

Matrix iS21 Universal Chiller Plant Control Solution



**UCC0882L UDC0882L
UCH1464L UCT1464L UWP0882L**

Matrix iS21 is a family of versatile hardware and software products developed and manufactured by Matrix Controls Pte Ltd for HVAC and lighting controls of Intelligent Building Systems.

DESCRIPTION

The iS21 series Universal Chiller Plant Control Solution (CPCS) is an application specific LonWorks® DDC based system for capacity and lead/lag control of a group of chillers and necessary peripheral equipment. The system is pieced together using specific interactive modules, one for each type of equipment that makes up a chiller plant, and together with duty coordinating modules and a capacity commander module, is able to sequence all related equipment for the proper functioning of the chiller

plant in a reliable and energy efficient manner.



FEATURES

- CPCS automatically calculates cooling demand from supply/return temperature and the flow rate of chilled water to decide the number of chillers to switch on or off.
- Determines next available chiller, pump and cooling tower to turn on or off in sequence to maintain equal running hours and even wear & tear of each piece of equipment.
- Modulates bypass valve to maintain differential pressure across supply and return headers. System also works with de-coupling systems without bypass valves.
- Eliminates single point failures by having distributed intelligence- each piece of equipment is assigned one DDC- ensuring reliable chiller plant control.
- CPCS automatically avoids activating faulty equipment, relying on serviceable equipment to meet calculated cooling demand.
- Universal CPCS is suitable for all chiller plants piped in common header pipe configuration, even when of quantity of chillers, cooling towers and water pumps are not equal in number (E.g.: in plants with extra standby pumps and or cooling towers)
- Chiller plants with secondary pumps need only add USP2484L for control of the secondary pump set.

**UCC0882L UDC0882L
UCH1464L UCT1464L UWP0882L**

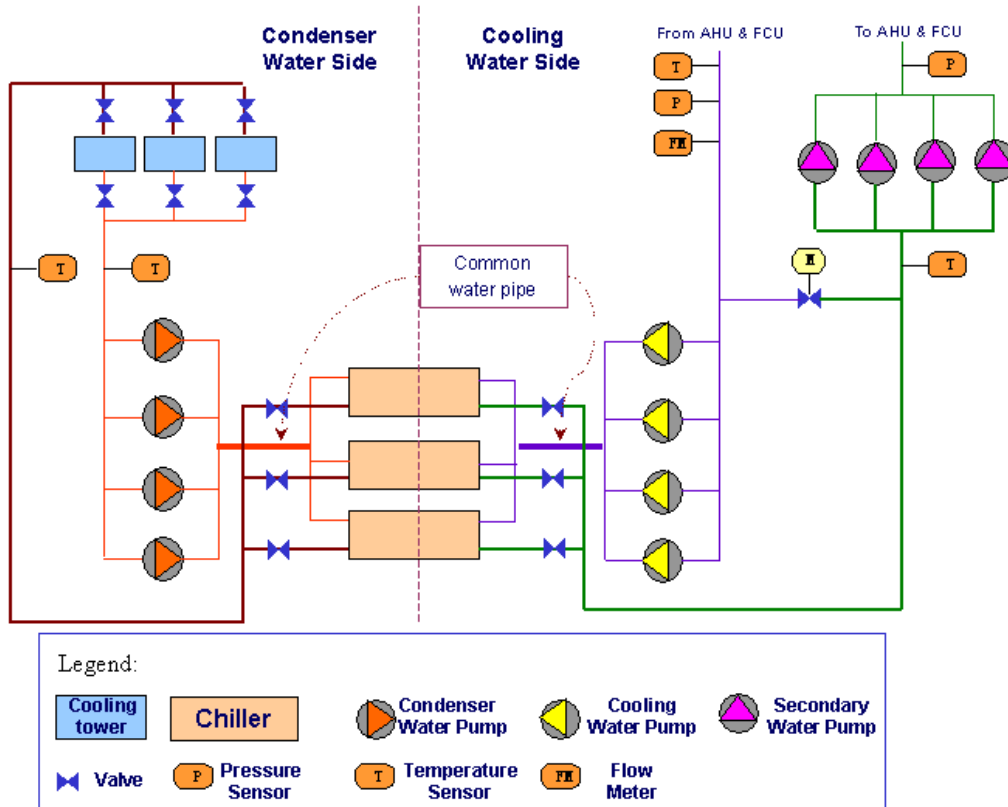


Figure 1

Common Piping Configuration of Chiller Plant

Common piping (fig. 1) leading water from condenser and cooling water pumps to the chillers allow cross control of the chiller and pump: i.e.: chiller need not be tied to its own pump only; chillers can share all available pumps.

Universal CPCS can effectively control this advantage to overcome the problem that dedicated pump and chiller sets can present. Using dedicated pumps for chillers means if a pump were to fail, the chiller that it serves can no longer be operated until the pump is serviced.

Different numbers of chillers and pumps as seen here can be controlled by Universal CPCS. Different numbers of cooling towers can also be handled by the system.



**UCC0882L UDC0882L
UCH1464L UCT1464L UWP0882L**

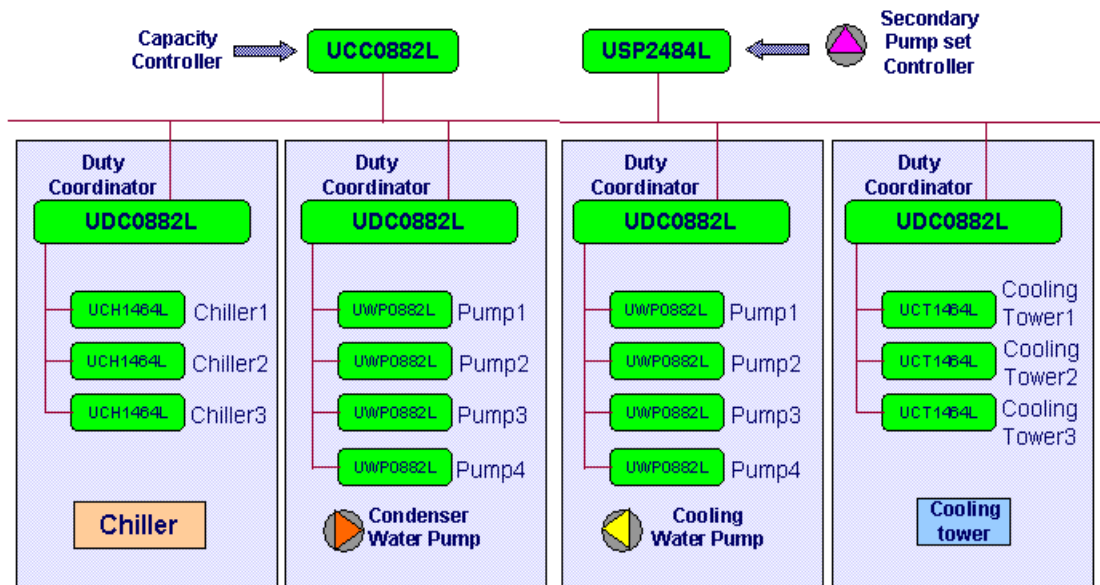


Figure 2

Distributed Responsibility, Minimising Single Point Failures

The above configuration of controllers shows ASDDC assignment to the chiller plant in Figure 1. Each piece of equipment receives its own ASDDC for control and monitoring of operations. Equipment breakdown or even certain ASDDC malfunctions will not affect the overall operation of the system.

UDC0882L duty coordinators will automatically avoid calling into operation ASDDC of pump, chiller or cooling tower that are not functioning or whichever mechanical equipment has a malfunction detected by its ASDDC. Instead, the next available serviceable unit - according to even wear permutation algorithm - is automatically activated. This feature ensures the continued operation of the chiller plant, providing cooling according to BTU demand up to the point where it is limited in cooling output by the malfunctioning equipment (e.g.: faulty chiller).

Description of DDC Models and Function

UCC0882L- Unitary Capacity Control DDC

UCC0882L performs the functions of cooling load calculation to determine number of chillers and cooling towers to operate. The command is then sent out via the network to the two UDC0882L so that they can activate the next duty chiller and the next duty cooling tower. Similarly, when there is a fall in demand, UCC0882L will command the respective UDC0882L to shut down chillers, cooling towers and pumps.

Whilst control of the number of chillers and cooling towers is based on cooling load as well as condenser water temperature, the number of cooling water pumps in operation are equal to the number of chillers and the number of condenser water pumps in operation are equal to the number of cooling towers in operation. Therefore, UCC0882L sends commands to the two UDC0882L in charge of water pumps when it increases or decreases the number of chillers and/or cooling towers.

UCC0882L also handles control of the bypass valve for water pressure balance.

Matrix iS21 Universal Chiller Plant Control Solution



UCC0882L UDC0882L UCH1464L UCT1464L UWP0882L

UDC0882L- Unitary Duty Coordinator DDC

The main function of UDC0882L is to coordinate the duty of all equipment under it to maintain an even rate of wear and tear. The equipment duty is rotated evenly between equipment by means of fixed rotation or by run hours. This facilitates the planning of preventive maintenance and reduces chances of equipment failure.

E.g.: when UDC0882L receives the command to cut-in one more set of chiller, it will command UCH1464L of the chiller with least run time to switch on.

UCH1464L- Unitary CHiller DDC

UCH1464L is an application specific DDC for the control of chiller sets. It will switch on or off the chiller when command is received from its supervising UDC0882L.

Faults and other statuses of the chiller are also monitored by the UCH1464L. When any fault that is detected disallows a chiller to be turned on, or during operation a fault should occur, the UCH1464L will switch off the chiller (if it is running) and send a signal to the UDC0882L so that it can command the next duty chiller set to switch on.

UWP0882L- Unitary Water Pump DDC

UWP0882L controls the function of water pumps for condenser and cooling water. It commands the pump to switch on/off when the command is received from its supervisory UDC0882L as well as monitors the status of the pumps. Similar to the UCH1464L, if any pump is faulty, the UWP0882L will send a signal to the UDC0882L so that the Duty Coordinator can command the next UWP0882L to activate the next duty pump.

UCT1464L- Unitary Cooling Tower DDC

The functions of the cooling towers are controlled and monitored by UCT1464L. The UCT1464L will switch on/off the cooling tower when command is received from its supervisory UDC0882L. Also, when any fault is detected that necessitates the shut down of a cooling tower, or prevents it from being switched on, the UCT1464L will signal its supervisory UDC0882L so that it can command the next cooling tower to be switched on.

In addition, UCT1464L can maintain a predetermined returned condenser water temperature by monitoring its temperature and controlling the fan speed of the cooling tower by VSD so that chillers run efficiently. This also saves energy as the fans can run at low speed when the water temperature is already low.

USP2484L- Unitary Secondary Pumps DDC

USP2484L controls all secondary pumps as illustrated in Fig 1. One USP2484L ASDDC is capable of controlling four secondary pumps and modulating the speeds of the pumps to maintain pressure setpoint.

USP2484L operates independent of UCC0882L and UDC0882L command.

Matrix iS21 Universal Chiller Plant Control Solution



LONMARK®
PARTNER



UCC0882L UDC0882L
UCH1464L UCT1464L UWP0882L

SPECIFICATIONS

Supply

- ❑ 24Vac, +/-5%, 50-60Hz
- ❑ Consumption: < 6.0 VA (per DDC)

Communication protocol

- ❑ LonTalk(R)

Communication Channel

- ❑ FT/TP 78.6 kbps

Neuron Type

- ❑ FT-3150, 10MHz

Transceiver

- ❑ FT-X1

Neuron Type

- ❑ FT-3150, 10MHz

Conformance to standards

- ❑ Emission ----- EN50081-1
- ❑ Immunity ----- EN50082-1

LonMark(R) Version

- ❑ 3.2

Size & Weight (Uxx0882L platforms)

- ❑ 180 x 140 x 52mm
- ❑ Approximately 150 gm

Size & Weight (Uxx1464L platforms)

- ❑ 240 x 180 x 52mm
- ❑ Approximately 190 gm

Operating Environment

- ❑ 0 to 50 degrees Celsius
- ❑ 0 to 95% RH (non-condensing)

Inputs & Outputs

- ❑ Refer to Annex A for details

Interoperability

- ❑ Conforms to LonMark(R) Interoperability Guidelines.

Matrix iS21 Universal Chiller Plant Control Solution



LONMARK
PARTNER



**UCC0882L UDC0882L
UCH1464L UCT1464L UWP0882L**

Annex A

Controller Name: UCC0882L --- T1V1
Neuron Program ID: 90 006B 5100 0404 13

Software Point Type	Description	Signal Type	Qty	Hardware Channel
Analogue Input (AI)	Return Chilled Water Temp. Supply Chilled Water Temp.	10K Thermistor (Precon III)	2	UI1 to UI8 (Selectable)
	Pressure 1 Pressure 2 Water Flow Rate	0-5Vdc, 4-20mA	3	
Analogue Output (AO)	Bypass Valve	0-10Vdc	1	AO1 to AO2 (Selectable)

Important Note: 1. Hardware Points On Board: UI: 8 no.s (12 bit AD)
AO: 2 no.s
DO: 8 no.s

Controller Name: UDC0882L-T1V1
Neuron Program ID: 90 006B 5100 0404 05

Software Point Type	Description	Signal Type	Qty	Hardware Channel
Universal Input (UI)	Universal Input 1 Universal Input 2	10K Thermistor (Precon III) 0-5Vdc, 4-20mA Dry Contact	1	UI1 to UI8 (Selectable)
	Analogue Output (AO)	Bypass Valve Control	0-10Vdc, 4-20mA	

Important Note: 1. Hardware Points On Board: UI: 8 no.s (12 bit AD)
AO: 2 no.s
DO: 8 no.s

Matrix iS21 Universal Chiller Plant Control Solution



LONMARK
PARTNER



**UCC0882L UDC0882L
UCH1464L UCT1464L UWP0882L**

Annex A

Controller Name: UCH1464L --- T1V1
Neuron Program ID: 90 006B 5028 0404 01

Software Point Type	Description	Signal Type	Qty	Hardware Channel
Analogue Input (AI)	Return Chilled Water Temp. Return Condensed Water Temp. Supply Chilled Water Temp. Supply Condensed Water Temp.	1K RTD, 10K Thermistor (Precon III)	4	UI1 to UI8 (RTD or 10K) UI8 to UI9 (10K)
Digital Input (DI)	Chiller On/off Status Chiller Trip alarm Chiller Selector Switch Chilled Water Valve Status Condensed Water Valve Status	Dry Contact	5	UI1 to UI11 (Selectable)
Universal Input (UI)	Universal Input 1 Universal Input 2 Universal Input 3 Universal Input 4 Universal Input 5 Universal Input 6 Universal Input 7	1K RTD, 10K Thermistor (Precon III) 0-5Vdc, 4-20mA Dry Contact	7	UI1 to UI11 (Selectable) DI1 to DI3 (DI)
Digital Output (DO)	Chiller Start/Stop Chilled Water Valve Open/Close Condensed Water Valve Open/Close	Triac Output 24 Vac	6	DO1 to DO6 (Selectable)

- Important Note:**
- Hardware Points On Board:
 - UI: 11 no.s (12 bit) , UI1 to UI8 (RTD or 10K), UI8 to UI9 (10K)
 - DI: 3 no.s
 - AO: 4 no.s
 - DO: 6 no.s
 - PI: DI1~DI2 (software support)
 - Maximum of 14 software Points (AI+DI+UI) are allowed.

Matrix iS21 Universal Chiller Plant Control Solution



LONMARK
PARTNER



**UCC0882L UDC0882L
UCH1464L UCT1464L UWP0882L**

Annex A

Controller Name: UWP0882L-T1V1
Neuron Program ID: 90 006B 5114 0404 20

Software Point Type	Description	Signal Type	Qty	Hardware Channel
Digital Input (DI)	Water Pump On/off Status Water Pump Selector Switch Water Pump Trip alarm	Dry Contact	3	UI1 to UI8 (Selectable)
Universal Input (UI)	Universal Input 1 Universal Input 2 Universal Input 3 Universal Input 4 Universal Input 5 Universal Input 6 Universal Input 7 Universal Input 8	10K Thermistor (Precon III) 0-5Vdc, 4-20mA Dry Contact	8	
Analogue Output (AO)	Variable Speed Driver	0-10Vdc, 4-20mA	1	AO1 to AO2 (Selectable)
Digital Output (DO)	Water Pump Start/Stop	Triac Output 24 Vac	1	DO1 to DO8 (Selectable)

Important Note:

- Hardware Points On Board:
 - UI: 8 no.s (12 bit AD)
 - AO: 2 no.s
 - DO: 8 no.s
- Maximum of 8 software Points (DI+UI) are allowed.