valex VX-950 plus Ver.02

DIGITAL CONTROLLER FOR REFRIGERATION WITH ELECTRONIC EXPANSION VALVE MODE

VX-950 HMI | Electronic expansion valve | Sitrad Supervisory sistem | FG-CAP

Full Gauge® CONTROLS

⚠ Have this manual in your hands using the **FG Finder** app.

WARNING

⚠ **BEFORE INSTALLING THE CONTROLLER WE RECOMMEND READING THE INSTRUCTION MANUAL THOROUGHLY IN ORDER TO AVOID POSSIBLE DAMAGES TO THE PRODUCT.**

⚡ **PRECAUTIONS WHEN INSTALLING THE PRODUCT:**
Before performing any procedure in this instrument, disconnect it from the mains; make sure the instrument has proper ventilation, avoiding installation in panels containing devices that may force it to work outside the specified temperature limits;
Install the product away from sources that can generate electromagnetic disturbances, such as: motors, contactors, relays, solenoid valves, etc.

🛠 **AUTHORIZED SERVICES:**
The installation and maintenance of the product must only be performed by qualified personnel.

⚠ **ACCESSORIES:**
Only use original accessories of Full Gauge Controls.
If you have any questions, please contact our technical support.

DUE TO CONSTANT EVOLUTION, FULL GAUGE CONTROLS RESERVES THE RIGHT TO CHANGE THE INFORMATION CONTAINED IN THIS MANUAL.

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1. DESCRIPTION

Digital temperature controller designed to drive the electronic expansion valve, as well as superheating, pressure, defrost and room temperature control. The temperature control relies on two setpoints: one for the temperature in normal operation and the other for economy mode operation. It also allows monitoring the controls in three ways: monitoring only with Sitrad; only with **VX-950 HMI** or both, in different RS-485 networks, to view measurements, parameterize functions and commands like manual defrosting and function lock.

2. APPLICATIONS

• Chiller, plug in, walk-ins and displays of frozen goods.

3. TECHNICAL ESPECIFICATIONS

- **Power Supply:** 13 ±10% Vdc 1.3A (use only the source that comes with the controller)
- **Temperature control:** -50 to 60°C/ -58 to 140°F
- **Temperature operation:** 0 to 50 °C / 32 to 122°F
- **Control pressure:** 0 to 500 psi/ 0 to 34,4 bar
- **Sensors available for aquisition:** 0 to 200 psi / 0 to 13.8 bar (using SB69-200A transducer*)
  0 to 500 psi / 0 to 34.4 bar (using SB69-500A transducer*)
  *Sensors sold separately
- **Pressure resolution:** 0,1 bar / 1 psi
- **Operation humidity:** 10 to 90%UR (without condensation)
- **Maximum current: REFR:** 1HP: 230Vac - compressor output
  FANS: 3(2)A/ 250Vac 1/10HP - fan output
  DEFR: 7A / 250V/ 1750W - defrost output
- **Sensors: S1:** Room sensor
  S2: Evaporator sensor
  S3: Suction line temperature sensor (wire)
  P1: Pressure sensor
- **Dimensions:** 84x120x40mm (LXAxP)
- **Electronic Expansion Valve (EEV):** Item sold separately
⚠ **WARNING: In order to select the right Electronic Expansion Valve (EEV) see the attachment at the end of the manual.**

IMPORTANT

To find out which valve is best for your application, visit the site or QR code below: **http://www.fullgauge.com.br/veeselector**

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4. FIRST STEPS

STEP 1: Install the electronic expansion valve according to the practical installation **guide attached** to the product.
Before the first charge of refrigerant, switch on one **VX-950 plus**, **VX-950 HMI** and FG-CAP, if there is one.

STEP 2: The initialization corresponds to the charging time of the FG-CAP- about 6 minutes- and the calibration time of the electronic expansion valve, about 1 minute. Upon switching on **VX-950 plus**, the LEDs will light as shown below:
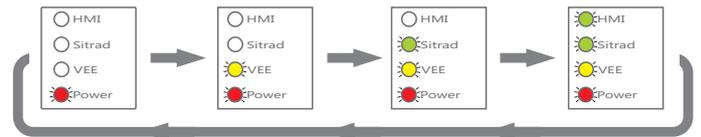
NOTE 1:

If only the power LED keeps blinking, it is a sign that there is a problem related to the independent power supply if FG CAP is being used or not.
1 - Make sure there is power in the mains.
2 - Make sure the power supply output has 13 Volts DC.
Otherwise, contact Full Gauge Controls.

NOTE 2:

The VX950 controller is enabled at the factory to use the FG CAP, which can be seen through the signaling in **VX-950 HMI** in the 🛈 LED as shown in the figure below.

LED 🛈 on: FG-CAP enabled
LED 🛈 off: FG-CAP disabled

The message `ErUC` indicates that the FG-CAP is enabled, but is not properly installed or the charging time is insufficient. On the first time it is installed, it is strongly recommended to review all electrical connections and to perform tests simulating a power fault by disconnecting the voltage source that powers the FG-CAP, making sure the discharge pressure is airtight with the valve fully closed.
To disable the message `ErUC`, enter code `717` in **VX-950 HMI**.

WARNING

⚠ **IF THE USER CHOOSES NOT TO USE THE FG-CAP, IT IS IMPERATIVE TO USE A SOLENOID VALVE.**

⚠ **TO DISABLE THE FG-CAP, ENTER THE CODE 222 IN VX-950 HMI. FG-CAP INDICATION LED WILL BE TURNED OFF IN VX-950 HMI.**

ELECTRONIC EXPANSION VALVE (EEV)
SOLENOID

STEP 3: Setting the basic fictions:

Fun	Description
F04	Maximum operating pressure
F08	Cooling fluid type
F11	Initial EEV opening
F17 / F18	Economy/operation setpoint
F21 / F22	Economy/operation hysteresis
F28	Defrost type
F30	Refrigeration time
F37	Defrost time

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5. PARAMETER TABLE

Fun	Description	psi Min	psi Max	psi Unit	psi Default	bar Min	bar Max	bar Unit	bar Default
F01	Pressure offset (P1)	-5	5	psi	0	-0.3	0.3	bar	0
F02	Pressure sensor range	1	5	-	2	1	5	-	2
F03	Low pressure alarm (LOP)	-1	500	psi	0	-1	34.4	bar	0
F04	High pressure alarm (MOP)	-1	500	psi	65	-1	34.4	bar	4.5
F05	Static gain (Kp)	0	999	-	2	0	999	-	1
F06	Integral time (Ti)	0	999	seg.	25	0	999	seg.	25
F07	Derivative time (Td)	0	999	seg.	0	0	999	seg.	0
F08	Cooling fluid type	0	5	-	3	0	5	-	3
F09	Total number of steps of the electronic valve	1	9999	-	480	1	9999	-	480
F10	Operating speed (steps per seconds)	1	120	pas/s	30	1	120	pas/s	30
F11	Initial valve opening value (%)	0	100	%	25	0	100	%	25

Fun	Description	CELSIUS				FAHRENHEIT			
		Min	Max	Unit	Default	Min	Max	Unit	Default
F12	Time delay for superheating control	1	999	min.	1	1	999	min.	1
F13	Superheating setpoint	0	60.0	ºC	9.0	0	140	ºF	16
F14	Critical superheating alarm	0	60.0	ºC	2.0	0	140	ºF	2
F15	Low superheating alarm	0	60.0	ºC	4.0	0	140	ºF	7
F16	High superheating alarm	0	60.0	ºC	6.0	0	140	ºF	27
F17	Operating setpoint	-50.0	60.0	ºC	-15.0	-58	140	ºF	5
F18	Economy setpoint	-50.0	60.0	ºC	-10.0	-58	140	ºF	14
F19	Minimum setpoint alowed to the user	-50.0	60.0	ºC	-50.0	-58	140	ºF	-58
F20	Maximum setpoint alowed to the user	-50.0	60.0	ºC	60.0	-58	140	ºF	140
F21	Operating setpoint control differential	0.1	20.0	ºC	2.0	1	40	ºF	4
F22	Economy setpoint control differential	0.1	20.0	ºC	2.0	1	40	ºF	4
F23	Digital input operating mode	0	3	-	1	0	3	-	1
F24	Intensity of the digital filter applied to the room sensor (S1)	0	9	-	0	0	9	-	0
F25	Room temperature offset (S1)	-5.0	5.0	ºC	0	-9	9	ºF	0
F26	Evaporator temperature offset (S2)	-5.0	5.0	ºC	0	-9	9	ºF	0
F27	Suction line temperature offset (S3)	-5.0	5.0	ºC	0	-9	9	ºF	0
F28	Defrost type (0 = resistence / 1 = hot gas / 2 = natural)	0	2	-	0	0	2	-	0
F29	Condition to start defrosting (0 = time / 1 = temperature)	0	1	-	1	0	1	-	1
F30	Refrigeration time (Interval between defrosting)	1	999	H	4	1	999	H	4
F31	Evaporator temperature to the start defrosting if F29 = 1	-50.0	60.0	ºC	-50.0	-58	140	ºF	23
F32	Confirmation time of low temperature (S2) to start the pre-defrost if F29 = 1	0	999	ºC	10	0	999	ºF	10
F33	Time to collect the gas before starting the defrost	0	999	min.	0	0	999	min.	0
F34	Evaporator temperature to the end the defrosting	-50.0	60.0	ºC	8.0	-58	140	ºF	46
F35	Room temperature to terminate the defrost	-50.0	60.0	ºC	6.0	-58	140	ºF	42
F36	Maximum time without defrosts if F29 = 1	1	999	H	12	1	999	H	12
F37	Maximum defrost time	1	999	min.	20	1	999	min.	20
F38	Locked temperature indication during defrost	-1	999	min.	15	-1	999	min.	15
F39	Defrost when powering the controller	0	1	-	0	0	1	-	0
F40	Draining time	0	999	min.	10	0	999	min.	10
F41	Fan operation mode - normal mode	0	2	-	2	0	2	-	2
F42	Fan operation mode - Power-saving mode	0	2	-	2	0	2	-	2
F43	Fan ON time if F41 / F42 = 0	1	999	min.	1	1	999	min.	1
F44	Fan OFF time if F41 / F42 = 0	1	999	min.	99	1	999	min.	99
F45	Fan operation when opening the door	0	1	-	0	0	1	-	0
F46	Fan deactivation by high temperature in evaporator	-50.0	60.0	ºC	35.0	-58	140	ºF	95
F47	Evaporator temperature for fan reactivation after draining	-50.0	60.0	ºC	2.0	-58	140	ºF	36
F48	Maximum fan reactivation time after draining (fan-delay)	0	999	min.	1	0	999	min.	1
F49	Open door time until instant defrost begins if F23 = 1 / F23 = 2	0	999	min.	30	0	999	min.	30
F50	Open door time to switch off COMP and VENT when F23 = 1 / F23 = 2	0	999	min.	5	0	999	min.	5
F51	Closed door time until activation of power-saving mode if F23 = 1 / F23 = 2	0	999	H	3	0	999	H	3
F52	Minimum time with compressor OFF	0	999	min.	0	0	999	min.	0
F53	Minimum time with compressor ON	0	999	min.	0	0	999	min.	0
F54	Compressor ON time in case of S1 error	0	999	min.	20	0	999	min.	20
F55	Compressor OFF time in case of S1 error	0	999	min.	10	0	999	min.	10
F56	Compressor delay time when powering the controller	0	999	min.	0	0	999	min.	0
F57	Maximum compressor ON time without reaching the setpoint	0	999	H	24	0	999	H	24
F58	Minimum room temperature audible alarm	-50.0	60.0	ºC	-50.0	-58	999	ºF	58
F59	Maximum room temperature audible alarm	-50.0	60.0	ºC	60.0	-58	999	ºF	140
F60	Door opening time until the alarm is activated	0	999	min.	5	0	999	min.	5
F61	Audible temperature alarm inhibition time	0	999	min.	0	0	999	min.	0
F62	Audible alarm inhibition time upon power up	0	999	min.	10	0	999	min.	10
F63	End of defrost by time alarm	0	1	-	1	0	1	-	1
F64	Control functions shutdown	0	1	-	0	0	1	-	0
F65	RS-485 network address	1	247	-	247	1	247	-	247

6.1. DESCRIPTION OF THE PARAMETERS

F01 - Pressure offset (P1):
Allows adjusting any deviations in the pressure measurement.

F02 - Pressure sensor range:

1	100 PSI / 6.9BAR
2	200 PSI / 13.8BAR
3	300 PSI / 20.7BAR
4	400 PSI / 27.6BAR
5	500 PSI / 34.4BAR

F03 - Low pressure alarm (LOP):
When the evaporation pressure falls below this value the Electronic Expansion Valve (EEV) gradually opens to increase the pressure in the system. This process will happen until the pressure reaches the value set in this function.

F04 - High pressure alarm (MOP):
When the evaporation pressure rises above the value configured in this function, the controller gradually closes the Electronic Expansion Valve (EEV) to keep the pressure below the established value. This protection is intended to avoid superheating with an extremely low value causing the return of liquid to the compressor.

F05 - Static gain (Kp):
Proportional Gain: Acts directly by proportionally opening or closing the Electronic Expansion Valve (EEV) in relation to the variation of the superheating temperature. The value is a multiplying factor that establishes the relationship between "Valve steps / ºC".
Proportional Action: Proportional Gain x (Superheating Reading - Superheating Setpoint).

Exemple: F05 = 10, F13=8, Superheating reading = 4
EEV action = 10 x (4 - 8) = - 40
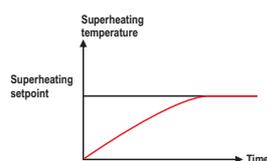This way the valve will close 40 steps.
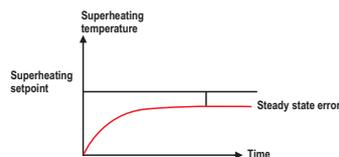
F06 - Integral time (Ti):
This is the action time to correct the difference between the read superheating and the corresponding setpoint is with constant value.
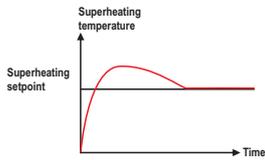**High integral time values:** slower action.
Low integral time values: faster action

F07 - Derivative time (Td):
This is the response time in relation to the variation rate of the superheating in the system. It helps to cancel the overshoot caused by the integral time.

F08 - Cooling fluid type:
This function allows selecting the type refrigerant type that will be used. It is possible to select the gas in accordance to the table below:

0	R22
1	R134A
2	R401A
3	R404A
4	R407C
5	R410A

F09 - Total number of steps of the electronic expansion valve:
This function defines the number of steps specified for the Electronic Expansion Valve (EEV).
➡ **NOTE:** This function cannot be changed in this model.

F10 - Operating speed (steps per second):
This function defines the number of steps per second.
➡ **NOTE:** This function cannot be changed in this model.

F11 - Initial valve opening value (%):
This function defines the opening value of the Electronic Expansion Valve (EEV) when the control is started and it acts together with F12.

F12 - Time delay for superheating control:
Time for which the Electronic Expansion Valve (EEV) will remain open as defined in F11.
See item 6 - operating mode.

F13 - Superheating setpoint:
This is the reference value for superheating control.

F14 - Critical superheating alarm:
When the superheating temperature drops below this value, the critical superheating alarm will activate the message display $A5HC$ and activate the audible alarm.

F15 - Low superheating alarm:
When the superheating temperature drops below this value the superheating alarm will be activated and gradually close the Electronic Expansion Valve (EEV).

F16 - High superheating alarm:
When the superheating temperature rises above this value the superheating alarm will be activated and gradually open the Electronic Expansion Valve (EEV).

F17 - Operation setpoint:
This is the control temperature for the normal operating mode. The compressor will be switched off when the room temperature drops below the value configured in this function.

F18 - Economic setpoint:
This is the control temperature when the power-saving mode is active. The compressor will be switched off if the room temperature drops below the value configured in this function.

F19 - Minimum setpoint allowed to the user:
It is a threshold aimed at preventing an exceedingly low temperature setpoint from being adjusted inadvertently.

F20 - Maximum setpoint allowed to the user:
It is a threshold aimed at preventing an exceedingly high temperature setpoint from being adjusted inadvertently.

F21 - Operation setpoint control differential:
This is the difference between turn ON and turn OFF the refrigeration cycle in normal operating mode.
Example: You want to control the temperature at 4.0 °C with a differential of 1.0 °C. Therefore, the refrigeration will be turned off at 4.0 °C and turned on again at 5.0 °C (4.0 + 1.0).

F22 - Control differential of oconomy setpoint:
This is the difference between turning refrigeration OFF and BACK ON in power-saving mode.

F23 - Digital input operating mode:
It allows choosing the way the digital input will operate:
0 - disabled port
1 - operate as port (contact NF)
2 - operate as port (contact NA)
3 - Manual defrost

F24 - Intensity of the digital filter applied to the room sensor (S1):
It defines the intensity of the digital filter, which is aimed at increasing the response time of the controller for a quick change in the temperature measured by S1, i.e. increasing the thermal inertia of the sensor. The larger the value adjusted in this function, the longer the response time is of sensor S1.
A typical application requiring this filter is the freezer for ice cream and frozen goods because when the door is opened a hot air mass reaches the sensor directly, causing a quick rise in the indication of the measured temperature, which causes the compressor to be activated unnecessarily many times.

F25 - Room temperature offset - S1:
Enables compensation for any temperature deviations resulting from sensor replacement or change in the cable length

F26 - Evaporator temperature offset - S2:
Enables compensation for any temperature deviations resulting from sensor replacement or change in the cable length.

F27 - Suction line temperature offset - S3:
Enables compensation for any temperature deviations resulting from sensor replacement or change in the cable length.

F28 - Defrost type (0 = resistence / 1 = hot gas / 2 = natural):
0 -Electric defrost (by resistance), only the defrost output is activated.
1 -Defrost by hot gas in plug-in systems (with reversion valve), the compressor and defrost outputs are activated. The compressor is compulsorily switched off before starting the defrost cycle, and the minimum compressor off time is observed before starting it (in order to reduce water hammer effect of the cooling fluid in the ducts).
2 -Natural defrost, the compressor and the defrost output remain off.
➡ **NOTE:** The fan output will depend on the parameters configured in functions F23 and F42.

F29 - Condition to start defrosting (0 = time / 1 = temperature):
0 = Defrost by time
1 = Defrost by temperature

F30 - Cooling time (Interval between defrosts):
It is the time for which the compressor will be switched on and off by the room temperature and it is counted from the moment the fan is switched on after the stage of fan-delay (return of the fan after draining).
⚠ **Warning:** Defrost will only started if the temperature in the evaporator sensor is below the value adjusted in F34 (evaporator temperature to end the defrost) and F35 (room temperature to end the defrost).

F31 - Evaporator temperature to start defrost when F29 = 1(defrost by temperature):
When the evaporator temperature reaches the value configured by this function, the controller will initiate the countdown to defrost.

F32 - Time to confirm a low temperature (S2) to start pre-defrosting when F29 = 1 (defrost by temperature):
When the evaporator temperature drops and then reaches the value set in F31, the controller starts counting the confirmation time to start defrosting. During this step, if the temperature remains low the controller starts defrosting.
Otherwise, if the temperature rises above the configured value, the system reverts to the refrigeration step.

F33 - Time to collect the gas before starting the defrost:
When starting the defrosting, the controller will keep only the fan on during this time to take advantage of the residual energy of the gas.

F34 - Evaporator temperature to end the defrost:
If the temperature on the evaporator (S2) reaches the set value, the end of the defrost will happen by temperature, which is desirable. This optimizes the defrost process, resuming the refrigeration as soon as the evaporator is clean.

F35 - Room temperature to end the defrost:
If the temperature on the evaporator (sensor S2) reaches the set value, the end of defrost will happen by temperature, which is desirable. This optimizes the defrost process.

F36 - Maximum time without defrost if F29 = 1:
It acts as a safety time when it is configured to defrost by temperature and the evaporator temperature does not reach the value set in F31. This function defines the maximum time the controller will remain without performing the defrosting.

F37 - Maximum defrost time:
For safety reasons, if the evaporator temperature does not reach the value adjusted in F35 and F34, the end of the defrosting will take place by time. Whenever this happens, a point will keep flashing in the lower right corner of the **VX-950 HMI** display or Sitrad screen.

F38 - Temperature indication (S1) locked during defrost:
This function defines if the room temperature displayed in **VX-950 HMI** will be frozen during (and after) a defrosting. The purpose of this function is to avoid the visualization of a variation in the room temperature due to the defrosting, and the operation of the function will depend on the type of defrosting being performed:
Defrost:
no - Function disabled (S1 temperature is never locked as a function of the defrosting)
0 - Upon starting the defrosting, the controller stores the room temperature and freezes it on the display. The indication will remain frozen until the defrosting is finished.
1 to 60 - Upon starting the defrosting, the controller stores the room temperature and freezes it on the display. The indication will remain frozen until one of the following conditions happen: If the temperature reaches a value below the one registered in the beginning of the defrosting or if the time configured in this function has expired. This time starts to be counted when the defrosting finishes

F39 - Defrost when the instrument is powered on:
It allows performing a defrosting when the controller is powered on, for example when the electric power returns (in case of a power fault).

F40 - Draining time (defrost water dripping):
It defines the dripping time so that the last drops of water in the evaporator have flown when the controller finishes the defrosting. All outputs remain off. If not required in this step this function must be configured with 0 (zero).

F41 - Fan operation mode - normal mode:
F42 - Fan operation mode - Power-Saving mode:
0 - **Automatic:** the fan will be permanently switched on while the compressor is activated.
When the compressor is off, the fan will spin according to the set time established in F43 and F44.
1 - **Continuous:** the fan will be constantly activated.
2 - **Dependent:** the fan will be activated with the compressor.

F43 - Fan on time if F41 / F42 = 0:
It defines the time for which the fan is kept on when F41 / F42 = 0 (Fan operating mode: Automatic).

F44 - Fan off time if F41 / F42 = 0:
It defines the time for which the fan is kept off when F41 / F42 = 0 (Fan operating mode: Automatic).

F45 - Fan operation when opening the door:
The fan may be configured to stay either on or off while the door is kept open.
➡ **NOTE:** Function F45 has priority over F50.

F46 - Fan stop due to high temperature in the evaporator:
This aims at switching off the evaporator fan until the room temperature approaches the temperature provided for in the cold storage installation project, thus avoiding high discharge pressure and temperatures that could damage the compressor. If the evaporator temperature surpasses that of the set value, the fan is turned off, turning back on with a set hysteresis of 2°C below this value. It is a valuable resource when, for example, a cold storage installation is started up after several days of inactivity, or when a walk-in chamber or display is replenished with goods.

F47 - Evaporator temperature (S2) for fan reactivation after draining (fan-delay):
The fan-delay cycle is started after the draining phase. The refrigeration (REFR) is activated immediately because the room temperature is high, but the fan is activated only after the temperature on the evaporator drops below the adjusted value. This process is required to remove the heat that already exists on the evaporator as a result of the defrosting to avoid transferring it to the environment.

F48 - Maximum fan reactivation time after draining (fan-delay):
For safety reasons, if the evaporator temperature does not reach the value in F47 or the defrost sensor (S2) is disconnected, fan reactivation will occur in the function's set time.

F49 - Open door time for instantaneous defrost if F23 ≠ 0:
If the door is kept open longer than the time defined in this function, an instantaneous defrosting will be performed provided that the evaporator temperature (sensor S2) is lower than F34 (evaporator temperature to end the defrosting) and the room temperature (sensor S1) is lower than F35 (room temperature to end the defrosting).

F50 - Door open time to switch off COMP and FAN when F23 ≠ 0:
For safety reasons, if the door is kept open longer than the time defined in this function, the compressor and fan will be switched off.
➡ **NOTE:** Function F45 has priority over F50.

F51 - Door closed time until activation of power-saving mode if F23 ≠ 0:
If the digital input is configured as the door, the economy mode is activated when the door remains closed longer than the time set in this function.

F52 - Minimum compressor off time:
It is the minimum time the compressor will remain off, i.e. the length of time between the last stop and the next start up. It helps to relieve the discharge pressure and increase the lifespan of the compressor.

F53 - Minimum compressor on time:
It is the minimum time for which the compressor remains switched on, i.e. the length of time between the last start up and the next stop. It helps to prevent high voltages within the power grid.

F54 - Compressor on time in case of S1 error:
If the room sensor (sensor S1) is disconnected or out of range, the compressor will be switched on in accordance with the time set in this function.

F55 - Compressor off time in case of S1 error:
If the room sensor (sensor S1) is disconnected or out of range, the compressor will be switched off in accordance with the time set in this function.

F56 - Compressor delay time when powering the controller:
When the controller is turned on, its control will remain disabled for a while, delaying the start of the process. During this time, it works only as a temperature indicator. It is used to prevent peaks in electricity demand in case of power shortage or return thereof, when there are multiple devices connected to the same mains. For this, simply adjust the times for each piece of equipment. This delay may be related to the compressor or the defrosting process (when there is defrosting upon turning on the controller).

F57 - Maximum compressor on time without reaching the setpoint:
The message $\boxed{ALrc}$ is displayed when the compressor remains on longer than the time set in this function without reaching the setpoint.

F58 - Low room temperature alarm:
It is the room temperature (S1) below which the instrument will activate the low temperature alarm. The indication can be visual and audible in **VX-950 HMI** ($\boxed{AtLo}$ and Buzzer), or even through Sitrad (temperature out of range).

F59 - High room temperature alarm:
It is the room temperature (S1) above which the instrument will activate the high temperature alarm. The indication can be visual and audible in **VX-950 HMI** ($\boxed{AtHi}$ and Buzzer), or even through Sitrad (temperature out of range).

F60 - Door opening time until the alarm is activated:
If the digital input is configured as door (F23) in this function the time to sound the alarm (buzzer) will be counted.

F61 - Alarm silencing time by temperature:
This function works to inhibit the alarm during a certain period due to an occasional temperature rise. The alarm is disabled during the defrosting, draining and fan-delay operations.

F62 - Alarm silencing time when powering the controller:
During the time set in this function, the audible alarm remains off, waiting for the system to start working.

F63 - End of defrost alarm:
When the defrost operation is ended by timeout instead of by temperature, the user can be warned by a flashing point in the lower right corner of the display (**VX-950 HMI**).

F64 - Control Functions Shutdown:
It allows switching off the refrigeration, fan, and defrost outputs after the electronic expansion valve is fully closed.

F65 - Equipment's address in the RS-485 network (serial communication):
Any equipment connected to the RS-485 network must have a unique address, different from the others so that the computer can identify the equipment.
⚠ **Warning:** Make sure that there are no devices with the same address to avoid communication problems.

7. OPERATING MODE (MANUAL / AUTOMATIC)

A calibration of the step motor of the Electronic Expansion Valve (EEV) is performed when **VX-950 _plus_** is initialized. Thus the Sitrad will indicate in the status field it is initializing. Then the controller will open the Electronic Expansion Valve (VEE) according to the value specified in function F11 (initial valve opening value) and remain in that position for the time specified in F12 (time delay for overheating control). After this procedure the controller adjusts the control according to the **manual mode** (F5 = 0, F6 = 0, and F7 = 0) or **automatic mode** (PID control).

Note 1: In manual mode the Electronic Expansion Valve (EEV) keeps the value of function F11 (initial opening value of the Electronic Expansion Valve (EEV)) fixed during the cooling process.
The valve is closed during the other processes.

Note 2: The Electronic Expansion Valve (EEV) acts together with the compressor. Upon shutdown the valve is closed independently of the overheating value.
When the compressor is switched on again the Electronic Expansion Valve (EEV) will open until the value specified in function F11 (initial opening value of the Electronic Expansion Valve (EEV)) so the cooling fluid is allowed to expand as soon as the compressor is back in operation, also observing the time configured in function F53 (minimum compressor off time).
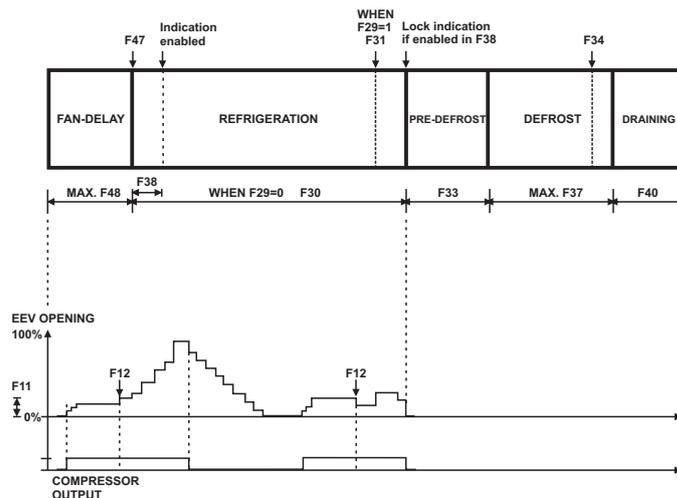
8. POWER MODULE FASTENING MODES

8.1. FASTENING BY DIN RAIL
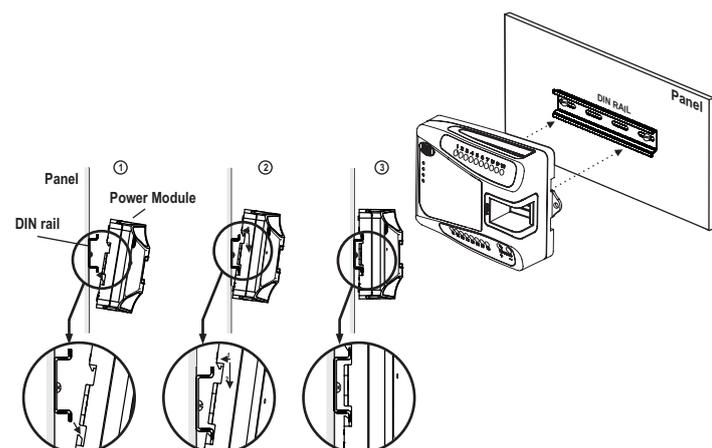
8.2. FASTENING WITH SCREWS
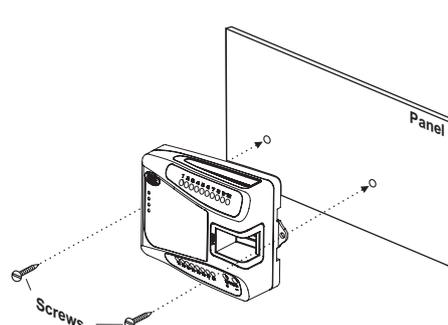
9. ELECTRIC CONNECTION SCHEMATIC

UPPER TERMINAL BLOCK:

1/4" SAE

LOWER TERMINAL BLOCK:

115/230 Vac
Load power supply
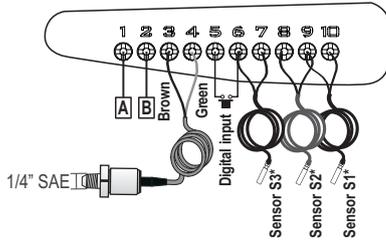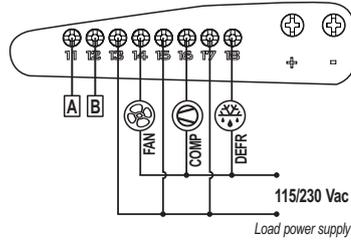
ELECTRONIC EXPANSION VALVE:

⚠ CONNECT THE ELECTRONIC EXPANSION VALVE TO THE POWER OUTPUT OF THE EEV.
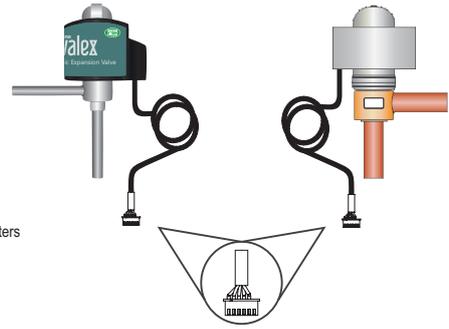
TRANSDUCER ELECTRIC CONNECTION
Brown: 12Vdc
Green: 4~20mA
* **Sensor S1** must be in the room (black).
* **Sensor S2** must be fastened to the evaporator with a metal clamp (gray).
* **Sensor S3** must be in the suction line (black - wire sensor - SB47).

➡ **Note:** Sensor cable length can be increased to up to 200 meters by using a PP2 x 24AWG cable.

10. PRESENTATION OF VX-950 *plus* PANEL

VX-950 HMI (Communication LED)
Sitrad (Communication LED)
Electronic Expansion Valve (Activity LED)
Power (Instrument ON Indication)

● HMI
● Sitrad
● VEE
● Power

*

VX- 950 *plus*

| HMI	SENS. TEMP. / DIG. IN
1	HMI (A)	5-6	digital input (door)
2	HMI (B)	6-7	sens. suction temp.
SENS. PRESS.	8-9	sens. evap. temp.
3	12Vdc (brown)	9-10	sens. ambient temp.
4	4~20mA (green)	
SITRAD	**RELAYS**
11	SITRAD (A)	13-14	fans
12	SITRAD (B)	15-16	compressor
	17-18	defrost
Power Supply	
12Vdc - 1.3A	

✱ Obs.: In version 02 the power is 13 ± 10% Vdc.

11. SIMULTANEOUS CONNECTION WITH SITRAD AND VX-950 HMI

Sitrad
Keep Sitrad up-to-date throught the site: http://www.sitrad.com.br

CONV. 32 or CONV. 256
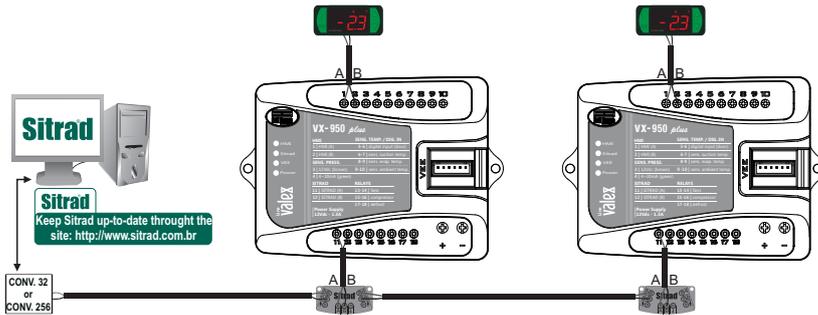
WARNING!

⚠ *Different from version 01, only one VX-950 HMI must be used for each VX-950 Plus.*

***CONNECTION BLOCK FOR SERIAL COMMUNICATION**
It is used to interconnect more than one instrument to the Interface. The wires must be connected as follows: Terminal **A** of the instrument connected to terminal **A** of the connection block, which in turn must be connected to terminal **A** of the Interface. Repeat the procedure for terminals **B** and ⊥, with ⊥ being the cable mesh (optional ground). Terminal ⊥ of the connection block must be connected to the respective terminals ⊥ of each instrument.

12. SIGNALING

ALARM

`RoPn`	Open door alarm.
`RPhi`	High pressure alarm.
`RPLo`	Low pressure alarm.
`RSHH`	High superheating alarm.
`RSHL`	Low superheating alarm.
`RSHC`	Critical superheanting alarm.
`inib`	Inhibit audible alarm.
`RLrc`	Alarm of compressor on without reaching the setpoint.
`Rthi`	High room temperature alarm.
`RtLO`	Low room temperature alarm.

DISPLAYS AND INDICATIONS

`oPEn`	Open door.
`PrES`	Pressure reading (the configured pressure unit is displayed before the pressure value: `PSi` or `bAr`)
`SH`	Superheating temperature.
`UEE`	Electronic expansion valve opening percentage.
`t - 1`	Temperature sensor 1.
`t - 2`	Temperature sensor 2.
`t - 3`	Temperature sensor 3.

ERROR

`Ecnn`	Conection error.
`ESHC`	Superheating calculation error.
`PErr`	Pressure reading error.
`PPPP`	Reconfigure function values (not programmed).
`PPPC`	VX-950 HMI not programmed.
`ErUC`	FG-CAP enabled but not installed.
`Err1`	Error 1 - temperature sensor 1.
`Err2`	Error 2 - temperature sensor 2.
`Err3`	Error 3 - temperature sensor 3.
`ECRL`	Please contact Full Gauge Controls.

Wiring diagram of suppressors in contactors

A1 and A2 are the contactor coil terminals.
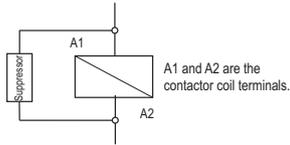
Wiring diagram of suppressors in direct drive loads

For direct drive take into account the maximum specified current.
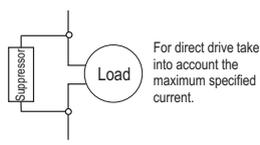
IMPORTANT:
According to chapters of NBR 5410 standard:
1. Install surge protectors on the power line.
2. Serial communication sensor cables can be installed together but not in the same conduit where power supply and load drive cables are installed.
3. Install transient suppressors (RC filter) in parallel with the loads as a way to increase the service life of the relays.

ENVIRONMENTAL INFORMATION

Packaging:
The materials used in the packaging of Full Gauge products are 100% recyclable. Try to perform disposal through specialized recyclers.

Product:
The components used in Full Gauge controllers can be recycled and reused if disassembled by specialized companies.

Disposal:
Do not incinerate or dispose the controllers that have reached the end of their service as household garbage. Observe the laws in your area regarding disposal of electronic waste. If in doubt, please contact Full Gauge Controls.

WARRANTY - FULL GAUGE CONTROLS

Products manufactured by Full Gauge Controls, as of May 2005, have a two (02) year warranty, as of the date of the consigned sale, as stated on the invoice. They are guaranteed against manufacturing defects that make them unsuitable or inadequate for their intended use.

EXCEPTIONS TO WARRANTY
The Warranty does not cover expenses incurred for freight and/or insurance when sending products with signs of defect or faulty functioning to an authorized provider of technical support services. The following events are not covered either: natural wear and tear of parts; external damage caused by falls or inadequate packaging of products.

LOSS OF WARRANTY
Products will automatically lose its warranty in the following cases:
- The instructions for assembly and use found in the technical description and installation procedures in Standard IEC60364 are not obeyed;
- The product is submitted to conditions beyond the limits specified in its technical description;
- The product is violated or repaired by any person not a member of the technical team of Full Gauge Controls;
- Damage has been caused by a fall, blow and/or impact, infiltration of water, overload and/or atmospheric discharge.

USE OF WARRANTY
To make use of the warranty, customers must send the properly packaged product to Full Gauge Controls together with the invoice or receipt for the corresponding purchase. As much information as possible in relation to the issue detected must be sent to facilitate analysis, testing and execution of the service.

These procedures and any maintenance of the product may only be provided by Full Gauge Controls Technical Support services in the company's headquarters at Rua Júlio de Castilhos, 250 - CEP 92120-030 - Canoas - Rio Grande do Sul – Brasil

Rev. 03

Line
valex
Electronic Expansion Valve

EEV GENERAL DESCRIPTION

• **APPLICATIONS:**
- Refrigeration equipament

• **BI-FLOW CAPABILITY:**
- Two-way flow in the EEV

• **T Y P E S   O F COOLING FLUID:**
- R22
- R134a
- R404a
- R407C
- R410A

• **C O M M O N SPECIFICATIONS:**
- Maximum operating pressure: 600psi
- Operatind range: 0 to 480 steps

WARNING

⚠ THE LENGTH OF THE EEV EXTENSION CABLE MUST BE 15 METERS (45 FEET) OR LESS AND THE WIRE GAUGE MUST BE EQUAL TO, OR LARGER THAN, THE WIRES OF THE EEV CABLE.

IMPORTANT

⚠ READ CAREFULLY THE PRACTICAL GUIDE THAT COMES WITH THE ELECTRONIC EXPANSION VALVE (EEV) AND FOLLOW THE INSTALLATION INSTRUCTIONS PROPERLY.

EEV DIMENSIONS
Unit.: mm
• **UKV TYPE:**

MODEL	OPENING (mm)	CONNECTION (SOLDER)		MAX. REVERSE PRESSURE (bar)
		A (mm)	B (mm)	
SB88	1,0	ϕ 7.94	ϕ 7.94	35
SB89	1,4	ϕ 7.94	ϕ 7.94	20
SB90	1,8	ϕ 6.35	ϕ 6.35	28
SB91	2,5	ϕ 7.94	ϕ 7.94	22
SB92	3,0	ϕ 7.94	ϕ 7.94	15
SB93	3,2	ϕ 7.94	ϕ 7.94	12
SB94	4,0	ϕ 7.94	ϕ 7.94	7

• **AKV TYPE:**

MODEL	OPENING (mm)	CONNECTION (SOLDER)		MAX. REVERSE PRESSURE (bar)
		A (mm)	B (mm)	
SB96	6,5	ϕ 15.88	ϕ 15.88	25

CAPACITY TABLE

BROCHURE	EVAPORATION TEMP. [°C]	REFRIGERATION CAPACITY [kW]																							
		R22					R134a					R404A					R407C					R410A				
		CONDENSATION TEMP. [°C]																								
		20	30	38	40	50	20	30	38	40	50	20	30	38	40	50	20	30	38	40	50	20	30	38	40	50
SB88	10	1.57	2.15	2.45	2.52	2.74	1.25	1.71	1.94	1.98	2.14	1.23	1.60	1.75	1.76	1.75	1.65	2.24	2.53	2.59	2.77	1.94	2.59	2.88	2.92	3.02
	5	1.85	2.32	2.58	2.63	2.81	1.47	1.82	2.01	2.05	2.17	1.44	1.71	1.82	1.82	1.77	1.94	2.40	2.64	2.69	2.82	2.30	2.80	3.03	3.06	3.10
	0	2.06	2.45	2.67	2.71	2.86	1.62	1.91	2.06	2.09	2.18	1.59	1.80	1.86	1.86	1.78	2.15	2.53	2.72	2.76	2.85	2.57	2.97	3.14	3.17	3.17
	-5	2.22	2.55	2.74	2.78	2.90	1.72	1.97	2.09	2.12	2.18	1.70	1.85	1.89	1.88	1.77	2.30	2.62	2.78	2.81	2.87	2.78	3.10	3.23	3.25	3.21
	-10	2.34	2.63	2.79	2.82	2.92	1.80	2.01	2.11	2.13	2.17	1.78	1.89	1.90	1.89	1.76	2.42	2.69	2.82	2.84	2.88	2.93	3.20	3.30	3.31	3.24
	-20	2.51	2.73	2.85	2.87	2.93	1.88	2.04	2.11	2.12	2.12	1.87	1.92	1.89	1.87	1.70	2.56	2.76	2.84	2.86	2.85	3.15	3.33	3.37	3.37	3.25
	-30	2.59	2.77	2.86	2.88	2.90	1.91	2.02	2.07	2.07	2.05	1.90	1.90	1.84	1.81	1.61	2.62	2.76	2.82	2.82	2.78	3.26	3.38	3.39	3.37	3.21
SB89	10	2.32	3.18	3.63	3.72	4.05	1.85	2.53	2.87	2.94	3.17	1.82	2.37	2.59	2.61	2.59	2.44	3.31	3.75	3.83	4.09	2.88	3.83	4.26	4.33	4.47
	5	2.74	3.43	3.81	3.89	4.16	2.17	2.70	2.98	3.03	3.21	2.13	2.54	2.69	2.69	2.62	2.87	3.56	3.91	3.98	4.17	3.41	4.15	4.48	4.53	4.59
	0	3.05	3.63	3.95	4.01	4.24	2.39	2.82	3.05	3.10	3.23	2.36	2.66	2.76	2.75	2.63	3.18	3.74	4.03	4.09	4.22	3.81	4.40	4.65	4.69	4.69
	-5	3.29	3.78	4.06	4.11	4.29	2.55	2.91	3.10	3.13	3.23	2.52	2.74	2.80	2.78	2.62	3.41	3.88	4.12	4.16	4.25	4.11	4.59	4.79	4.81	4.75
	-10	3.47	3.89	4.13	4.18	4.32	2.66	2.97	3.12	3.15	3.21	2.64	2.80	2.82	2.79	2.60	3.58	3.98	4.17	4.20	4.26	4.34	4.74	4.88	4.90	4.79
	-20	3.71	4.04	4.22	4.25	4.34	2.79	3.01	3.12	3.13	3.14	2.77	2.84	2.80	2.77	2.51	3.79	4.08	4.21	4.23	4.21	4.66	4.93	4.99	4.99	4.81
	-30	3.83	4.10	4.23	4.26	4.30	2.82	2.99	3.06	3.06	3.03	2.81	2.81	2.73	2.68	2.39	3.87	4.09	4.17	4.18	4.12	4.82	5.00	5.01	4.99	4.76
SB90	10	6.83	9.36	10.70	10.97	11.94	5.46	7.44	8.46	8.65	9.33	5.36	6.98	7.62	7.67	7.63	7.19	9.75	11.04	11.28	12.06	8.47	11.29	12.54	12.75	13.16
	5	8.08	10.11	11.23	11.45	12.25	6.39	7.95	8.78	8.93	9.45	6.29	7.47	7.92	7.93	7.72	8.45	10.48	11.52	11.72	12.29	10.04	12.22	13.20	13.35	13.53
	0	8.99	10.69	11.64	11.82	12.48	7.05	8.32	9.00	9.12	9.51	6.95	7.83	8.12	8.10	7.75	9.37	11.02	11.88	12.03	12.44	11.21	12.95	13.71	13.81	13.80
	-5	9.69	11.13	11.95	12.11	12.63	7.51	8.57	9.13	9.23	9.51	7.43	8.08	8.24	8.20	7.73	10.04	11.42	12.13	12.25	12.52	12.10	13.52	14.10	14.17	13.99
	-10	10.22	11.47	12.18	12.31	12.73	7.84	8.74	9.20	9.28	9.46	7.77	8.24	8.30	8.23	7.66	10.54	11.71	12.29	12.38	12.54	12.79	13.96	14.39	14.42	14.11
	-20	10.93	11.90	12.43	12.52	12.78	8.22	8.87	9.18	9.23	9.25	8.16	8.37	8.25	8.15	7.41	11.15	12.01	12.40	12.45	12.42	13.71	14.51	14.71	14.70	14.17
	-30	11.29	12.07	12.47	12.54	12.66	8.32	8.81	9.00	9.02	8.93	8.27	8.28	8.04	7.91	7.04	11.40	12.05	12.30	12.32	12.13	14.19	14.73	14.73	14.71	14.01
SB91	10	11.95	16.36	18.71	19.17	20.88	9.55	13.01	14.79	15.13	16.31	9.37	12.20	13.32	13.42	13.33	12.57	17.05	19.31	19.73	21.08	14.81	19.73	21.93	22.29	23.00
	5	14.12	17.67	19.63	20.02	21.42	11.17	13.90	15.35	15.62	16.52	10.99	13.06	13.84	13.87	13.50	14.78	18.32	20.15	20.49	21.49	17.55	21.37	23.08	23.34	23.65
	0	15.73	18.69	20.35	20.67	21.81	12.32	14.55	15.73	15.95	16.62	12.15	13.69	14.20	14.17	13.55	16.38	19.28	20.77	21.04	21.76	19.60	22.65	23.97	24.15	24.13
	-5	16.94	19.47	20.89	21.17	22.09	13.13	14.99	15.97	16.14	16.62	12.99	14.13	14.41	14.33	13.51	17.56	19.98	21.21	21.42	21.90	21.16	23.64	24.65	24.77	24.47
	-10	17.87	20.06	21.29	21.52	22.26	13.72	15.29	16.09	16.23	16.54	13.59	14.42	14.51	14.39	13.39	18.43	20.48	21.49	21.65	21.93	22.37	24.41	25.16	25.22	24.68
	-20	19.11	20.81	21.73	21.89	22.34	14.37	15.52	16.05	16.13	16.18	14.27	14.63	14.43	14.24	12.95	19.50	21.01	21.68	21.77	21.71	23.98	25.37	25.72	25.70	24.77
	-30	19.74	21.11	21.81	21.92	22.14	14.54	15.40	15.74	15.78	15.61	14.46	14.48	14.06	13.82	12.30	19.94	21.07	21.50	21.53	21.21	24.82	25.76	25.82	25.73	24.50
SB92	10	16.30	22.32	25.53	26.16	28.49	13.03	17.75	20.18	20.64	22.24	12.78	16.64	18.17	18.31	18.19	17.15	23.26	26.34	26.92	28.76	20.21	26.92	29.92	30.41	31.38
	5	19.26	24.11	26.78	27.31	29.22	15.24	18.96	20.94	21.31	22.54	14.99	17.82	18.88	18.92	18.41	20.17	25.00	27.49	27.95	29.32	23.95	29.15	31.48	31.84	32.26
	0	21.45	25.49	27.76	28.20	29.76	16.80	19.84	21.46	21.76	22.67	16.58	18.68	19.37	19.33	18.48	22.35	26.30	28.34	28.71	29.68	26.74	30.90	32.70	32.95	32.92
	-5	23.11	26.56	28.50	28.88	30.14	17.92	20.45	21.78	22.02	22.68	17.72	19.28	19.66	19.55	18.43	23.95	27.25	28.93	29.22	29.87	28.86	32.25	33.63	33.79	33.38
	-10	24.38	27.37	29.04	29.36	30.37	18.71	20.85	21.95	22.14	22.56	18.54	19.67	19.80	19.63	18.27	25.14	27.93	29.32	29.54	29.91	30.51	33.30	34.32	34.41	33.66
	-20	26.06	28.39	29.64	29.87	30.47	19.60	21.17	21.90	22.01	22.07	19.47	19.95	19.69	19.43	17.67	26.60	28.66	29.58	29.70	29.62	32.71	34.61	35.09	35.06	33.79
	-30	26.93	28.79	29.75	29.91	30.20	19.84	21.01	21.48	21.52	21.29	19.72	19.75	19.18	18.86	16.78	27.20	28.75	29.33	29.38	29.94	33.86	35.14	35.22	35.10	33.43

CAPACITY TABLE

BROCHURE	EVAPORATION TEMP. [°C]	REFRIGERATION CAPACITY [kW]																								
		R22					R134a					R404A					R407C					R410A				
		CONDENSATION TEMP. [°C]																								
		20	30	38	40	50	20	30	38	40	50	20	30	38	40	50	20	30	38	40	50	20	30	38	40	50
SB93	10	17.55	24.04	27.49	28.17	30.68	14.04	19.11	21.73	22.23	23.95	13.76	17.92	19.57	19.71	19.59	18.47	25.05	28.36	28.99	30.97	21.77	28.99	32.22	32.75	33.79
	5	20.75	25.26	28.84	29.41	31.47	16.41	20.42	22.55	22.95	24.27	16.15	19.19	20.33	20.38	19.83	21.72	26.92	29.60	30.10	31.58	25.79	31.39	33.90	34.29	34.74
	0	23.10	27.45	29.90	30.37	32.05	18.10	21.37	23.11	23.43	24.42	17.85	20.12	20.86	20.81	19.91	24.07	28.32	30.52	30.91	31.97	28.80	33.28	35.22	35.49	35.45
	-5	24.89	28.60	30.69	31.10	32.46	19.30	22.02	23.46	23.72	24.42	19.08	20.76	21.17	21.06	19.85	25.79	29.35	31.15	31.47	32.17	31.09	34.74	36.22	36.39	35.95
	-10	26.26	29.47	31.28	31.62	32.71	20.15	22.46	23.64	23.84	24.30	19.97	21.18	21.32	21.14	19.67	27.08	30.08	31.57	31.81	32.21	32.86	35.86	36.96	37.05	36.25
	-20	28.07	30.57	31.93	32.17	32.82	21.11	22.80	23.59	23.70	23.76	20.97	21.49	21.20	20.93	19.03	28.65	30.86	31.86	31.99	31.89	35.26	37.28	37.79	37.75	36.39
	-30	29.01	31.01	32.04	32.21	32.53	21.37	22.63	23.13	23.18	22.93	21.24	21.27	20.66	20.31	18.07	29.29	30.96	31.59	31.64	31.16	36.46	37.85	37.93	37.80	36.00
SB94	10	25.15	34.44	39.39	40.36	43.95	20.11	27.39	31.13	31.85	34.32	19.72	25.67	28.04	28.25	28.06	26.47	35.90	40.64	41.53	44.37	31.18	41.54	46.17	46.93	48.42
	5	29.72	37.20	41.33	42.14	45.08	23.52	29.26	32.30	32.88	34.78	23.14	27.50	29.14	29.19	28.41	31.12	38.57	42.41	43.13	45.24	36.95	44.98	48.57	49.12	49.78
	0	33.10	39.33	42.83	43.52	45.92	25.93	30.62	33.11	33.57	34.99	25.58	28.82	29.88	29.82	28.52	34.49	40.58	43.72	44.29	45.80	41.26	47.68	50.46	50.84	50.80
	-5	35.67	40.98	43.98	44.56	46.50	27.65	31.56	33.61	33.98	34.99	27.34	29.74	30.34	30.17	28.44	36.96	42.05	44.64	45.09	46.09	44.54	49.77	51.89	52.14	51.50
	-10	37.62	42.23	44.81	45.30	46.86	28.87	32.18	33.87	34.16	34.82	28.61	30.35	30.55	30.29	28.18	38.80	43.10	45.23	45.58	46.15	47.08	51.38	52.95	53.09	51.94
	-20	40.22	43.80	45.74	46.09	47.02	30.24	32.66	33.79	33.96	34.05	30.05	30.79	30.38	29.98	27.26	41.04	44.22	45.64	45.83	45.70	50.47	53.41	54.15	54.09	52.14
	-30	41.56	44.43	45.90	46.14	46.60	30.61	32.42	33.14	33.21	32.86	30.43	30.47	29.60	29.10	25.90	41.96	44.36	45.26	45.33	44.65	52.24	54.23	54.35	54.16	51.58
SB96	10	60.15	82.40	94.20	96.60	105.20	48.10	65.50	74.50	76.20	82.10	37.94	61.40	67.10	67.60	67.20	63.35	85.90	97.30	99.40	106.20	74.63	99.40	110.50	112.30	115.90
	5	71.38	89.00	98.90	100.80	107.90	56.26	70.00	77.30	78.70	83.20	55.36	65.80	69.70	69.90	68.00	74.46	92.30	101.50	103.20	106.30	88.39	107.60	116.20	117.60	119.10
	0	79.19	94.10	102.50	104.10	109.90	62.05	73.30	79.20	80.30	83.70	62.27	69.00	71.50	71.40	68.30	82.51	97.10	104.60	106.00	109.60	98.72	114.10	120.70	121.70	121.60
	-5	85.34	98.10	105.20	106.60	111.30	66.14	75.50	80.40	81.30	83.70	66.20	71.20	72.60	72.20	68.00	88.42	100.60	106.80	107.90	110.30	106.59	119.10	124.20	124.80	123.20
	-10	90.03	101.10	107.20	108.40	112.10	69.11	77.00	81.10	81.70	83.30	66.64	72.60	73.10	72.50	67.40	92.80	103.10	108.20	109.10	110.40	112.62	122.90	126.70	127.00	124.30
	-20	96.26	104.80	109.50	110.30	112.50	72.42	78.20	80.90	81.30	81.50	71.90	73.70	72.70	71.80	65.20	98.21	105.80	109.20	109.70	109.40	120.82	127.80	129.60	129.40	124.80
	-30	99.41	106.30	109.80	110.40	111.50	73.27	77.60	79.30	79.50	78.60	72.80	72.90	70.80	69.60	62.00	100.40	106.10	108.30	108.50	106.80	125.24	129.80	130.40	129.60	123.40