 3T / [*driver option*]**

**VTU / DIN / 3T / [*driver option*]**

**CTU / DIN / 3T / [*driver option*]**

**Output driver options** for Heating version (Heat Source) and Cooling version (Cool source)

| Heating Option | Cooling Option | Output A | Output B | Output C |
|---|---|---|---|---|
| 3T / 101 | 3T / 201 | Time Proportional | Not used | Occupation Switch or optimum start switch |
| 3T / 105 | 3T / 205 | Valve Open | Valve Close | Occupation Switch or optimum start switch |
| 3T / 108 | 3T / 208 | Sequence 2 triacs at 33% and 66% of demand | | Occupation Switch or optimum start switch |
| 3T / 109 | 3T / 209 | Sequence 3 triacs at 25%, 50% and 75% of demand | | |

| Input Configuration | Input A | Input B |
|---|---|---|
| | Return Sensor (optional) or VFC status / alarm / occupancy | Flow Sensor |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