# **TOSHIBA**



# UNIVERSAL SMART X INVERTER MODULAR CHILLER AND HEAT PUMP



# UNIVERSAL SMART X SERIES EDGE

Toshiba's first modular air-cooled inverter chiller / heat pump designed for Europe. High efficiency combined with cutting-edge space saving design.

THREE DIFFERENT CAPACITIES

MODULARITY EVEN WITH A SINGLE MODULE



4 INDEPENDENT

CIRCUITS



4 COMPRESSORS ALL INVERTER

# A UNIQUE COMPACT MODULE



# WITH THE INVERTER EFFICIENCY



4 FANS ALL INVERTER



WATER PUMP INVERTER



# HIGH ENERGY EFFICIENCY LEVELS

- Outstanding high energy efficiency at full load and partial load, thanks to the combination of the low GWP refrigerant R32 and the new generation of DC inverter compressor.
- Precise control of water volume and pressure based on the required load, thanks to the internal pump module with variable flow bypass control, for greater system efficiency.



#### SEASONAL EFFICIENCY



# CAPACITY RANGE Basic module unit 16 units x 8 groups 50HP (150kW) 60HP (180kW) 70HP (200kW) 1,500 Up to 16 units connectable Module Controller (RBP-MC003SS)



# EFFICIENCY AT PART LOAD

#### HIGH PERFORMANCE AT PART LOAD (FOR HIGH EFFICIENCY AT LOW LOAD)

#### ✓ High performance at part-load and energy savings



A module with all compressors running can reduce its capacity by up to 20%.





5~100% 5~100% 5~100% 5~100% 5~100% 5~100% 5~100% 5~100% 5~100% 5~100%

All modular units evenly control capacity

In addition, as a system of multiple modular units, the minimum capacity can be as high as 5%.

Together with individual compressor

its capacity by up to 20%:4 = 5%.

control, each modular unit can reduce

EXCELLENT AIR DISTRIBUTION



#### HIGH PERFORMANCE AT PART LOAD (ALSO AS A SYSTEM)

For example, with a 50% load, the USX EDGE chiller and heat pump distributes the system load evenly over the entire system.

#### System: 150kW×10 units



#### Model: Serie USX 50HP x 10 units / [RUAGP421H1] ×10



Load: 750kW (=50% di 1.500kW) Outlet water temperature: 7°C Water flow rate: 430L/min per unit Ambient temperature: **35°C** 

Cap. 150kW x 5 = 750kW COP 3.62 (at full load) P.I. 42.5kW x 5 = 212.5kW

Cap. 75.0kW x 10 = 750kW COP 4.03 (load 50%) IMPROVMENT BY 11%

P.I. 18.6kW x 10 = 186kW 12% SAVINGS

THIS LOAD DISTRIBUTION METHOD IS ALSO APPLIED TO SINGLE-UNIT SYSTEMS TO ACHIEVE THE SAME HIGH PARTIAL LOAD PERFORMANCE.

# EXTREMELY COMPACT INSTALLATIONS



#### THE ERGONOMIC X-SHAPE OF THE USX IS AT THE ORIGIN OF **OUTSTANDING ADVANTAGES**

The X-frame chassis was designed using airflow analysis.

Optimised air distribution allows the units to be installed at a side by side distance of 30mm with no reduction in the USX EDGE's performance.

# RISK DIVERSIFICATION FOR PEACE OF MIND

#### HIGHLY RELIABLE MODULAR SYSTEM

- There are four independent refrigerant circuits in each module, allowing excellent diversification.
- Cost-effective solution with low costs for backup.
- The reduction in available capacity for maintenance or repair is extremely limited: from a maximum of 1/4 of the total power in the case of single-module applications up to 1/(4xN) in the case of N-module applications.





\* Considering this example, the maximum available power reduction is limited to 1/(4x12)=2% of the total.

180kW

45kW - 25%

Total module capacity

Total capacity reduction

# The defrosting operation is performed separately for each compressor.

The use of the backup function allows the defrosting of only one compressor at a time, thus avoiding the reduction of the temperature of the hot water produced by the module.





#### SINGLE COMPRESSOR SHUTDOWN FOR DEFROSTING OR MAINTENANCE





System: USX Modular Chiller and Heat Pump 1,800kW (512RT)



### One-unit stop: 10 modular units of 180kW

180kW - only 10,0% of the total capacity

Stopping a compressor: 4 circuits of 45kW for each unit - only 2.5% of the total capacity

### VERSIONS

		C00	LING	HEA	TING	Water	
		Temperature		Temperature		temperature	Power supply
		Ambient	Water	Ambient	Water	delta	
Standard		-15/+52	+4/+30	-15/+21	+25/+55	5-10	
High EER		-15/+52	+4/+30	-15/+21	+25/+55	5-10	
Low temperature		-15/+52	+4/+30	-20/+21	+25/+55	5-10	3ph + N 50Hz/60Hz 380-415V
Brine	Cooling only	-15/+52	-5/+30			5-16**	
and glycol)	Heat pump	-15/+52	-15/+30	-20/+21	+25/+55	5-16**	

#### **Product codification**



\*\* Only with high delta T option

- E: Europe 8: 3ph 4 wires 50Hz/60Hz 380 - 415V Blank: Water / R: Brine **Blank**: Standard type / **N**: High – EER type L: Without pump 1: Internal pump (pump capacity 1.5kW) 2: Internal pump (pump capacity 2.5kW) 3: Internal pump (pump capacity 3.7kW) 5: Internal pump (pump capacity 5.5kW) 7: Internal pump (pump capacity 7.5kW) **C**: Cooling only **H**: Heat pump (cooling/heating) **F**: Low temperature model Version number USRT capacity 42: 50HP / 51: 60HP / 56: 70HP
- Universal Smart X EDGE (R32)
- Chiller and Heat Pump Air/Water

# IMPROVED HARMONIC SUPPRESSION FUNCTION

The harmonic suppression function is installed as a standard feature on all models and achieves a power factor of up to 99%. This decreases electric transformer volume as well as reducing installation costs.

#### Adavantages of the PWM converter

- 1. Eliminates the problems caused by harmonic current.
- 2. Reduces in consumption volume of electrical equipment.



#### Achieve the 99% power factor

- 1. Power loss reduction through load current.
- **2.** Improving the efficiency of electrical equipment through current reduction.



### \_\_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_,



# ENHANCED HEATING CAPACITY AT LOW TEMPERATURES

The low temperature EDGE version achieves a high heating capacity, with outside temperatures down to -20°C, and in some conditions down to -25°C. It also minimizes capacity drop-off during defrosting operations.

#### USX EDGE LOW TEMPERATURE VERSION

At outside temperatures as low as -15°C, the system is still able to produce hot water up to 50°C. At -20°C, the hot water produced is up to 45°C.

Performance between -20°C and -25°C is not guaranteed. Exceptional environmental factors, such as blizzard, may inhibit operation at temperatures of -20°C or below.





Thanks to a new and advanced controller, the EDGE low temperature models can reduce the loss of capacity during defrosting by three times compared to standard models.



## A WIDE OPERATING RANGE

### **USX EDGE HEATING MODE OPERATION**



#### SERIE EDGE 50HP / 60HP / 70HP

Outlet water temperature	Difference in temperature (inlet/outlet)	°C	5~10

### A WIDE OPERATING RANGE

#### **USX EDGE COOLING MODE OPERATION**



Outlet water temperature

# HIGH POWER TWIN ROTARY COMPRESSOR WITH DC INVERTER

USX EDGE series achieves impressive heating capacities and operating temperature range even at low ambient temperatures thanks to one of the world's largest capacity DC inverter twin rotary compressors equipped with R32 refrigerant.







- Significant wide operating range with the standard models and further expanded with the brine versions not only for ambient comfort applications but also for process cooling.
- Cooling is guaranteed up to 52°C ambient.

°C	10~30
°C	20~40

Difference in temperature (inlet/outlet) °C 5~10		Difference in temperature (inlet/outlet)	°C	5~10
--	--	--	----	------

# EFFECTIVE CONTROL SYSTEM

Easy to use and collect data with different types of control available.





## **GROUP CONTROLLER**

#### The Group Controller allows control of each of the various sub-assemblies of modules in the system

Up to eight sets, for a total of 128 units, can be controlled from a single controller. Individual settings and operating states can be controlled and displayed via a touch panel, supporting the customer's energy management.

FUI	NCTIONS			
	For each model	Start/Stop, Operating Mode, Fa Temperature, Flow Rate, Integr		
Display of	For each controller model	Start/Stop, Operating Mode, E Temperature, Flow Rate, Cons		
status	For each model	Start/Stop, Operating Mode, Erro Temperature, Flow Rate, Consur		
	For each circuit	Refrigeration Cycle Information,		
Operating status	s output (Total)	Start/Stop, fault, operating and		
Start / Stop		For the entire system, for each		
Setting up operat	tion sequences	It allows you to set up and switc and the entire system.		
Preset temperati	ure changes	You can change the temperatur		
Current settings	request	You can configure the demand		
System settings		All connected modules can be		
Program setting	5	You can configure the operating		
Viewing error his	story	You can check the error history		
Storage of opera	ational data	The displayed data can be save		
Trend visualizati	ion	Outdoor water and air temperation COP and power can be displayed		
Energy savings		Allows to switch the application		

#### NOTE

aults, Operating and Basic Capacity, Inlet and Outlet Water ral Power, Consumption, COP.

rror Code, Operating and Basic Capacity, Inlet and Outlet Water umption, COP.

or Code, Operating and Basic Capacity, Inlet and Outlet Water mption, COP, Outside Air Temperature.

, Compressor Run Time, Compressor Start Counts.

basic capacity, consumption, operating settings.

model and for each controller module.

ch the operating sequences of the group controller

re settings of all models.

for electricity.

systematically classified (for each module control system).

ig program (monthly, weekly, daily).

ed on a Micro Memory Card.

tures, operating and basic capacities, consumption, ed on a graph.

n settings to validation or non validation.

## DATA ANALYSIS VIA WIFI

### The operating data can be analyzed with a tablet. The MC is wireless LAN ready.

The tablet improves ease of use as well as management and can be easily connected to the MC, which is ready for Wi-Fi LAN connection with the use of the optional Flash Air SD card<sup>[1]</sup>. Information is easily collected without opening the service panel.



Supported tablet: Android 5.0 or higher. 10.1" screen recommended. <sup>(1)</sup> Toshiba Flash Air SD Card W-04 or equivalent.

#### Screen display



Operating Status Main Screen



Operating status System data

Confirmation screen



#### Visualize the operating status of the module controller and of the unit controller and allows for safe and quick operations even in bad weather conditions!

Users can set a maximum current (demand) limit using the regulator.

#### Peak shaving scenario

The upper limit of the current demand can be set to the desired value in increments of 1 amp for each system.

運転状態 設定

民る <前系統 次系統>

/ド>能力、

F 各種操作 故障関歴

**拡大 >** 

Operational trends

(capacity, input, COP)

Confirmation screen

Data is displayed over a period of time which is easy to confirm or change

保守

0 kH

2013/ 1/18 9:54 (金)



# TOSHIBA USX MILESTONES



#### **INTEGRATED SCREW CHILLER - 50~160HP**

• Equipped with a small, high-efficiency screw compressor • Adopted R134a refrigerant with ozone depletion potential = 0 (Industry first)

#### FLEX MODULE CHILLER FMC - 30, 40HP

• Equipped with high-efficiency reciprocating compressor • Modular design (Industry first) Partial load priority group control • Built-in variable flow pump (Industry first) • Equipped with water spray (Industry first)

- SUPER FLEX MODULE CHILLER SFMC 30, 45HP
- Equipped with high-efficiency scroll compressor (Industry no. 1) • X-frame structure (Industry first) • Improvment of water spray efficiency (Industry no. 1) • High-precision pump variable flow control (Industry first) • Partial load priority group control
- (Parallel control of three compressors and module group control)
- Uses refrigerant R410A (Industry first)

#### UNIVERSAL SMART X USX - 30, 40, 50HP

• New development of the world's largest capacity high-efficiency inverter twin rotary compressor (Industry no. 1) • Partial load priority group control • Evolution of X-frame structure (Industry no. 1) • Module in module design (Industry no. 1) • Improved of water sprinkler efficiency (Industry no. 1) • More precise pump variable flow control (Industry no. 1)

• High efficiencyby concentrated winding, etc. • New development of compressor (Industry no. 1) • No power supply harmonics by three-phase PWM (Industry no. 1) • 99% power factor with three-phase PWM (Industry no. 1)

#### **UNIVERSAL SMART X USX EDGE SERIES - 60, 70HP**

• World's largest high-efficiency inverter (Industry no. 1) • 70HP module (Industry no. 1) • Both capacity and space saving with EDGE design (Industry no. 1) • Improved low outside air heating capacity (Industry no. 1)

#### UNIVERSAL SMART X USX EDGE SERIES - 50, 60 & 70HP

• USX EDGE series available with R32 refrigerant for Japan, Europe, the Middle East and Africa • Large capacity DC inverter twin rotary compressor • Reduced installation costs due to advanced harmonic and power factor correction

- Enhanced heating capacity for low ambient conditions
- High reliability achieved from compact / space-saving modular design
- Modular control up to 8960HP
- Wi-Fi connection for data collection and analysis

# THE SMART CHOICE

Environmental oriented refrigerant, outstanding energy efficiencies, and much more to the benefit of all stakeholders. Choose inspired technologies to support building decarbonization.

HEALTHCARE











# THEY TRUST US

Meet energy efficiency, high scalability, and world-class quality with one solution: Toshiba Universal Smart X Series EDGE now also available for Europe. Engineered with cutting-edge technology, designed for low running costs, excellent risk diversification and ease of installation/maintenance - this solution committed to reliable performance is ideal for your heating and cooling needs.





Name of the project: Centro logistico CJ Daejun

Place: **Korea** 

Application: Warehouse **cooling/heating** 

USX EDGE: 46 x 60HP USX EDGE with integrated 5.5kW pump

Name of the project: Lisan Pungdong Car Showroom

Place: **Korea** 

Application: Cooling/heating (chilled water storage) USX EDGE:

6 x 60HP USX EDGE

# TOSHIBA

	TECHNICAL DATA USX EDGE SERIES STANDARD HEAT				ARD HEAT PUMP		
					SERIES EDGE 50HP	SERIES EDGE 60HP	SERIES EDGE 70HP
					Standard	Standard	Standard
Mode	el .				RUAGP421H18	RUAGP511H18	RUAGP561H28
Nomi	inal cooling cap	acity		(kW)	150	180	200
Nieme				(1.) (1.)	150	100	200
Nom	inat neating cap	асцу		(KVV)	100	180	200
		Height		(mm)	2,350	2,350	2,350
Dime	insions	Width		(mm)	1,000	1,000	1,000
		Length (flange included)		(mm)	3,470	3,470	3,470
Opera	ating weight			(kg)	1,384	1,384	1,393
Powe	r supply		(Note 1)			3Ph + N 50/60Hz 380V/400V/415	/
Curre	ent for sizing po	wer cables	(Note 2-3)	(A)	82.1	103	119
		Current rating		(A)	65.3	84.8	99.7
		Absorption		(kW)	42.5	55.2	64.9
	Cooling	EER			3.53	3.26	3.08
Ice		SEER			4.88	4.77	4.72
nan		Power factor	(Note 4)	[%]	99	99	99
orn		Current rating		(A)	63.6	79.6	90.1
erf		Absorption		(k/W)	41 4	51.9	59
۵.	Heating	COP		((()))	3.62	3 / 7	3 39
	rieating	SCOR			0.02	/ 25	( 29
		Devves fa star	(blata /)	(0/)	4.28	4.35	4.20
		Power lactor	(INOLE 4)	(%)	77	77	77
		Туре				Hermetic Twin Rotary x4	
		Reach		(kW)	8.8x4	8.8x4	13.2x4
Compressor		Starter type				Inverter starter	
		Crankcase heater		(W)	37x4	37x4	37x4
		Oil charge		(L)	2.0x4	2.0x4	2.0x4
Air si	de heat exchang	ger			Fin coil	Fin coil	Fin coil
		Туре			Propeller fan	Propeller fan	Propeller fan
-		Reach		(m³/min)	1,230 (maximum)	1,230 (maximum)	1,230 (maximum)
Fan		Starter type				Inverter starter	
		Output motor power × number		(kW)	1.2x4	1.2x4	1.2x4
Pump (1)		Output motor power		(kW)	1.5	1.5	2.2
		Туре		. ,	Centrifugal pump	Centrifugal pump	Centrifugal pump
		Flow control					Inverter
		Maximum current		(A)	3.1	3 1	4.3
		Minimum power consumption			2	2	2.8
		and an power consumption	(Noto E)	(1(14)	L	Brazad plata (SUS214 activate	2.0
Water side fleat exchanger			(NOTE 3)		D00		ED00
		Charge		(1)	<u>к</u> зг	<u>к</u> зг	<u>пзг</u>
Refri	gerant	Control		(Kġ)	6.8X4 Electric expansion valve Electric expansion valve Electric expansion valve	o.8x4 Electric expansion valve	6.6X4 Electric expansion valve
Сара	city control ster	05	[Note 6]	[%]	0; 5~100	0: 4~100	0: 4~100
Operational control					Microprocessor control	based on outlet water temperature a	nd temperature difference
Defro	ist system					Reverse Cycle Distributed System	n
Prote	rotective device High pressure switch, overcurrent protection, overload protection of inverters (compressors, fans, pump), crankcase heater, phase failure protection, microprocessor control (protections: compressor thunderstorm, antifreeze, high water temperature, low water flow, high su gas temperature, low pressure, temperature sensors, high water pressure error)				rotection of inverters ction, microprocessor control rature, low water flow, high supply water pressure error]		
		Cold/hot water inlet			Flange from 2-1/2"	Flange from 2-1/2"	Flange from 3"
Pipin	g diameter	Cold/hot water outlet			Flange from 2-1/2"	Flange from 2-1/2"	Flange from 3"
		Condensates drainage			Male screw PT1-1/2"	Male screw PT1-1/2"	Male screw PT1-1/2"
Soun	d power level			dB(A)	83.8	87.4	90.9

For the versions: Cooling Only, High Efficiency, Low Temperature and Brine for combinations thereoff refer to the Technical Databook Cooling: 12°C temp. inlet water [EWT], 45°C temp. water outlet (LWT], 35°C BS, 24°C BU temp. outside air [OAT].
Heating: 40°C temp. inlet water [EWT], 45°C temp. water outlet (LWT], 7°C BS, 6°C BU temp. outside air [OAT].
Always refer to the data in the Technical Databook for selection and sizing.
[1] Integrated pump: 1.5kW for 50 and 60HP sizes, 22.4kW for 70HP size, for all other integrated pumps please refer to the technical data book.
[Note 1] Maximum permissible voltage fluctuation is ± 10%. Maximum permissible frequency fluctuation is ± 2 %.
[Note 2] The power supply differs from the capacity of the pump. Consult the pump information chart to properly design the power supply.
[Note 3] Always instal a residual current circuit breaker. This machine is equipped with an inverter. To avoid malfunction use a high-frequency compatible product.
[Note 4] The working pressure is less than 0.7 MPa.
[Note 6] The flow rate adjustment range may vary at times depending upon the operating conditions of the unit.
[Note 6] The flow rate adjustment range may vary at times depending upon the operating conditions of the unit.



Through our commitment to world-class efficiency, versatile scalability and leading quality, Toshiba Air Conditioning advances leading-edge technologies to find the most forward-thinking solutions possible for your world.

