American CRS Equipment

CRS Industrial Power Equipment

PRODUCT MANUAL

Quasar

Manual for installation, use and maintenance

Q100 model: Rev. Bxx | Q150 model: Rev. Bxx

Q300 model: Rev. Bxx | Q500B model: Rev. Bxx

AIR AND WATER COOLED

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English



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1. INTRODUCTION

The present manual for use and maintenance serves as a reference for a complete guide and a quick identification of the machine and all its parts.

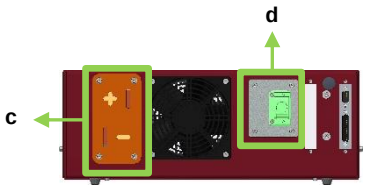
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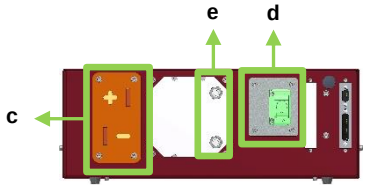
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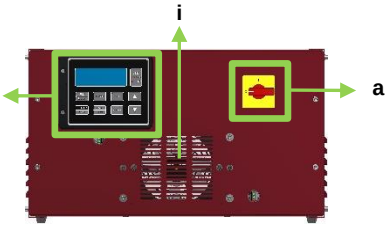
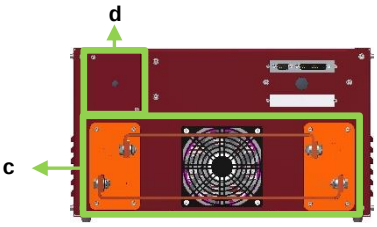
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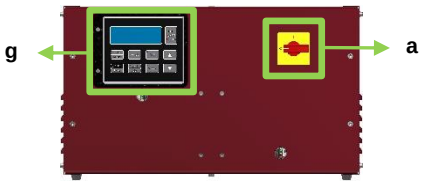
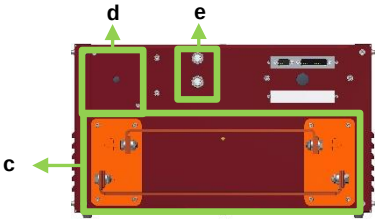
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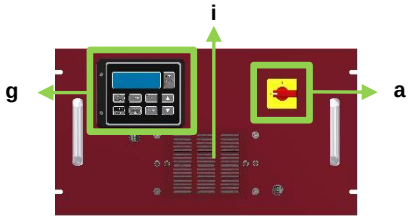
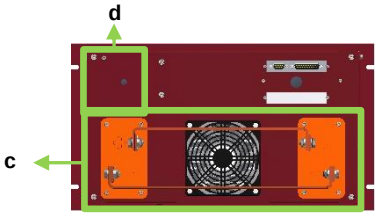
2.1. Machine Parts

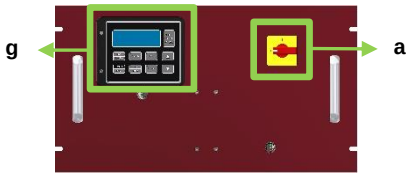
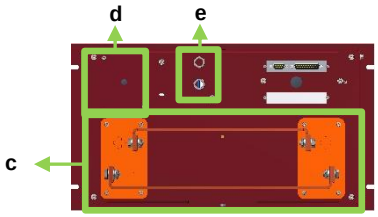
Model	*Front View*	*Back View*
Q100 Air cooled		

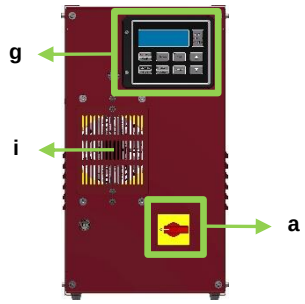
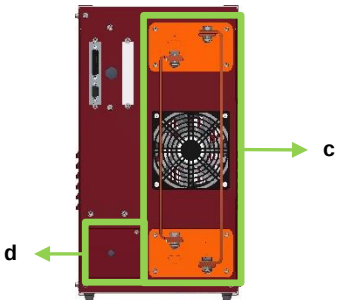
Model	*Front View*	*Back View*
Q100 Water cooled		

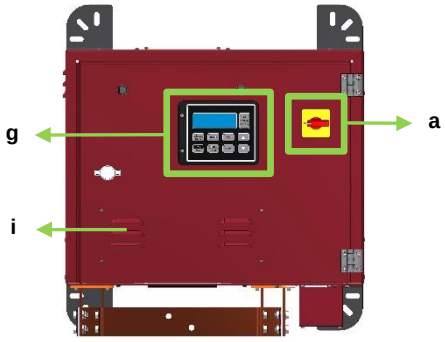
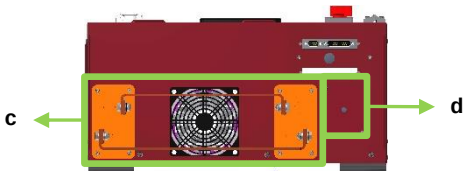
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Q150D Air cooled		

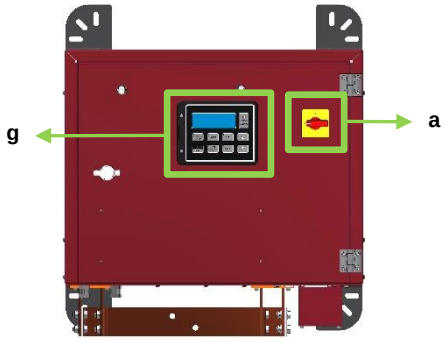
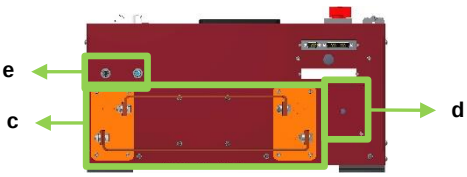
Model	*Front View*	*Back View*
Q150D Water cooled		

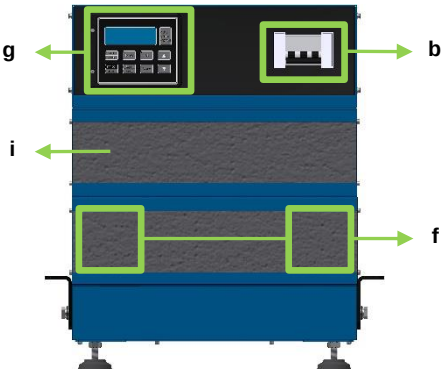
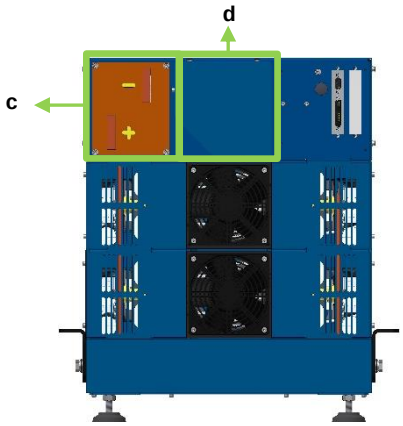
Model	*Front View*	*Back View*
Q150R Air cooled		

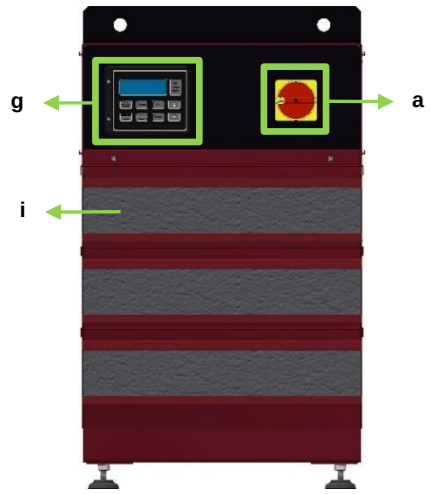
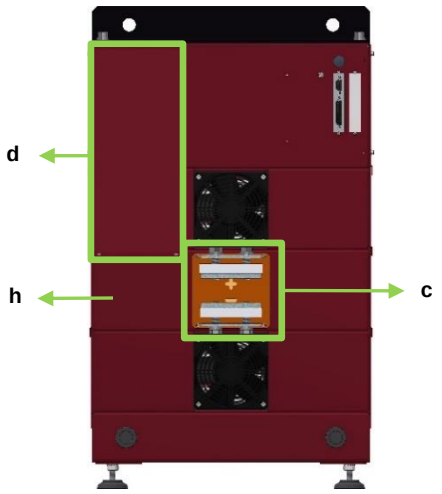
Model	*Front View*	*Back View*
Q150R Water cooled		

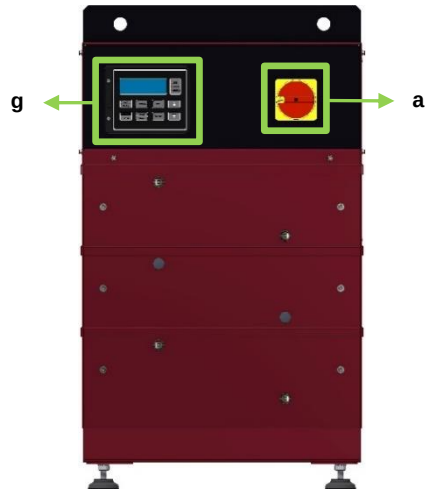
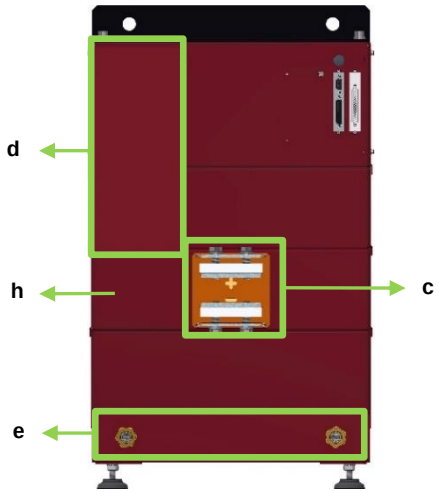
Model	*Front View*	*Back View*
Q150V Air cooled		

Model	*Front View*	*Bottom View*
Q150W Air cooled		

Model	*Front View*	*Bottom View*
Q150W Water cooled		

Model	*Front View*	*Back View*
Q300 Air cooled		

Model	*Front View*	*Back View*
Q500B Air cooled		

Model	*Front View*	*Back View*
Q500B Water cooled		

LEGEND

a	Main I/O switch (present on Q100, Q150 & Q500B only)	**f**	Additional fans on each module (present on Q300 only)
b	Circuit breaker (present on Q300 only)	**g**	Operator panel, with protection frame.
c	Output power bars	**h**	Intermediate cooling unit (present on Q500B only)
d	AC main input	**i**	Air filters (on air cooled rectifiers only)
e	Input / output water circuit		

2.2. Configurations

All Quasar machines have a predefined configuration and they can be interconnected via multi-tower system to reach higher output power requirements. Each machine can be made up by following 3 different units:

- DC Power modules - Present on all models and types. All power modules are identical on a machine.
- Reverse modules - Present only on Q300 & Q500B models (PPR fast/slow and DCR machine types)
- Intermediate cooling unit - Present only on Q500B models (air and water cooled)

See our “CRS_Qxxx_Conf_Spec” catalogue for mechanical details of each configuration.

3. SAFETY REGULATIONS

Read and carefully abide by the rules which are listed here under before installing, wiring, using, working or transporting the machine.

WARNING!

The use of equipment for the power distribution in the galvanic plants, considering the high currents involved, involves dangers for oneself and other persons. The reading, knowledge and observance of the safety measures, here listed, are a must which the careful operator, aware and faithful to his own duty, must follow for the maximum safety against any accident.

WARNING!

Do not try to install, to switch on or carry out the servicing or maintenance of this machine if you are not qualified to do so and if you have not read and understood this manual.

If you have doubts about the installation and the use of this machine ask the manufacturer (Customer care office).

WARNING!

Before installation, wiring, maintenance, service, inspection or reparation of this machine, be sure to turn OFF all input power with the main switch on the operator panel. Make sure whether the machine is powered ON or OFF.

Before setting-up the machine check that it has not any mechanical damages.

DO NOT REMOVE THE LOAD (BAR OR BARREL FROM THE BATH) BEFORE SETTING THE MACHINE IN STAND-BY MODE. This operation is extremely dangerous for the safety of the operators and the machine due to the voltage surge and could cause an explosion due to the development of hydrogen in proximity of the cathode element.

It is recommended to touch the machine wearing gloves, make sure that they are dry.

The accidental contact to ground can cause overheating and risks of fire.

Turn OFF the machine when is not being used and even in case of sudden suspension of electric power.

Do not touch the power connection lines when the machine is turned ON. Doing so may cause electri[illegible] burns.



WARNING!
RISK OF ELECTRIC SHOCK—High voltage warning—
Dangerous voltage is present on output bus bars. The professional installer must protect service personal from inadvertent contact with this dangerous voltage.

PROHIBITED
People having a pace maker are absolutely prohibited to get near this machine and to the connection bar

LOCATION AND INSTALLATION

WARNING!

The installation of the machine must be in conformity with local regulations regarding safety measures.

Do not operate or store the machine in the following environments:

- Outdoors
- Exposed to direct sunlight
- Exposed to rain droplet
- Near equipment that produces sparks
- Subjected to vibration or shock
- In presence of conductive liquids (water solutions, acids, etc.)
- Near sources of heat

WARNING!

Select the input and output wires of diameters suitable for this machine. Not doing do may cause overheating or fire.

Install the machine in an area which can support the weight of it. Not doing so may cause the dropping of the machine, which can cause fire or injury.

The output power bars of the machine must be used only for electrical connections purpose and not as a mechanical support.

Avoid absolutely that the weight of the cables or copper plates of the bath starting from the machine create torsions on the output bars of the machine.

Make the output connections paying particular attention not to pass near the signal cables from/to other equipment. This is to avoid that the high currents involved may disturb the electronic equipment.

OPERATION

WARNING!

Do not operate or store the machine in critical environments described in the present manual.

Do not remove the cover of the machine when the machine is turned ON. Doing so may cause electric shock or burns.

Before starting up the machine, ensure safety on the load side.

Do not operate for a long time with the CHECK LED flashing. Doing so may severely damage the machine.

Do not spray water or other liquids which could prejudice the safety against the machine.

Avoid absolutely direct contact to metallic parts under voltage with skin or wet clothes. Doing so may cause electric shock.

Do not leave the machine in operation unattended.

MAINTENANCE

WARNING!

The maintenance of the machine must be in conformity with local regulations regarding safety measures.

Before carrying out any maintenance or replacement operation, it is of utmost importance that the machine is turned OFF from the main switch on the operator panel. After turning it OFF make sure to wait for at least 2 minutes until all residual voltage inside the machine is discharged. In addition pay attention to the cooling elements which can reach a temperature of 80°C.

When performing maintenance, servicing or repairs make sure to wear suitable clothing.

4. TECHNICAL SPECIFICATIONS

4.1. Electrical specifications

		Q100 model	Q150 model	Q300 model	Q500B model
Output	Output current	See rectifier's identification label			
	Output voltage	See rectifier's identification label			
	Operation Mode	Current Control or Voltage Control			
	Resolution	V_{out}≤ 25V / I_{out}≤ 25A - Min. step: 0.01 - Display resolution: 2 decimal digits 25V< V_{out} ≤ 250V / 25A< I_{out} ≤ 250A - Min. step: 0.1 - Display resolution: 1 decimal digits 250V< V_{out} ≤ 450V / 250A< I_{out} ≤ 600A - Min. step: 0.2 - Display resolution: 1 decimal digits 600A< I_{out} ≤ 2000A - Min. step: 1 - Display resolution: No decimal digits 2000A< I_{out} ≤ 5000A - Min. step: 2 - Display resolution: No decimal digits I_{out} > 5000A - Min. step: 5 - Display resolution: No decimal digits			
	Accuracy	1% on full scale			
	Current regulation range	5V ≤ V_{out} < 60V : 2 - 100% of max current (CTRD03) 60V ≤ V_{out} ≤ 160V : 2 - 100% of max current (CTRD02) V_{out} > 160V : 2 - 100% of max current (CTRLB2)			
	Voltage regulation range	5V ≤ V_{out} < 60V : 5 - 100% of max voltage (CTRD03) 60V ≤ V_{out} 160V : 5 - 100% of max voltage (CTRD02) V_{out} > 160V : 5 - 100% of max voltage (CTRLB2) - No voltage regulation without load -			
	Low frequency current ripple (RMS)	<2.0% of rated output current in current operation mode (<1.0% on request for V_{out}≤160V)			
	Efficiency	89% (typ.) @ rated load / 92% (for ≥ 160VDC) @ rated load			
	Secondary withstand voltage	50VAC 50Hz 1min. between secondary to earth			
	Pole to be connected to ground	V_{out}<200V : Positive - V_{out}≥200V : Positive or Negative			
Main Supply	Line voltage	See rectifier's identification label			
	Frequency	50 - 60Hz			
	Neutral	NOT USED			
	Power factor	> 0,95 @ rated load			
	Primary current	See rectifier's identification label			
	Earth leakage current	See EMC filter input specifications			

4.2. General specifications

		Q100 model	Q150 model	Q300 model	Q500/B model
Technology		Switching mode PWM, Full Bridge IGBT inverter			
Cooling systems		•	•	•	•
		•	•	-	•
Operation conditions	Location	Indoor use only			
	Ambient temperature	0 - 40°C (up to 50°C with 15% derating -air cooled- / 10% derating -water cooled-)			
	Relative humidity	15 - 85% not condensing			
	Filter obstruction (air cooled)	15% max			
	Water input temperature (water cooled)	19 - 28°C			
	Altitude	≤ 2000m			
Degree of protection	Air cooled	IP31	IP31	IP21 (on request IP54)	IP32
	Water cooled	IP43	IP43 (on request IP54 SS)	-	IP42 (on request IP54 or IP65)
Enclosure color		RAL 3004	RAL 3004	RAL 5010	RAL 3004
Conformity of EU Directives		2006/95/EC - Low Voltage Directive			
		2004/108/EC - Electromagnetic Compatibility			

4.3. Software and Serial interface

Communication Protocols

CRS-ASCII	Included	RS485(1) network
Modbus-RTU	Included	RS485(1) network
Profibus-DP	Optional with additional board	Profibus-DP network
DeviceNet	Optional with additional board	CAN bus network
Modbus/TCP	Optional with additional board	Ethernet
Profinet	Optional with additional board	Ethernet
EthernetIP	Optional with additional board	Ethernet

Communication Ports

RS 485 (1)
RS 485 (2)

All the above protocols are managed by only one software for DC / DCR / PP slow / PPR slow rectiers.
One specic software is required for PP fast / PPR fast rectiers.

4.4. Protection

Burst & Surge
According to standard EN61000-4-11 (Burst)
According to standard EN61000-4-5 (Surge)

Output Short Circuit
Default limit set to 25% of max. Iout
Detection time: 1ms

Thermal Protection
With PTC on each module

Phase Missing
In case of one of the 3 phases is missing, the Output Power is shut down to 0
Detection: half cycle (10 ms)

Under Voltage lookout
Under Voltage warning message is displayed when the main input voltage goes below 80% of the nominal value
Under Voltage error message is displayed when the main input voltage goes below 75% of the nominal value. The output power of the rectifier is shut down to 0

Over Voltage lookout
Over Voltage warning message is displayed when the main input voltage goes above 115% of the nominal value
Over Voltage error message is displayed when the main input voltage goes above 120% of the nominal value. The output power of the rectifier is shut down to 0

Under Voltage / Over Voltage lookout is detected every ms. The triggering of the warning or error message occurs if the under or over voltage event has a duration > 1s.
The output power is automatically restarted in case the main voltage comes back within the limits (undervoltage and overvoltage protections), for phase missing protection it's necessary to switch off and switch on the rectifier.

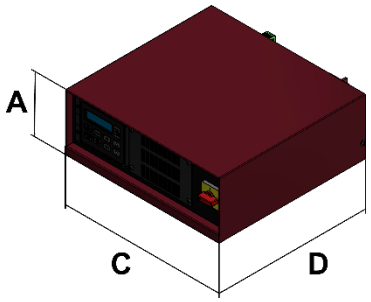
4.5. Total harmonic distortion of the absorbed current

The values reported in the table are referred to stable conditions of the mains three phase input line, properly sized (refer to short circuit ratio Rsce value according to the total installed power)

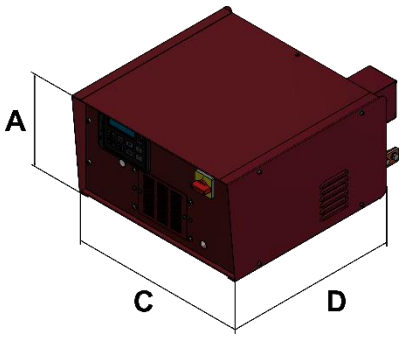
Harmonic	Freq. (Hz)	Absorbed Current Distortions
3	150	-
5	250	< 22.5%
7	350	< 12.5%
9	450	-
11	550	< 11.0%
13	650	< 7.6%
17	850	< 8.0%
19	950	< 4.8%
THD		MAX 30%

4.6. Mechanical Data

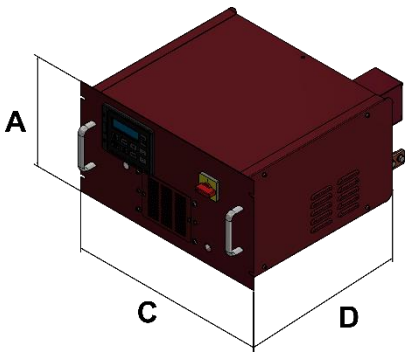
Q100



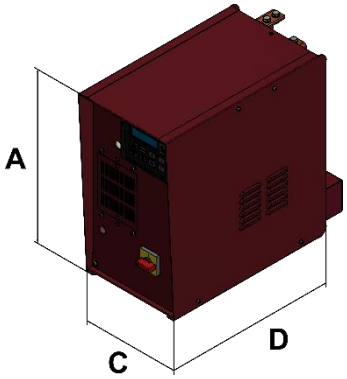
Q150D



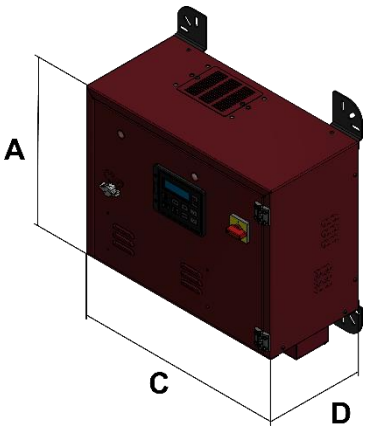
Q150R



Q150V



Q150W



Q100 Configurations

Config.	A (mm)	C (mm)	D (mm)	Weight (kg)	
				Air	Water
01	154	424	403	25	25

Q150D Configurations

Config.	A (mm)	C (mm)	D (mm)	Weight (kg)	
				Air	Water
01-1	260	450	520	33	35

Q150R Configurations

Config.	A (mm)	C (mm)	D (mm)	Weight (kg)	
				Air	Water
01-1	266	480	520	33	35

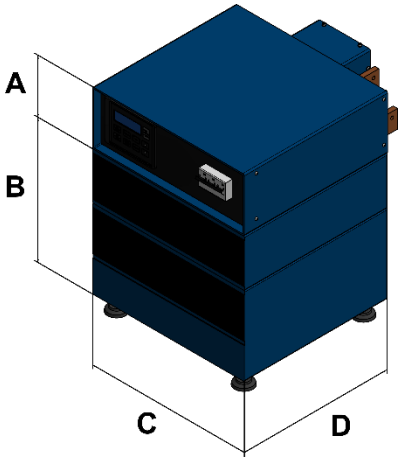
Q150V Configurations

Config.	A (mm)	C (mm)	D (mm)	Weight (kg)
				Air
01-1	450	250	520	33

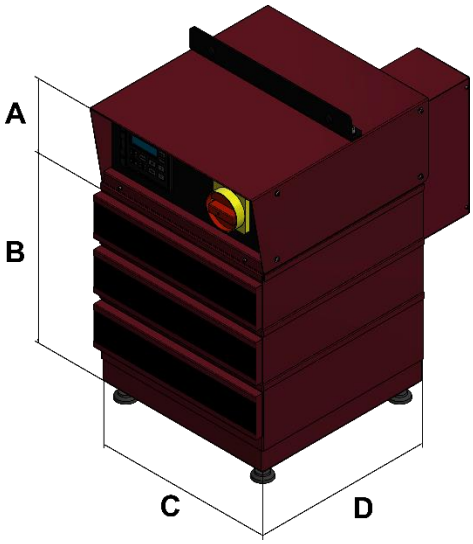
Q150W Configurations

Config.	A (mm)	C (mm)	D (mm)	Weight (kg)	
				Air	Water
01-1	560	518	260	35	38

Q300



Q500B



Q300 Configurations

Config.	A (mm)	B (mm)	C (mm)	D (mm)	Weight (kg) Air
01-1	150	219	424	429	45
02-2	150	351	424	429	69
03-3	150	483	424	429	89

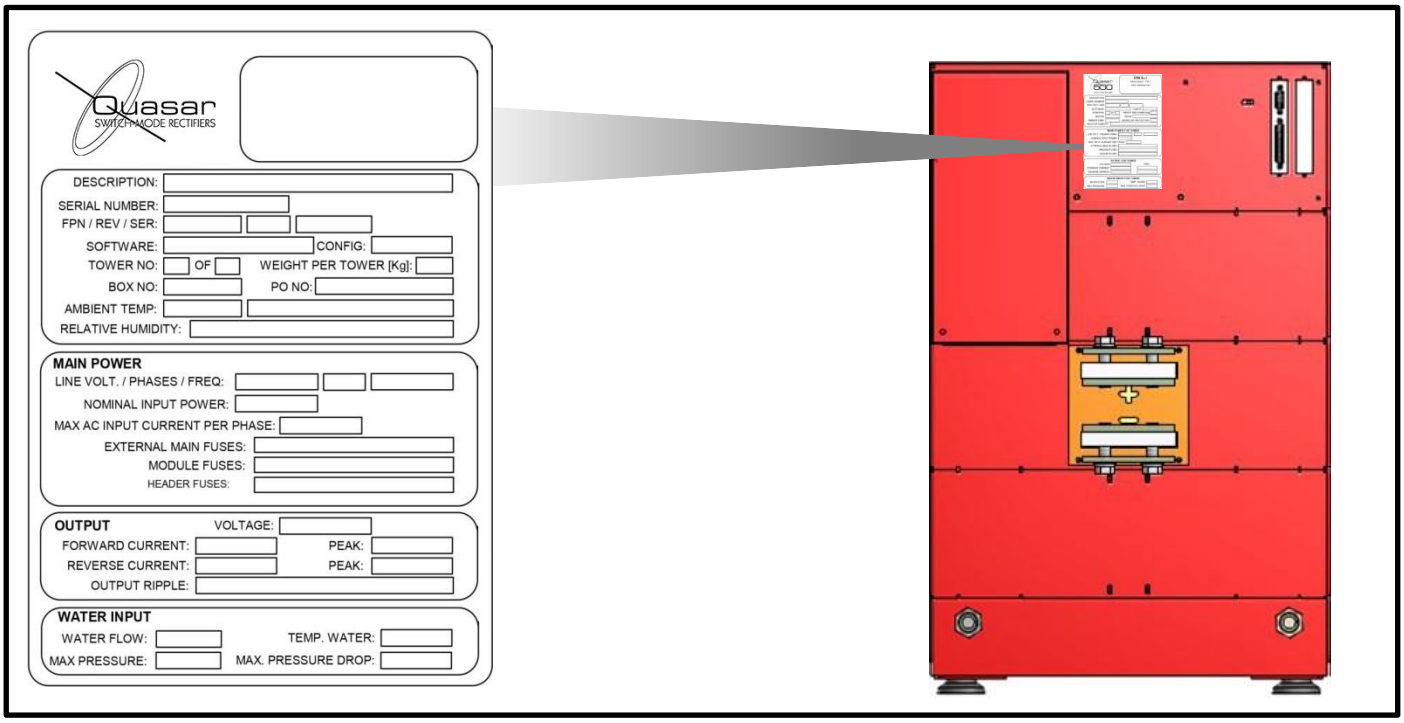
Q500B Configurations

Config.	A (mm)	B (mm)	C (mm)	D (mm)	Weight (kg) Air	Water
02-i1	200 *	351	454	479	79	86
03-1i1	200 *	483	454	479	99	110
03-Ri1	200 *	483	454	479	102	112
04-1i2	200 *	615	454	479	119	134
04-Ri2	200 *	615	454	479	122	136
05-1iRi1	200 *	747	454	479	143	160
05-2i2	200 *	747	454	479	139	158
05-1iRi1	200 *	747	454	479	146	162
05-1iRi2	200 *	747	454	479	142	160
06-2Ri2	200 *	879	454	479	162	184
06-1i2i1	200 *	879	454	479	163	184
06-2i3	200 *	879	454	479	159	182
06-1iRi2	200 *	879	454	479	166	186
07-1i3i1	200 *	1011	454	479	183	208
07-1iRRi2	200 *	1011	454	479	189	212
08-2i2i2	200 *	1143	454	479	203	232
08-2i1Ri2	200 *	1143	454	479	206	234
08-2iRRi2	200 *	1143	454	479	209	236
09-2i3i2	200 *	1275	454	479	223	256
09-2iR1Ri2	200 *	1275	454	479	229	260
10-2i4i2	200 *	1407	454	479	243	280
10-2i1RR1i2	200 *	1407	454	479	249	284
10-2iRRRi3	200 *	1407	454	479	252	286
11-2i2i2i2	200 *	1539	454	479	267	306
11-3i3i3	200 *	1539	454	479	263	304
11-3iRRRi3	200 *	1539	454	479	293	310
11-2i1R1R1i2	200 *	1539	454	479	287	304

** Up to 160A max input current per phase (Headers: CMH08F / CMH12F / CMH16F).*
Above 160A input (Header: CMH23F), dimension increases + 100 mm.

5. IDENTIFICATION DATA

A label placed on the rear of the rectifier indicates the machine type, serial number and the technical specifications of the machine:



SECTION 1 - GENERAL

DESCRIPTION:	Indicates the output current and voltage of the machine, type and cooling system
SERIAL NUMBER:	Identification number of machine
FPN / REV / SER:	CRS Part Number / CRS revision number / CRS internal identification number
SOFTWARE:	Software installed on the machine
CONFIG.:	Machine configuration (See chapter 4.6)
TOWER NO. / OF:	Tower number and number of towers that compose the machine
WEIGHT PER TOWER (kg):	Weight per tower
BOX NO.:	CRS internal box number
PO NO.:	Customer purchase order number
AMBIENT TEMP.:	Ambient temperature (See chapter 4.1)
DEGREE OF PROTECTION:	Degree of protection (See chapter 4.2)
RELATIVE HUMIDITY:	Relative humidity (See chapter 4.2)

SECTION 2 - MAIN POWER PER TOWER

LINE VOLT. / PHASES / FREQ.:	Line voltage / Number of phases / Frequency
NOMINAL INPUT POWER:	Nominal Input power
MAX. AC INPUT CURRENT PER PHASE:	Maximum input current
EXTERNAL MAIN FUSES:	Type of main fuses installed
MODULE FUSES:	Type of fuses installed on module rack
HEADER FUSES:	Type of fuses installed on header

SECTION 3 - OUTPUT PER TOWER

VOLTAGE:	Output range of DC voltage
FORWARD CURRENT:	Output range of forward DC current
FORWARD CURRENT PEAK:	Output range of forward peak DC current (Only for PP & PPR type)
REVERSE CURRENT:	Output range of reverse DC current (Only for DCR)
REVERSE CURRENT PEAK:	Output range of reverse peak DC current (Only for PPR type)
OUTPUT RIPPLE:	Output ripple

SECTION 4 - WATER INPUT PER TOWER

WATER FLOW:	Minimum quantity of water flow required in L/h (See chapter 6.6)
TEMP. WATER:	Input water temperature range (See chapter 6.6)
MAX. PRESSURE:	Maximum pressure of the water circuit (See chapter 6.6)
MAX. PRESSURE DROP:	Maximum pressure drop of the water circuit (See chapter 6.6)

6. INSTALLATION

WARNING!
The installation of the machine must be in conformity with local regulations regarding safety measures.

Ignoring the regulations listed in the present manual may severely damage the operation of the machine.

6.1. Transportation (Handling/Lifting)

All Quasar machines are wrapped in cellophane and positioned on a pallet or a wooden crate. The delicate transport of the machine is required to avoid abrupt hits to the structure; these can compromise the correct functioning of the machine itself.

WARNING!
Before setting-up the machine check that it has not any mechanical damages.

Q300 models

All machines are supplied with a couple of asymmetrical "L" section bars.
The usage of asymmetrical "L" is very simple and orientation depends on the method you intend to use for placing CRS machines in the final position:

A) Handling using a forklift
For this purpose fix the **WIDE** side of "L" horizontally; then adjust the inner distance of the forklift's forks to 47cm so you can lift the machine and place where needed.



B) Lifting using ropes
For this purpose fix the **NARROW** side of "L" horizontally; then use existing 20mm holes on the narrow side to fix eye-bolts (not included) and attach to them the security lifting slings.



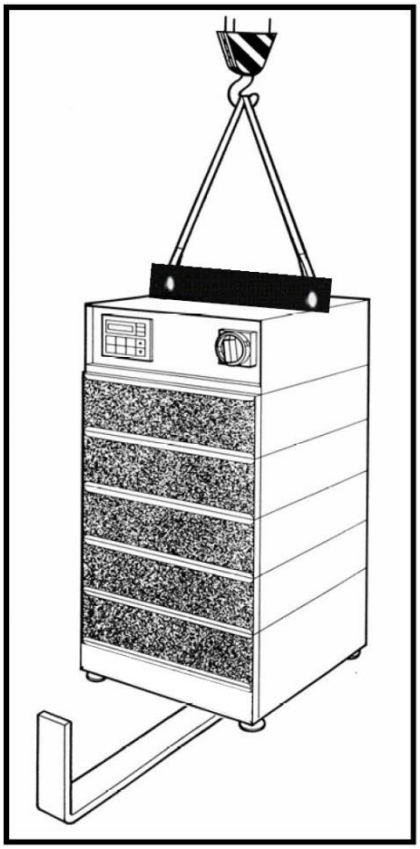
Security lifting slings must have the same length from top to bottom on each side to avoid balance difference on the supporting of machine's weight. The maximum distance allowed from the top part of the machine to the union of the security lifting slings must be 50cm. Weight must be distributed in equal parts along the ropes.

After machines are placed in their final positions, "L" section bars must be removed to reduce side space. Keep "L" section bars for future usage.

For more pictures about lifting solution using ropes, visit www.crspower.com

Q500B models

To uplift the machine, hook the bar with a small manual crane or use a forklift and place where needed. In the case where a forklift is used, the help on land of a second operator is necessary to keep the machine in balance during the movement.



6.2. Location

The machine must be installed:

1. Away from sources of heat.
2. Indoors in an area with enough natural airflow.
3. In the absence of the required aspiration of fumes, install the machine below the level of the tank so that the fumes do not affect the aspiration zone.
4. In order to favor the thermal dispersion and the maintenance operations, surrounding space on each side of the rectifier needs to be 50 cm on top, right, left, back sides and 100 cm on front side.
5. According to the IP / NEMA protection degree declared by CRS for the rectifier, and anyway absolutely avoid the use of the machine in the presence of conductive / aggressive liquids (watery solutions, acids and alkaline solutions, etc.).
6. Ensure that the operational surrounding area is dry, as all the objects present in it, including the machine.
7. Place the machine in an environment with a maximum temperature of 40°C
8. Taking into account about operator access for service and maintenance operations (see chapter 10)

6.3. Power Supply Cables

- Max input AC current per phase is reported on the identification data label placed on the rear of each rectifier.
- The power supply cables must be sized according to RMS input current (Iin_max) considering a proper insulation according to the RMS mains input voltage and their installation method.
- Refer to the international standard IEC 60364 “Electrical installations of buildings” part 5-52 “Selection and erection of electrical equipment” 2nd edition 2001-08” for the correct sizing of mains power supply cables.

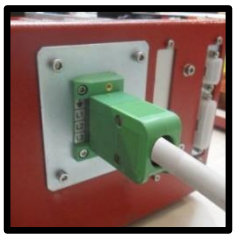
6.4. Connection to the Main Line

Each machine needs to be connected to the main line according to the following points:

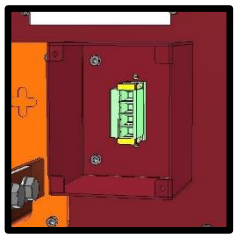
1. A manual circuit-breaker of an appropriate dimension pre-calculated as indicated in chapter 6.3.
2. Main line connections must be done by:

   Q100 model: 3 phases and PE cables connected with proper socket/plug system, provided with rectifier.
   Q150 model: 3 phases and PE cables connected with proper socket/plug system protected by AC box.
   Q300 model: 3 phases and PE cables connected with nuts and washers (provided with rectifiers) to screws on AC input box
   Q500B model: - Up to 160A input current per phase: 3 phases connected to the main NH fuse holder inside AC box
   - Above 160A up to 230A input current per phase: 3 phases connected to terminal blocks inside AC box
   - PE cable connected with nuts and washers (provided with rectifiers) to screw on main AC input box

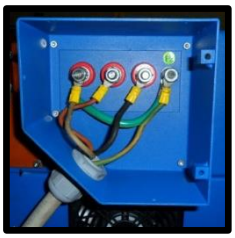
   For Q150, Q300 and Q500B models, input cable must be passed in a cable gland (min. IP43) with suitable dimension, fixed on metal input box. In order to assemble cable gland, the existing hole on metal input box must be enlarged according cable gland specification.



Q100



Q150



Q300



Q500B
up to 160A input



Q500B
above 160A input

6.4.1. E.M.C. filters

All Q150, Q300 and Q500B machines are supplied with E.M.C. filter installed.

6.4.2. Fuses

Quasar machines are supplied with below fuses, according to each model:

Q100 models
- On CPU card> Smd fuses are mounted on board (contact CRS technical office for information)
- Module fuses> N. 3 fuses 10x38mm gG/gL. Fuse values are reported on the identification label of the machine (for UL compliance version 10x38 LP-CC type)

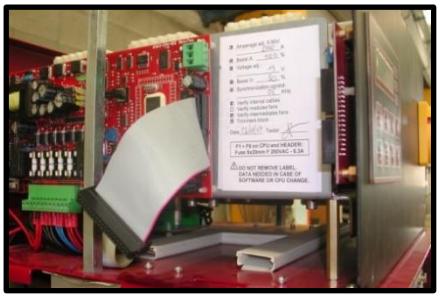
Q150 models
- On CPU card> Smd fuses are mounted on board (contact CRS technical office for information)
- Module fuses> N. 3 fuses 10x38mm gG/gL. Fuse values are reported on the identification label of the machine (for UL compliance version 10x38 LP-CC Type)

Inside header (auxiliary transformer)> 3 fuses 10x38mm GG. Fuse values are reported on the identification label of the machine (for UL compliance version 10x38 LP-CC Type) .

Q300 models
- Inside header (auxiliary transformer)> N.3 fuses 10x38mm GG. Fuse values are reported on the identification label of the machine (for UL compliance version 10x38 LP-CC Type) .
- On CPU card> Smd fuses are mounted on board (contact CRS technical office for information)
- Module fuses>N. 6 fuses 10x38mm gG/gL per each power module (3 on each side). Fuse values are reported on the identification label of the machine (for UL compliance version 10x38 LP-CC Type) .

Q500B models
- External (Main fuses)> N.3 fuses NH00 gG/gL enclosed on an external fuse holder NH00 690V/160A, located in the AC input box. User must connect the main AC input directly to the external fuse holder. Fuse values are reported on the identification label of the machine.
- Inside header (auxiliary transformer)> 3 fuses 10x38mm GG. Fuse values are reported on the identification label of the machine(for UL compliance version 10x38 LP-CC Type) .
- On CPU card > Smd fuses are mounted on board (contact CRS technical office for information)
- Module fuses > N.6 fuses 10x38mm gG/gL for each power module (3 on each side). Fuse values are reported on the identification label of the machine (for UL compliance version 10x38 LP-CC Type)



6.5. Connection to the Treatment Tank

Connect the output power bars of the machine (See Fig. 13) to the treatment tank with a cable or with a copper plate of appropriate dimensions, taking particular care on locking the screws, considering the currents involved.

Deoxidize the output power bars of the machine with emery cloth and apply some ELECTROLITIC copper-based grease.
Only the positive output pole of the machine can be connected to the earth.

The dimensions of the output power bars are reported in “CRS_Qxxx_Conf_Spec” document.

Size theoutput bars of the connection between rectifiers and tanks according to the material/cables used for the connection, number of bars paralleled and their orientation, ambient temperature, maximum working temperature of the bars/cables accepted, max voltage drop accepted.

WARNING!
Ignoring the rules listed here under could cause serious damage to the internal power components of the machine:

1. The output power bars of the machine have to be used only for the purpose of electrical connections and not as a mechanical support.
2. Avoid absolutely that the weight of the cables or copper plates starting from the machine to connect the tanks create torsions on the output bars of the machine.
3. Make the output connections paying particular attention not to pass near the signal / communication cables from/to other machine. This is to avoid that the high currents involved may disturb the electronic equipment.

6.6. Machines with Water Cooling System

		Q100 model	*Q150 model*	*Q500B model*
NOMINAL TEMP. OF INPUT WATER	**T-NOM**	19 - 28°C		
MAX. TEMP. OF INPUT WATER ADMITTED	**T-MAX**	35˚C		
DERATING	**-**	-2% of Iout for every 1˚C above 28˚C		
ΔT OUTPUT WATER	**ΔT**	+7 ˚C of T-MAX		
MAX. PRESSURE	**P-MAX**	9 bar		
WATER FLOW *	**Q**	See below method of calculation, depending of configuration and output power		
MAX. PRESSURE DROP *	**ΔP**	$\Delta P\ [bar] = Q^2 * \left(1.8 + \frac{2.71}{Config.}\right) * 10^{-3}$ Notes: - "Q" is the water flow [L/min] - "Config." is the total number of power modules, reverse modules and intermediates.You can easily use the first two digits of the configuration code of the rectifier. (e.g. configuration 04-1i2, use "Config."= 4 / configuration 10-2i4i2, use "Config."= 10)		
OPERATING AMBIENT TEMPERATURE	**T-AMBIENT**	40 °C		40°C (Up to 50°C with a derating of -10% of Iout, in addition at any derating applied for every 1°C above 28°C of input water)

* Accurate values are supplied with quotation or they can be calculated with "Quasar_Dimensioning". Values are present on rectifier's identification label.

6.6.1. Water flow dimensioning

To calculate a preliminary and estimated water flow rate in L/h for a correct cooling of each machine's tower, proceed as follows:

(1) Calculate the power loss: ***P****Loss (W) = ((****V****out * ****I****out)/****Eff****) - (****V****out * ****I****out)*

(2) Calculate the water flow rate per tower: ***Q*** *(L/h) = ((****P****Loss * 3600) / (4190 * 7))*

V*out* : Output voltage (V)

I*out* : Output forward current (A)

V*in* : Mains line voltage (Vac)

E*ff* : Rectifier efficiency - Contact our technical center for rectifiers' efficiency

6.6.2. Conversion of PLoss in other units

To calculate the power loss ***P****Loss* in watts follow points 1, 2 and 3 of chapter 6.6.1.

In Fr/h (Frigorie per hour)
1 watt (W) = 0,860 Fr/h

In Btu/h (British thermal unit per hour).
1 watt (W) is approximately 3.413Btu/h
1 horsepower (hp) is approximately 2,544Btu/h
1 "ton of cooling" is 12,000Btu/h

6.6.3. Condensation parameters

Condensation will occur if the water input temperature (°C) is below or equal to the value indicated in the below table which is between the relative humidity (%) and the air temperature (°C):

	Relative Humidity %														
Air Temp °C	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30
50	-	-	-	-	-	-	-	-	-	-	-	35	33	31	28
45	-	-	-	-	-	-	-	-	-	34	32	31	28	26	24
43	-	-	-	-	-	-	-	35	34	32	31	29	27	24	22
41	-	-	-	-	-	35	34	33	32	29	28	27	24	22	19
38	-	-	-	35	34	33	32	30	29	27	26	24	22	19	19
35	35	34	33	32	31	30	29	27	26	24	23	21	19	19	19
32	32	31	31	29	28	27	26	24	23	22	20	19	19	19	19
29	29	28	27	27	26	24	26	22	21	19	19	19	19	19	19
27	27	26	25	24	23	22	21	19	19	19	19	19	19	19	19
24	24	23	22	21	20	19	19	19	19	19	19	19	19	19	19
21	21	20	19	19	19	19	19	19	19	19	19	19	19	19	19

Safe operating area

(min. water input temperature to avoid condensation)
Max water temperature is 28 °C

Derating area

(min. water input temperature to avoid condensation)
Max water temperature is 35 °C, applying derating of -2% of I_{out} for every 1 °C above 28 °C

Not allowed area

6.6.4. Water specifications

The use of softened water, or even distilled or demineralized, is counterproductive and potentially aggressive, especially for amphoteric metals, and thus aggravating the problems related to corrosion. Therefore it is suggested the use of harder water, respecting the limits laid down in the table and sustain them with a proper chemical conditioning of the water.

WATER SPECIFICATION FOR WATER CIRCUIT **WITH** ALUMINUM PARTS

Analytical parameters	***Unit of measure***	***Maximum values of recirculated water***			
		Starting water	***With Pragma Chimica additives for water cooling system (CWT171 and PRAGMABIO420)***	***With Cortec additives for water cooling system (VpCi-649 BD)***	***With Pragma Chimica additives for glycolated cooling system (SANOTHERM MC 500)***
pH (25°C)	pH	7-8	7-8	7-8	7-8
Conductivity	µS/cm	Max 500	Max 500	Max 500	Max 500
Chlorides	mg/l	Max 100	Max 100	Max 100	Max 100
Total hardness (french degrees)	°f	Max 14	Max 14	Max 14	Max 14
Total hardness (german degrees)	°d	Max 8	Max 8	Max 8	Max 8
Total hardness (english degrees)	°e	Max 10	Max 10	Max 10	Max 10
Ammonium (NH4)	mg/l	Max 0.5	Max 0.5	Max 0.5	Max 0.5
Bacterial contamination	cfu/ml	$\leq 10^4$	$\leq 10^4$	$\leq 10^4$	$\leq 10^4$
Glycol (if used *)	%	-	-	-	≥ 30
Molybdenum **	mg/l	-	≥ 80	≥ 30	-

Table 2a

* use glycole in case of potential freezing problems also associated to long inactivity periods.
** Molybdenum must be checked only in presence of corrotion inibhitors from Pragma or Cortec and their related concentration.

WATER SPECIFICATION FOR WATER CIRCUIT **WITHOUT** ALUMINUM PARTS

Analytical parameters	***Unit of measure***	***Maximum values of recirculated water***			
		Starting water	***With Pragma Chimica additives for water cooling system (PRAGMABIO420)***	***With Cortec additives for water cooling system (VpCi-649 BD)***	***With Pragma Chimica additives for glycolated cooling system (SANOTHERM MC 500)***
pH (25°C)	pH	8-9.5	8-9.5	8-9.5	8-9.5
Conductivity	µS/cm	Max 500	Max 500	Max 500	Max 500
Chlorides	mg/l	Max 100	Max 100	Max 100	Max 100
Total hardness (french degrees)	°f	Max 14	Max 14	Max 14	Max 14
Total hardness (german degrees)	°d	Max 8	Max 8	Max 8	Max 8
Total hardness (english degrees)	°e	Max 10	Max 10	Max 10	Max 10
Ammonium (NH4)	mg/l	Max 0.5	Max 0.5	Max 0.5	Max 0.5
Bacterial contamination	cfu/ml	$\leq 10^4$	$\leq 10^4$	$\leq 10^4$	$\leq 10^4$
Glycol (if used *)	%	-	-	-	≥ 30
Molybdenum **	mg/l	-	-	≥ 30	-

Table 2b

* use glycole in case of potential freezing problems also associated to long inactivity periods.
** Molybdenum must be checked only in presence of corrotion inibhitors from Pragma or Cortec and their related concentration.

Refer to document **„CRS Quasar Water Cooling System "** for a complete guide relating to the treatment of the supply water and recirculating of closed cooling circuit, as well as the chemical and physical parameters to be met in order to allow a proper management of the same and contributing to the reduction of the typical drawbacks of such circuits. The observance of this document assures the efficiency and maintenance of the cooling system avoiding problems such as corrosion, deposit formation or fouling.

WARNING!
The use of water that contains foreign objects can cause problems such as pipe's obstructions of the water cooling system. Install a suitable filter (strainer) immediately upstream from the rectifier (or the solenoid, if present). As general rule, use 50 mesh. The starting water must have a maximum concentration of suspended solids less than 30 mg/l.

6.6.5. Conversion units of Total Hardness

1°f = 10 mg/l of $CaCO_3$ = 10 ppm
1°f = 1.78 °d
1°f = 1.42 °e

6.6.6. Required products

WARNING!
To protect the water cooling circuit the following products from either Pragma Chimica or Cortec are required. Not using these products (or other products previously approved by CRS) will invalidate any warrantee related damages to the rectifier due to corrosion, deposit formation or fouling.

PRAGMA CHIMICA
Viale dell'Industria 48/b
36071 Arzignano - Vicenza - ITALY
Phone: +39 0444 451373
Fax: +39 0444 452153
Web page: www.pragmachimica.it

Reference : Ignazio Tonin - Ignazio@pragmachimica.it

Additives

WATER COOLING SYSTEM

- ***CWT 171***
  Recommended dosage of 1% (Kg) of the water contained in the system (L or m³).
- ***PRAGMABIO 420***
  Recommended dosage of 0,1% (Kg) of the water contained in the system (L or m³).
- ***PRAGMABIO 3600*** *(alternative to PRAGMABIO 420)*
  Recommended dosage of 1% (Kg) of the water contained in the system (L or m³).

NOTE: PRAGMA3600 is used as alternative to PRAGMABIO 420 if a product classified as non hazardous is required and therefore not subject to specific regulations for the transport

GLYCOLATED COOLING SYSTEM

- ***SANOTHERM MC 500***
  Recommended dosage of 35% (Kg) of the water contained in the system (L or m³).

NOTE: SANOTHERM MC 500 and CWT171 must not be used together

Cleaning

WATER COOLING SYSTEM

- ***PRAGMACLEAN 330***
  Recommended dosage of 10% (Kg) of the water contained in the system (L or m³).
- ***CWT 181***
  Recommended dosage of 1% (Kg) of the water contained in the system (L or m³).

GLYCOLATED COOLING SYSTEM

- ***SANOTHERM 700***
  Recommended dosage of 10% (Kg) of the water contained in the system (L or m³).

CORTEC CORPORATION
4119 White Bear Parkway - St. Paul, MN 55110 U.S.A.
Phone: +1 651-429-1100
Fax: +1 651-429-1122
Toll Free: 1-800-426-7832
Web page: www.cortecvci.com
Reference :
China - Michael Qiu - mqiu@cortecvci.com
India - P.K. Mathew - pk.mathew@cortec-india.com
Mexico - Monica Tarragona - mtarragona@aishouston.com
Europe - Ivana Radic Borsic - iborsic@cortecvci.com

Additives

- ***VpCI-649 BD***
  Recommended dosage of 0,5% of the water contained in the system.
- ***S-16***
  Recommended dosage: max 0,5% of the total volume of VpCI-649 BD.

Cleaning

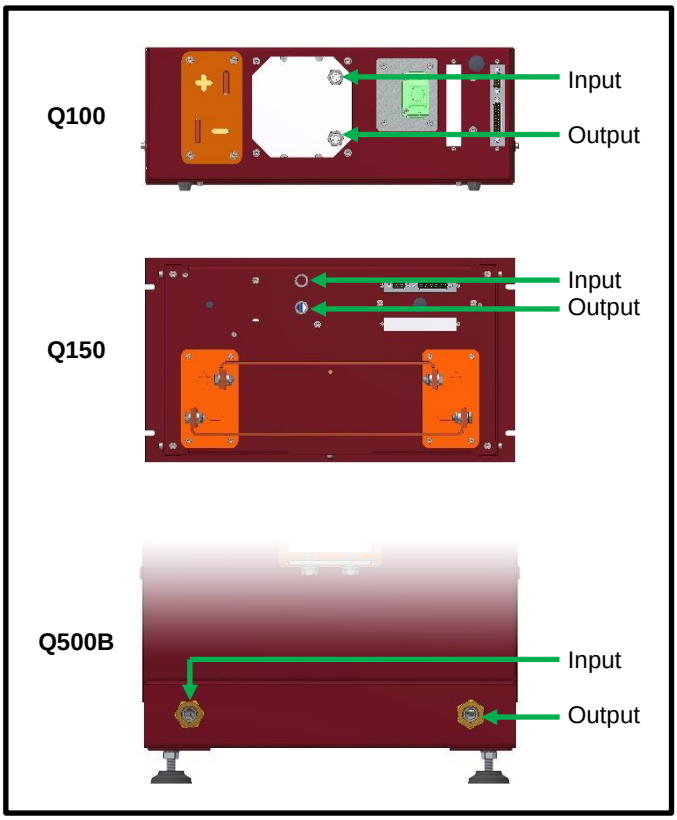
- ***VCI-414***
  Recommended dosage of 5% of the water contained in the system.

Corrosion remover

- ***VpCI-426***
  Recommended dosage of 50% of the total volume (water 1:1 solution).
  OR
- ***VpCI-426 Powder***
  Recommended dosage of 28% of the water contained in the system.

6.6.7. Water cooling circuit connection

1. Input and output connections of the water cooling circuit are located at the rear of the machine, indicated with the labels.
2. Connect the machine to a water cooling circuit with an appropriate capacity.
3. If the installed rectifier doesn't have the option of a sensor that measures the flow rate, install in the outside hydraulic circuit a sensor that detects and indicates when water flow is below the minimum required value.
   The machine has a solenoid switch that close the water circulation inside the machine and prevents the condensation during the inactivity time of the machine.
4. Check periodically if water quality is according to the specifications provided and periodically replace the cooling water if it is not compliant.

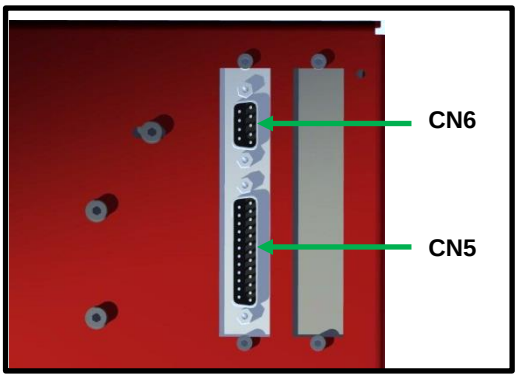


WARNING!
The inversion of input and output water connections can severely damage the machine.

7. RECTIFIER REAR CONNECTORS / COMMUNICATION PORTS

All Quasar machines are supplied with 2 male connectors Sub-D:
- CN5 (DB 25 pins male) and CN6 (DB 9 pins male).
- both ports are located at the rear of the machine.

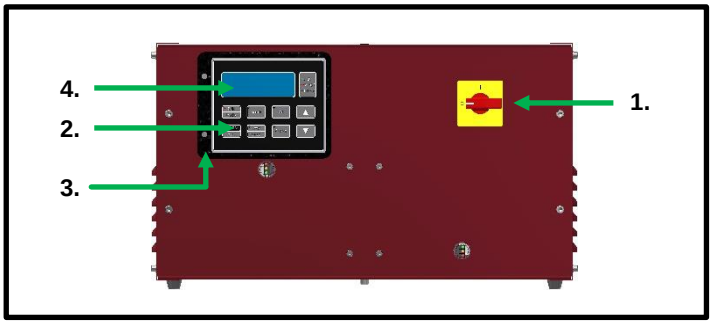
These connectors are used for different purposes: as interfaces with the daughter boards, to connect the rectifier to RS485 network and control some external devices by means of digital input / output ports.
Some of the pins can be configured for a proper function, please refer to the firmware manual of your machine for more details.



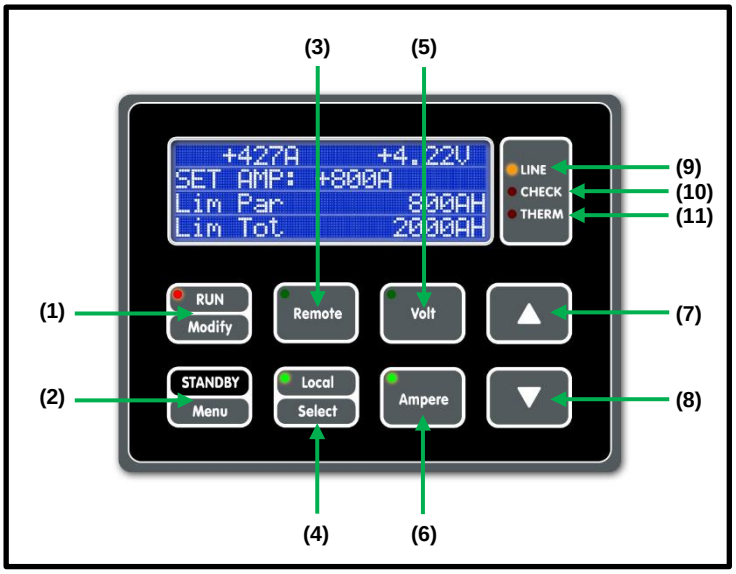
8. OPERATION

8.1. Operator control panel

The operator panel is composed by the following parts:
1. Main switch I/O, its rating depend on the model and size of the machine
2. Keyboard (See chapter 8.1.1)
3. Frame to protect the keyboard
4. Display, 4 rows in blue backlight.



8.1.1. Keys and indicators



(1) RUN/Modify	Function1:	Machine start in manual operation mode
	Function2:	In configuration Menu permits to save the data
	LED ON:	Machine started
	LED OFF:	Machine stopped (STAND-BY mode)
(2) STANDBY/Menu	Function1:	Machine stop (STAND-BY mode)
	Function2:	Access and Exit on main configuration Menu
(3) Remote	Function:	Automatic mode selection
	LED ON:	Machine operating automatically
	LED FLASHING:	Receiving data from serial communication ok
(4) Local/Select	Function1:	Manual mode selection
	Function2:	Sub-menu selection on main configuration menu
	Function 3:	Data modification on configuration menu
	Function 4:	Data Modify and Save for WAVEFROM and PATTERN
	LED ON:	Machine operating manually
	LED FLASHING:	Receiving data from serial communication ok
(5) Volt	Function:	Selection of voltage driving mode
	LED ON:	Machine in voltage driving mode
(6) Ampere	Function:	Selection of current driving mode
	LED ON:	Machine in current driving mode
(7) ▲	Function:	Increase value
(8) ▼	Function:	Decrease value
(9) LINE	LED ON:	The main input voltage is present.
(10) CHECK	LED FLASHING:	Anomaly encountered, which could be: a) Fail on a power module. b) Set point error c) Under voltage d) Over voltage e) Thermal protection
(11) THERM	LED ON:	Thermal protection in one of the modules

8.2. Starting Up

WARNING!
Before starting up the machine read carefully the safety regulations reported in chapter 3.

IMPORTANT: If no load is connected to the output power bars, the machine is not able to supply current or voltage, therefore ensure that there is a minimum load connected to the machine before switching it ON.

1. Turn the main switch I/O in position “I“ (ON)

   The LED on **LINE** will light up if power is available. Either the LED on the **AUTOMATIC** or **MANUAL/SELECT** key will light up depending on the mode previously used. Either the **VOLT** or **AMPERE** LED will light up depending on the previous usage.

   A carousel will appear on the display bearing the name of the manufacturer and the identification of the software installed; Example of software: CRS QV90_XX.YYY.Z,
   CRS = Manufacturer
   QV90 = Software name installed in DC/DCR and PP/PPR slow machines.
   P090 = Software name installed in PP/PPR fast machines
   XX= (numerical data) Revision of the CPU in which the software is istalled.
   YYY= (numerical data) Revision of the software.
   Z= this number is reserved to special firmware.

2. At this stage, the machine is in STANB-BY mode and it is ready to supply current or voltage in any of the following modes:

   - Manual operation mode
   - Automatic operation mode

If no any error are detected, see Chapter 9, the machine will display the message RECTIFIER OK

8.3. Operation testing

1. Short the outputs bars connecting positive and negative together with a wire of adequate size.
   Caution: the machines with output voltage > 50 V must be tested under load that permits to achive minimum 10 % of the full voltage of the machine.

2. Set the machine in MANUAL operation mode by clicking the **MANUAL/SELECT** key once and then set the machine in current driven mode by clicking **AMPERE** key; the green LED's of both keys should be lit at this time.

3. Start the machine by clicking **ON/MODIFY** key; its red LED will light up.

4. Press the ▲ key until you read 2-5 % of the full output current on the display; then release the ▲ key. If the current on the display goes down to 0.0 A after releasing the ▲ key, the machine is failing; otherwise it means that the forward current hardware is working fine.

5. If the machine has the reverse polarity feature (DCR & PPR type) and the previous step was done successfully, then set the current to zero amperes by pressing the ▼ key until you read 0.0 A on the display: when 0.0 A have been reached, release the ▼ key. Press the ▼ key again until you read 2-5 % of the full output current on the display; then release the ▼ key. If the current on the display goes to 0.0 A after releasing the ▼ key, the machine is failing, otherwise it means that the reverse current hardware is working fine.

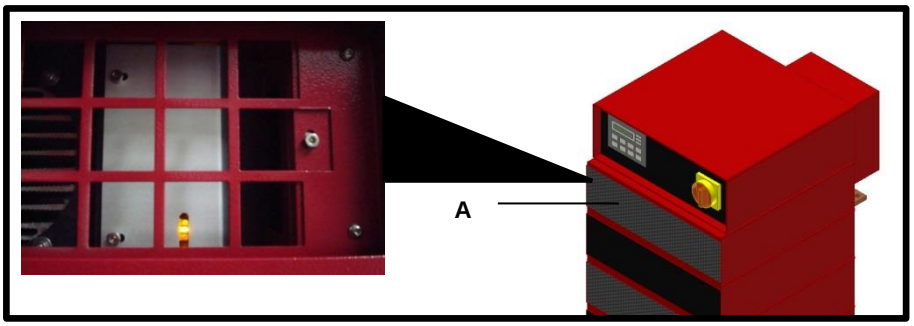
9. ERROR and MESSAGE TRACING

9.1. Machine Error Indicators

The errors are shown on the display of the machine through a numerical code (EXX) and a short description.
Siome of them are stored on CPU card, saved as LOG and checked at the display of the machine and/or with CRS Software manager program. In case the rectifier is connected through a fieldbus protocol , the LOG can be sent to PLC/Scada.
For errors map details refer to CRS software manual of the rectifier.

9.2. Power Module Error Indicators

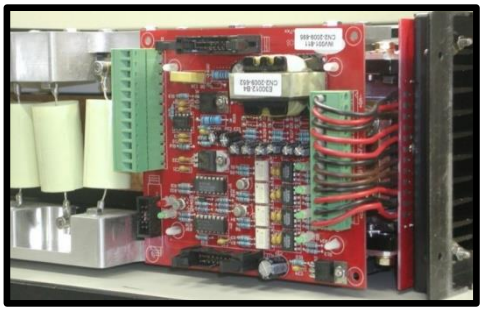
All power modules have 3 LED: **red, yellow and green** which indicate the state of the module. These LED are visible by removing the *filter A* from its respective external lid and looking through the window of the internal cover of the module. In water cooled machines you will find a round sight glass to check the status of the LED



REF	INDICATOR	CONDITION OF THE POWER MODULE	WHAT TO DO
A	ON OFF OFF	**A1**. If the machine is in STAND-BY mode, then the power module is in its normal stand-by condition (not supplying current). **A2**. If the machine is started, then the power module or the CPU card inside the header can have a problem.	In case of condition A2, Please contact a CRS Service center, The CPU or the module have to be replaced.
B	ON ON OFF	**B1**. If the machine is started, then the power module is in its normal functioning condition (supplying current). The intensity of the yellow LED is directly proportional to the intensity of the supplied current and therefore with low current values, yellow led may not be visible. **B2**. If the machine is working but the yellow LED is off, it means that power module is FAULTY. **B3** the yellow LED is ON but the machines is not delivering the correct current.	In case of condition B2. Please switch off the machine and check at the first the fuses of the power module. If the fuses are blown the primary IGBT stage of the module is in short circuit. The module has to be replaced. If the power fuses are fine then could be a problem in the CTRL card or in the output stage. The module has to be inspected. Please contact the CRS Service Center. One of the 3 fuses of the power module is blown. Replace the fuses.
C	ON OFF ON	**C1** Power module is not functioning as it is in THERMAL condition (overheating); in this case the machine keeps working with a reduced power, accordingly to the gravity of the anomaly. When temperature of the power components of the power module returns to normal, the power module will go to condition **B1**. **C2** In stand by mode, or after the module is cooled down, the red LED remain ON. (the thermal error is not resettable)	The module has to be inspected: In case of air cooled modules check if the fans are fine; if the machine is water cooled, check if there is obstruction in the pipes In case of frequent overheating of the module, replace the power module, see also Chapter 9.1. The CTRL card of the module is faulty, it is necessary to remove the module and replace the card.
D	OFF OFF OFF	The power module is completely FAULTY.	Replace the power module.

9.3. Reverse Module Error Indicators

The primary function of the reverse module is to change the output current direction; this is accomplished with a full bridge of MOSFET components, driven by the CPU of the machine. The interface between the CPU card and the MOSFET bridge is the INV001 card, located on the left side of the reverse module.

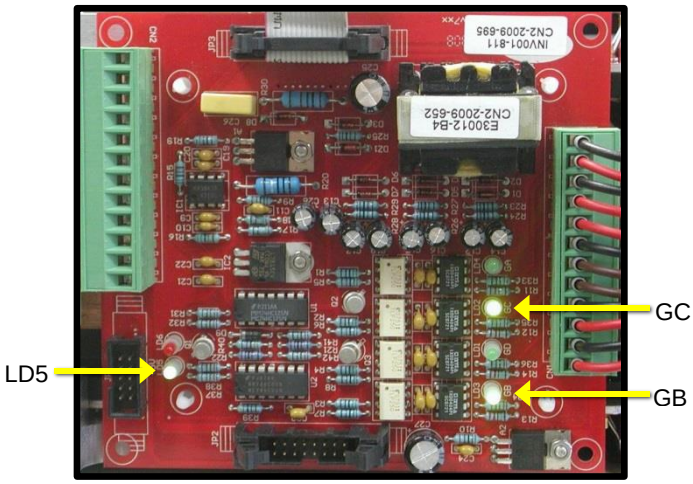


WARNING!
Never remove load while the machine is under working conditions (supplying forward or reverse current). The extra-voltage caused by this operation can easily damage the module MOSFET components, even if some protections are provided to avoid this.

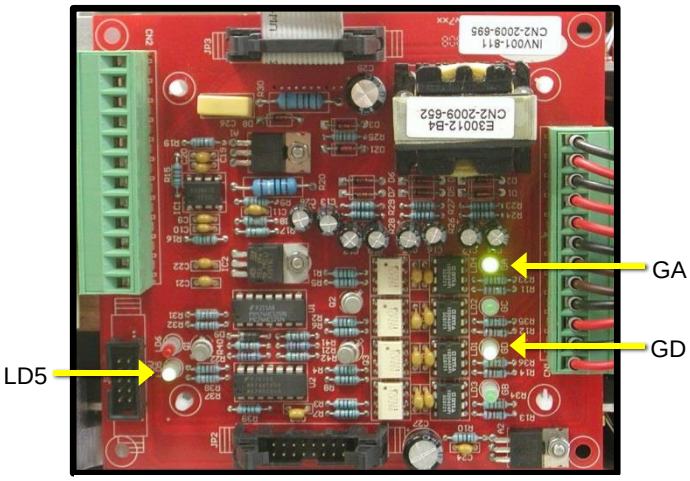
INV001 Card

The INV001 card has five green led indicators (LD5 for power indication and GA, GB, GC & GD for forward/reverse direction indication) and one red led indicator LD6 for thermal condition indication of MOSFET bridge.

Under normal working conditions (i.e. no thermal condition), green led LD5 must be ON while red led LD6 must be OFF:

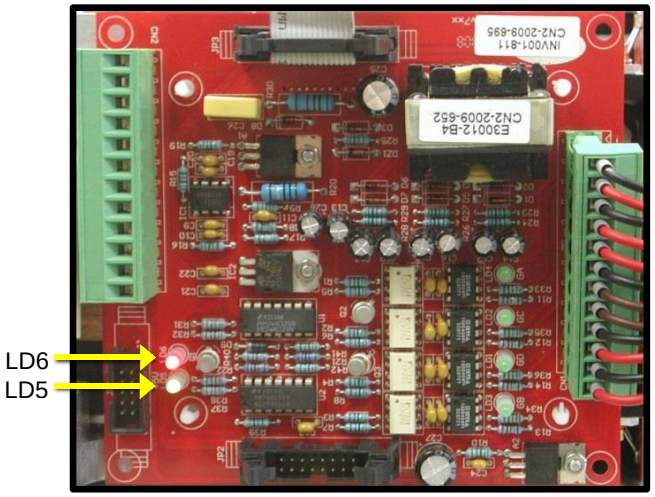


Normal working condition - forward (LD5, GB and GC must be ON)



Normal working condition - reverse (LD5, GA and GD must be ON)

Under thermal condition, the green led LD5 and red led LD6 must be ON, while the 4 green leds for forward / reverse direction indication must be OFF:



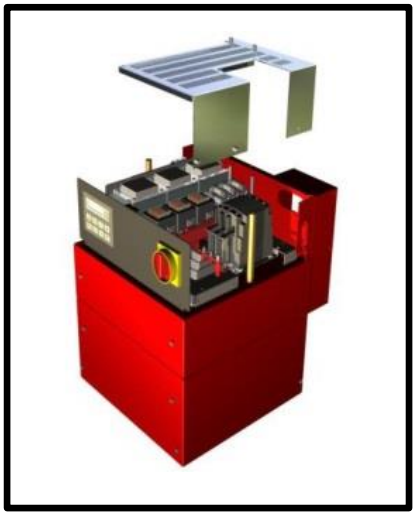
Thermal condition (LD5 and LD6 must be ON)

Important: after a thermal fault is detected the output power is shut down to 0 and the machine goes in stand by mode.
To restart to delivery the output power, after the issue is solved and the machine is cooled down, is necessary to switch OFF / ON the I/O switch in the operator panel

10. PROGRAMMED MAINTENANCE

The machine does not need a programmed maintenance with regards to the operating functions. The only maintenance needed regards the cleaning of the filters and the cooling elements such as the analysis of the cooling water and its correct treatment.

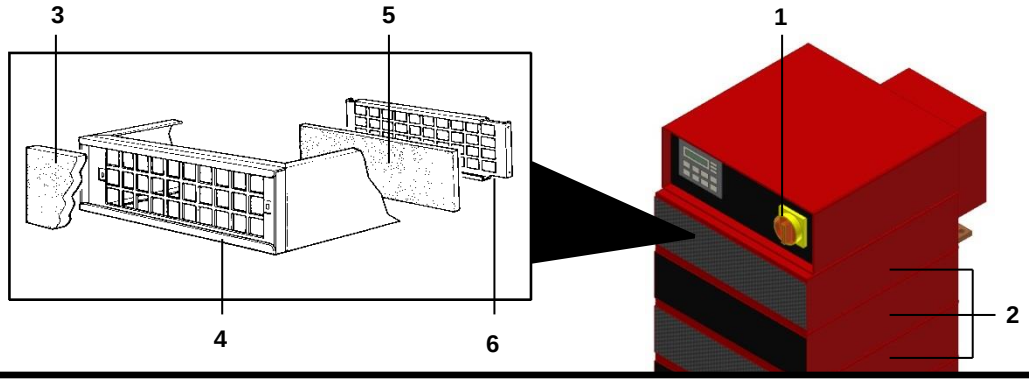
WARNING!
The maintenance of the machine must be in compliance with safety regulations.
Before carrying out any maintenance and service operation on the rectfier, it is mandatory that the machine is turned OFF from the main switch on the operator panel.
! Pay attention: with I/O swiched OFF, it is possible to remove the external metallic covers and acces to the power modules and to the CPU board. if necessary to make service the AC box and remove the metallic grid inside the header, THE MACHINE MUST BE ELETTRICALLY DISCONNECTED FROM THE MAIN LINE.



After turning the I/O switch OFF make sure to wait for at least 2 minutes until all residual voltage inside the machine is discharged. In addition pay attention don't touch the cooling elements which can reach a temperature of 80°C during operation.

10.1. Air Cooled Machine

1. Main switch
2. Lids
3. External filter
4. External grid
5. Internal filter
6. Internal grid



The scheduled cleaning may prevent the presence of air polluting elements in the filters and in the cooling elements.

WARNING!
The lack of cleaning may cause irreparable damages to the machine.

10.1.1. Filters

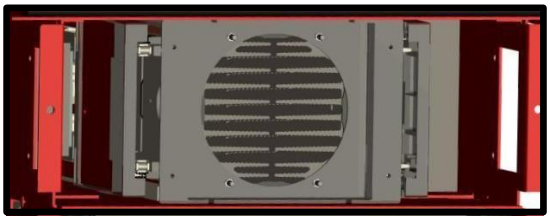
External and internal polyurethane filters need to be cleaned at least once every 3 months and be replaced with new filters once a year.

External Filters - of power modules and intermediate cooling units
1. Turn the main switch I/O in position “O“ (OFF) and wait for at least 2 minutes until all residual voltage inside the machine is discharged.
2. Extract the external filters (3) from their respective external grid (4).
3. Replace or clean the external filters. Use water to clean filters and let them dry before placing them back again.
4. Place back the external filters (3).

Internal Filters - of intermediate cooling units
1. Turn the main switch I/O (1) in position “O“ (OFF) and wait for at least 2 minutes until all residual voltage inside the machine is discharged.
2. Remove the lids (2). Pay attention on the cooling elements which can reach a temperature of 80°C.
3. Extract the internal filters (5) from their respective internal grid (6).
4. Replace or clean the internal filters. Use water to clean filters and let them dry before placing them back again.
5. Place back the internal filters (5).
6. Place back the lids (2).

10.1.2. Cooling elements

1. Turn the main switch I/O in position “O“ (OFF) and wait for at least 2 minutes until all residual voltage inside the machine is discharged.
2. Remove the lids. Pay attention on the cooling elements which can reach a temperature of 80°C.
3. Extract the internal filters from their respective internal grid.
4. Clean the processing residue deposited on the cooling elements. This operation needs to be carried out using compressed air.
5. Place back the internal filters.
6. Place back the lids.



10.2. Water Cooled Machine

The inspection of the required water parameters must be performed every 6 months.
Please refer to paragraph 6.6.4. “Water specifications“ for further details.

10.3. Condition of the cables

Check periodically the condition and the aspect of the insulation of power cables starting from the AC box of the machine.

10.4. Replacement of Components

WARNNG!
Before replacing any component make sure to switch OFF the machine from the main I/O switch on the operator panel. After turning it OFF make sure to wait for at least 2 minutes until all residual voltage inside the machine is discharged. In addition pay attention to the cooling elements which can reach a temperature of 80°C.

10.4.1. Replacement of the power module

1. Turn the main switch I/O in position “O“ (OFF) and wait for at least 2 minutes until all residual voltage inside the machine is discharged.
2. Unscrew the external screws of the corresponding lid protecting the power module and remove lid. If power module is air cooled, additionally remove the corresponding external filter. Pay attention on the cooling elements which can reach a temperature of 80°C.
3. Unscrew the external screws of the corresponding external grid and remove grid.
4. Unscrew all screws that secure the power module. Right side screws are indicated on Fig 10.4.1.a with numbers 1 to 6.

5. Remove the protections of each side of the power module. Right side protections are indicated on Fig 10.4.1.a with letters A and B.
6. Disconnect the primary line wires R, S and T, and the flat cables C and D by unclamping its connectors, indicated on Fig 10.4.1.b (if power module is air cooled) and Fig 10.4.1.c (if power module is water cooled). See also Fig 10.4.1.d for further details. If power module is water cooled, additionally unscrew the water circuit tubes indicated on Fig 10.4.1.c with letters E and F.
7. Disconnect the 3 wires R1, S1 and T1 from the rack module fuse holder of each side of the power module, indicated on Fig 10.4.1.b (if power module is air cooled) and Fig 10.4.1.c (if power module is water cooled). Take out the wires through the hole, very carefully, in order to avoid their damage.
8. Unscrew the 2 bolts of each side of the power module that connect the power module to the aluminium or copper bus bar system, indicated on Fig 10.4.1.e.
9. Fold the primary line wires R, S and T towards the bottom and the flat cables C and D towards the top and pull out the power module forwards from the rack using both hands, as indicated on Fig 10.4.1.f. Pay much attention to the 3 primary line wires, making sure that they go towards the bottom in order to avoid their damage.
10. To mount the new power module, simply follow the steps from last to first. For the bolts in Fig 10.4.1.e use a mounting torque of 18-20 N·m.

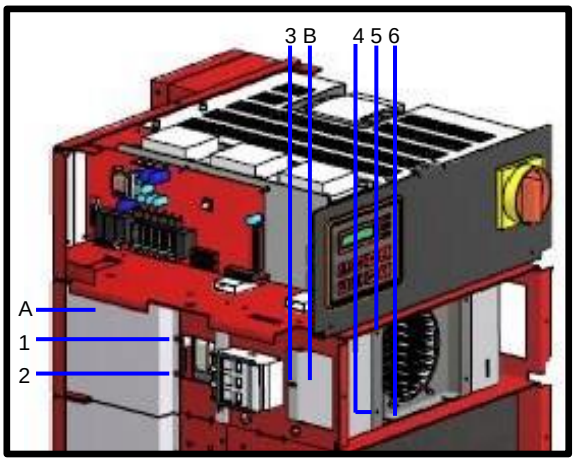


Fig 10.4.1.a



Fig 10.4.1.b

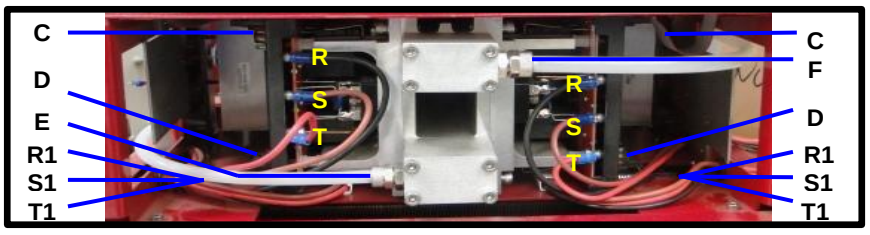


Fig 10.4.1.c



Fig 10.4.1.d

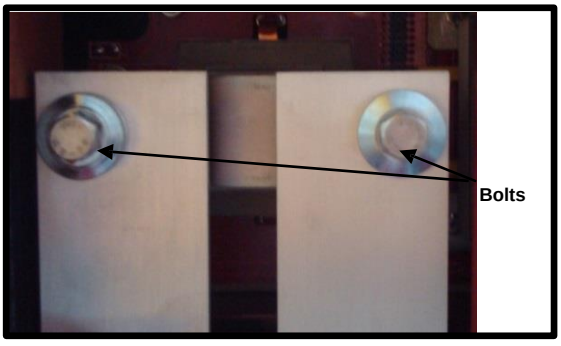


Fig 10.4.1.e

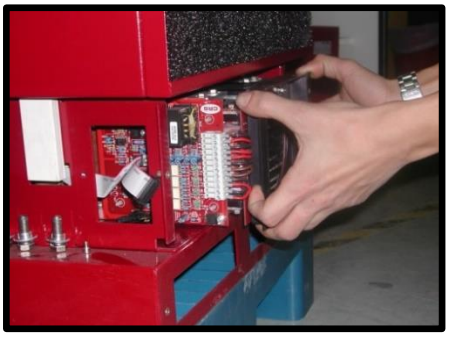


Fig 10.4.1.f

10.4.2. Replacement of the air reverse module

1. Turn the main switch I/O in position “O“ (OFF) and wait for at least 2 minutes until all residual voltage inside the machine is discharged.
2. Unscrew the external screws of the corresponding lid protecting the reverse module and remove lid. Pay attention on the cooling elements which can reach a temperature of 80°C.
3. Remove the corresponding external filter (See Fig 10.4.2.a)
4. Unscrew the external screws of the corresponding external grid (See Fig 10.4.2.b) and remove grid.
5. Unscrew the side screws from the aluminium protections of each side of the reverse module. Right side screws are indicated on Fig 10.4.2.c with the numbers 1 to 5.
6. Remove the 2 aluminium protections of each side of the reverse module. Right side protections are indicated on Fig 10.4.2.c with leters A and B.
7. Unscrew the 2 screws that secure the reverse module, indicated on Fig 10.4.2.e with numbers 1 and 2.
8. Remove the flat cable 16 pin female connecting the reverse module to the CPU card, indicated on Fig 10.4.2.d. This flat cable is held in-place into the card male connector by 2 plastic clamps, indicated on Fig 10.4.2.d with the yellow arrows. Open-up horizontally the 2 clamps with your fingers and the flat cable will be automatically pushed out from the male connector; there is no need to force it out.
9. Unscrew the 4 bolts of each side of the reverse module that connect the reverse module to the aluminium or copper bus bar system, indicated on Fig 10.4.2.f.
10. Rout the flat cable out of the machine and firmly pull out the reverse module forwards from the rack using both hands with extreme care, as indicated on Fig 10.4.2.g.
11. To mount the new reverse module, simply follow the steps from last to first.



Fig 10.4.2.a



Fig 10.4.2.b

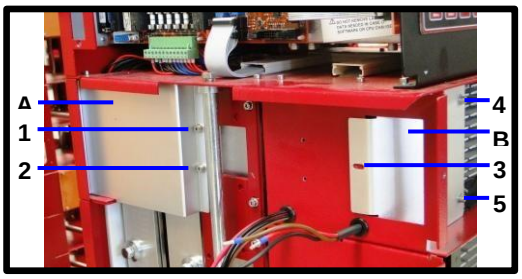


Fig 10.4.2.c

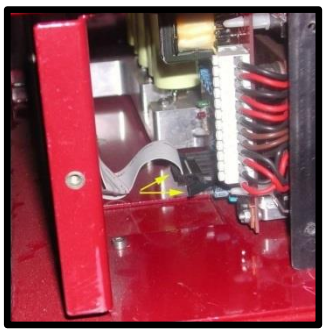


Fig 10.4.2.d



Fig 10.4.2.e



Fig 10.4.2.f

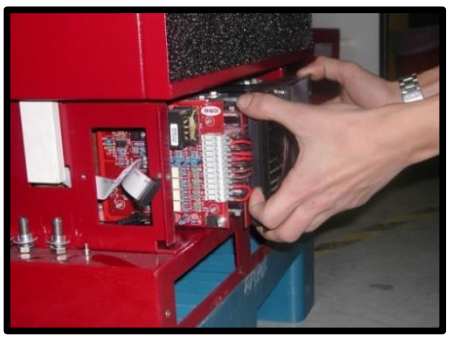


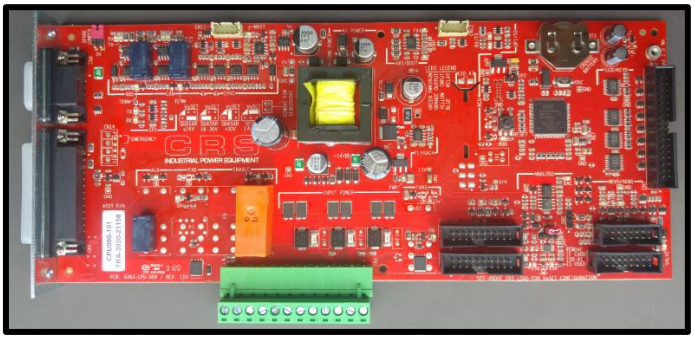
Fig 10.4.2.g

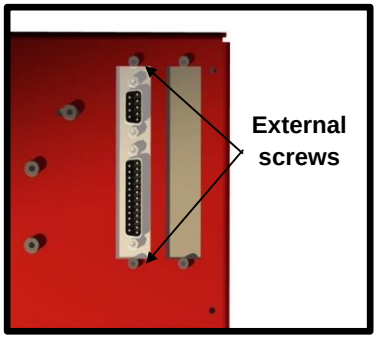
10.4.3. Replacement the CPU card

Check for Revision No of the CPU card before replacing it. The part number is CPU090 and it is written on the label of the board followed by the number of revision. The corresponding software installed is QV090_XX… or P090_XX…, see par. 8.2.

1. Turn the main switch I/O in position “O“ (OFF) and wait for at least 2 minutes until all residual voltage inside the machine is discharged.
2. Unscrew the external screws of the top cover and remove it.
3. Disconnect the flat cable that connects the CPU card to the display, the 2 bus flat cables that connect the CPU card to the power modules and the reverse driving flat cable (if a DCR or PPR machine is installed).
4. Disconnect the CPU power connector pulling it downward.
5. Unscrew the 2 external screws located on the rear of the machine.
6. Remove the CPU card from the 4 plastic supports that are holding it and replace it.
7. Place back all components in the reverse order.







11. STORAGE

In the case of a temporary stop of the machine, it is necessary to store it in a dry and aired environment to prevent the creation of condensation drops which would damage the electric parts.

12. APPENDICES

The appendices are found on the following pages.

12.1. Appendices documents

Contact CRS S.r.l. customer care office to request any of the documents listed below.

No.	CONCEPT	REFERENCE FILE
1	Spare parts - Q500B Air machine - block with covers	Q450-017-R01.pdf
2	Spare parts - Q500B Water machine - block with covers	Q450-018-R01.pdf
3	pare parts - Q500B Air machine - exploded block	Q450-017-R02.pdf
4	Spare parts - Q500B Water machine - exploded block	Q450-018-R02.pdf
5	Spare parts - Q500B Header (up to 160A)	Q450-011-R05.pdf
6	Spare parts - Q500B Header (above 160A)	Q450-010-R04.pdf
7	Spare parts - Q100-Q300-Q500B Operator panel unit kit - 4 lines	Q200-080-R02.pdf
8	Spare parts - Q100-Q300-Q500B Air power module	Q300-100-R01.pdf
9	Spare parts - Q100-Q500B Water power module	Q300-121-R01.pdf
10	Spare parts - Q500B Air reverse module	Q300-160-R01.pdf
11	Spare parts - Q500B Water reverse module	Q300-159-R01.pdf
12	Spare parts - Q100-Q300-Q500B Module primary kit	Q200-107-R01
13	Spare parts - Q500B Intermediate unit	Q100-068-R01.pdf
14	Spare parts - Q500B Fans cooling unit - FAD02A	Q450-019-R01.pdf
15	Spare parts - Q500B Bus output bars	Q100-088-R01.pdf
16	Spare parts - Q500B Water cooling system	Q450-020-R01.pdf
17	Spare parts - Q300 Air machine - exploded block	Q400-040-R01.pdf
18	Spare parts - Q100 Air machine - exploded block	Q400-020-R01.pdf
19	Spare parts - Q100 Water machine - exploded block	Q400-030-R01.pdf
20	Spare parts - Q100 header - MIN	Q100-062-R01.pdf
21	Q100 configuration spec	CRS_Q100_ Conf_Spec_ENG.pdf
22	Q150 configuration spec	CRS_Q150_ Conf_Spec_ENG.pdf
23	Q300 configuration spec	CRS_Q300_ Conf_Spec_ENG.pdf
24	Q500B configuration spec	CRS_Q500B_ Conf_Spec_ENG.pdf
25	User Service Manual	CRS_Quasar_User_Service_Manual_ENG.pdf
26	Technical Documentation Book	CRS_Quasar_Tech_Doc_ENG.pdf