# ECH 200
# Electronic Controller for mono- and bi-Compressor Chillers

Technical Data Sheet

## GENERAL DESCRIPTION

*ECH 200*


**ECH 200** is a compact device enabling control of the following types of air conditioning units:

- air-air
- air-water
- water-water
- motor-condensing

single circuit, with 1 or 2 compressors (steps). 7 models are available:

| CODE | MODEL | DESCRIPTION |
|---|---|---|
| MW320010 | ECH 210 | 2-STEP CHILLER |
| MW320020 | ECH 210A | 2-STEP CHILLER WITH OPTIONAL ANALOG OUTPUT |
| MW320012 | ECH 210B | 2-STEP CHILLER AND INTERNAL PROPORTIONAL FAN + MODBUS |
| MW320022 | ECH 210BA | 2-STEP CHILLER WITH OPTIONAL ANALOG OUTPUT + MODBUS |
| MW320030 | ECH 211 | 2-STEP, HEAT PUMP |
| MW320032 | ECH 211B | 2-STEP, HEAT PUMP AND EXTERNAL PROPORTIONAL FAN + MODBUS |
| MW320040 | ECH 215B | 2-STEP, HEAT PUMP + FAN ON/OFF WITH INTERNAL RELAY + MODBUS |
| MW320600 | EKP 200 | REMOTE KEBOARD FOR ECH 200, WALL MOUNTING |
| MW320602 | EKP/S 200 | REMOTE KEBOARD FOR ECH 200, WITH TEMPERAUTRE SENSOR, WALL MOUNTING |

Condensation fan speed can be controlled proportionately for currents of up to 2 A without using external devices. (ECH 210)

**FUNCTIONS**

- Water/air temperature control on probe at input or output
- Condensation control
- Automatic change-over
- Control of boiler or supplementary electrical heaters for heating
- Internal fan control up to 3 steps in the air-air application
- Dynamic set point
- Defrost cycles control
- Water pump cycle operation control
- Hot Start
- Anti-freeze
- Remote selection of hot/cold mode;
- Temperature or pressure operation
- Recording of on-duty hours
- Parameter setting from the keyboard or through a personal computer
- User interface with a menu featuring 2 different levels of access through password management
- Complete alarm diagnostics.
- For 2xxB models: interfacing facility with BMS via Modbus protocol

**ACCESSORIES**

- Copy card for uploading and downloading parameter maps
- Remote keyboard (up to 100 m) connecting directly without a serial interface
- 4-20 mA or 0-10 V output (optional internal card)
- CF Modules for commanding condenser fans with current rating of over 2A.
- Interface Module for connection to personal computer
- Software "Param Manager" controlled by personal computer
- Temperature probes
- Pressure transducers
- Power transformers
- Front panel Protection

## INSTALLATION

**ANALOG INPUTS**

There are 4 analogue inputs: 3 temperature probes, NTC probe (ST1 – ST3), 1 configurable input for NTC probe or for signal 4...20 mA (ST4).
Available configurations:

| | |
|---|---|
| ST1 | • Probe absent<br>• NTC input: water/air at input<br>• Digital input: request for heating<br>• Digital input: temperature controller request<br>• differential NTC input |
| ST2 | • Probe absent<br>• NTC input Outlet water/air, anti-freeze<br>• Digital input: Cooling request |
| ST3 | • Probe absent<br>• NTC input: condensation<br>• Input 4..20mA for condensation<br>• Input 4..20mA for dynamic setpoint<br>• NTC input: anti-freeze for water-water machines with automatic (internal) reversing of coolant gas<br>• NTC probe: temperature controller in heating mode for water-water machines with manual reversal on water side |
| ST4 | • Probe absent<br>• NTC input: condensation<br>• Multifunctional digital input<br>• NTC input: outdoor temperature |

### DIGITAL INPUTS

There are 5 voltage-free digital inputs (ID1...ID5).
ST1, ST2 and ST4 can be added to them if configured as digital inputs. The following configurations are available:

| | |
|---|---|
| ID1: | High pressure input |
| ID2: | Low pressure input |
| ID3<br>ID4<br>ID5<br>ST4 | • Thermal switch compressor 1<br>• Thermal switch - fan<br>• Flowswitch<br>• Remote heat cool<br>• Remote On-off<br>• Thermal switch for compressor 2<br>• 2nd power step request |

Polarities can be configured.

### OUTPUTS

The instrument has the following outputs:

- 4 contacts on relay (5 on 215B)
- triac outputs
- optional output (ECH 210A/211)
- 1 keyboard output
- Fan module pilot output
- Serial outputs
-

**Relays**

The following configurations are available:

| | |
|---|---|
| RL1 | Compressor |
| RL2 | • Pump<br>• Internal fan on speed 1 |
| RL3 | • Reversing valve<br>• Internal valve on speed 3<br>• 2nd compressor or step control relay |
| RL4 | • Anti-freeze electrical heaters<br>• Internal fan on speed 2<br>• Boiler |

**Triac**

| | |
|---|---|
| TK (NO on 215B) | • Condensation fan proportional control<br>• ON/OFF control of fan according to temperature<br>• anti-freeze electrical heater output for water-water machines with gas reversal<br>• ON/OFF control of fan linked to compressor<br>**ONLY ON 210 & 210B MODELS** |
| ALL | Alarm output |

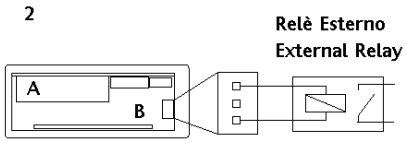
**NOTE: HIGH VOLTAGE INPUTS**

**Optional output (ECH 210A/211)**

2 different types of optional outputs are available, corresponding to two different versions:

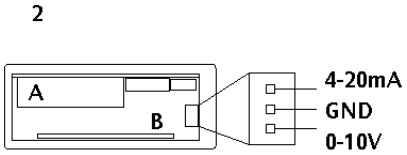
- open collector output for piloting the relay of the second compressor

*Connection to open collector output*




- output 4-20 mA plus 0-10 V:

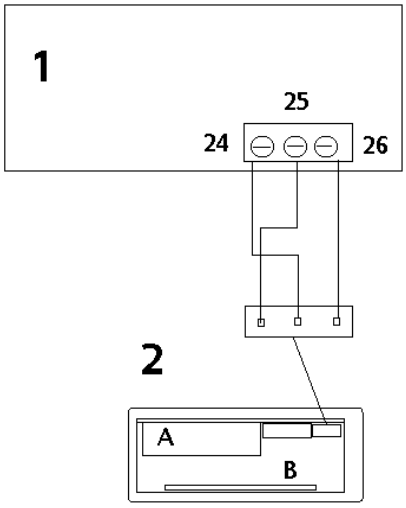
*Connection to output 4-20mA plus 0-10V*




**Remote keyboard output**

This output controls the additional keyboard which should be connected as follows:

*Connection to Remote Keyboard*




| Label | Description |
|---|---|
| 1 | Remote Keyboard (rear view) |
| 2 | ECH 200 (rear view) |
| A | Connector A |
| B | Connector B |

**Fan module pilot output**

TC – **Low voltage output** piloting fan control external modules.

**NOTE: LOW VOLTAGE INPUTS**

**Serial outputs**

There are 2 asynchronous outputs on the control:

- channel for serial communication with a personal computer through a suitable interface module
- channel for serial communication with a suitable keyboard. Power supply 12 V⎓ (2400,e,8,1).

## USER INTERFACE

The interface, on the instrument front panel, enables all the instrument's operations, and especially the following:

- Set operation mode
- Control alarm situations
- Check status of resources

### KEYS

| | |
|---|---|
| | • Resets alarms, as well as switching the instrument on and off<br>• In the menu mode, it becomes the SCROLL DOWN or DOWN key ( value reduced) |
| | • In heat mode, whenever you press this key, the sequence is: **Stand-by → cooling → heating → stand-by**<br>• if heat mode is not enabled: **Stand-by → cooling → stand-by**<br>In the menu mode, it becomes the SCROLL UP or UP key (value increased). |
| set | If you press and release both keys within 2 seconds, you drop down by one level in the viewing menu.<br>If you press and release both keys within 2 seconds, you rise by one level |

### LED

| | |
|---|---|
| 1 | • ON if compressor 1 active<br>• OFF if compressor 1 is inactive<br>• BLINK if safety timings are in progress |
| 2 | • ON if the compressor (step control) is active<br>• OFF if the compressor (step control) is inactive<br>• BLINK if safety timings are in progress |
| | • ON if defrosting is active<br>• OFF if defrosting ended or disabled<br>• BLINK if time count is in progress (defrosting interval) |
| | • ON if the anti-freeze internal heater or boiler are active<br>• OFF if the anti-freeze internal heater or boiler are inactive |
| | ON if the device is in heating mode. |
| | ON if controller in cooling mode |

### DISPLAY

The following are shown under normal viewing:

- control temperature in tenths of Celsius degrees with decimal point, or in Fahrenheit without decimal point
- alarm code, if at least one alarm is active.
- If temperature control depends on the status of a digital input, the "ON" or "OFF" label is shown depending on temperature controller status (active - inactive)
- Labels and codes are used in the menu mode
- Decimal point: when duty hours are shown, it indicates that the values must be multiplied by 100

### REMOTE KEYBOARD

Functions are the same as those of the main keyboard .
The only difference is the use of the UP and DOWN keys (increase and reduction of value) which are separated from the MODE and ON/OFF keys (see photo).

*Remote keyboard*


### PARAMETERS

By means of a set of parameters, one can set the different types of machine and the operating values of the different algorithms. Parameters can be set in the following ways:

- instrument keyboard
- Copy Card
- from PC (with software "Param Manager" and interface module).

Viewability or non viewability of parameters and labels can be programmed from the Personal Computer.

# TEMPERATURE CONTROL FUNCTIONS

### OPERATING MODES

The control has 4 operating statuses:

- cooling
- heating
- stand-by
- off

The operating mode can be selected from the keyboard or from the digital inputs according to set parameters.
Unless the machine is configured as a motorised condensing type, activation and de-activation of loads depends dynamically on the set temperature control functions, on the temperature/pressure values measured by the probes and on setpoints.

### DYNAMIC SETPOINT

The regulation algorithm may be used to modify the set point automatically on the basis of outdoor conditions.
The purpose is to save ECH and to compensate for drops in machine performance if outside temperatures are particularly demanding.

### AUTOMATIC CHANGE-OVER

Changes from cooling to heating according to parameters and ambient conditions.

### DIFFERENTIAL TEMPERATURE CONTROL

Used to control temperature according to the two inputs. With this type of control, for example, a fluid can be thermostat controlled whether in cooling or heating mode, setting the fluid equal to outside ambient temperature plus a constant differential (positive or negative) set by the user.

### CONDENSATION CONTROL

The following speeds can be set for the ventilation unit (located outside on the heat exchanger, which acts as a condenser: minimum speed, maximum speed, SILENT speed corresponding to a silenced operating condition (e.g. for night-time).

### DEFROSTING

Defrosting is active in HEAT mode only. It is used to prevent ice forming on the surface of the outside exchanger. Ice significantly cuts down the machine's thermo-dynamic performance and may lead to damage.

### BOILER/ELECTRICAL HEATERS

An output is dedicated to boiler control, combining with supply of hot water in heating mode (heat pump).

### HOT START

This HEAT mode function enables ventilation only if the internal exchanger is sufficiently hot. Unpleasant cold air flows are thus avoided.

### ANTI-FREEZE

If a refrigerating water internal exchanger is supplied, this function prevents water icing in cooling mode, by activating a heater.

### DISCHARGED MACHINE

In all operating modes except active boiler or defrosting modes, the machine is checked for leakage in the cooling circuit or breakage of the reversal valve (heat pump operation).

### INTERNAL FAN

Up to 3 inputs can be configured to command the same number of fan speeds in the internal exchanger.

### RECORDING OF DUTY HOURS

The device stores the number of duty hours of the following in permanent memory:

- hydraulic pump
- compressors

# DIAGNOSTICS

The controller can perform full systems diagnostics of the machine and signal alarms.

For some alarms the signal will not be given for a certain amount of time, preset by a parameter. For others, the number of tripping events/hour is counted. If, in the space of one hour, these events exceed a set threshold established by means of a parameter, an alarm is activated and is then manually reset.

Alarms with manual reset are reset by pressing the ON-OFF button.

When an alarm is triggered, two things occur:

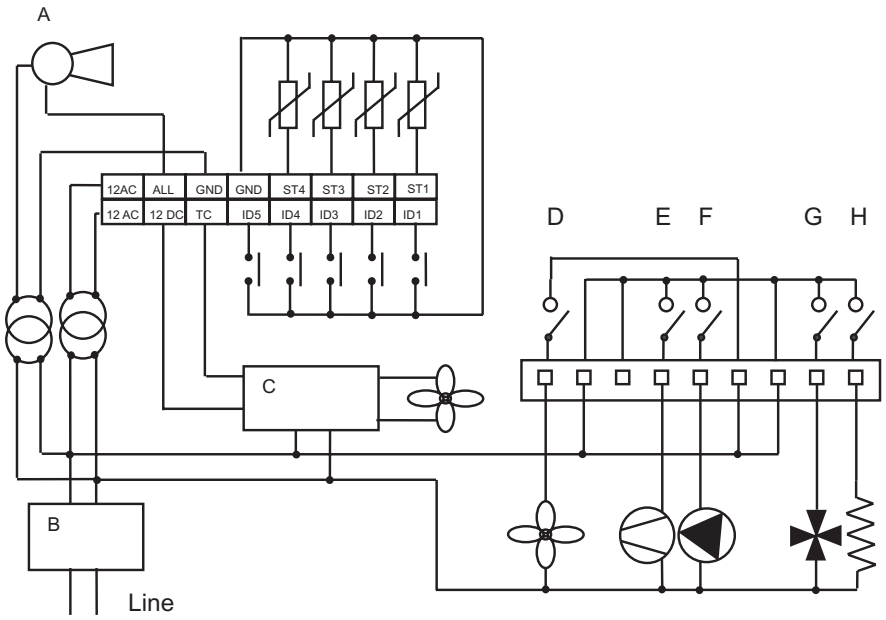
- Corresponding loads are shut down
- The alarm is indicated on the keyboard display

The alarm/event messages are identified by labels (code errors Exx).

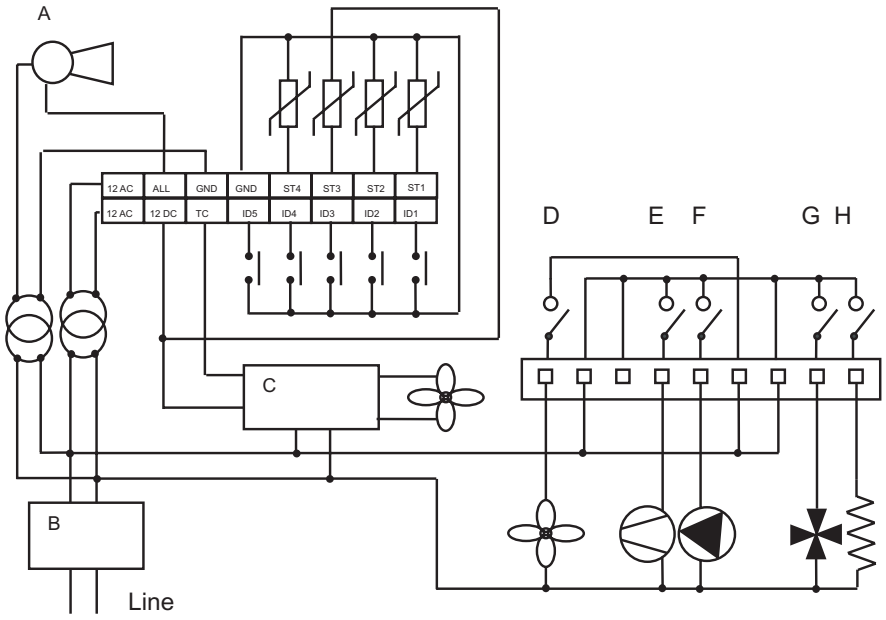
A table of reported alarms is shown at the end of the document.

# CONNECTION DIAGRAMS

*ST3 probe configured as NTC*




*ST3 probe configured as 4-20mA*




| *Key* | **Description** |
|---|---|
| **A** | Alarm exit |
| **B** | EMI Filter |
| **C** | CF control |
| **D** | TK / Relay 5 (215B) |
| **E** | Relay 1 |
| **F** | Relay 2 |
| **G** | Relay 3 |
| **H** | Relay 4 |

# TECHNICAL DATA

## TECHNICAL DATA

| | Typical | Min. | Max. |
|---|---|---|---|
| Power supply voltage | 12V~ | 10V~ | 14V ~ |
| Power supply frequency | 50Hz/60 Hz | --- | --- |
| Power | 5VA; | --- | --- |
| Insulation class | 1 | --- | --- |
| Operating temperature | 25°C | -10°C | 60°C |
| Operating ambient humidity (non-condensing) | 30% | 10% | 90% |
| Storage ambient temperature | 25°C | -20°C | 85°C |
| Storage ambient humidity (non-condensing) | 30% | 10% | 90% |

## ELECTRO-MECHANICAL CHARACTERISTICS

| | |
|---|---|
| 120/240 V~ digital outputs | • n° 4 relays 2A ¼ hp 240V~; 1/8 hp 120V~<br>**Note: Total current on relays must not exceed 8A**<br>• 1 TRIAC 2 A<br>**NOTE: HIGH VOLTAGE INPUTS** |
| 24V~ outputs | • 1 TRIAC output, not optically insulated; max. 500 mA.<br>**NOTE: LOW VOLTAGE INPUTS** |
| Analogue inputs | • 3 temperature sensors, range -30°C ÷ 90°C;<br>• 1 configurable input: 4...20 mA transducer or temperature sensor, range -30°C ÷ 90°C; |
| Digital inputs | • n° 5 voltage-free digital inputs |
| Terminals and connectors | • 1 9-way snap-on high voltage connector AWG 16-28<br>• 1 16 way snap-on low voltage connector, thread 4.2, AWG 16-28<br>• 1 p2,5 5–way remote control and copy card connector, AWG 24-30<br>• 1 p 2 3-way remote keyboard or optional relay connector, AWG 22-30; |
| Display and led | • 3 digits + sign;<br>• 5 red led |
| Keys | • 2 keys |
| Serials | • n° 1 serial 9600<br>• n° 1 serial 2400 |

The instrument must be powered with a suitable current transformer with the following characteristics:

- Primary voltage: 230V~±10%; 110V~±10%
- Secondary voltage: 12V~
- Power supply frequency: 50Hz; 60Hz
- Power: 5VA;

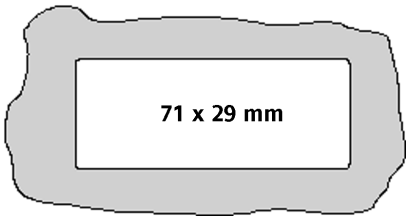
*Signalled alarms table*

| | SIGNAL | *LOADS SHUT DOWN* | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | COMPRESSOR 1 | COMPRESSOR 2 | EXTERNAL FAN | INTERNAL FAN | PUMP | RES. 1 | RES 2 |
| E00 | Remote Off | YES | YES | YES | YES | YES | YES | YES |
| E01 | High pressure (digital) | YES | YES | | | | | |
| E02 | Low pressure (digital) | YES | YES | YES | YES | | | |
| E03 | Thermal cut-out for compressor 1 | YES | | | | | | |
| E04 | Thermal cut-out for condenser fan | YES | YES | YES | YES | | | |
| E05 | Anti-freeze | YES | YES | YES | | | | |
| E06 | Probe ST2 fault | YES | YES | YES | YES | YES | YES | YES |
| E07 | Probe ST3 fault | YES | YES | YES | YES | YES | YES | YES |
| E11 | High pressure / high temperature (analogue) | YES | YES | | | | | |
| E12 | Low pressure / low temperature (analogue) | YES | YES | YES | YES | | | |
| E13 | Thermal prot. for compressor 2 | | YES | | | | | |
| E40 | Probe ST1 fault | YES | YES | YES | YES | YES | YES | YES |
| E41 | Flowswitch | YES | YES | YES | | YES | | |
| E42 | Probe ST4 fault | YES | YES | YES | YES | YES | YES | YES |
| E43 | Anti-freeze alarm (water-water machines with gas reversal) | YES | YES | | | | | |
| E44 | Machine out of coolant | YES | YES | YES | YES | | | |
| E45 | Configuration error | YES | YES | YES | YES | YES | YES | YES |
| E46 | Over temperature | YES | YES | | | | | |

## DIMENSIONS AND ASSEMBLY

- Dimensions: Front panel 76x34x58mm
- Container: PC+ABS plastic resin with V0 extinguishing classification
- Assembly: Panel, on 71x29mm hole

*Panel Hole*




## REGULATIONS

The product complies with the following European Community Directives:

- **Council Directive 73/23/CEE and subsequent modifications**
- **Council directive 89/336/CEE and subsequent modifications**

and complies with the following harmonised regulations:

- **LOW VOLTAGE: EN60730**
- **EMISSION: EN50081-1 (EN55022)**
- **IMMUNITY: EN50082-2 (IEC 1000-4-2/3/4/5)**

# USE CONDITIONS

### PERMITTED USE

This product is used to control single circuit chillers and heat pumps. To ensure safety, the controller must be installed and operated in accordance with the instructions supplied, and access to high voltage components must be prevented under regular operating conditions. The device must be properly protected against water and dust and must be accessible by tool only. The device is suitable for installing in a household appliance and/or similar air conditioning device. It is classed, under the relevant reference standards, as an electronic automatic command device to be built-in by independent assembly, or to be integrated, as follows: according to its automatic operation characteristics, as a type 1 action command device depending on manufacturing tolerances and drift; as a class 2 device depending on protection against electrical shocks; as a class A device depending on class and structure of software.

### FORBIDDEN USE

Any use other than the permitted use is forbidden. Please note that relay contacts supplied are functional and are subject to faults (as they are controlled by an electronic component and may be shorted or remain open). Protective devices recommended by product standards or suggested by common sense in response to evident safety requirements must be implemented outside of the instrument.

# RESPONSIBILITY AND RESIDUAL RISKS

**Invensys Controls Italy S.r.l.** shall not be held liable for any damage due to: installation/use other than that specified, and, in particular, not conforming to the safety prescriptions of current standards and/or provided in this booklet; use on appliances not guaranteeing adequate protection against electrical shocks, water and dust under effected assembly conditions; use on appliances permitting access to hazardous parts without tools; installation/use on appliances not conforming to current standards and regulations.

# DISCLAIMER



Invensys Controls Italy S.r.l.
via dell'Industria, 15 Zona Industriale Paludi
32010 Pieve d'Alpago (BL) ITALY
Telephone +39 0437 986111
Facsimile +39 0437 989066
Internet http://www.climate-eu.invensys.com

ECH 200
2002/04
Cod: 8IS20101