

CAREL

Universal Controller

Universal electronic controller



UNIVERSAL
controller

Meneghetti Matteo

Introduction

The Universal Controller is a configurable solution for regulating the main physical variables (temperature, pressure, humidity) in air conditioning, refrigeration and heating units.

The configurable settings are **ON/OFF**, **proportional** and **PID**.

If the **second probe** is connected, it is possible to perform a differential type regulation or activate a second independent regulation with dedicated set point, differential and outputs.



If the **third probe** is connected, it is possible to activate a summer, winter or summer+winter compensation action.



Hardware

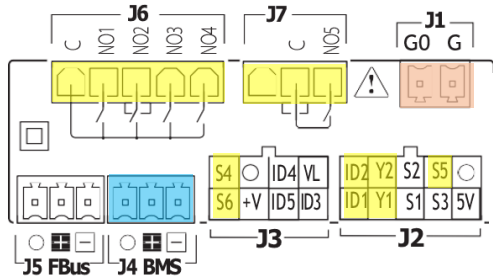
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Models and Features

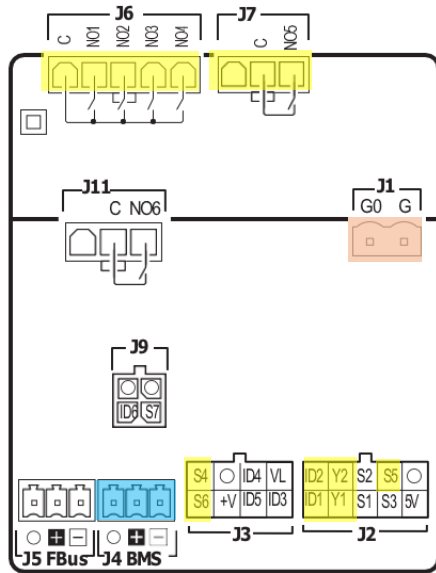
	U20R00UC00250 (DIN)	U20R00UC00200 (PANEL)
Image		
Analog Inputs	2x 0-5V/4-20mA/NTC (S4, S5) 1x 0-10V/NTC/0-5V/4-20mA/PT1000 (S6)	2x 0-5V/4-20mA/NTC (S4, S5) 1x 0-10V/NTC/0-5V/4-20mA/PT1000 (S6)
Digital Inputs	2x DI free voltage	2x DI free voltage
Analog Outputs	2x 0-10V (no PWM, no VCC)	2x 0-10V (no PWM, no VCC)
Digital Outputs	5x SPST 5A	5x SPST 5A
Power Input	24 VAC/VDC	24 VAC/VDC
Apply Connectivity	Bluetooth (BLE)	Bluetooth (BLE)
Serial ports	2x RS485 (BMS, Fieldbus) not opto-isolated	2xRS485 (BMS, Fieldbus) not opto-isolated
RTC backup	Supercap (72h)	Supercap (72h)

Terminal block

PANEL



DIN RAIL



Ref.		Description
J1	G	24 VAC/VDC power supply
	G0	Neutral
J2	S5	Ratiometric probe power supply
	S3	Analogue input 3 (not used)
	S1	Analogue input 1 (not used)
	Y1	Analogue output 1
	ID1	Digital input 1
	O	Common GND
	S5	Analogue input 5 (probe 3)
	S2	Analogue input 2 (not used)
	Y2	Analogue output 2
	ID2	Digital input 2
J3	ID3	Digital input 3 (not used)
	ID5	Digital input 5 (not used)
	+V	Power supply to 4-20 mA active probes
	S6	Analogue Input 6 (probe 1)
	VL	N/A
	ID4	Digital Input 4 (not used)
	O	Common GND
J4	-	BMS port (RS485) Rx/Tx-
	+	BMS port (RS485) Rx/Tx+
	O	BMS port (RS485) GND

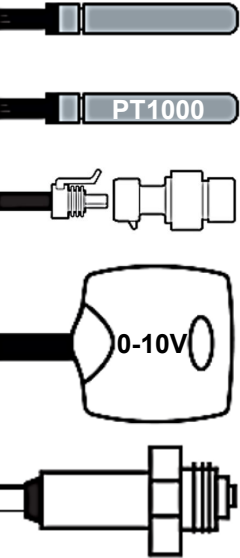
Ref.		Description
J5	-	Fieldbus port (RS485) Rx/Tx-
	+	Fieldbus port (RS485) Rx/Tx+
	O	Fieldbus port (RS485) GND
J6	C	Common for relays 1, 2, 3, 4
	NO1	Digital output 1
	NO2	Digital output 2
	NO3	Digital output 3
J7	NO4	Digital output 4
	C	Common for relay 5
J9	NO5	Digital output 5 (alarm)
	S7	Analogue input 7 (not used)
	ID6	Digital input 6 (not used)
J11	O	Common GND
		N/A
	C	Common for relay 6
	CN6	Digital output 6 (not used)

Connectable sensors

Probe 1 (input S6):

- NTC
- NTC HT
- PT1000
- 0-10 VDC
- Ratiometric 0-5 VDC
- 0..20 mA
- 4..20 mA

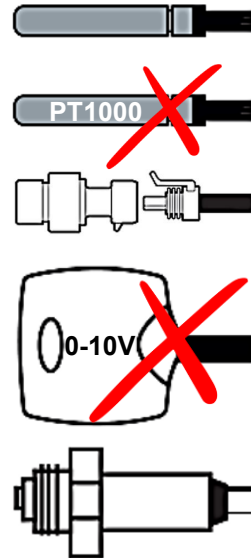
Configurable by parameter



Probe 2 (input S4) and Probe 3 (input S5):

- NTC
- NTC HT
- Ratiometric 0-5 VDC
- 0..20 mA
- 4..20 mA

Configurable by respective parameters



With a **single hardware** it is possible to manage multiple types of sensors.

IR33/DN33 code comparison

IR33-DN33 UNIVERSALE					
TYPE	CODE				CHARACTERISTICS
	panel installation		DIN rail assembly		
	Temperature inputs (*)	Universal inputs (*)	Temperature inputs (*)	Universal inputs (*)	
1 relay	IR33V7HR20	IR33V9HR20	DN33V7HR20	DN33V9HR20	2AI, 2DI, 1DO, BUZ, IR, 115 to 230 V
	IR33V7HB20	IR33V9HB20	DN33V7HB20	DN33V9HB20	2AI, 2DI, 1DO, BUZ, IR, RTC, 115 to 230 V
	IR33V7LR20	IR33V9MR20 ●	DN33V7LR20	DN33V9MR20 ●	2AI, 2DI, 1DO, BUZ, IR, 12 to 24Vac, 12 to 30 Vdc (● = 24 Vac/Vdc)
2 relays	IR33W7HR20	IR33W9HR20	DN33W7HR20	DN33W9HR20	2AI, 2DI, 2DO, BUZ, IR, 115 to 230 V
	IR33W7HB20	IR33W9HB20	DN33W7HB20	DN33W9HB20	2AI, 2DI, 2DO, BUZ, IR, RTC, 115 to 230 V
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4 relays	IR33Z7HR20	IR33Z9HR20	DN33Z7HR20	DN33Z9HR20	2AI, 2DI, 4DO, BUZ, IR, 115 to 230 V
	IR33Z7HB20	IR33Z9HB20	DN33Z7HB20	DN33Z9HB20	2AI, 2DI, 4DO, BUZ, IR, RTC, 115 to 230 V
	IR33Z7LR20	IR33Z9MR20 ●	DN33Z7LR20	DN33Z9MR20 ●	2AI, 2DI, 4DO, BUZ, IR, 12 to 24 Vac, 12 to 30 Vdc (● = 24 Vac/Vdc)
4 SSR	IR33A7HR20	IR33A9HR20	DN33A7HR20	DN33A9HR20	2AI, 2DI, 4SSR, BUZ, IR, 115 to 230V
	IR33A7HB20	IR33A9HB20	DN33A7HB20	DN33A9HB20	2AI, 2DI, 4SSR, BUZ, IR, RTC, 115 to 230V
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1 relay +1 0 to 10Vdc	IR33B7HR20	IR33B9HR20	DN33B7HR20	DN33B9HR20	2AI, 2DI, 1DO+1AO, BUZ, IR, 115 to 230 V
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NO power supply 230V

NO power supply 230V

NO power supply 230V

NO outputs SSR

NO power supply 230V

NO power supply 230V

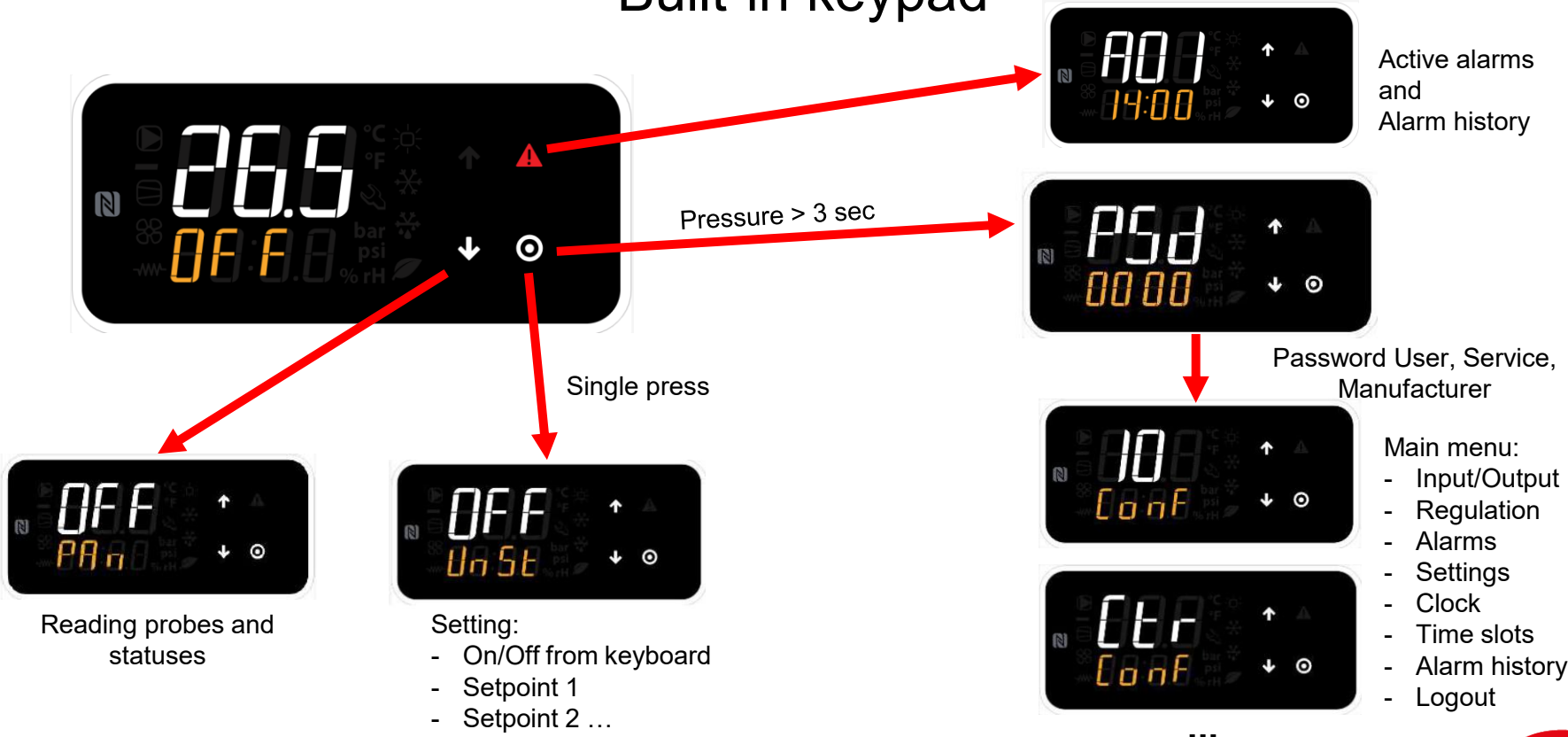


Programming

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Programming

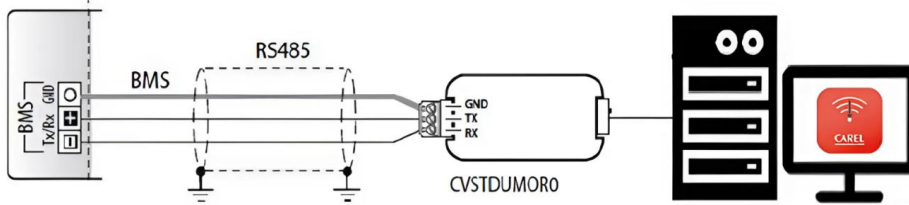
Built-in keypad



Programming Applica Desktop

With *Applica Desktop* is possible to:

- Create, copy and load configurations
- Write parameters and read states
- Default parameter settings
- Live trend for testing
- Application update



The screenshot shows the CAREL ApplicaDesktop 1.0.363 software interface. The main window displays a table of configurations and a live trend graph. A context menu is open over the 'Apply' button, showing options like 'Apply Configuration', 'Apply clone', 'Apply Factory config. from file', and 'Apply Clone From File'. The live trend graph shows a step function with multiple channels.

Name	Description	Value	Tags
B000	B000 - Operating mode (0=Special, 1=Direct, 2=Reverse)	0	OperatingMode
B001	B001 - Setpoint differential 1	2	SetpointDifferential1
B002	B002 - Setpoint differential 2	2	SetpointDifferential2
B003	B003 - Dead band differential	2	DeadBandDifferential
B004	B004 - Control Type (0=Proportional, 1=PID)	FALSE	ControlType

Name	Description	Value	Tags
DOU1	Analog output 1	100 %	AnalogOutput1
DOU2	Analog output 2	100 %	AnalogOutput2
DI1	Digital input 1 value	FALSE	DigitalInput1
DI2	Digital input 2 value	FALSE	DigitalInput2
DOU1	Digital Output 1	TRUE	DigitalOutput1
DOU2	Digital Output 2	TRUE	DigitalOutput2
DOU3	Digital Output 3	TRUE	DigitalOutput3
DOU4	Digital Output 4	TRUE	DigitalOutput4
DOU5	Digital Output 5	FALSE	DigitalOutput5
DOU6	Digital Output 6	FALSE	DigitalOutput6
DOU7	Digital Output 7	FALSE	DigitalOutput7
DOU8	Digital Output 8	FALSE	DigitalOutput8
DOU9	Digital Output 9	FALSE	DigitalOutput9
DOU10	Digital Output 10	FALSE	DigitalOutput10
DOU11	Digital Output 11	FALSE	DigitalOutput11
DOU12	Digital Output 12	FALSE	DigitalOutput12
DOU13	Digital Output 13	FALSE	DigitalOutput13
DOU14	Digital Output 14	FALSE	DigitalOutput14
DOU15	Digital Output 15	FALSE	DigitalOutput15
DOU16	Digital Output 16	FALSE	DigitalOutput16
DOU17	Digital Output 17	FALSE	DigitalOutput17
DOU18	Digital Output 18	FALSE	DigitalOutput18
DOU19	Digital Output 19	FALSE	DigitalOutput19
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DOU94	Digital Output 94	FALSE	DigitalOutput94
DOU95	Digital Output 95	FALSE	DigitalOutput95
DOU96	Digital Output 96	FALSE	DigitalOutput96
DOU97	Digital Output 97	FALSE	DigitalOutput97
DOU98	Digital Output 98	FALSE	DigitalOutput98
DOU99	Digital Output 99	FALSE	DigitalOutput99
DOU100	Digital Output 100	FALSE	DigitalOutput100

Programming Applica Mobile



Available for free at:



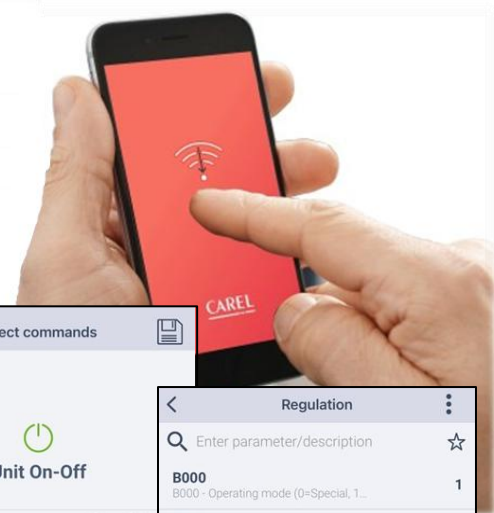
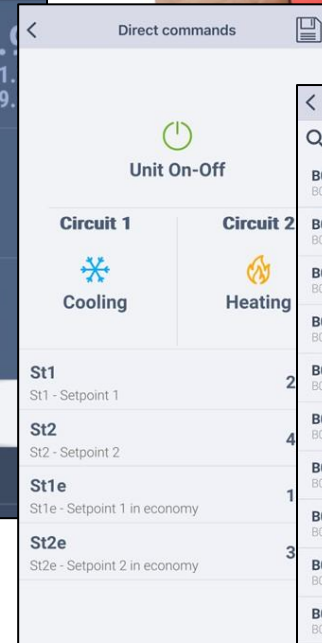
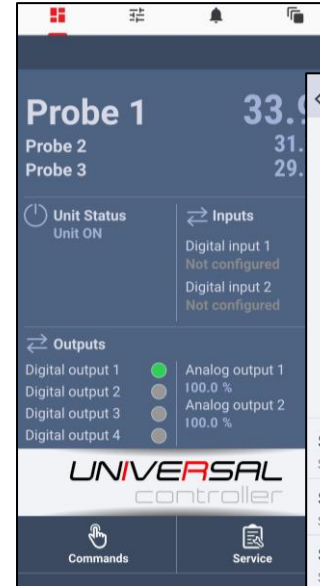
Google Play



App Store

With *Applica Mobile* (via Bluetooth) is possible to:

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- Write parameters and read states
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Functionality

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controller

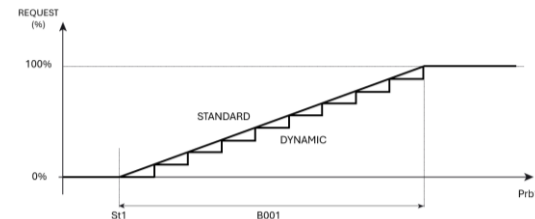
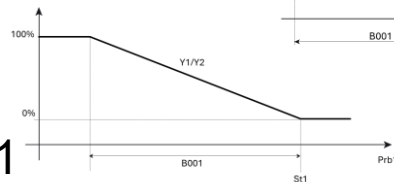
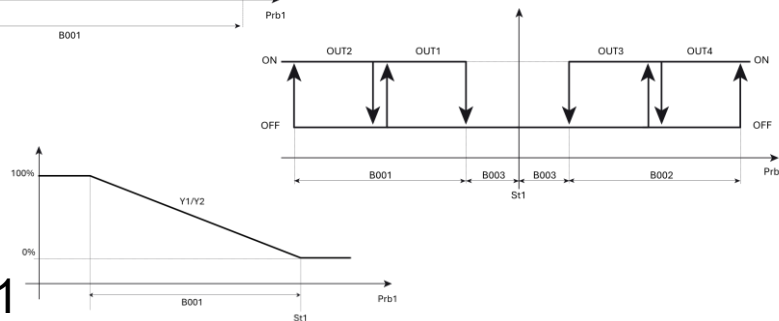
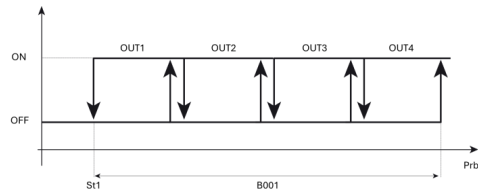
Main regulation

Probe 1

Main control loop type ON/OFF, proportional, PID type based on Probe 1.

Regulation choice between:

- Direct
- Reverse
- Neutral zone
- Direct/reverse switching from DI1
- Direct: Setpoint and differential from DI1
- Reverse: Setpoint and differential from DI1
- Direct/Reverse with two distinct setpoints
- **3-point valve**



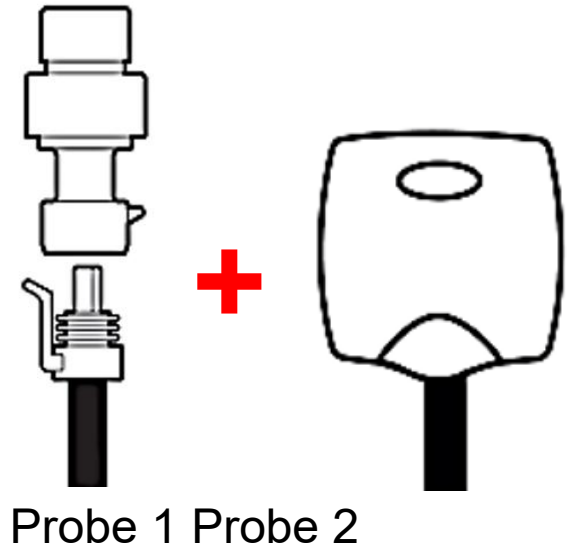
Auxiliary regulation

Probe 2

Loop for additional logic or addition of a second independent circuit on Probe 2.

Adjustment of your choice tra:

- Differential operation (Probe 1-Probe 2)
- Enable control based on the absolute setpoint
- Enable control based on the setpoint differential
- Independent operation (Circ.1 + Circ.2)
- Control on higher probe value
- Control on lower probe value
- Control setpoint from Probe 2
- Automatic summer/winter from Probe 2



Probe 1 Probe 2

Compensation logics

Probe 3

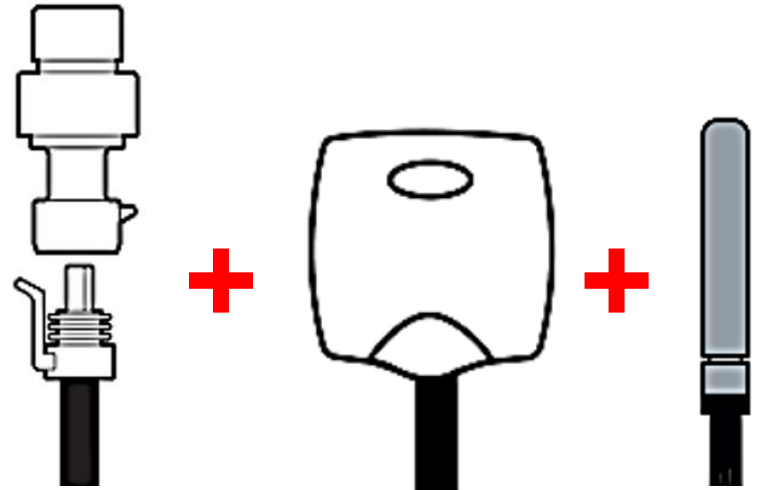


Loop for compensation logics of the setpoint based on Probe 3.

Regulation choice between:

- Summer compensation
- Winter compensation
- Summer/winter compensation
- Read only

This allows the management of up to **3 Loops** (main regulation + auxiliary regulation+ compensation) using 3 probes connected to the same controller.



Probe 1 Probe 2 Probe 3

Custom operation

Special Logic

It is possible to create a customized operating logic that allows to configure the regulation of each individual output using additional parameters, referred to as special parameters:

- **Regulation type**

- Regulation on thresholds
- Regulation on St1 and B001
- Regulation on St2 and B002
- Alarm Status
- Unit status ON/OFF
- Regulation status ON/OFF

- **Regulation probe**

- Probe 1
- Probe 2
- Probe 1/Probe 2 from DI1
- Probe 1 - Probe 2
- Probe 2 - Probe 1

- **Thresholds**

- Activation/request at 100%
- Deactivation/request at 0%

- **Alarm dependency
(On-Off outputs only)**

- Global alarm
- Alarm on Probe 1/Circuit 1
- Alarm on Probe 2/Circuit 2
- Alarm on Probe 3
- High alarm on Probe 1
- Low alarm on Probe 1
- High alarm on Probe 2
- Low alarm on Probe 2
- High alarm on Probe 3
- Low alarm on Probe 3

- **Regulation type
(for On-Off output only)**

- On-Off
- 3-point valve opening
- 3-point valve closure

- **Output mode**

- Direct
- Reverse
- Direct/Reverse from Summer/Winter

LEGEND

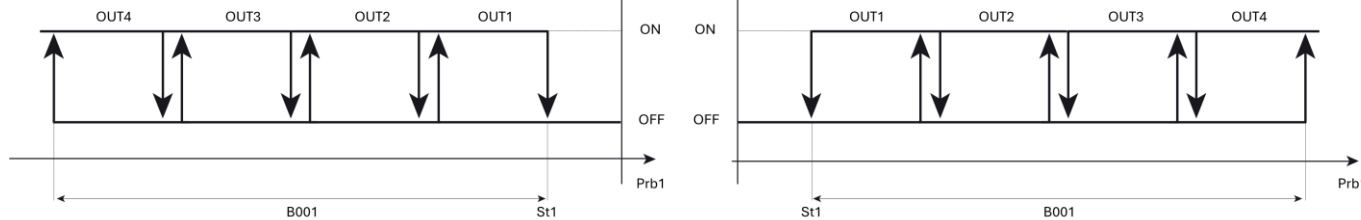
- Special regulation logic
- Special alarm logic
- Special state logic

Summer/Winter



The transition from one **season** to another allows the current regulation setting to be reversed according to an external signal (configurable between DI1 only, DI2 only or both), without having to change the operating mode from the parameter.




It is also possible to further reverse the regulation for each individual circuit using the respective parameters.



**WINTER
REVERSE
HEATING**



**SUMMER
DIRECT COOLING**

 Unit On-Off	
Circuit 1  Cooling	Circuit 2  Heating
St1 St1 - Setpoint 1	20.0
St2 St2 - Setpoint 2	40.0
St1e St1e - Setpoint 1 in economy	15.0
St2e St2e - Setpoint 2 in economy	35.0

Time Bands

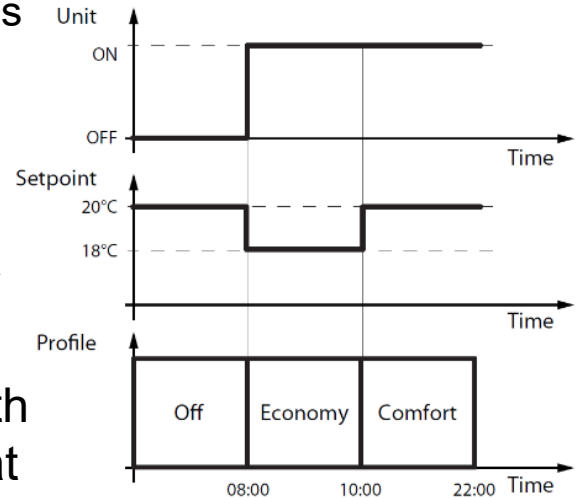


Scheduler with 3 different programmable profiles:

- **COMFORT** → Specific setpoints and compensation thresholds
- **ECONOMY** → Specific setpoints and compensation thresholds
- **OFF** → Unit switched off

Possibility to set up to **3 programs**(P1, P2, P3), each with a maximum of **4 daily time bands**.

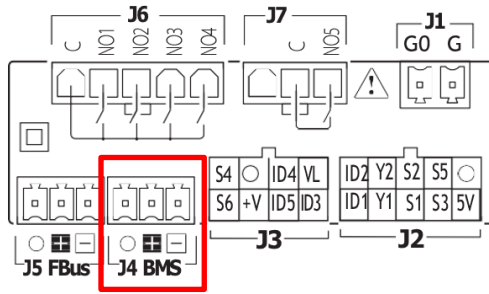
Vacation period management, specifying the day and month the vacation period starts/ends and the operating mode that will be applied during this period.



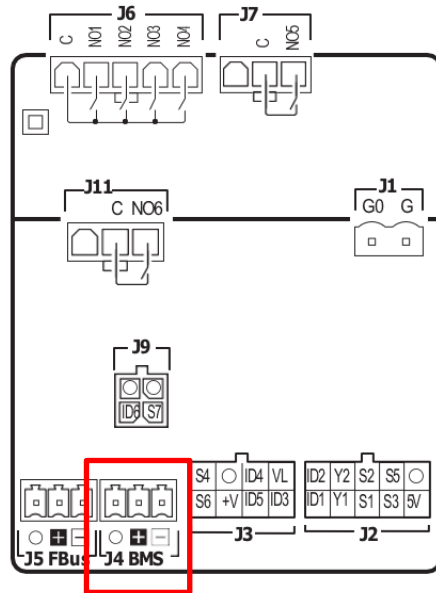
Supervision



PANEL



DIN RAIL



- Modbus RTU Server protocol via RS485 port (J4-BMS). Configurable communication parameters
- Boss model available
- tERA model available
- Parameters list and variables exposed to supervision available
- Main variables and parameters backwards compatible with existing supervisions

New features

Compared to IR33 Universal



- Management of **Summer/Winter unit** from digital input (DI1, DI2, DI1+DI2)
- Management **Independent Summer/Winter** for Circuit 1 and Circuit 2 (from parameters)
- New main feature: **3-point valve management**
- New Probe 2 feature: **Second 3-point valve (Circuit 2)**
- Compensation function revised and moved to **Probe 3**
- Management up to **3 regulation loops** (main + auxiliary + compensation)
- **Time bands management**: 3 programs, 4 daily bands and Off/Comfort/Eco profiles
- Parameterization via **Applica Mobile** And **Applica Desktop**

Documentation

UNIVERSAL
controller

Documentation

Downloadable from KSA

Parameter comparison list with
universal IR33*
(ITA)

List of variables in Supervision
shared with universal IR33**
(ITA/ENG)

IR33 UNIVERSALE						UNIVERSAL CONTROLLER					
Code	Descrizione	Default	Min	Max	Unit	Code	Descrizione	Default	Min	Max	Unit
PAGINA PRINCIPALE											
S1	Set point 1	20(68)	c21	c22	°C (°F)	S1	Setpoint 1	20	80/13	80/14	°C
S2	Set point 2	40 (104)	c23	c24	°C (°F)	S2	Setpoint 2	40	80/15	80/16	°C
Pos	Comando di ON-OFF del controllo	0	0	1	-	Unit	Impostazione On/Off unità da tastiera	0	0	1	-
CONFIGURAZIONE REGOLAZIONE											
Modo di funzionamento 1= direct 2= reverse 3= zona neutra 4= PWM 5= allarme 6= direct-reverse da D11 7= direct-direct da D11 8= reverse-reverse da D11 9= direct-reverse con set point distinti.						Modalità funzionamento: 0=funzionamento speciale (custom) 1=Direct 2=Reverse 3=Zona neutra 4=Riservato 5=Riservato 6=Commutazione direct-reverse da D11 7=Direct-Setpoint e differenziale da D11 8=Reverse-Setpoint e differenziale da D11 9=Direct-Reverse con due setpoint distinti 10=Valvola 3 punti					
c3	Disabilitato	2	1	9	-	3000	0=funzionamento speciale (custom)	1	0	10	-
Funzionamento speciale											
Modalità funzionamento: 0=funzionamento speciale (custom) 1=Direct 2=Reverse 3=Zona neutra 4=Riservato 5=Riservato 6=Commutazione direct-reverse da D11 7=Direct-Setpoint e differenziale da D11 8=Reverse-Setpoint e differenziale da D11											
c13	Abilitato	0	0	1	-	3000	1=Direct	1	0	10	-

Code	Short	IT	EN	Display	Read/Write	Address read	Address write	Dimension	Length	Bit position	Read function	Write function
ALARMS												
A19	A19	Allarme sonda 1 guasta	Probe 1 fault alarm	None	Read only	8	8	8	8	0	Discrete Input	None
A18	A18	Allarme sonda 2 guasta	Probe 2 fault alarm	None	Read only	9	9	8	8	0	Discrete Input	None
A11	A11	Allarme immediato esterno (circuito 1)	Immediate external alarm (circuit 1)	None	Read only	10	10	8	8	0	Discrete Input	None
A12	A12	Allarme di alta temperatura sonda 1	High temperature alarm probe 1	None	Read only	11	11	8	8	0	Discrete Input	None
A13	A13	Allarme di bassa temperatura sonda 1	Low temperature alarm probe 1	None	Read only	12	12	8	8	0	Discrete Input	None
A16	A16	Allarme RTC guasto	RTC fault alarm	None	Read only	15	15	8	8	0	Discrete Input	None
A17	A17	Allarme Eeprom parametri macchina	EEPROM unit parameters alarm	None	Read only	16	16	8	8	0	Discrete Input	None
s_H_2	s_H_2	Allarme di alta temperatura sonda 2	High temperature alarm probe 2	None	Read only	48	48	8	8	0	Discrete Input	None
s_LO_2	s_LO_2	Allarme di bassa temperatura sonda 2	Low temperature alarm probe 2	None	Read only	49	49	8	8	0	Discrete Input	None
s_SA	s_SA	Allarme di sola segnalazione immediato	Immediate signal-only alarm	None	Read only	51	51	8	8	0	Discrete Input	None
s_M_Loop_2	s_M_Loop_2	Allarme immediato esterno (circuito 2)	Immediate external alarm (circuit 2)	None	Read only	52	52	8	8	0	Discrete Input	None
ONLY READ												
A2	A2	Valore sonda 1	Probe 1 value	Home	Read only	1	1	16	16	0	Input Register	None
A3	A3	Valore sonda 2	Probe 2 value	Home	Read only	2	2	16	16	0	Input Register	None
s_out_1	s_out_1	Percentuale uscita 1	Output 1 percentage	Main	Read only	226	226	16	16	0	Input Register	None
s_out_2	s_out_2	Percentuale uscita 2	Output 2 percentage	Main	Read only	227	227	16	16	0	Input Register	None
D1	Output1	Stato uscita 1	Status of output 1	None	Read only	0	0	8	8	0	Discrete Input	None
D2	Output2	Stato uscita 2	Status of output 2	None	Read only	1	1	8	8	0	Discrete Input	None
D3	Output3	Stato uscita 3	Status of output 3	None	Read only	2	2	8	8	0	Discrete Input	None
D4	Output4	Stato uscita 4	Status of output 4	None	Read only	3	3	8	8	0	Discrete Input	None
D6	Output6	Stato ingresso digitale 1	Digital input 1 status	Status	Read only	5	5	8	8	0	Discrete Input	None
D7	Output7	Stato ingresso digitale 2	Digital input 2 status	Status	Read only	6	6	8	8	0	Discrete Input	None
READ-WRITE												
D06	S1	Comando ON/OFF unità	Unit ON/OFF command	Main	Read/Write	35	35	8	8	0	Coil	Single Coil
S1	S1	Set point 1	Set point 1	Main	Read/Write	3	3	16	16	0	Holding Register	Single Register
S2	S2	Set point 2	Set point 2	Main	Read/Write	4	4	16	16	0	Holding Register	Single Register
P1	P1	Differenziale set point 1	Differential 1	Main	Read/Write	5	5	16	16	0	Holding Register	Single Register
P2	P2	Differenziale set point 2	Differential 2	Main	Read/Write	6	6	16	16	0	Holding Register	Single Register
P25	P25	Soglia di allarme di bassa temperatura su sonda 1	Low temperature alarm threshold on probe 1	Main	Read/Write	16	16	16	16	0	Holding Register	Single Register
P26	P26	Soglia di allarme di alta temperatura su sonda 1	High temperature alarm threshold on probe 1	Main	Read/Write	19	19	16	16	0	Holding Register	Single Register

*Parameters used in completely modified or revised managements are not present

**Register types and addresses are shared only for main variables and parameters

Code list

Code	Description
Models	
U20R00UC00200	UNIVERSAL CONTROLLER FOR EEMEA MARKET, PANEL, NFC, BLE
U20R00UC00250	UNIVERSAL CONTROLLER FOR EEMEA MARKET, DIN WITH HMI, NFC, BLE
Connector kit	
UCHCONP010	CONN. AND CABLE KIT UCHILLER PANEL MOLEX/FREE 100CM
UCHCONP030	CONN. AND CABLE KIT UCHILLER PANEL MOLEX/FREE 300CM
UCHCOND010	CONN. AND CABLE KIT UCHILLER DIN MOLEX/FREE 100CM
UCHCOND030	CONN. AND CABLE KIT UCHILLER DIN MOLEX/FREE 300CM
Accessories	
CVSTDUMOR0	USB-RS485 CONVERTER 3-WAY TERMINAL



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