
EBARA

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INTRODUCTION

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HERTZ ONE SERIES

The new HERTZ ONE control box is an automatic device for the control of single or three phase centrifugal electropumps equipped with induction motor. Supply of the control box is only single phase.

PRINCIPLE

The HERTZ ONE control box is designed to adjust the speed of centrifugal pumps through an inverter (electronic frequency converter) that supplies their motor.
Pump capacity and head vary according to the speed of rotation hence offering best efficiency for a wide range of operating conditions (Fig.101)

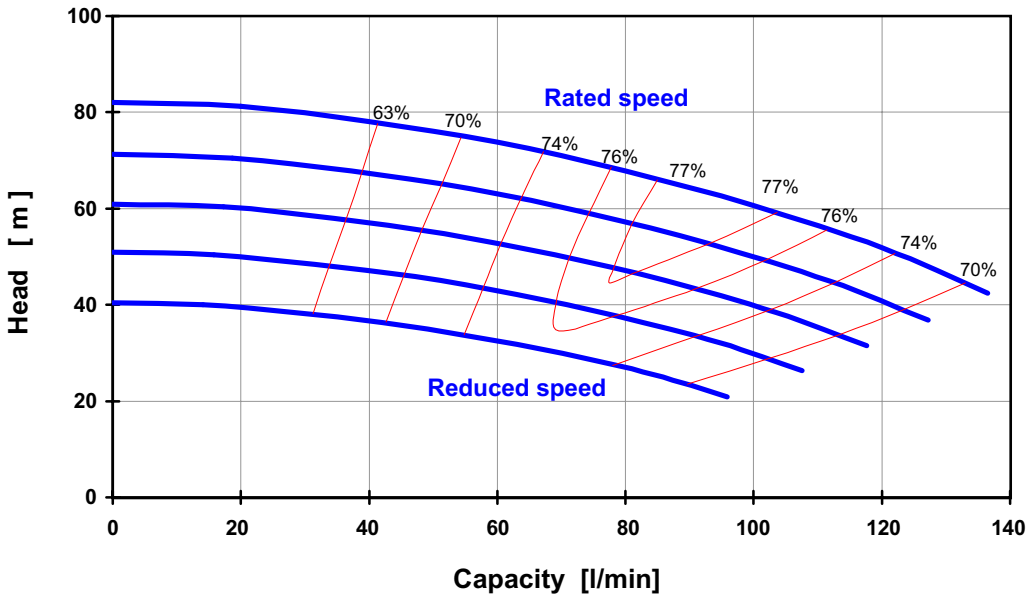

Fig.101 – Pump performance variation with speed

The settings allow to keep a constant pressure after a change of capacity.

The speed variation presents the following advantages compared to a throttling valves regulation:

- Energy saving (less specific energy)
- Better and faster regulation,
- Reduction of water hammering thanks to a gradual starting and stop,
- Enhanced comfort in heating, conditioning and booster systems,
- Lower noise levels with reduced loads,
- Considerable reduction in the volume of storage systems.

The use of an inverter provides the following advantages:

- Reduced starting current,
- Better thermal protections against overloads.

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MODEL RANGE

The product HERTZ ONE with single phase output is available for one, two or three electropumps.
The product HERTZ ONE with three phase output can control only one electropump. Systems with many three phase electropumps have their single boxes (if equipped with transmission option) connected through a serial network RS485 (a simple phone line) in order to create a MASTER / SLAVE (where each pump is controlled through an inverter).

Input	Electropump(s) output		Motor type	Optional
	Variable speed	Constant speed		
Single phase	No.1	---	Single phase	Serial communication card (RS 232, RS 485)
	No.1	No.1	Single phase	
	No.1	No.2	Single phase	
	No.1	---	Three phase	

TYPE KEY:

Example: **HZ ONE 1x1,1M**

HZ ONE	1x	1,1	M	
HZ ONE				Inverter name
	1x			No. of pumps that can be connected
	2x			
	3x			
		1,1		Max power for each pump [kW]
		1,5		
			M	Single phase pump supply = M Single phase pump supply = MX with buster exchange Three phase pump supply = T

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BASIC FUNCTIONING

SINGLE PUMP VERSION

When the system pressure drops below the setpoint value, the HERTZ ONE controller starts the electropump. The box detects the system pressure through a transmitter and keeps it constant with an error lower than 0.1 bar. When water demand ceases, the pressure tends to increase and exceed the setpoint. The controller will then stop the pump (in a non transitional situation).

TWO OR THREE PUMPS VERSION

When the system pressure drops below the setpoint value, the HERTZ ONE controller starts the inverter-driven electropump. The system pressure is detected through a transmitter and is kept constant with an error lower than 0.1 bar.
The controller adjusts the pump speed till the user setpoint is reached. In case the user sets a head value that cannot be reached with a single pump, the HERTZ ONE starts another of the two pumps that are directly supplied by the single phase line.

The controller, through a continuous check of the system pressure, keeps adjusting the inverter-driven electropump in order to maintain the preset pressure and switches back to the single inverter-driven pump working mode when possible.
If working load increases (this means that two electropumps are not enough to keep the preset pressure) the HERTZ ONE controller will start a third pump (if available).
The HERTZ ONE controller will always adjust the inverter-driven electropump in order to maintain the preset pressure also in case that three pumps are running. Working conditions are continuously detected in order to work with the lowest number of pumps possible. The equal use of pump no.2 and 3. is ensured by recalculating the starting sequence at every restart.

When pressure reaches the preset value, all pumps are switched off.
Electropumps 2 and 3 can be driven by pressure switches (when connected) in case of inverter failure.

MOTOR REQUIREMENTS

Asynchronous motors (pump motors) used with a HERTZ ONE controller are the same motors that can be used in standard applications, since much attention was put on the fact that the inverter-generated wave does not create tension peaks on the auxiliary winding (if not the insulation could fail in case of single phase motors).
For three phase applications the supply tension of the three phase pump is 230V (delta connection).

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SINGLE PHASE HERTZ ONE

COMPOSITION

The HERTZ ONE control box is composed of:

- Auxiliary starting circuits and electropumps protection,
- Frequency converter no.1 for pump governing,
- Control and regulation board with display,
- Auxiliary circuits,
- EMC compliant filter,
- Start/stop keys for each electropump with luminous signalling,
- Disconnecting switch with door lock.

FEATURES

The main HERTZ ONE features are synthesized below:

- Control and regulation of a pump or of a group of pumps according to the better logic for the application needs,
- Starting of pump no.1 with speed adjustment, starting and monitoring of the remaining pumps through relay,
- In case of groups, uniform distribution of the load among the pumps,
- Ensure automatic working in case of emergency,
- Avoid excessive starting per hour.
- Protect motors and inverter with relative alarms
- Ensure people's safety

EBARA PUMPS THAT CAN BE CONNECTED

SERIES	SINGLE PHASE MODEL
MD	MD 32-125/1.1M
EVM	EVM3 9N5/1.1 – EVM 3 11N5 1.1 EVM5 6N5/1.1 – EVM10 3N5/1.1
JES – JE / JESX –JEX	JESM 8 – JEM 120 – JESXM8 – JEXM 120
AGA – AGE – AGF	AGA 100M – AGE 0.80M – AGF 0.80M
CMA – B – C	CMA 100M – CMB 100M – CMC 100M -
CDA	CDA 100 M
COMPACT	COMPACT AM/12 – COMPACT BM/12
CVM	CVM AM/12 – CVM AM/15 - CVM B/12
MULTIGO	MULTIGO M40/15 – MULTIGO M80/15
PRA	PRA 1.00M
IDROGO	IDROGO M40/15 – IDROGO M80/15
WINNER	Motor OY up to 1.1, motor WY up to 0.75
DW	DWM 100 M
CD – CDX – 2CD – 2CDX	CDM 120/12 – CDXM 120/12 – 2CDM 70/12 – 2CDXM 70/12
MATRIX	Please check current conditions on page 203

The table shows the pumps with max power input allowed by the single phase HERTZ ONE control box. Pumps with lower power input can be connected too.

EBARA GROUPS THAT CAN BE CONNECTED

GP COMPACT – CDXM – CMA – CDA – MULTIGO – CVM - EVM
(Max size of pump that can be connected is shown on the previous paragraph table)

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SPECIFICATIONS

Input voltage	230 V +10%, -15%
Phases	Phase + neutral
Input frequency	50 or 60 Hz
No. Of pumps that can be connected	Standard: 1 to 3 single phase pumps
Single motor power	From 0.25 to 1.1 kW (in order to match 1.1 kW or lower inverter and electropumps please check rated and starting current limits. Ensure that motor starting current is 8-10% lower than max peak current of the inverter).
Max rated current	1 x 8 A 2 x 8 A 3 x 8 A
Current limit (60 seconds)	1,6 times the preset current for 60 seconds. Automatic restart for three times, manual restart at fourth intervention.
Max peak current limit	31 A with automatic limitation and automatic restart (max 4 cycles reaching the limit for 2.5 seconds) for three times, fourth intervention is manual.
Starting and supply type Pump no.1	Supply through fixed inverter with preset tension ramp. Optional: Inverter pump swapping upon restart. (Two pumps version)
Starting and supply type Other pumps	On line supply with: - Direct starting for motors up to 1.1kW Automatic emergency starting (through pressure switch)
Ambient temperature	–10°C + 50°C
Storage temperature	-25°C + 55°C
Degree of protection	IP55
Relative humidity (without condensing)	50% at 40°C 90% at 20°C
Altitude	1000 m (a.s.l.) Current loss of 2% every 100 meters over 1000 m a.s.l.
Drive mounting	Vertical ± 30°
Conformity	CE mark EN 60204, EN 60439-1
Conformity to EMC directives	Immunity Complies to:IEC/EN 61000-4,IEC/EN 61800-3,IEC/EN 50082-1 Emissions IEC/EN 61800-3, EN 55011, EN 55022 class B, IEC/EN 50081-1
Minimal output frequency	Suggested 25 Hz for single impeller pumps 30 Hz for multistage pumps
Analog input – pressure transmitter	4 ÷ 20 mA
Switching frequency	10 kHz Another important aspect of the inverter is its switching frequency. A low switching frequency can increase the motor noise, while a high

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	switching frequency requires the inverter to be equipped with high power components as well as an efficient cooling system.	Rev.A

FUNCTIONS

Working	Dual possibility: ● During normal working the group gets a signal from the pressure transmitter and by means of the inverter-equipped control box it detects the speed of pump no.1, starting the remaining pumps in sequence, by contactors. Alternate starting of electropumps 2 and 3 ● By PRESSURE SWITCHES (if connected) the group (inverter is excluded) replies to the signal from the pressure transmitter of every single pump, and keeps the preset pressure field constant. The working mode by pressure switches is automatically activated in case of inverter or pressure transmitter failure (the inverter-driven pump is excluded in the pressure switch mode)
Motor protections	- Against overload - Against short-circuits (12 A fuses AM type) - Automatic restart with a reference pressure reduced of 0.5 bar to avoid continuous restarts
Pump protections	- Against dry running (inverter-driven pump is stopped after a minute of shut-off working) - Against overpressure - Monitoring of working hours for each electropump
Inverter protections	- Against overload - Against short circuits (10A fuses type Gg)
Distance control	- Control of each pump by pressure switch - Control of the system by pressure transmitter

SIGNALLING

Indications	- Four digit LED for INVERTER control box parameters
Luminous signals	- Pumps running - Pumps enabled at startup - Generic alarm for any of the following cases: - Motor maintenance, wrong parameters, transmitter failure, electrical connections interruption, pumps overload, inverter alarm, overpressure, minimal pressure
Distance signals	By potential free contacts (contact N.A. 5A 250V) A pair of connectors collects the following alarms: - Lack of water or minimal pressure - Overpressure - No signal from the pressure transmitter - Inverter alarm - Motor overload A dual-output module (RS485 and RS232) for PC software monitoring of the system is available upon request. RS232 output is suitable for use with a local PC RS485 output is suitable for use with a remote PC (an adaptor from RS485 to

DESCRIPTION AND SPECIFICATION

	RS232 is required for the control PC)

THREE PHASE HERTZ ONE

(one pump only)

COMPOSITION

Control box is composed of:

- Frequency converter for three phase pump governing,
- Control and regulation board with display,
- Auxiliary circuits,
- EMC compliant filter,

FEATURES

The main features are synthesized below:

- Control and regulation of a pump or of a group of pumps when a network of control boxes is installed
- Starting of pump no.1 with speed adjustment,
- In case of groups, uniform distribution of the load among the pumps,
- Avoid excessive startings per hour
- Protect motors and inverter with relative alarms
- Ensure people's safety

EBARA PUMPS THAT CAN BE CONNECTED

SERIES	THREE PHASE MODEL
EVM	EVM3 9N5/1.1 – EVM5 5N5/1.1 EVM 5 6N5/1.1 - EVM10 3N5/1.1
JES – JE / JESX –JEX	JES8 – JE120 – JESX8 – JEX120
AGA – AGE – AGF	AGA 1.00T – AGE 0.80T – AGF 0.80T
CMA – B – C	CMA 1.00T – CMB 1.00T – CMC 1.00T
CDA	CDA 1.00T
COMPACT	COMPACT A/12 – COMPACT B/12
CVM	CVM A/15 – CVM B/15
PRA	PRA 1.00
CD – CDX – 2CD – 2CDX	CD 200/12
DWC	DWC 300/1.1
MATRIX	Please check current conditions on page 206

The table shows the pumps with max power input allowed by the three phase HERTZ ONE control box.

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SPECIFICATIONS

Input voltage	230 V +10%, -15%
Phases	Phase + neutral
Input frequency	50 or 60 Hz
No. Of pumps that can be connected	1 three phase
Single motor power	From 0.25 to 1.1 kW (three phase motor delta connection) (in order to match 1.5 kW inverter and electropumps please check rated and starting current limits. Ensure that motor starting current is 8-10% lower than max peak current of the inverter).
Max rated current	1 x 8 A
Current limit (60 seconds)	1,6 times the preset current for 60 seconds. Automatic restart for three times, manual restart at fourth intervention.
Max peak current limit	31 A with automatic limitation and automatic restart (max 4 cycles reaching the limit for 2.5 seconds) for three times, fourth intervention is manual.
Starting and supply type Pump no.1	Supply through fixed inverter with preset tension ramp
Ambient temperature	–10°C + 50°C
Storage temperature	-25°C + 55°C
Degree of protection	IP55
Relative humidity (without condensing)	50% to 40°C 90% to 20°C
Altitude	1000 m (a.s.l.); Current loss of 2% every 100 meters over 1000 m a.s.l.
Drive mounting	Vertical ± 30°
Conformity	CE mark EN 60204, EN 60439-1
Conformity to EMC directives	Immunity Complies to IEC/EN 61000-4, IEC/EN 61800-3, IEC/EN 50082-1 Emissions IEC/EN 61800-3, EN 55011, EN 55022 class B, IEC/EN 50081-1
Minimal output frequency	Suggested 25 Hz for single impeller pumps 30 Hz for multistage pumps
Analog input – pressure transmitter	4 ÷ 20 mA

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FUNCTIONS

Working:	The group gets a signal from the pressure transmitter and by means of the inverter-equipped control box it controls the speed of pump no.1. Alternate starting of electropumps 2 , 3 and 4 achieved through their respective control boxes .
Motor protections	- Against overload - Against short-circuits (12 A fuses AM type) - Automatic restart with a reference pressure reduced of 0.5 bar to avoid continuous restarts
Pump protections	- Against dry running (automatic stop, after a minute, of the inverter supplied pump with capacity = 0 litres/min). - Against overpressure - Monitoring of working hours of electropump
Inverter protections	- Against overload - Against short circuits (10A fuses type Gg)
Distance controls	- Control of the system by pressure transmitter.

SIGNALLING

Indications	- Four digit LED for INVERTER control box parameters.
Luminous signals	- Pump running - Pump enabled at startup. - Generic alarm for any of the following cases:- - Motor maintenance, wrong parameters, transmitter failure, electrical connections interruption, pump overload, inverter alarm, overpressure, minimal pressure
Distance signals	By potential free contacts (contact N.A. 5A 250V) A pair of connectors collect the following alarms: - Lack of water or minimal pressure - Overpressure - No signal from the pressure transmitter - Inverter alarm - Motor overload An-output module (RS485 and RS232) for PC software monitoring of the system is available upon request. This option is only available for a single-pump system In order to connect multiple three phase HERTZ ONE the RS485 serial output must be used, then the remaining RS232 serial output must be connected to a PC based monitoring software.

CONSTRUCTION

SERIAL COMMUNICATION OPTION

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A serial communication module for PC monitoring and programming of single or multiple frequency converters is available upon request.
The software displays the following information:

- frequency of the inverter-driven pump
- system pressure
- set pressure
- single pumps status
- system parameters can be edited;
- alarm signalling (maintenance, wrong parameters transmitter failure, thermal alarms inverter fault, danger ;

The optional module is equipped with 2 serial ports:

- RS232
- RS485

The choice between the two ports depends on the distance from the controller to the PC.
The RS485 standard can transmit the signal to hundreds of meters (up to 1 km), while shorter distances (up to 10 m) can be reached by the RS232 standard
The RS232 standard allows a direct connection to the PC (if a port is available) with a DB9 connector (9 pins)
The RS485 standard requires an adaptor from RS485 to RS232 on the PC.
The required cable for RS485 is made of two twisted wires of about 10 rounds per meter and a third wire as reference.
Connections made of non-twisted wires are not suitable (unless used for a few centimetres in a low interferences ambient and low speed.
In order to obtain good performances (in terms of interferences) a shielded cable must be used.

HERTZ ONE NETWORKING

The three phase HERTZ ONE (inverter single-phase supply, electropump three-phase supply) can be connected in a network.
The maximum number of HERTZ ONE that can be connected is four. (1 MASTER and 3 SLAVES).
The above-mentioned configuration can be obtained by inserting the optional module described on paragraph “Serial communication option”. All HERTZ ONE control boxes connections are RS485 standard.
The pressure transmitter is connected to the controller terminal identified as Master, the others SLAVE controllers get the pressure signal in chain (MASTER – SLAVE1 – SLAVE2 – SLAVE3).
The system obtained is commanded by the MASTER, and the differences with the previous types are described below.

- Supply of the electropumps is three phase;
- Each electropump speed is modulated by its respective inverter;
- Pumps starting sequences is modified every restart.

When many three phase HERTZ ONE are connected together the port RS485 is no longer available (as already used) for the connection with a PC. In this case the serial port RS232 of the MASTER HERTZ ONE must be used (max distance for connection:10 mt).

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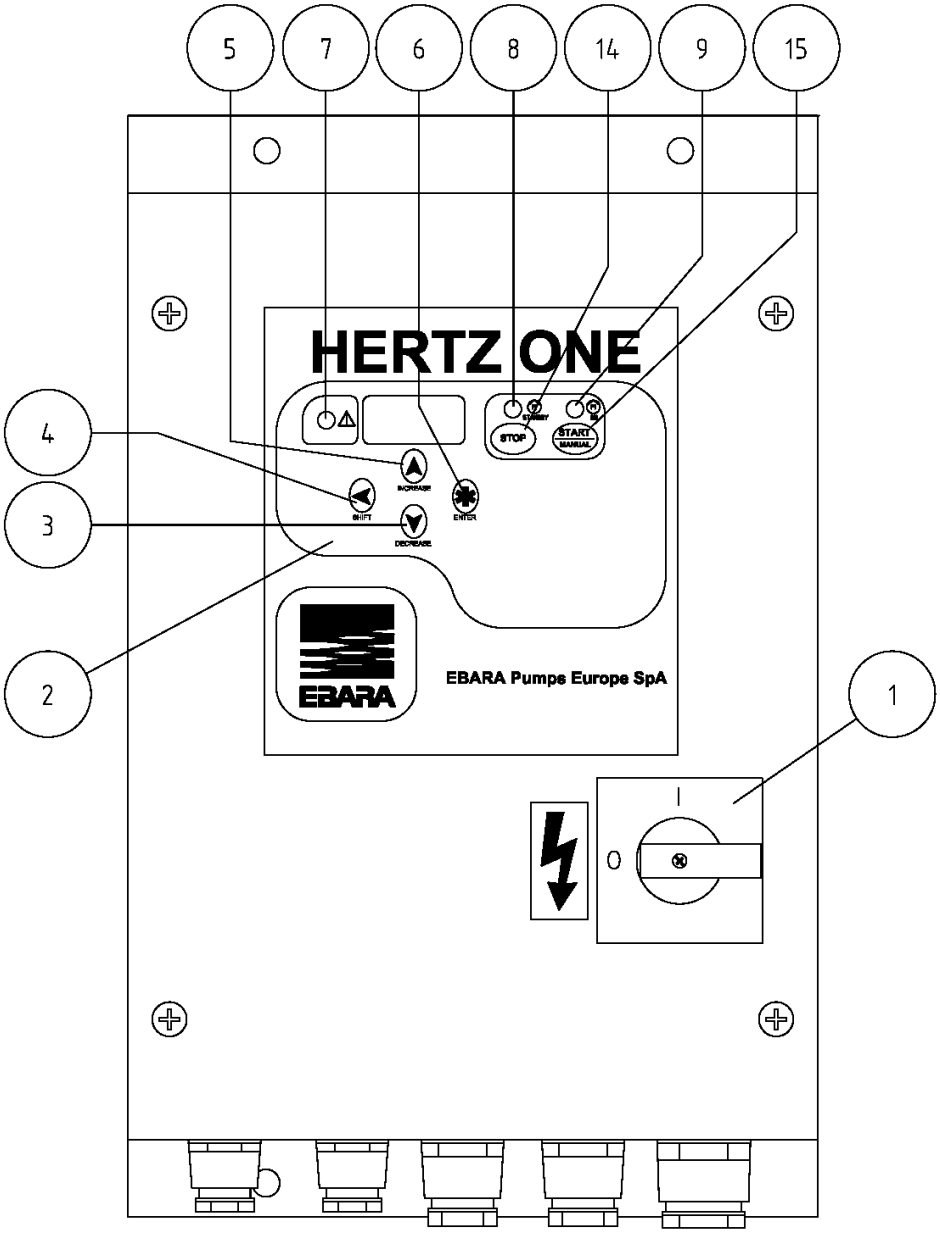
CONTROL BOX FRONTAL VIEW

CONTROL BOX SINGLE PUMP



Pos.	COMPONENTS	Pos.	COMPONENTS
1	Disconnecting switch	7 ÷ 9	Signalling LED
2	Frontal of the System Controller board	14	STOP KEY (disable pump for automatic run)
3 ÷ 6	Keys to confirm, edit , increase and decrease the electronic control parameters	15	START KEY (enable pump for automatic run)

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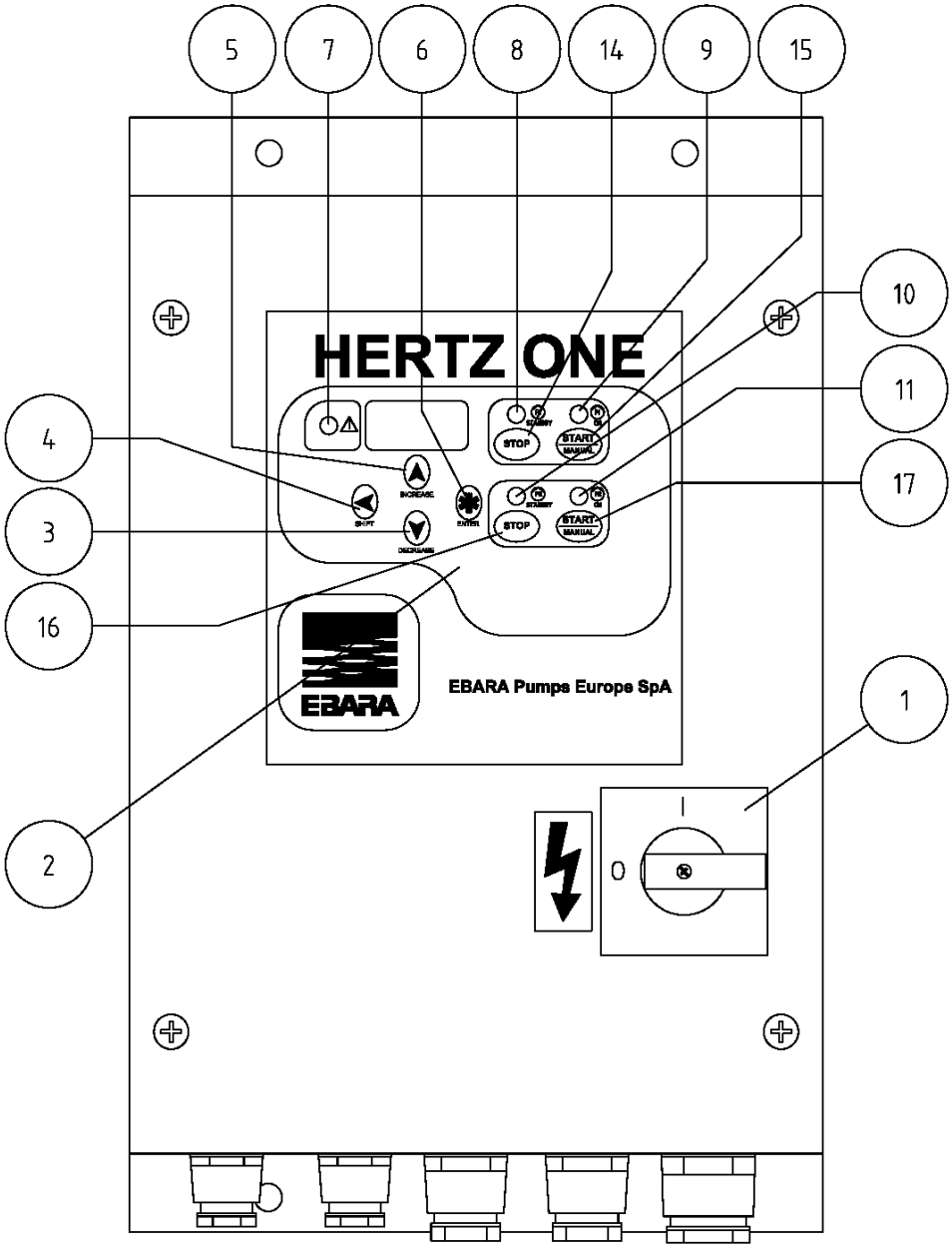
CONTROL BOX FRONTAL VIEW

CONTROL BOX TWO PUMPS



Pos.	COMPONENTS	Pos.	COMPONENTS
1	Disconnecting switch	7 ÷ 11	Signalling LED
2	Frontal of the system controller board	14 ÷ 15	Stop / Start key Pump 1
3 ÷ 6	Keys to confirm, edit , increase and decrease the electronic control parameters	16 ÷ 17	Stop / Start key Pump 2

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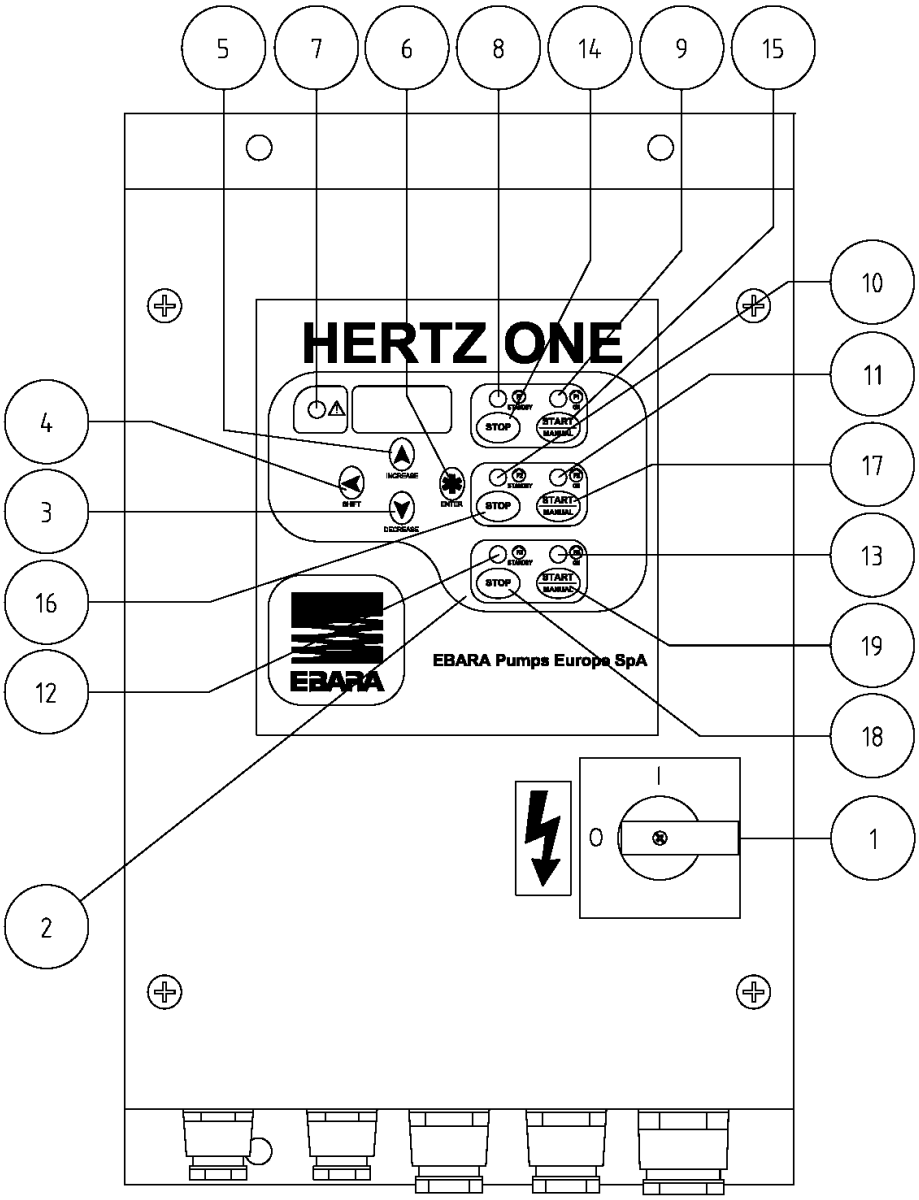
CONTROL BOX FRONTAL VIEW

CONTROL BOX THREE PUMPS



Pos.	COMPONENTS	Pos.	COMPONENTS
1	Disconnecting switch	14 ÷ 15	Stop / Start key Pump 1
2	Frontal of the System Controller board	16 ÷ 17	Stop / Start key Pump 2
3 ÷ 6	Keys to confirm, edit , increase and decrease the electronic control parameters	18 ÷ 19	Stop / Start key Pump 3
7 ÷ 13	Signalling LED		

CONSTRUCTION

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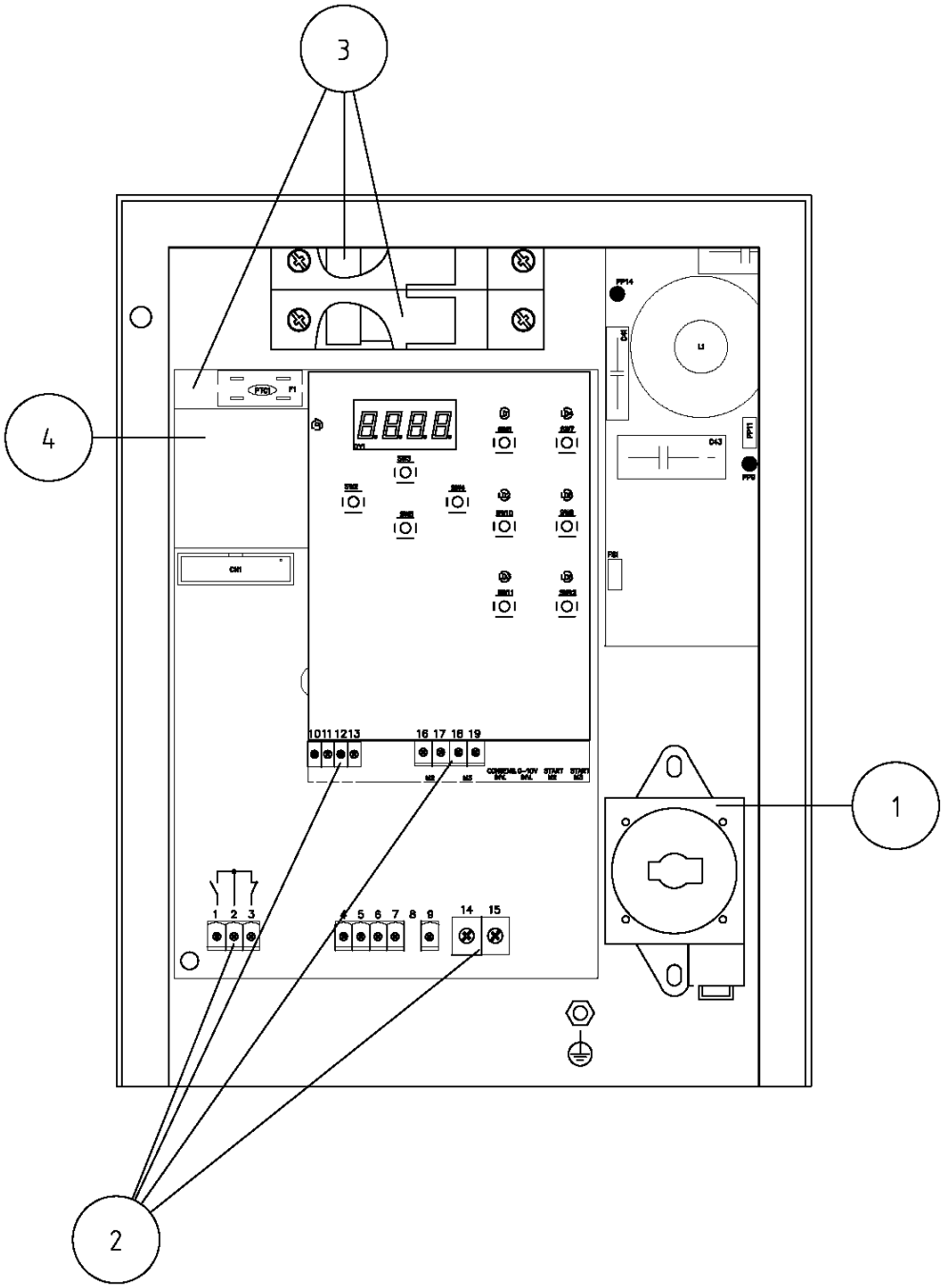
INTERNAL DRAWING WITH MAIN COMPONENTS

CONTROL BOX THREE PUMPS



Pos.	COMPONENTS	Pos.	COMPONENTS
1	Disconnecting switch	3	Fuses
2	Terminal board	4	Inverter electronics transformer

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DISPLAY PANEL CHARACTERISTICS

FRONT PANEL

The front panel is the interface used to monitor all functions as well as the system pressure.
The drawing below is an example of the three pumps version.

ENTER (**ENTER**) key to confirm the entered value.

SHIFT (**SHIFT)** key to select the value to edit.

INCREASE (**INCREASE)** key to increase the selected value or to access the upper parameters line

DECREASE (**DECREASE**) key to decrease the selected value or to access the lower parameters line.

The **STOP** key (one for each pump) is used to disable the current pump. The **START** key (one for each pump) enables the pump for automatic working, if held more than 5 seconds, it starts the pump. When the key is released the pump is stopped.
The yellow LED **STANDBY** means the pump is ready for startup, the green led **ON** means the pump is running.

CONSTRUCTION

HOW TO READ PARAMETERS ON DISPLAY

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The parameters shown on the display in the view mode (when the programming mode is off, no password inserted) are listed on table 1.
Keys **INCRESE** e **DECREASE** are used to browse trough the parameters.
When the HERTZ ONE Is activated the actual system pressure is displayed (all LEDS are off as well as all pumps).

Tab.1

DISPLAY	DESCRIPTION
P 00.0	Actual system pressure. (bar)
r 00.0	Set pressure. (bar)
Inv0	HERTZ ONE models with inverter pump swapping only shows pump currently driven by inverter Inv1: inverter activated on pump no.1 Inv2: inverter activated on pump no.2
F 00.0	Inverter supplied motor frequency (Hz)
A 00.0	Inverter supplied Pump no.1 motor input (Ampere)
b 00.0	Pump no.2 motor input (Ampere)
c 00.0	Pump no.3 motor input (Ampere)
An1	Working hours pump no.1. 1 unit= 10 working hours
An2	Working hours pump no.2. 1 unit= 10 working hours
An3	Working hours pump no.3. 1 unit= 10 working hours
PSET	System pressure to be kept constant
CP	Proportional correction of the error between the system pressure and the reference pressure PSET (decrease the value in case of excessive pressure fluctuations, increase the value if pressure drops excessively at startup.)
AL0	Alarms memory
SrE1	Software version
PASS	Password to be entered: 2222

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ALARM CODES

AL1	Maintenance alarm: Working hours of TnAm parameter have been exceeded (PROGRAMMING SET) The alarm does not stop the pumps, that will keep running In addition to the display warning the alarm red LED is on.
AL2	Programming error due to: PSET>Pn or Pn>PFS (from the pressure transmitter). This alarm stops all pumps and the red LED alarm is on Pump P1 (inverter driven) is off Pumps P2 and P3 (if they are available) will work with the pressure switches.
AL4	Sensor failure (it could also be activated in case of disconnection of the sensor cable). This alarm turns off all pumps. If pressure switches connection is activated, pumps 2 and 3 are run by the controller while the inverter driven pump is off The alarm red LED is on.
AL8	Motor overload alarm (three restarts each minute, manual at fourth attempt). If restarts fail, the system controller stops the motor(s) presenting an overload. During the automatic restarts the red LED is flashing, in case of manual intervention , the red LED is on. The following messages are used to identify the defective pump: **a 8** = pump P1 fault; **b 8** = pump P2 fault; **c 8** = pump P3 fault;
AL16	Inverter fault. The inverter driven pump (number 1) is stopped. The controller will run pumps no.2 and no.3 (if they are available) by direct command through pressure transmitter Alarm red LED is on
AL32	Overpressure The controller stops all pumps. When pressure becomes normal with a minimum time of 5 seconds there is a restart. Alarm red LED is on
AL64	Lack of water (three automatic restarts each minute, manual restart at fourth attempt). Alarm red LED is on.

When many alarms are active at the same time the display will show them as sum of the two respective alarms.

- **ALARM 12 = ALARMS 4 + 8**
- **ALARM 24 = ALARMS 8 + 16**
- **ALARM 68 = ALARMS 4 + 64**
- **ALARM 72 = ALARMS 8 + 64**

As previously described each alarm turns on a red LED (the LED is situated beside the display, with the alarm triangle indication). Below is a drawing of the alarm.

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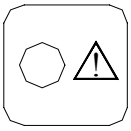

PROGRAMMING

To access programming mode, do the following:

Power on the HERTZ ONE box, and when display turns on press 

till the symbol **PASS** appears on the display, then press the 

key to access the password page. When the value 0 appears, use the key 

to select it (value 0 starts flashing). Enter the password 2222. To increase the value 0 to 2 , use the 

key and then confirm with 

.

Repeat the above mentioned procedure to set to 2 the second and third digit.

When fourth digit is increased to 2, press 

At this point the parameters codes will be displayed as described in “Programming parameters table”

To browse trough parameter use the key **DECREASE.** Press any other key to exit the programming mode.

To view and edit programming parameters use the key **RETURN**. When pressed for the first time view and edit of the field is enabled, when pressed for the second time this mode is off.

When inside the edit/view field, a pressure of the key **SHIFT** will cause the first digit of the value to flash (further pressure of the **SHIFT** key will select the next digit.

Keys **INCREASE**/**DECREASE** are used to edit the value while the key **RETURN** confirms the entered value

If no key is pressed in 10 min the display will exit the programming mode and display the current system pressure.

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PROGRAMMING PARAMETERS TABLE

PARAMETERS CODE	DESCRIPTION	FIELD
A	Max input motor no.1 (inverter driven) Insert rated current of the motor	0 ÷ 10 (Ampere)
B	Max input motor no.2 (direct working motor). Insert rated current of the motor	0 ÷ 10 (Ampere)
C	Max input motor no.3 (direct working motor). Insert rated current of the motor	0 ÷ 10 (Ampere)
CI	Constant correction of the error between the system pressure and the reference pressure PSET (a value too high can produce fluctuations. No correction applied if the value is “0”, error instantly corrected if value is “255”	0 ÷ 255
Pn	Pump rated pressure with no capacity (0 litres) (insert pump pressure at 0 litres).	0 ÷ 25.5 (bar)
VEL	Minimum inverter speed for stopping of pumps 2 and 3. Parameter is calculated based on values at PSET and Pn	0 ÷ 100 (%)
Pr	Restarting pressure.	0,0 ÷ 2 (bar)
Vrp	Minimal inverter speed. Below this value the inverter stops	0 ÷ 100 (%)
rP	PSET reduction to stop inverter driven pump	0,0 ÷ 2 (bar)
InTr	Time interval to enable PSET reduction (inverter driven pump stop)	0,0 ÷ 99 (secondi)
PH20	Minimal pressure for stopping the pumps due to lack of water in suction.	0 ÷ 25.5 (bar)
PPEr	Pressure setting at which HERTZ ONE stops all pumps PPEr (Warning P.) = PSET x 1,5 x (Pn-PSET)	0 ÷ 100 (%)
PFS	End scale pressure of the pressure transmitter installed on the system	(0 ÷ 10 bar) (0 ÷ 16 bar) (0 ÷ 25 bar)
TIP	System kind: one, two or three pumps	1, 2, 3
Addr**	Serial port address	0 ÷ 4
SEO	Hour of change of starting order Insert a value from 1 to 24 to invert the starting sequence of the pumps at a specific time of the day. Insert the value 25 to change the sequence at every restart	1 ÷ 25
TnAm*	Pump maintenance time (1 unit = 10 working hours)	0 ÷ 9999

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*: To remove the MOTOR MAINTENANCE AL1 (or AL2 /AL3) select the parameter TnAm of the desired pump (pump has reached the working hours set)


and press SHIFT . The indication ON appears. Then press 
ENTER to exclude the motor maintenance.

The display will show the value 0000

** To activate the serial communication the parameter **Addr** (address) must be entered
Addr = 0, HERTZ ONE is not connected to a pc or other inverters
Addr = 1, HERTZ ONE is set as MASTER
Addr = 2 ÷ 4, HERTZ ONE is set as SLAVE
.

ELECTRICAL CONNECTIONS

GENERAL SAFETY WARNINGS

Rev.A

CLASS A differential switches must be installed in the system before the HERTZ ONE control boxes.(the type A differential is tested for sinusoidal as well as pulsating current with a continuous component) with leakage current that can be set till a max of 30 mA, selective and protected against behind time activation with a delay of 0.5 sec.

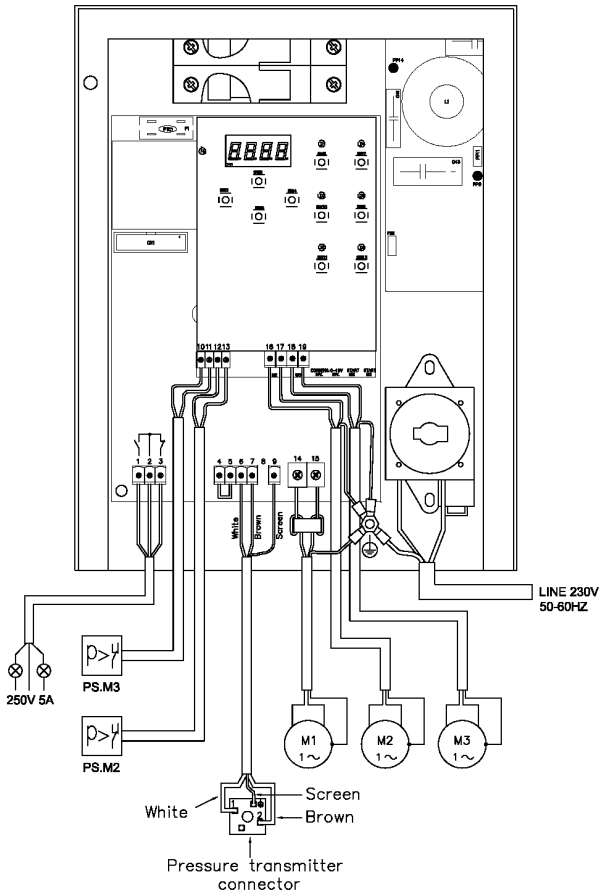
As regards the automatic protection against short-circuits, the supply line must be protected with fuses type “AM” or with magnetotermic switches type D.
Please make sure the earth connection is correctly made.
The following table shows the correct values of the fuses for the line protection (calculated on max load).

Power (kW) of controller HERTZ ONE	Rated supply tension 230 V – 10%, 230 V +15%	
	Current (A)	Fuses type
1 x 1.1	12 A	AM – 10 x 38
2 x 1.1	25 A	AM – 10 x 38
3 x 1.1	32 A	AM – 14 x 51
1 x 1,5	12 A	AM – 10 x 38

ELECTRICAL CONNECTIONS

CONNECTIONS IN A THREE PUMPS CONTROL BOX

Rev.A

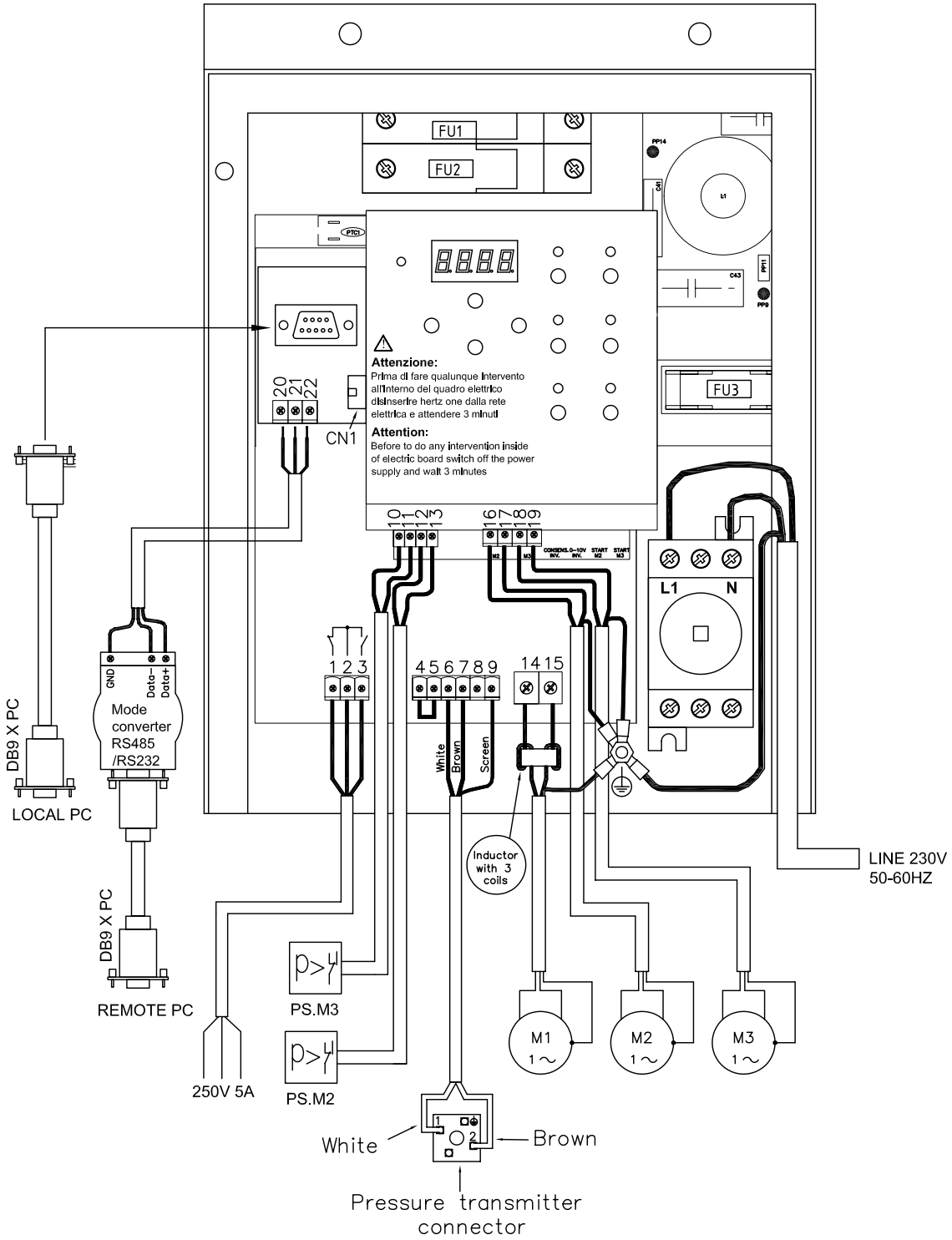


TERMINAL	DESCRIPTION
ALARM 1 – 2 –3	Terminals for remote signalling of control box alarms (inverter alarm, motor overload, lack of water or minimal pressure, sensor failure)
REMOTE CONT 4 – 5	Terminals for remote control connection. If used, remove the bypass jumper situated between terminals 4 and 5 Input characteristics: 24 Vac 0.04 A
PR:TR 6 – 7 - 9	Terminals for connection of pressure transmitter Input characteristics: 15 Vd.c, 4÷20 mA Terminal: 6 supply 7 signal input 9 screen
PSM2 10 – 11	Cables connected to pressure switch PS1 for control of pump no.2
PSM3 12 – 13	Cables connected to pressure switch PS2 for control of pump no.3
L / N 14 – 15	Connection of pump no.1 to inverter
L / N 16 – 17	Connection of pump no.2
L / N 18 - 19	Connection of pump no.3

ELECTRICAL CONNECTIONS

CONNECTIONS OF CONTROL BOX FOR REMOTE PC MANAGEMENT

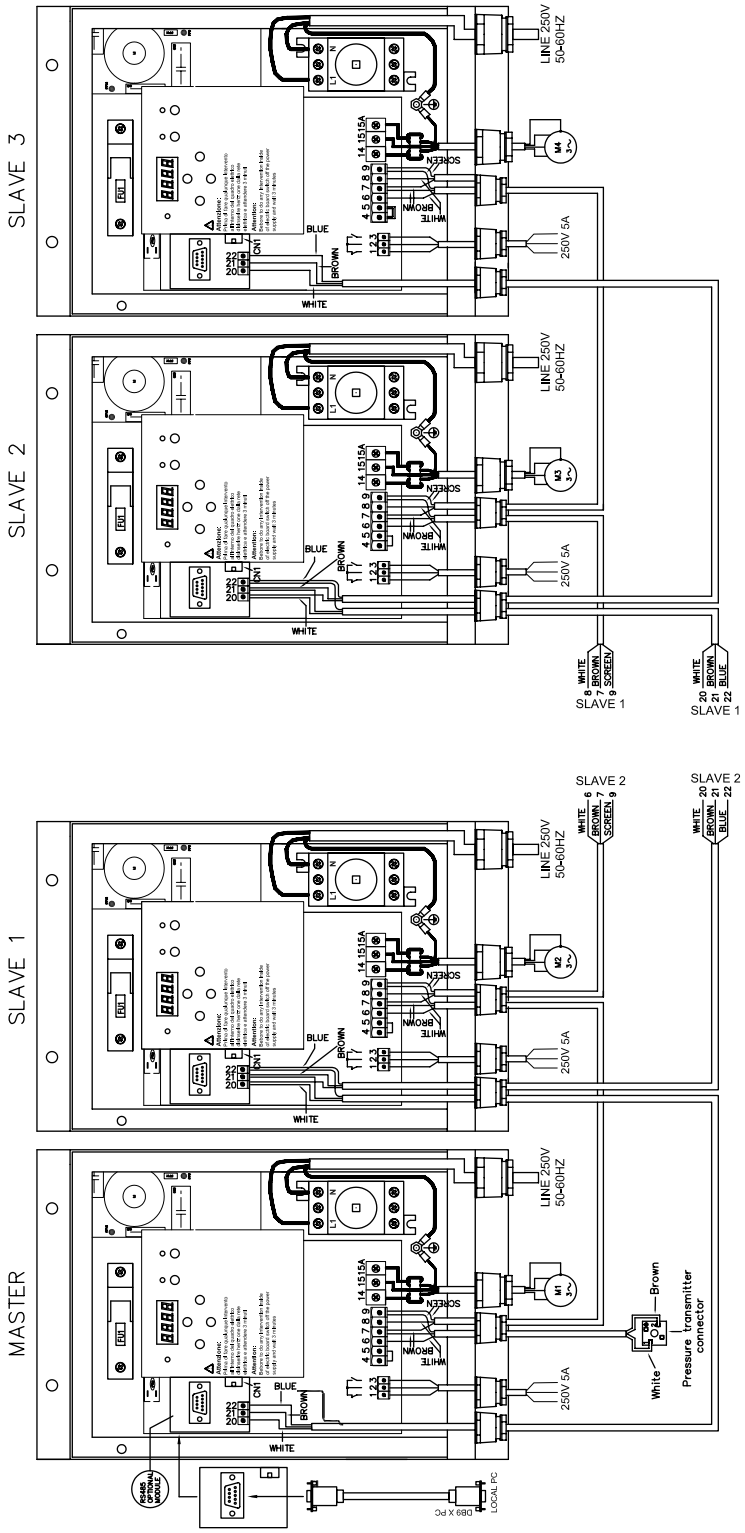
Rev.A



ELECTRICAL CONNECTIONS

THREE PHASE CONTROL BOX CONNECTION IN A MASTER/SLAVE SYSTEM

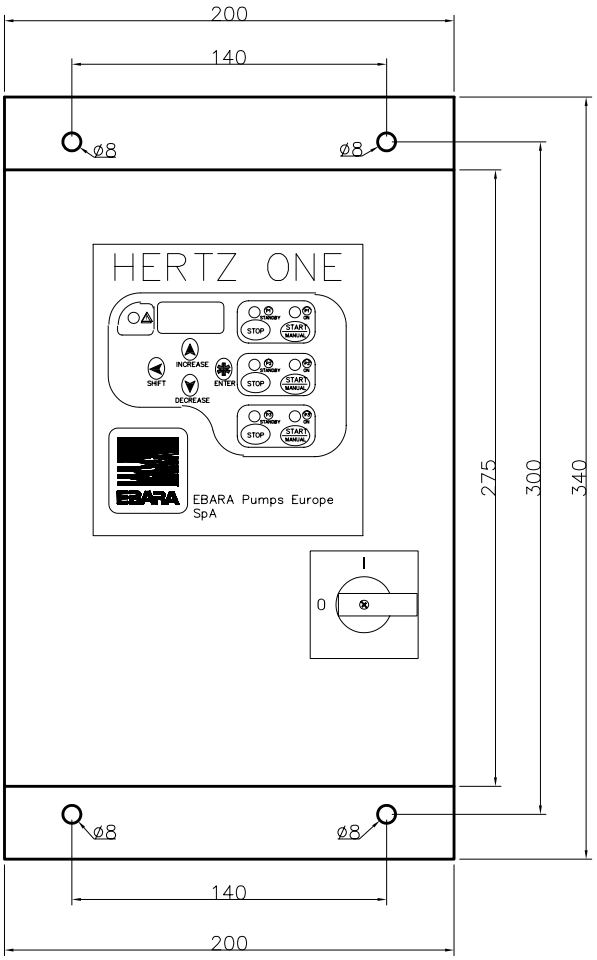
Rev.A

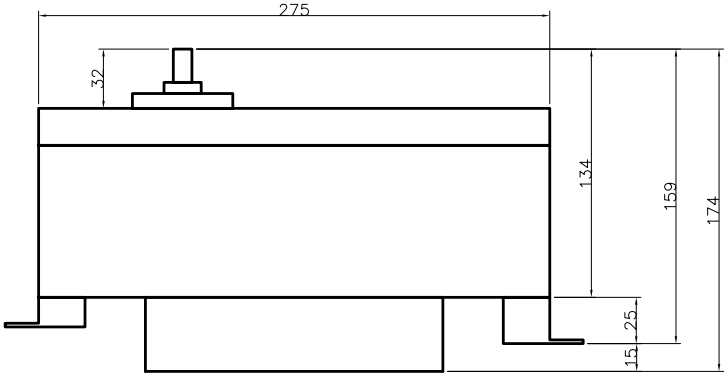


DIMENSIONS AND WEIGHT

Rev.A

DIMENSIONS





DIMENSIONS AND WEIGHT

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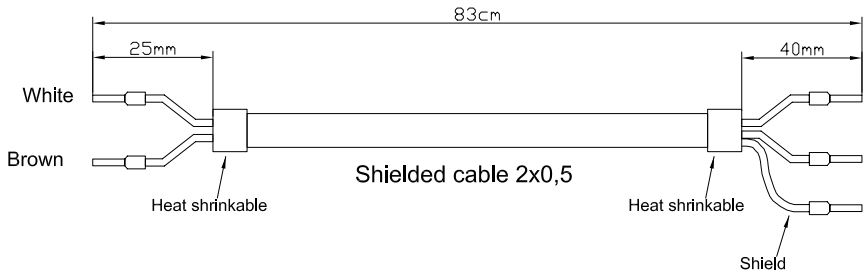
CONNECTION CABLES

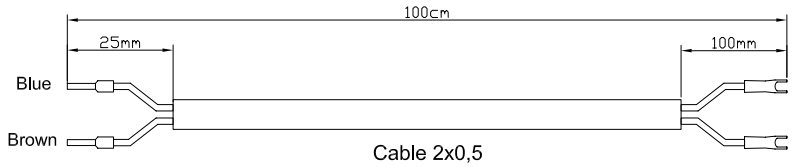
Here below are specified all the cables that can be supplied with the control box:

Transmitter cable

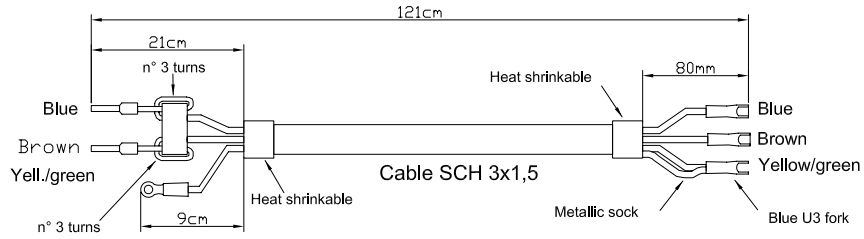


The transmitter cable used with the cabinet is 140 cm long instead of 83 cm.

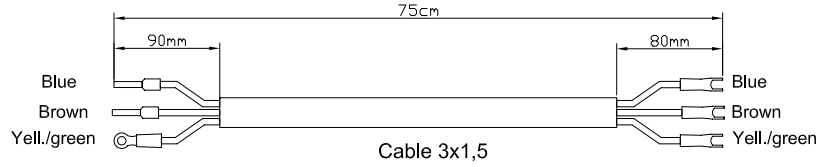
Pressure switch cable



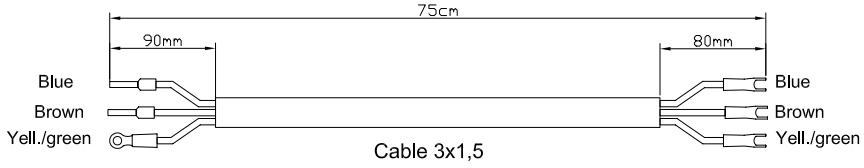
Motor cable 1



Motor Cable 2



Motor cable 3



DIMENSIONS AND WEIGHT

Rev.A

WEIGHT

SINGLE PUMP CONTROL BOXES

MODEL	WEIGHT (Kg)
HZ ONE 1x1,1M	5,5
HZ ONE 1x1,5T	5,5

TWO PUMPS CONTROL BOXES

MODEL	WEIGHT Kg
HZ ONE 2x1,1M	5,7

THREE PUMPS CONTROL BOXES

MODEL	WEIGHT Kg
HZ ONE 3x1,1M	6

APPENDIX

Rev.A

PUMP SELECTION ON A VARIABLE SPEED SYSTEM

Single pump HERTZ ONE – constant pressure (Fig.601)

Pump must be chosen starting from the basic requirements:
- Pressure required (H_{set})
- Maximum system capacity (Q_{max}).

With the above-mentioned data the hydraulic curves of the variable speed pumps must be checked, and the one that covers the rated pressure field up to Q_{max} must be selected.
This point should be at the right of the maximum efficiency point of the pump, but it should also have an efficiency which is not lower than 10% of the maximum.
Possibly, the minimum capacity point should have an efficiency not lower than 10% of the maximum, too.

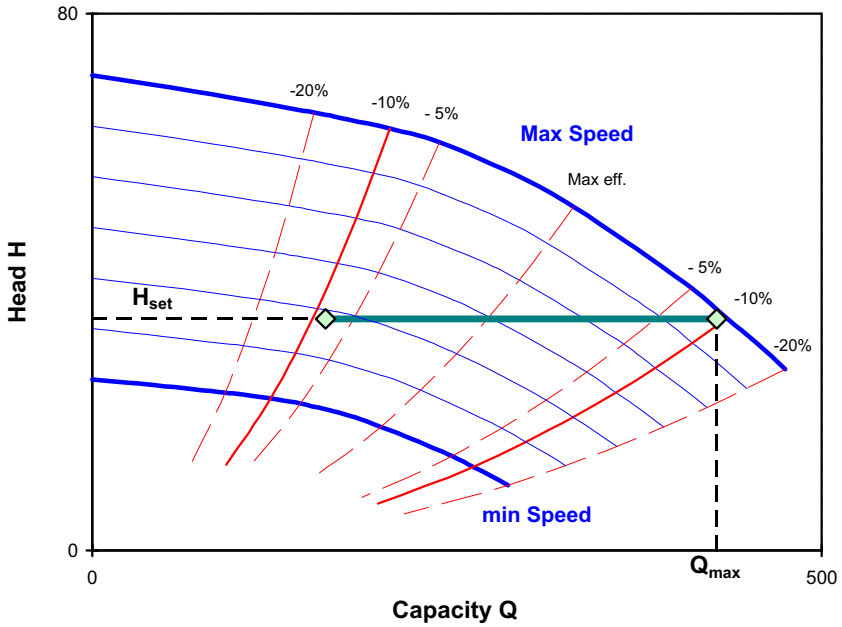


Fig.601 : Pump selection in constant pressure system

The optimal use of the selected pump, as far as energy saving is concerned, is possible when point Q_{max}-H_{set} is very close to the pump maximum speed curve.
Furthermore, when conditions are particularly critical, a check of the NPSH at the conditions of Q_{max}-H_{set} should be performed by calculating the NPSH available for the system. This should be higher than the one requested by the pump at max. speed. Concerning the conditions at reduced speed, the situation becomes less critical as the required NPSH decreases and generally, the available one increases.

APPENDIX

Rev.A

PUMP SELECTION IN A VARIABLE SPEED GROUP

General information

The dimension of a pressure-boosting unit is the result of the analysis of the capacity demand in a period of time (ex 24H) and the study of the distribution/use circuit. This defines the main parameters Q_{max}, H_{max}, H_{set}, max no. of working pumps and if a spare pump is required (stand-by).
In any case, to optimize the use of the group, it is necessary to find the max head point as close as possible to the curve referred to the parallel of each pump of the group, working at max. speed.
In case of critical conditions, a NPSH check should be performed at the condition of Q_{max}-H_{max}, as in the case when all pumps are working.
For the description of the different cases, a group of three pumps of the same type will be considered.

Three pumps HERTZ ONE – Constant pressure

With reference to the example in Fig.602, when point Q_{max}-H_{set} is not placed on the curve referring to the parallel of each pump working at max. speed, pump no.1 is not working at max. speed when the maximum capacity is required.
When water demand decreases, pump 1 will decrease its rotation speed till its capacity becomes null. At this point (M) pump no. 3 is stopped and pump 1 will be brought to its max. speed.
As a result, the variable speed pump works from no flow to maximum capacity along the straight-line A-B .
Pump selection should be made as in the case of a single pump but, since there are some fixed speed pumps, it is better to place the max. capacity point (B) in a way that its efficiency is as close as possible to the max value with a gap lower than 5%

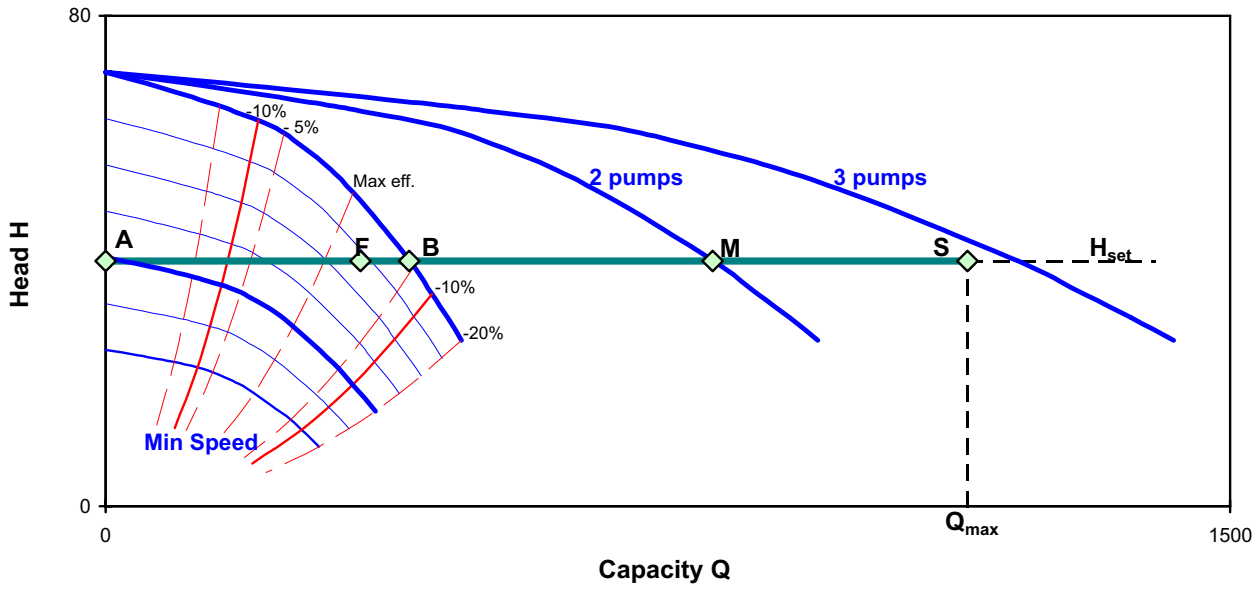


Fig.602 : Pump selection in a constant pressure system, single inverter

No. 3 HERTZ ONE three phase in a NETWORK – Constant pressure

With reference to the example of Fig.603, in case point Q_{max}-H_{set} is not placed over the curve referring to the parallel of each pump working at max speed, pumps are working at reduced speed even when maximum capacity is required (point G on each pump).

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When water demand decreases, pump 1, 2 and 3 will decrease their rotation speed till capacity Q_{2-3} (point F on each pump).
At this point (M) pump no. 3 is stopped and pump no. 1 and 2 will increase their rotation speed to adjust to the new conditions.
After a further decrease of water supply, pumps 1 and 2 will reduce their rotation speed till capacity Q_{1-2} is reached (point E on each pump). At this point (B) pump no. 2 will stop and pump no.1 will increase its speed to adjust to the new conditions. From this moment till the point of no demand (point A), pump no 1 works individually. As a result, all pumps at variable speed work from no capacity to max capacity along the straight-line A-B but mostly in the field E-B.

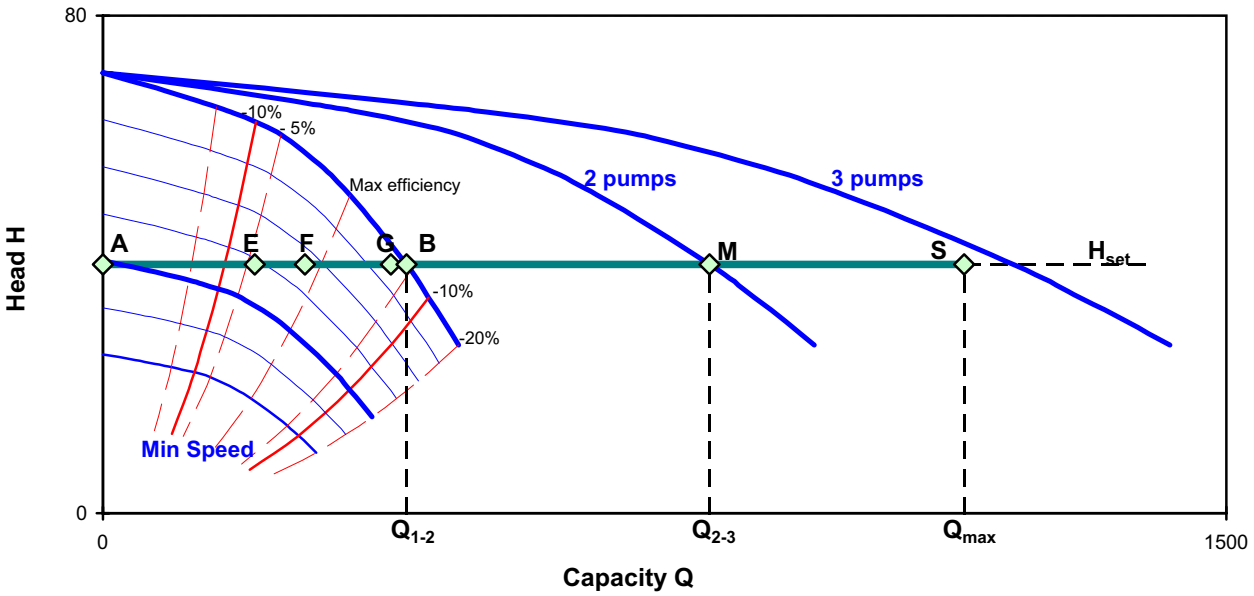

Fig.603 : pump selection in a constant pressure group-Multi-inverter

The pump selection should be made as in the case of a single pump, but considering the speed variation of all the group units, it is better to place the maximum capacity point (B) in a way that its efficiency is as close as possible to the max value with a gap lower than 5%. Point E should have good values of efficiency too.