DIGITAL CONTROLLER WITH ADVANCED ENERGY SAVING MANAGEMENT

XRB60CH

1 GENERAL WARNINGS

1.1 PLEASE READ BEFORE USING THIS MANUAL

- This manual is part of the product and should be kept near the instrument for easy and quick reference.
- The instrument shall not be used for purposes different from those described hereunder. It cannot be used as a safety device.
- Check the application limits before proceeding.
- Dixell Srl reserves the right to change the composition of its products, even without notice, ensuring the same and unchanged functionality.

1.2 SAFETY PRECAUTIONS

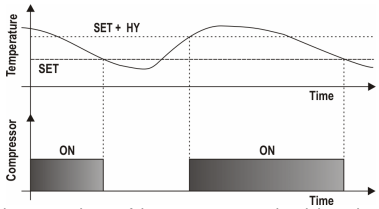
- Check the supply voltage is correct before connecting the instrument.
- Do not expose to water or moisture: use the controller only within the operating limits avoiding sudden temperature changes with high atmospheric humidity to prevent formation of condensation
- Warning: disconnect all electrical connections before any kind of maintenance.
- Fit the probe where it is not accessible by the End User. The instrument must not be opened.
- In case of failure or faulty operation send the instrument back to the distributor or to "Dixell S.r.l." (see address) with a detailed description of the fault.
- Consider the maximum current which can be applied to each relay (see Technical Data).
- Ensure that the wires for probes, loads and the power supply are separated and far enough from each other, without crossing or intertwining.
- In case of applications in industrial environments, the use of mains filters (our mod. FT1) in parallel with inductive loads could be useful.

2 GENERAL DESCRIPTION

The **XRB60CH**, **32x74x60mm format**, is a microprocessor based controller suitable for applications on medium or low temperature ventilated refrigeration units. It has 3 relay outputs to control compressor, fans and lights. The device is also provided with up to 4 NTC probe inputs: the first one for temperature control, the second one to be located onto the evaporator to control the defrost termination temperature and to manage the fan and the third and fourth, optionals, to control condenser temperature and for other functions. There is also a configurable digital input. By using the **HOT-KEY** it is possible to program the instrument in a quick and easy way.

3 REGULATION

The regulation is performed according to the temperature measured by the thermostat probe with a positive differential from the set point: if the temperature increases and reaches set point plus differential, the compressor will start. The compressor will stop when the temperature reaches the set point value again.



In case of fault because of the thermostat probe, the start and stop of the compressor are timed through parameters **CoF** and **Con**.

4 ENERGY REDUCTION ALGORITHM

4.1 DESCRIPTION

The device permits to set different temperature to be used during normal and reduced power use. The standard SET-POINT (**SET**) is used to maintain the temperature at a certain value when the energy saving status (ES) is not active. On the other side, when the ES status is active a different SET-POINT (**SET_ES**), higher than the standard one, will be used. The parameter **HES** will have to be set to change the regulation temperature according to the following formula:

SET_ES = SET + HES

There are also two different differential values for SET and SET_ES, which are used for compressor cut-in and cut-out: when ES status is active the **HYE** parameter will be used instead of the **HY** parameter.

The device uses special **E**nergy **r**eduction **Al**gorithm (**ErA** algorithm from Dixell) to optimize loads activation during the day. It is possible to set two different algorithms (**ErA=bAS or Aut).** They differ for the used sensor and for the total length of the interval of time involved.

4.2 BASIC ENERGY SAVING ALGORITHM – ErA=bAS

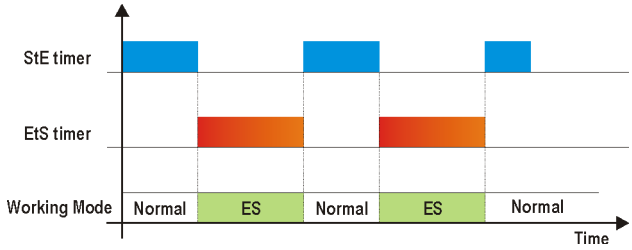
This will be used when **ErA=bAS**. The energy saving status will be always saved in the internal memory to resume previous operation if a power failure occurs. It needs the presence of a door switch to work (**i1F=dor**).

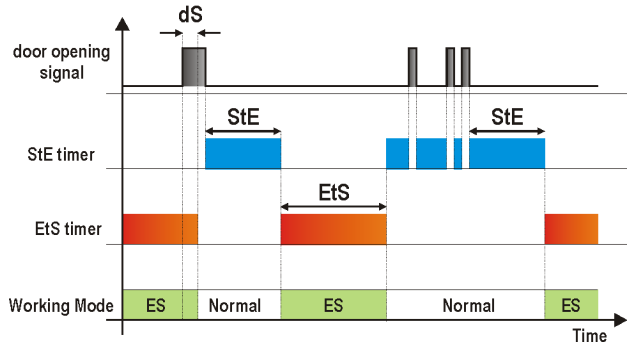
4.2.1 Parameter involved and suggested values:

- **ErA=bAS**
- **i1F=dor**
- **StE=4.0 hours**
- **EtS=6.0 hours**
- **HES=4.0 to 5.0 °C**
- **HYE=3 to 4°C**
- **dS=5 to 10 sec**
- **LdE=Y**

FROM	TO	CHANGED BY
Normal mode	Energy Saving	- Push the **DOWN** button for 3 sec (if enabled). - Door continuously closed for the **StE** time.
Energy Saving	Normal mode	- Push the **DOWN** button for 3 sec (if enabled). - Controller in ES mode for the **EtS** time. - If the controller is in ES mode, it returns in Standard mode (normal set-point) after opening the door more than **dS** time.

NOTE: the cycling mode (ES - Normal mode - ES - etc.) works if **i1F=dor** and **EtS** and **StE** are different from zero. If **EtS=0** or **StE=0,** the controller will not change the operating mode, and it will be possible to change from the normal mode to the energy saving mode by using ES button or by setting **i1F=ES**. See the below diagrams where the status changing is depicted:





4.3 AUTOMATIC ENERGY SAVING ALGORITHM

This will be used when **ErA=Aut**. The operations are controlled by using the **Aid** parameter. After powering on the device, it automatically starts to analyze the temperature behavior by using the only room temperature probe. In this way it can build the best energy saving model according to the application. The device uses temperature behavior information of the previous **Aid** interval to manage the loads during the current period. When **Aid** is set to use long periods (**Aid>1**), a day-by-day model will be used during the first interval of time.

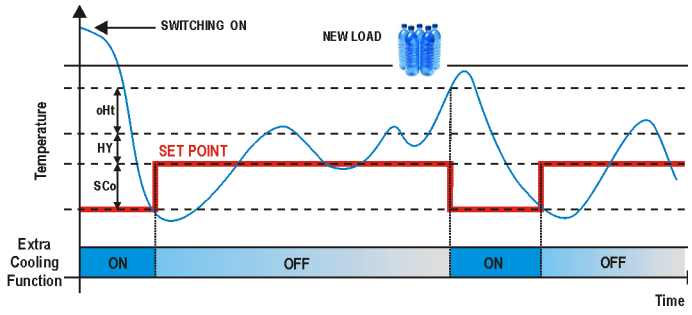
4.3.1 Parameter involved and suggested values:

- **ErA=Aut**
- **Aid=1 or 7**
- **LdE=Y**
- **HES= 4.0 to 5.0°C**
- **HYE=3 to 4°C**

NOTES:

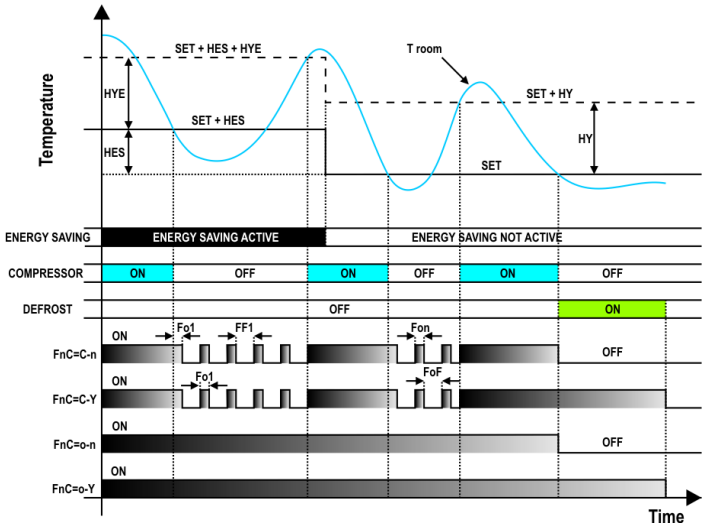
1. In case of any blackout, the calculated energy saving model will be reset.
2. **ErA** can exclusively drive the light output by using the **LdE** parameter. When **LdE=YES**, the light output status will change according to the energy saving (ES) status:
   a. OFF if ES is active
   b. ON if ES is not active
3. It is always possible to override the light output status by using the frontal button. Anyway, this modification will have a temporary impact on the lights if **LdE=YES**. In fact, **ErA** will take the control after the next ES status change.
4. **ErA <u>does not</u> need any door switch input to work**.
5. Be sure to place the room temperature probe in near the upper zone of the cabinet: this gives the best results in terms of temperature variation analysis.
6. The **Aid** parameter indicates the interval of analysis as "number of days". The suggested values for it are 1 or 7, depending on the application.
7. When **Aid=1**, the first day will be used to analyze the temperature behavior and to build the model to apply to the second day. The model will be updated every day to better match the working conditions.
8. When **Aid=7**, the first 7 days will be used to analyze the temperature behavior and to build the model to apply to the next 7 days. The model will be updated every 7 days to better match the working conditions.
9. When **Aid=7**, the first 7 days after power on will use a sub analysis base on 1-day model.

5 EXTRA COOLING FUNCTION



The SUPER-COOLING function is active when the room temperature measured from the probe 1 goes over the **SET+oHt+HY** value. In this case, a special set-point value, lower than the normal **SET** value, will be enabled. As soon as the room temperature reaches the **SET-SCo** value, the compressor will be stopped and the normal regulation will restart. **N.B.:** super-cooling function is disabled when **SCo=0**.
The **tSC** parameter sets the maximum activation time for super cooling operations. When **tSC** expires, the super cooling will be stopped and the standard SET-POINT will be restored. **NOTE:** in case of energy saving mode active, the used values will be: **SET_ES=SET+HES, oHE** and **SCE.**

6 EVAPORATOR FANS



With **FnC** parameter it can be selected the fans functioning:

- **FnC=C-n** → fans will switch ON and OFF with the compressor and **not run** during defrost; when compressor is OFF, fans will enter a duty-cycle working mode (see **FoF**, **Fon**, **FF1** and **Fo1** parameters).
- **FnC=o-n** → fans will run even if the compressor is off, and not run during defrost;
- **FnC=C-Y** → fans will switch ON and OFF with the compressor and **run** during defrost; when compressor is OFF all fans will enter a duty-cycle working mode (see **FoF**, **Fon**, **FF1** and **Fo1** parameters).
- **FnC=o-Y** → fans will run continuously also during defrost.

After defrosting, there is a timed fan delay allowing for drip time, set by means of the **Fnd** parameter.
An additional parameter **FSt** provides the setting of temperature, detected by the evaporator probe, above which the fans are always OFF. By using this parameter, it is possible to assure air circulation only if air temperature is lower than **FSt** value.

6.1 EVAPORATOR FAN AND DIGITAL INPUT

When the digital input is configured as door switch (**i1F=dor**), fans and compressor status will depend on the **odC** parameter value:

- **odC=no** → normal regulation;
- **odC=FAn** → evaporator fan OFF;
- **odC=CPr** → compressor OFF;
- **odC=F-C** → compressor and evaporator fan OFF.

When **rrd=Y** the regulation will restart after a door open alarm.

7 DEFROST

7.1 DEFROST MODE

Any defrost operation can be controlled in the following way:

- **EdF=rtC**: by using an internal real-time clock (only for models equipped with RTC).
- **EdF=in**: timed defrost, in this case a new defrost will start as soon as the idF timer elapses.
- **EdF=Aut**: automatic management, in this case the controller will start a new defrost any time a change from normal to energy saving mode will occur (valid if **ErA=Aut**).

7.2 TIMED OR PROBE CONTROLLED MODE

Two defrost modes are available: timed or controlled by the evaporator's probe. A couple of parameters is used to control the interval between defrost cycles (**idF**) and its maximum length (**MdF**). During the defrost cycle is possible to select some different display indications by using the **dFd** parameter. These modes are available with any kind of defrost type:

- **tdF=EL**: electric heater defrost
- **tdF=in**: hot gas defrost.

7.3 AUTOMATIC DURATION DETECTION

When a defrost operation is performed by compressor stop (means by stopping the compressor and by activating the internal ventilators), it will be possible to use an automatic defrost mode by setting **tdF=ALt**. In this case the device will use the evaporator probe (which MUST to be present and properly mounted on the evaporator surface) to detect the end of the actual defrost phase. In any case, a maximum period (**MdF**) and an upper evaporator temperature value will be used to stop the current defrost phase. If **ErA=Aut**, the automatic defrost mode will activate a defrost at the beginning of any energy saving mode period. In this case the **idF** delay is used as safety function. It forces the controller to activate a defrost operation when **idF** runs. **NOTE:** during the defrost phase the loads (compressor and evaporator fans) will be controlled from the defrost algorithm.

8 INTERNAL COUNTERS

The next table shows the implemented load and function counters.

n1H	Number of compressor activation (thousands of)
n1L	Number of compressor activation (hundreds of)
n2H	Number of fan activation (thousands of)
n2L	Number of fan activation (hundreds of)
n3H	Number of defrost activation (thousands of)
n3L	Number of defrost activation (hundreds of)
n4H	Number of light activation (thousands of)
n4L	Number of light activation (hundreds of)
nPd	Number of door openings during last day (read only)
nPH	Number of door openings (thousands of) (read only)
nPL	Number of door openings (hundreds of) (read only)
oCH	Compressor working hours (thousands of)
oCL	Compressor working hours (hundreds of)

In this way it is possible to monitor the application and discovering bad functioning that could lead to damages. They are updated in EEPROM every hour. It is not possible to reset them.
NOTE: the compressor activation counters consider also defrost in case of inversion (hot gas) mode.

9 FRONT PANEL COMMANDS

SET	Press to display target set point and the real set point. When in programming mode, it selects a parameter or confirms an operation
	(**LIG**) To switch on and off the light
	(**DEF**) To start a defrost (when function available)
	(**UP**) In programming mode it browses the parameter codes or increases the displayed value.
	(**DOWN**) In programming mode it browses the parameter codes or decreases the displayed value. Keep it pressed 3 sec to activate the Energy Saving mode
	(**ONOFF**) Keep it pressed for 3 sec to activate or deactivate the key function (see par. **onF**)

KEYS COMBINATION	
+	To lock or unlock the keyboard
SET +	To enter in programming mode
SET +	To return to room temperature display

ICON	MODE	MEANING
	On	Compressor enabled
	Flashing	Anti-short cycle delay enabled (**AC** parameter)
	On	Light output enabled
	On	Fans output enabled
	Flashing	Fans delay after defrost
°C, °F	**On**	Measurement unit
	Flashing	Programming mode
	On	Energy saving mode active
	On	An alarm condition is present
	Flashing	Start-up operations are pending

NOTE: start-up operations lasts about 30 sec after powering on the device. At the end of this phase, the alarm icon will switch off if no alarm is active.

9.1 SET POINT MENU

The **SET** key gives access to a quick menu where it is possible to see:

- the set point value.
- the real set point value (**rSE**)

Push and release the **SET** key five times or wait for 60 sec to return to normal visualisation.

9.2 CHANGE THE SETPOINT

1. Push the **SET** key for more than 2 sec to change the Set point value;
2. The value of the set point will be displayed and the "°C" LED starts blinking;
3. To change the Set value push the **UP** or **DOWN** button.
4. To memorise the new set point value push the **SET** key again or wait for 60 sec.

9.3 HOW TO: START A MANUAL DEFROST

Push the **DEFROST** button for more than 2 sec to start a manual defrost.

9.4 HOW TO: CHANGE A PARAMETER VALUE

To change the parameter values, operate as follows:
1. Enter the Programming mode by pressing the **SET+DOWN** buttons for 3 sec ("**°C**" LED starts blinking).
2. Select the required parameter. Press the **SET** button to display its value
3. Use **UP** or **DOWN** buttons to change its value.
4. Press **SET** to store the new value and move to the following parameter.

To exit: Press **SET+UP** buttons or waits for 15 sec without pressing any key.

NOTE: the set value is stored even when the procedure exits by waiting the time-out to expire.

9.5 HOW TO: SHOW THE HIDDEN MENU

The hidden menu includes all the parameters of the instrument.

ENTER THE HIDDEN MENU

1. Enter the Programming mode by pressing **SET+DOWN** buttons for 3 sec ("**°C**" or "**°F**" LED starts blinking).
2. Released the keys and then push again **SET+DOWN** buttons for more than 7 sec. The "**L2**" label will be displayed immediately followed from the **HY** parameter.
   NOW YOU ARE IN THE HIDDEN MENU.
3. Select the required parameter.
4. Press the **SET** key to display its value
5. Use **UP** or **DOWN** to change its value.
6. Press **SET** to store the new value and move to the following parameter.

To exit: Press **SET+UP** or wait for 15 sec without pressing any key.

NOTE1: if there are no parameters in **L1**, after 3 sec the "**nP**" label will be displayed. Keep the keys pushed till the "**L2**" message will be displayed.

NOTE2: the previous set value will be stored even if the programming mode exits by waiting for the time-out to expire.

MOVE PARAMETERS FROM THE HIDDEN MENU TO THE FIRST LEVEL AND VICEVERSA.

Each parameter present in the HIDDEN MENU can be removed or put into "THE FIRST LEVEL" (user level) by pressing **SET+DOWN**. If a parameter is visible also in the First Level, in the HIDDEN MENU the decimal point will be lit.

9.6 HOW TO: LOCK THE KEYBOARD

1. Keep both **UP** and **DOWN** buttons pressed for more than 3 sec.
2. The "**oFF**" label will be displayed and the keyboard will be locked. If any button is pressed more than 3 sec, the "**oFF**" message will be displayed.

9.7 HOW TO: UNLOCK THE KEYBOARD

Keep both **UP** and **DOWN** buttons pressed together for more than 3 sec till the **"on"** message will be displayed.

10 PARAMETERS

REGULATION

HY	**Differential in normal mode (energy saving not active):** (0.1 to 25.0°C; 1 to 45°F) differential for set point. Compressor Cut-IN is **[SET-POINT + HY]**. Compressor Cut-OUT is when the temperature reaches the set point.
HYE	**Differential when energy saving mode is active:** (0.1 to 25.0°C; 1 to 45°F) differential for set point. Compressor Cut-IN is **[SET-POINT + HES + HYE]**. Compressor Cut-OUT is when the temperature reaches the **[SET-POINT + HES]**.
LS	**Minimum SET POINT:** (-55.0°C to SET; -67°F to SET) sets the minimum value for the set point.
US	**Maximum SET POINT:** (SET to 110.0°C; SET to 230°F) set the maximum value for set point.
ot	**Thermostat probe calibration:** (-12.0 to 12.0°C; -21 to 21°F) allows to adjust any possible offset of the first probe.
P2P	**Evaporator probe presence: n** = not present; **Y** = the defrost stops by temperature.
oE	**Evaporator probe calibration:** -12.0 to 12.0°C; -21 to 21°F) allows to adjust any possible offset of the second probe.
P3P	**Third probe presence: n** = not present; **Y** = the condenser temperature alarm is managed.
o3	**Third probe calibration:** (-12.0 to 12.0°C; -21 to 21°F) allows to adjust any possible offset of the condenser probe.
P4P	**Fourth probe presence: n** = not present; **Y** = the condenser temperature alarm is managed.
o4	**Fourth probe calibration:** (-12.0 to 12.0°C; -21 to 21°F) allows to adjust any possible offset of the condenser probe.
odS	**Outputs activation delay at start up:** (0 to 255 min) this function is enabled after the start-up of the instrument and inhibits any output activation for the period of time set in the parameter.
AC	**Anti-short cycle delay:** (0 to 50 min) minimum interval between a compressor stop and the following restart.
Con	**Compressor ON time with faulty probe:** (0 to 255 min) time during which the compressor is active in case of faulty thermostat probe. With **CY=0** compressor is always OFF.
CoF	**Compressor OFF time with faulty probe:** (0 to 255 min) time during which the compressor is OFF in case of faulty thermostat probe. With **Cn=0** compressor is always active.

DISPLAY

CF	**Temperature measurement unit:** (°C; °F) **°C** = Celsius; **°F** = Fahrenheit.
rES	**Resolution (only for °C):** (dE; in) **dE** = decimal; **in** = integer.
Lod	**Probe displayed:** (P1; P2; P3; P4; Set; dtr; USr) **Px**=measured value from selected probe. **SEt**=setpoint value; **dtr**=calculated value; **USr**=label "USr"
dLY	**Display temperature delay:** (0.0 to 20min00sec, res. 10 sec) when the temperature increases, the display is updated of 1°C or 1°F after this time.

DEFROST

tdF	**Defrost type: EL**=electrical heaters; **in**=hot gas; **ALt**=automatic, only for for compressor stop.
dFP	**Probe selection for defrost control (termination): nP**=no probe; **P1**=thermostat probe; **P2**=evaporator probe; **P3**=do not use it; **P4**=Probe on Hot Key plug.
dtE	**Defrost termination temperature:** (-55 to 50°C; -67 to 122°F) if **P2=Y** it sets the temperature measured by the evaporator probe, which causes the end of defrost.
idF	**Interval between two consecutive defrost cycles:** (0 to 255 hours) determines the time interval between the beginnings of two defrosting cycles.
MdF	**Maximum length for defrost:** (0 to 255 min; 0 means no defrost) when **P2P=n** (no evaporator probe presence) it sets the defrost duration, when **P2P=Y** (defrost end based on evaporator temperature) it sets the maximum length for defrost.
dSd	**Start defrost delay:** (0 to 255 min) delay in defrost activation.
dFd	**Display during defrost:** (rt; it; SP; dF) **rt** = real temperature; **it** = start defrost temperature; **SP** = SET-POINT; **dF** = label "**dF**".
dAd	**Max delay for updating display after a defrost:** (0 to 255 min) delay before updating the temperature on the display after finishing a defrost.
Fdt	**Draining time:** (0 to 255 min)
dPo	**First defrost after start-up:** (n; Y) to enable defrost at power on.
dAF	**Defrost delay after freezing:** (0.0 to 24h00min, res. 10 min) delay before activating a defrost.

FANS

FnC	**Fan mode operation:** (Cn; on; CY; oY) • **Cn** = runs with the compressor, duty-cycle when compressor is OFF (see **FoF**, **Fon**, **FF1** and **Fo1** parameters) and OFF during defrost; • **on** = continuous mode, OFF during defrost; • **CY** = runs with the compressor, duty-cycle when compressor is OFF (see **FoF**, **Fon**, **FF1** and **Fo1** parameters) and ON during defrost; • **oY** = continuous mode, ON during defrost.
Fnd	**Fan delay after defrost:** (0 to 255 min) delay in fan activation after a defrost.
FCt	**Differential of temperature for forced activation of fans**
FSt	**Fans stop temperature:** (-55 to 50°C; -67 to 122°F) setting of temperature, detected by evaporator probe. Over this value of temperature fans are always OFF. **NOTE: it works only for the evaporator fan, NOT for the condenser fan.**
Fon	**Fan on time when the compressor is off:** (0 to 255 min) used when energy saving status is not active.
FoF	**Fan off time when the compressor is off:** (0 to 255 min) used when energy saving status is not active.
FAP	**Probe selection for fan management: nP**=no probe; **P1**=thermostat probe; **P2**=evaporator probe; **P3**=do not use it; **P4**=Probe on Hot Key plug.
Fo1	**Fan on time with compressor off in Energy Saving:** (0 to 255 min) used when energy saving status is active.
FF1	**Fan off time with compressor off in Energy Saving:** (0 to 255 min) used when energy saving status is active.

ALARMS

ALP	**Probe selection for temperature alarm:** (nP; P1; P2; P3; P4) **nP**=no probe; **P1**=thermostat probe; **P2**=evaporator probe; **P3**=do not use it; **P4**=Probe on Hot Key plug.
ALC	**Temperature alarms configuration:** (Ab, rE) **Ab** = absolute; **rE** = relative.
ALU	**Maximum temperature alarm:** when this temperature is reached, the alarm is enabled after the **Ad** delay time. • If **ALC=Ab** → ALL to 110.0°C or ALL to 230°F. • If **ALC=rE** → 0.0 to 50.0°C or 0 to 90°F.
ALL	**Minimum temperature alarm:** when this temperature is reached, the alarm is enabled after the **Ad** delay time. • If **ALC=Ab** → -55.0°C to ALU or -67°F to ALU. • If **ALC=rE** → 0.0 to 50.0°C or 0 to 90°F.
AFH	**Differential for temperature alarm recovery:** (0.1 to 25.0°C; 1 to 45°F) differential for alarms.
ALd	**Temperature alarm delay:** (0 to 255 min) delay time between the detection of an alarm condition and the relative alarm signalling.
dAo	**Delay of temperature alarm at start up:** (0.0 to 24h00min, res. 10 min) delay time between the detection of a temperature alarm condition and the relative alarm signalling, after powering on the instrument.

CONDENSER TEMPERATURE ALARM

AP2	**Probe selection for second temperature alarms:** (nP; P1; P2; P3; P4) **nP**=no probe; **P1**=thermostat probe; **P2**=evaporator probe; **P3**=do not use it; **P4**=Probe on Hot Key plug
AL2	**Second low temperature alarm:** (-55.0 to 110.0°C; -67 to 230°F)
AU2	**Second high temperature alarm:** (-55.0 to 110.0°C; -67 to 230°F)
AH2	**Differential for second temperature alarm recovery:** (0.1 to 25.0°C; 1 to 45°F)
Ad2	**Second temperature alarm delay:** (0 to 255 min; 255 = not used) delay time between the detection of a condenser alarm condition and the relative alarm signaling.
dA2	**Delay for second temperature alarm at start up:** (0.0 to 24h00min, res. 10 min)
bLL	**Compressor off because of second low temperature alarm:** (n; Y) **n** = no, compressor keeps on working**; Y** = yes, compressor is switched off till the alarm is present, in any case regulation restarts after **AC** time at minimum.
AC2	**Compressor off because of second high temperature alarm:** (n; Y) **n** = no, compressor keeps on working**; Y** = yes, compressor is switched off till the alarm is present, in any case regulation restarts after **AC** time at minimum.
tbA	**Alarm muting:** (n; Y) to disable the (optional) buzzer and the output configured as alarm.

DIGITAL OUTPUT

oA1	**Digital output 1 configuration:** (dEF; FAN; ALr; LiG; AUS; onF; db; CP2; HES) **dEF**=defrost; **FAN**=evaporator fan; **ALr**=alarm; **LiG**=light; **AUS**=auxiliary; **db**=neutral zone; **CP2**=do not use it; **HES**=energy saving
AOP	**Alarm relay configuration:** (CL; oP) **CL** = activated by closing the contact; **oP** = activated by opening the contact.

DIGITAL INPUT

i1P	**Digital input 1 polarity:** (CL; oP) **CL** = activated by closing the contact; **oP** = activated by opening the contact.

i1F	**Digital input 1 configuration:** (dor; dEF; LiG; AUS; Lis; ES) • **dor** = door switch function; • **dEF** = defrost activation; • **LiG** = light activation / deactivation; • **AUS** = not used; • **LiS** = not used; • **ES** = energy saving activation / deactivation.
did	**Digital inputs alarm delay:** (0 to 255 min) when **i1F=EAL** or **bAL**, it is the delay between the detection of an external alarm condition and the relative signalling. When **i1F=dor,** this represents the delay before the activation of the door open alarm.
doA	**Door alarm delay:** (0 to 255 min)
odC	**Compressor and fan status after opening of the door:** (no; FAn; CPr; F-C): **no** = normal; **FAn** = Fans OFF; **CPr** = Compressor OFF; **F-C** = Compressor and fans OFF.
rrd	**Regulation restart after door open alarm:** (n; Y) **n** = no regulation if door is opened; **Y** = when **did** is elapsed, regulation restarts even if a door open alarm is present.

ENERGY SAVING

ErA	**Energy reduction algorithm used:** (nu; bAS; Aut) **nu**=no energy saving algorithm used; **bAS**=basic energy saving algorithm; **Aut**=automatic energy saving algorithm.
HES	**Differential for energy aaving mode:** (-30.0 to 30.0°C; -54 to 54°F) it sets the increasing value of the set point during the Energy Saving cycle.
LdE	**Energy saving mode controls the lights (lights off when E.S. goes active):** (n; Y) the light status depends on the energy saving mode and is managed from **ErA**.
Aid	**Period of analysis for ErA (valid if ErA=Aut):** (1 to 20 days) set the interval of time for temperature variation analysis.
nCE	**Number of contiguous cells to activate Energy Saving (valid if ErA=Aut):** (1 to 20) minimum pattern (1 cell = 30 min) without activity for energy saving activation
nCC	**Number of contiguous cells with energy saving for Set-Point variation (valid if ErA=Aut):** (1 to 12) minimum interval of time for SET-POINT variation by steps (1°C or 1°F every 30 minutes)
Pdt	**Pull Down time after energy saving:** (1 to 8) energy saving mode is deactivated in advance
tUn	**System tuning: L**=low sensibility**; H**=high sensibility
PPU	**Temperature probe used for temperature variation analysis:** (P1, P2, P3, P4) which probe is used from Energy Reduction Algorithm
FEn	**Force status change from energy saving mode to normal mode (valid if ErA=Aut):** (1 to 15) number of intervals with activity for mode changing
FnE	**Force status change from normal mode to energy saving mode (valid if ErA=Aut):** (1 to 15) number of intervals without activity for mode changing
StE	**Period of time to switch from normal mode to energy saving mode (valid if ErA=bAS):** (0.0 to 24h00min, res. 10 min) if door stay closed for **StE** time, the energy saving mode will be activated. NOTE: this will require a door switch to work.
EtS	**Period of time to switch from energy saving to normal mode (valid if ErA=bAS):** (0.0 to 24h00min, res. 10 min) maximum time for energy saving mode. NOTE: this will require a door switch to work.
dS	**Door open time to switch from EtS to StE (valid if ErA=bAS):** (0 to 999 sec) the energy saving mode will be immediately deactivated as soon as the door stay open more than the **dS** time. NOTE: this will require a door switch to work.
oHt	**Overheating before activating the super cooling function (when in normal mode):** (1.0 to 12.0°C; 1 to 21°F) this is the upper threshold limit used to activate the super cooling function.
SCo	**Subcooling for Super Cooling function (when in normal mode):** (0.0 to 12°C; 0 to 21°F) this is the special set-point value used during a super cooling function (cut-off value for compressor). If **SCo=0**, the super cooling function during normal mode is disabled.
tSC	**Maximum duration for Super Cooling function (both for normal and energy saving mode):** (0.0 to 24h00min, res. 10 min) maximum length for super cooling mode.
oHE	**Overheating before activating the super cooling function (when in energy saving mode):** (1.0 to 12.0°C; 1 to 21°F) this is the upper threshold limit used to activate the super cooling function.
SCE	**Subcooling for Super Cooling function (when in energy saving mode):** (0.0 to 12°C; 0 to 21°F) this is the special set-point value used during a super cooling function (cut-off value for compressor). If **SCE=0**, the super cooling function during energy saving mode is disabled.

COUNTERS

nH1	**Number of compressor activation (thousands of) (read only)**
nL1	**Number of compressor activation (hundreds of) (read only)**
nH2	**Number of fan activation (thousands of) (read only)**
nL2	**Number of fan activation (hundreds of) (read only)**
nH3	**Number of defrost activation (thousands of) (read only)**
nL3	**Number of defrost activation (hundreds of) (read only)**
nH4	**Number of light activation (thousands of) (read only)**
nL4	**Number of light activation (hundreds of) (read only)**
nPd	**Number of door openings during last day (read only)**
nPH	**Number of door openings (thousands of) (read only)**
nPL	**Number of door openings (hundreds of) (read only)**
oCH	**Compressor working hours (thousands of) (read only)**
oCL	**Compressor working hours (hundreds of) (read only)**

OTHER

Adr	**Serial address for Modbus communication:** 0 to 247
onF	**ONOFF button configuration: nu**=not used; **onF**=ON/OFF function; **ES**=change working mode from normal to energy saving mode and vice-versa.
LPC	**Light button configuration: nu**=not used; **Lig**=light output; **AUS**=auxiliary output; **dEF**=defrost activation
dPC	**Defrost button configuration: nu**=not used; **AUS**=auxiliary output; **dEF**=defrost activation
d1	**Thermostat probe display (read only)**
d2	**Evaporator probe display (read only)**
d3	**Pb3 probe display (read only)**
d4	**Pb4 probe display (read only)**
rSE	**Real Set point (read only)**
rEL	**Firmware Release (read only)**
Ptb	**Parameter code table (read only)**
FdY	**Firmware release information (read only).**
FMt	**Firmware release information (read only).**
FYr	**Firmware release information (read only).**

11 DIGITAL INPUT

The free voltage digital input is programmable in different configurations by the **i1F** parameter.

DOOR SWITCH (i1F=dor)

It signals the door status and the corresponding relay output status through the **odC** parameter:

no = normal (any change); **FAn** = Fan OFF; **CPr** = Compressor OFF; **F-C** = Compressor and fan OFF. Since the door is opened, after the delay time set through parameter **did**, the door alarm is enabled, the display shows the message **"dA"** and **the regulation restarts if rrd = Y.** The alarm stops as soon as the external digital input is disabled again. With the door open, the high and low temperature alarms are disabled.

START DEFROST (i1F=dEF)

It starts a defrost if there are the right conditions. After a defrost is finished, the normal regulation will restart only if the digital input is disabled otherwise the instrument will wait until the **MdF** safety time is expired.

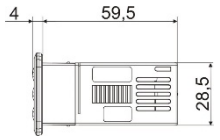
LIGHT CONTROL (i1F=LiG)

The light output status will change with the digital input.

ENERGY SAVING (i1F=ES)

The energy saving mode will be enabled / disabled with the digital input.

12 INSTALLATION AND MOUNTING



Instrument **XRB-CH** shall be mounted on vertical panel, in a 29x71 mm hole, and fixed using the special bracket supplied.
The temperature range allowed for correct operation is 0 to 60°C. Avoid places subject to strong vibrations, corrosive gases, excessive dirt or humidity. The same recommendations apply to probes. Let air circulate by the cooling holes.

13 OPTIONAL FEATURES

The **MDP/CX** rear cover can be used to increase the protection from water and dust.

The **HOT-KEY** is used for a quick and easy upload (from device to **HOT-KEY**) or download (from **HOT-KEY** to device) of the parameter map.

The **PROG-KEY** is used for firmware upgrade operations.

WIZMATE PROG-TOOL KIT
With this self-powered tool kit it is possible to easily modify the internal parameter map of any XRB device. The **WIZMATE®** software (part of this KIT) permits to build any personal configuration in a short time and to load it into the controller memory.

14 ELECTRICAL CONNECTIONS

The instrument is provided with screw terminal block to connect cables with a cross section up to 2.5mm^2. Before connecting cables make sure the power supply complies with the instrument's requirements. Separate the probe cables from the power supply cables, from the outputs and the power connections. Do not exceed the maximum current allowed on each relay, in case of heavier loads use a suitable external relay.

14.1 PROBES

The probes shall be mounted with the bulb upwards to prevent damages due to casual liquid infiltration. It is recommended to place the thermostat probe away from air streams to correctly measure the average room temperature. Place the defrost termination probe among the evaporator fins in the coldest place, where most ice is formed, far from heaters or from the warmest place during defrost, to prevent premature defrost termination.

15 USE THE HOT KEY

15.1 SAVE PARAMETERS IN A HOT KEY (UPLOAD FROM INSTRUMENT)

1. Program one controller with the front keypad.
2. When the controller is ON, insert the "**HOT-KEY**" and push **UP** button; the "**UP**" message appears followed a by flashing "**End**"
3. Push "**SET**" key and the "**End**" will stop flashing.
4. Turn OFF the instrument and then remove the "**HOT-KEY**". At the end turn the instrument ON again.

NOTE: the "**Err**" message appears in case of a failed programming operation. In this case push again the **UP** button if you want to restart the upload again or remove the "**HOT-KEY**" to abort the operation**.**

15.2 COPY PARAMETERS FROM A HOT KEY (DOWNLOAD PARAMETER VALUES)

1. Turn OFF the instrument.
2. Insert a **programmed "HOT-KEY" into the 5-PIN receptacle** and then turn the Controller ON.
3. Automatically the parameter list of the "**HOT-KEY**" is downloaded into the Controller memory, the "**do**" message is blinking followed a by flashing "**End**".
4. After 10 seconds the instrument will restart working with the new parameters.
5. Remove the "**HOT-KEY**".

NOTE: the message "**Err**" is displayed for failed programming. In this case turn the unit off and then on if you want to restart the download again or remove the "**HOT-KEY**" to abort the operation**.**

16 USE THE PROG-KEY

During 30 sec which following a switch on it will be possible to upgrade the internal firmware by using a special tool named **PROG-KEY**. This operation does not change the internal parameter configuration.

PAY ATTENTION: this operation MUST be carried out only from expert personnel in order not to damage the controller. Please contact your regional reseller to have more information.

17 ALARM SIGNALLING

Label	Cause	Outputs
"oFF"	Keyboard locked	Outputs unchanged
"on"	Keyboard unlocked	Outputs unchanged
"P1"	Room probe failure	Compressor output according to **Con** e **CoF**
"P2"	Evaporator probe failure	Defrost end is timed
"P4"	Fourth probe failure	Linked temperature alarm is not managed
"HA"	Maximum temperature alarm	Outputs unchanged
"LA"	Minimum temperature alarm	Outputs unchanged
"H2"	Maximum temperature for second temperature alarm	Outputs unchanged
"L2"	Minimum temperature for second temperature alarm	Outputs unchanged
"dA"	Door open more than **doA** time	Compressor and fans restarts
"EA"	External alarm	Outputs unchanged
"CA"	Serious external alarm	Outputs disabled
"EE"	EEPROM alarm	Outputs unchanged

17.1 ALARM RECOVERY

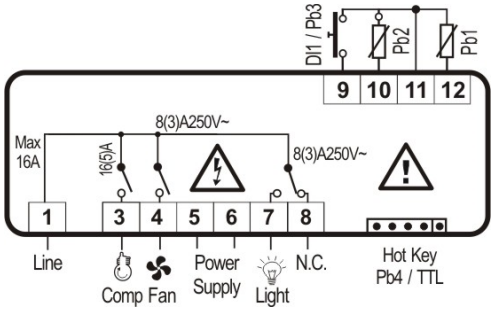
Probe alarms "**P1**", "**P2**", "**P3**" and "**P4**" start some seconds after the fault in the related probe; they automatically stop some seconds after the probe restarts normal operation. Check connections before replacing the probe. Temperature alarms "**HA**", "**LA**", "**H2**" and "**L2**" automatically stop as soon as the temperature returns to normal values. It is possible to reset the "**EE**" alarm by pressing any button.
The alarms "EA", "CA" and "dA" will automatically stop as soon as the digital input is disabled.
The optional buzzer can be muted by pressing any key if parameter **tbA=Y**.

18 TECHNICAL DATA

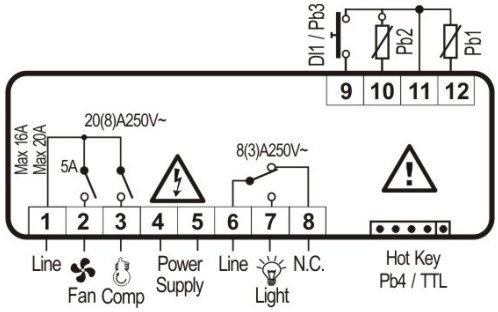
Housing: self-extinguishing ABS
Case: frontal 32x74 mm; depth 60mm
Mounting: panel mounting in a 71x29mm panel cut-out
Body Protection: IP20
Frontal protection: IP65
Connections: Screw terminal block ≤ 2.5 mm² wiring
Power supply: (according to the model) 230Vac ±10%, 50/60Hz; 110Vac ±10%, 50/60Hz
Power absorption: 3.5VA max
Display: 3 digits red LED, 14.2 mm high
Inputs: up to 3 NTC probes.
Digital input: free voltage contact.
Relay outputs: **Compressor** SPST 16(5)A or 20(8)A, 250VAC
Light: SPDT 8(3)A, 250VAC
Fans: SPST 5(2) or 8(3)A, 250VAC
Data storing: on the non-volatile memory (EEPROM)
Kind of action: 1B
Pollution degree: 2
Software class: A
Rated impulsive voltage: 2500V; **Overvoltage Category**: II
Operating temperature: 0 to 60°C (32 to 140°F)
Storage temperature: -25 to 60°C (-13 to 140°F)
Relative humidity: 20 to 85% (no condensing)
Measuring and regulation range:
NTC -40 to 110°C (-40 to 230°F)
Resolution: 0.1°C or 1°C (selectable).
Accuracy (ambient temp. 25°C): ±0.1°C ±1 digit.

19 WIRINGS

19.1 XRB60CH – 16+8+8A – 110 OR 230VAC

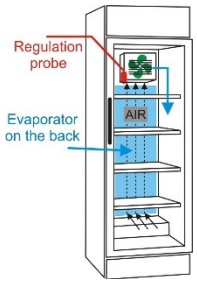


19.2 XRB60CH – 20+8+5A – 230VAC

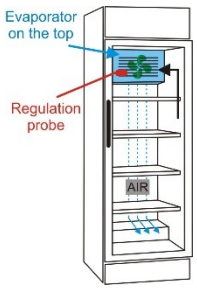


20 APPLICATION NOTES

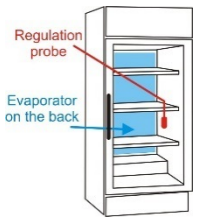
Pay attention to the positioning of the regulation probe. In fact, the XRB can obtain the best performances of the system under control when the regulation probe is placed by following these guidelines:



Ventilated applications – Evaporator placed on the back of the refrigerated zone, ventilator placed above the evaporator
- The regulation probe is normally placed in the outlet air flow from the evaporator
- The regulation probe can be placed both inside or outside the ventilator pack, paying attention to avoid positions too near to the motor of the ventilator



Ventilated applications – Evaporator placed on the top side of the refrigerated zone, ventilator placed on the outlet air flow from the evaporator
- The regulation probe is normally placed in the inlet air flow to the evaporator
- The regulation probe has to be installed outside the evaporator, avoiding any contact with the metallic parts of the evaporator itself



Static applications – Coolers without ventilators:
- The regulation probe is normally placed at the side-wall of the refrigerated zone, approximately from 30% to 50% (of the internal height) from the bottom and 20% to 30% (of the internal width) from the back

21 DEFAULT SETTING VALUES

Label	Description	Value	Level
HY	Differential in normal mode (energy saving not active)	2.0	Pr1
HYE	Differential when energy saving active	3.0	Pr1
LS	Minimum set point	-50.0	Pr1
US	Maximum set point	50.0	Pr1
ot	Thermostat probe calibration	0.0	Pr1
P2P	Evaporator probe presence	yes	Pr1
oE	Evaporator probe calibration	0.0	Pr1
P3P	Third probe presence	no	Pr2
o3	Third probe calibration	0.0	Pr2
P4P	Fourth probe presence	no	Pr2
o4	Fourth probe calibration	0.0	Pr2
odS	Outputs delay activation after start up	1	Pr1
AC	Anti short cycle delay	1	Pr1
Con	Compressor ON time with faulty probe	15	Pr2
CoF	Compressor OFF time with faulty probe	30	Pr2
CF	Temperature measurement unit	°C	Pr1
rES	Resolution (only for °C): decimal, integer	dE	Pr1
Lod	Probe displayed	P1	Pr1

dLy	Display temperature delay	00:00	Pr2
tdF	Defrost type: electrical heating, hot gas, compressor stop	EL	Pr2
dFP	Probe selection for defrost control	P2	Pr1
dtE	Defrost termination temperature for defrost control	10.0	Pr1
idF	Interval between two consecutive defrost cycles	12	Pr1
MdF	Maximum length for defrost	20	Pr1
dSd	Start defrost delay	0	Pr2
dFd	Displaying during defrost	dEF	Pr1
dAd	Max delay for updating display after a defrost	1	Pr1
Fdt	Draining time	1	Pr1
dPo	First defrost after start-up	no	Pr1
dAF	Defrost delay after fast freezing	nu	Pr2
FnC	Fan mode operation	C_Y	Pr1
Fnd	Fan delay after defrost	0	Pr1
FCt	Differential of temperature for forced activation of fans	0	Pr1
FSt	Fan stop temperature	20.0	Pr1
Fon	Fan on time with compressor on	5	Pr1
FoF	Fan off time with compressor off	10	Pr1
FAP	Kind of action for fan	P2	Pr1
Fo1	Fan on time with compressor off in energy saving	5	Pr1
FF1	Fan off time with compressor off in energy saving	12	Pr1
ALP	Probe selection for temperature alarm	P1	Pr2
ALC	Temperature alarms configuration	Ab	Pr2
ALU	Maximum temperature alarm	110.0	Pr1
ALL	Minimum temperature alarm	-50.0	Pr1
AFH	Differential for temperature alarm recovery	1.0	Pr2
ALd	Temperature alarm delay	0	Pr2
dAo	Delay of temperature alarm at start up	04:00	Pr2
AP2	Probe selection for second temperature alarms	nP	Pr2
AL2	Second low temperature alarm	-50.0	Pr2
AU2	Second high temperature alarm	110.0	Pr2
AH2	Differential for second temperature alarm recovery	2.0	Pr2
Ad2	Second temperature alarm delay	0	Pr2
dA2	Delay for second temperature alarm at start up	01:30	Pr2
bLL	Compressor off because of second low temperature alarm	no	Pr2
AC2	Compressor off because of second high temperature alarm	yes	Pr2
tbA	Alarm relay switched off by pushing any key	yes	Pr2
oA1	First relay configuration	LiG	Pr2
AOP	Alarm relay polarity	CL	Pr2
i1P	Digital input 1 polarity	CL	Pr1
i1F	Digital input 1 configuration	dor	Pr1
did	Digital inputs alarm delay	1	Pr1
doA	Door alarm delay	5	Pr1
OdC	Compressor and fan status after opening of the door	FAn	Pr1
rrd	Regulation restart after door open alarm	yes	Pr1
ErA	Energy reduction algorithm used	Aut	Pr2
HES	Differential for energy aaving mode	3	Pr2
LdE	Energy saving mode controls the lights (lights off when energy saving goes active)	yes	Pr2
Aid	Period of analysis for ErA (valid if ErA=Aut)	7	Pr2
nCE	Number of contiguous cells to activate Energy Saving (valid if ErA=Aut)	4	Pr2
nCC	Number of contiguous cells with energy saving for Set-Point variation (valid if ErA=Aut)	8	Pr2
Pdt	Pull Down time after energy saving	2	Pr2
tUn	System tuning: 0=low sensibility; 1=high sensibility	high	Pr2
PPU	Temperature probe used for temperature variation analisys	P1	Pr2
FEn	Force status change from energy saving mode to normal mode (valid if ErA=Aut)	1	Pr2
FnE	Force status change from normal mode to energy saving mode (valid if ErA=Aut)	8	Pr2

StE	Period of time to switch from normal mode to energy saving mode (valid if ErA=bAS)	04:00	Pr2
EtS	Period of time to switch from energy saving to normal mode (valid if ErA=bAS)	06:00	Pr2
dS	Door open time to switch from EtS to StE (valid if ErA=bAS)	5	Pr2
oHt	Overheating before activating the super cooling function (when in normal mode)	0.0	Pr2
SCo	Subcooling for Super Cooling function (when in normal mode)	0.0	Pr2
tSC	Maximum duration for Super Cooling function (both for normal and energy saving mode)	00:00	Pr2
oHE	Overheating before activating the super cooling function (when in energy saving mode)	0.0	Pr2
SCE	Subcooling for Super Cooling function (when in energy saving mode)	0.0	Pr2
n1H	Number of compressor activation (thousand of)		Pr1
n1L	Number of compressor activation (hundreads of)		Pr1
n2H	Number of fan activation (thousand of)		Pr1
n2L	Number of fan activation (hundreads of)		Pr1
n3H	Number of defrost activation (thousand of)		Pr1
n3L	Number of defrost activation (hundreads of)		Pr1
n4H	Number of light activation (thousand of)		Pr1
n4L	Number of light activation (hundreads of)		Pr1
nPd	Number of door openings during last day		Pr1
nPH	Number of door openings (thousand of)		Pr1
nPL	Number of door openings (hundreads of)		Pr1
oCH	Compressor working hours (thousand of)		Pr1
oCL	Compressor working hours (hundreads of)		Pr1
Adr	Serial address	1	Pr2
OnF	On/off key configuration	OFF	Pr2
LPC	Light key configuration	LiG	Pr2
dPC	Defrost probe value	dEF	Pr2
dP1	Probe P1 value visualization	0	Pr1
dP2	Probe P2 value visualization	0	Pr1
dP3	Probe P3 value visualization	0	Pr1
dP4	Probe P4 value visualization	0	Pr1
rSE	Real Set point (SET + ES + oHx)	0	Pr1
rEL	Firmware Release	0	Pr1
Ptb	Parameter map code	1	Pr1
FdY	Firmware release: day		Pr1
FMt	Firmware release: month		Pr1
FYr	Firmware release: year		Pr1
SEt	Set point	3.0	

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