TECHNICAL SPECIFICATION FOR 3PHASE RECTIFIERS

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SPECIFICATIONS FOR THREE-PHASE RECTIFIERS, SERIES RT

This specification describes the applications and performances of a series of three-phase rectifiers with total control, which are employed for industrial and emergency applications.
The diagrams enclosed to this document represent three typical applications that are often used in the industry and more generally to supply continuous direct current in emergency conditions.

The first diagram (Figure 1) shows a single rectifier with buffer battery and utilities that can be powered directly with the battery voltage, provided that this is able to tolerate all the voltage excursion (0.85 ÷1.2 Vnom.). This is achieved using a stepped stabilizer that offers a more limited excursion (0.85 ÷ 1.05 Vnom.) or through a switching stabilizer able to power utilities that require a close stabilization of voltage even during battery discharge.

The second diagram (Figure 2) shows an example of a " two-branched rectifier", which represents a rectifier commonly used on industrial equipment. This unit is constituted by two rectifiers, respectively employed to power the utilities at rated voltage and to charge the system battery and maintain it in charge. The absence of power on the mains closes contactor K1, which connects the battery to the loads, for the interval of time equivalent to the response time of the automatic device, which is equivalent to a few hundreds of milliseconds. This represents the interval of time between the lack of power from the mains and the closure of K1 and is covered by the voltage supplied to the load by the continuity diode branched to the battery socket.
The voltage supplied to the load has a limited excursion (0.85 ÷ 1.05 Vnom.) with no power dissipation as occurs with stepped regulators.
The installation of a rectifier of the same size both on the service and battery sides enables to achieve redundant functions and double the reliability of the system, because if the rectifier on the service side fails, the rectifier on the battery side reduces its voltage, closes contactor K1 and powers the utilities without using the charge of the battery. This configuration also reduces the time required to repair the system, which can be extremely important in industrial applications.
The battery is protected also by teleruptor K2 that opens when the voltage falls to the minimum, due to a power failure on the mains, protecting the battery from excessive discharges.

The third diagram (Figure 3) shows two direct current systems that are completely redundant also at a battery level. This configuration is recommended when operating reliability is critical.
In the event of failure or maintenance on the system, it is possible to use a manual circuit breaker to power the battery and the equipment with the rectifier of the other system.
In the layout shown, the utilities must support the whole battery dynamics.
(0,85÷1,2Vnom.) Even in this case, part or all the utilities can be powered by a stepped regulator if it is necessary to reduce the range of applied voltage.

The locking diodes, which are present in all configurations, enable to disconnect the machines. This can be useful to prevent the propagation of failure and, above all, to prevent false starts during start-up and operation.

CHARACTERISTICS SHARED BY ALL SIZES

CA input

MAINS VOLTAGE	400 V 3F
NORMAL OPERATING RANGE	360 ÷ 440 V
MAINS FREQUENCY	50 / 60 Hz
NORMAL OPERATING RANGE	47.5 ÷ 63 Hz
LINE CURRENT DISTORTION	≤30%

DC output

RESIDUAL OVERLAPPED ALTERNATE CURRENT	1% Vdc rat. (V.eff.)
(WITHOUT BATTERY CONNECTED)	3% Vdc rat. (V.pkpk)
REGULATION ACCURACY FOR STATIC VOLTAGE *	± 1%
CALIBRATION RANGE FOR OUTPUT VOLTAGE	- 10% ÷ +20% Vdc rat
REGULATION ACCURACY FOR DYNAMIC VOLTAGE** (WITHOUT BATTERY CONNECTED)	± 15% Vdc rat
RECOVERY TIME ***	< 300 msec
ACCURACY OF CURRENT TRIPPING THRESHOLDS	± 5% Idc rat
CALIBRATION RANGE FOR CURRENT THRESHOLDS	10%÷110% Idc rat

* For crossed mains and load variations close to regulation limits.
** For stepped variations of the load ranging from 10% to 100% and vice versa
*** From the loading step to the return to the static stability range of the machine

ENVIRONMENTAL SPECIFICATIONS

ORDINARY OPERATING TEMPERATURE RANGE	0 ÷ 40 ° C
MAX. RELATIVE HUMIDITY WITHOUT CONDENSATE	90%
MAX. INSTALLATION HEIGHT WITHOUT DEGRADATION	2000 m above sea level
POLLUTION CLASS (CEI EN 60950)	2

STANDARD HARDWARE CHARACTERISTICS

Cubicle with vertical uprights in zinc-passivated steel sheet 20/10
Side and top cover in zinc-passivated steel sheet 15/10
Epoxy paint, color RAL 7035
Protection class with closed doors: IP20

SIGNALS FROM SYNOPTIC PANEL TO LEDs (standard two-branch configuration)

MAINS POWER PRESENT / ABNORMAL
RECTIFIER 1 ENABLED / DISABLED
RECTIFIER 2 ENABLED / DISABLED
BATTERY DISCONNECTOR OPEN / CLOSED
BATTERY IN CHARGE (Ve) / OUT OF CHARGE (Gi)
CONTINUITY TELERUPTOR OPEN/CLOSED
UTILITIES STATUS: POWERED FROM SERVICES SIDE (Ve): POWERED FROM BATTERY SIDE (Gi)

SIGNALS AND ALARMS DISPLAYED

NORMAL OPERATION
NO MAINS POWER
RECTIFIER 1 ENABLED / STATIC STOP
RECTIFIER 2 ENABLED / STATIC STOP
RECTIFIER 2 IN BUFFER
RECTIFIER 2 IN QUICK CHARGE
BATTERY LOW
ELECTRIC PROTECTIONS OPEN RECT. 1 / RECT. 2
OUTPUT PROTECTIONS TRIPPED RECT. 1 / RECT. 2
VARISTOR FUSES TRIPPED
OUTPUT OVERVOLTAGE RECT. 1 / RECT. 2
OVERTEMPERATURE ALARM RECT. 1 / RECT. 2
BATTERY DISCONNECTOR OPEN
FAULT ON BATTERY TEMPERATURE SENSOR
BATTERY TEST IN PROGRESS
LOW SYSTEM INSULATION

MEASUREMENTS DISPLAYED

MAINS VOLTAGE ($V_{R/S} - V_{S/T} - V_{T/R}$) (CL.1,5)
TOTAL LINE CURRENT (I_R , I_S , I_T) (CL.3)
DC OUTPUT VOLTAGE RD1 (UTILITIES) (CL.1)
DC OUTPUT VOLTAGE RD2 (BATTERY) (CL.1)
OUTPUT CURRENT RECTIFIERS1 / 2 (CL.2)
BATTERY CURRENT (CL.2)
BATTERY TEMPERATURE (CL.1)

DESCRIPTION OF REMOTE SIGNALING SYSTEMS

By connecting a normally open button to two auxiliary terminals on the machine board, it is possible to stop the system in emergency mode. The selection of the button disengages the two coils of the power circuit breakers, stopping the machine.
All the signals exchanged between the machine and the external environment are conveyed through the client interface card.
The status of the system can be monitored using non-powered relay contacts. The status of these relays can be acquired in two ways:
- Using a cup connector DB9 to monitor four contacts at a time
- Using a combined terminal strip to monitor them all

For more detailed information on the signals available for connector DB9 and the terminal boards, read the following paragraph (which is not relevant for the understanding of the rest of these technical specifications).

Detailed description of the signals available on connector CN1 and on the terminal boards

The cup connector DB9, (CN1 in Figures 4 and 5) enables to connect a PC to monitor the status of the rectifier with specific software.
Terminal boards M1, M2, M3 (Figure 4) generate the same signals of connector DB9, in addition to other signals and alarms.

Description of connector CN1
Connector CN1 is an insulated communication port that cleans the contacts. These are generally used by the software applications employed to monitor and control the system (for further information, contact SIAC S.r.l.).

The closure of a contact is equivalent to the event shown in Figure 5, which shows a standard connection. On request, it is also possible to change the connections to the pins by means of jumpers J1...J6.

Description of terminal boards M1, M2 and M3.

Terminal boards M1, M2, M3 clean the contacts (both N.O. and N.C.) of the most important signals of the rectifier.
Figure 6 shows the relays in idle position, while the indications of the signals refer to an energized relay.

Description of the optical fibers used for communication purposes

This card also has three connectors for optical fibers.
Transmission via optical fibers is the ideal solution to safely send data over long distances, when there is a lot of noise on the mains (industrial environments, closeness to transmitters, impossibility of separating the signal from the power cables, etc).
For more detailed information on the transmission of signals via optical fibers, read the following paragraph (which is not relevant for the understanding of the rest of these technical specifications).

Detailed description of optical fiber connections

SIAC S.r.l. may supply special repeaters/amplifiers if data have to be transmitted over distances above the maximum distance permitted (about 100m).
Connector IC11 that is used for the interfacing with a dedicated synoptic panel, enables to display the main rectifier parameters on a small console even without a personal computer.
Connectors IC8 and IC9 are used for the optical fiber connection to a computer that must be equipped with a software that enables to graphically display all the signals and measurements sent by the system, maintain an accurate historical file of the events and enable the control of the machine.
Besides ordering a software of this kind, it is also necessary to purchase the optical fiber and a converter from optical fiber to RS232 (available from SIAC S.r.l.), which have to be installed next to the PC.
Customers wishing to process the rectifier signals and measurements with their own software, must write to SIAC S.r.l. to request the authorization to use its communication protocol.
Even in this case, it is necessary to remember to order the optical fiber and the fiber-RS232 converter.

CYCLIC BATTERY EFFICIENCY CHECK

The battery efficiency test, which can be set from the keyboard, consists in lowering the voltage of the rectifier down to the battery discharge level, so that the latter can supply the utilities during the fixed test time (corresponding to about 2 minutes).
The test consists in checking the status and efficiency of the battery.
Operators can set the date and start time of the first test and the frequency with which it has to be repeated.

OPTIONS

Automatic/Manual Operation

Operators can also select the automatic or manual operation of the battery branch rectifier. The selection of Manual enables to adjust, with the two on-board potentiometers, the voltage and current.
Voltage can be changed within a range of ± 20% of the rated voltage of the rectifier, while current can be reduced to a lower value as compared to the battery current limit.

OCSystem control system

This software has been developed by SIAC S.r.l.. in order to allow operators to control and manage rectifiers by means of a personal computer. This software enables to monitor several conversion units regardless of their power. The OCSystem software centralizes the information acquired from single machines, related to operating statuses, conditions and anomalies.
The data acquired from each converter are conveyed, by means of optical fibers, to a computer (which doesn't need to be necessarily located close), to allow the processor to manage and display the status of each machine in real time and to update the related history file.
This system can operate on Windows platforms and can be displayed in several languages.

Client Interface Card with RS232 serial line

In addition to all the characteristics described in paragraph "Description of remote signals", this card (shown in Figure 4) also has a second DB9 (female) connector that allows data to be transmitted by means of a RS232 serial line. This connector is marked with CN2 in the figure.
The serial port is completely insulated from the electronic components of the converter and can be interfaced with all computers equipped with RS232 port.
The interconnection cable is a "Nullmodem" cable, on which terminals 2 and 3 are inverted (this cable can be supplied by SIAC S.r.l. on request).
The baud rate is equivalent to 9600 Bit/sec and can be changed only by SIAC S.r.l.:

SIAC S.r.l. uses special software applications that enable to graphically view all the signals and measures sent by the machine, to maintain an accurate history file of the events and to manage the rectifier from the PC.

Users who wish to use their own software to manage the signals and measures made available by the rectifier may ask SIAC S.r.l. in writing an authorized copy of the communication protocol employed by the company.
All the signals issued by RS232 cables can be acquired also by the optical fibers described above.

Second client interface

This option enables o increase the number of signals output by the converter. More specifically:

- Connector CN1 of Figure 4 (see paragraph "Detailed description of the signals available on connector CN1 and terminal boards") is duplicate and employs the same signals.
- Terminal boards M1, M2 and M3 are duplicate.

REFERENCE STANDARDS

The system described is compliant with the current applicable laws and in particular with the following standards:
CeiEN60146-1-1
CeiEN60439-1
CeiEN60950

As for electromagnetic compatibility, the system is compliant with the following standards:
CeiEN50081-2 Emissions
CeiEN50082-2 Susceptibility

Table 1 : one-branch rectifiers (RT1) See Figure 1

Rated voltage(V)	Rated current (A)	Dimensions (lxdxh)	Weight (kg)	Code
24	50	790 x 825 x 1800 mm	130	
	100	790 x 825 x 1800 mm	200	
	200	790 x 825 x 1800 mm	250	
	400	790 x 825 x 1800 mm	320	
	600	790 x 825 x 1800 mm	400	
48	25	790 x 825 x 1800 mm	120	
	50	790 x 825 x 1800 mm	180	
	100	790 x 825 x 1800 mm	240	
	200	790 x 825 x 1800 mm	300	
	400	790 x 825 x 1800 mm	420	
	600	790 x 825 x 1800 mm	550	
110	25	790 x 825 x 1800 mm	160	
	40	790 x 825 x 1800 mm	200	
	60	790 x 825 x 1800 mm	230	
	100	790 x 825 x 1800 mm	280	
	150	790 x 825 x 1800 mm	350	
	200	790 x 825 x 1800 mm	420	
	300	790 x 825 x 1800 mm	550	
	400	790 x 825 x 1800 mm	700	
220	15	790 x 825 x 1800 mm	140	
	25	790 x 825 x 1800 mm	160	
	40	790 x 825 x 1800 mm	190	
	60	790 x 825 x 1800 mm	240	
	80	790 x 825 x 1800 mm	290	
	100	790 x 825 x 1800 mm	370	
	150	790 x 825 x 1800 mm	450	
	200	790 x 825 x 1800 mm	600	
	300	790 x 825 x 1800 mm	700	
	400	790 x 825 x 1800 mm	900	

NOTE: WEIGHTS ARE INDICATIVE ONLY AND ARE PROVIDED TO ALLOW USERS TO ESTIMATE INSTALLATION AND TRANSPORTATION REQUIREMENTS

Table 2 : two-branch rectifiers (RT2) See Figure 2

Rated voltage (V)	Rated current (A)	Dimensions (lxdxh)	Weight (kg)	Code
24	50 + 50	790 x 825 x 1800 mm	190	
	100 + 100	790 x 825 x 1800 mm	330	
	200 + 200	790 x 825 x 1800 mm	400	
	400 + 400	790 x 825 x 1800 mm	560	
48	25 + 25	790 x 825 x 1800 mm	180	
	50 + 50	790 x 825 x 1800 mm	290	
	100 + 100	790 x 825 x 1800 mm	400	
	200 + 200	790 x 825 x 1800 mm	490	
	400 + 400	# 2 790 x 825 x 1800 mm	730	
110	25 + 25	790 x 825 x 1800 mm	250	
	40 + 40	790 x 825 x 1800 mm	320	
	60 + 60	790 x 825 x 1800 mm	380	
	100 + 100	790 x 825 x 1800 mm	470	
	150 + 150	790 x 825 x 1800 mm	600	
	200 + 200	# 2 790 x 825 x 1800 mm	720	
220	15 + 15	790 x 825 x 1800 mm	200	
	25 + 25	790 x 825 x 1800 mm	260	
	40 + 40	790 x 825 x 1800 mm	310	
	60 + 60	790 x 825 x 1800 mm	410	
	80 + 80	790 x 825 x 1800 mm	490	
	100 + 100	790 x 825 x 1800 mm	640	

Table 3 : rectifiers in dual redundant configuration (RT2P) See Figure 3

Rated voltage (V)	Rated current (A)	Dimensions (lxdxh)	Weight (kg)	Code
24	50 + 50	790 x 825 x 1800 mm	190	
	100 + 100	790 x 825 x 1800 mm	330	
	200 + 200	#2 790 x 825 x 1800 mm	400	
	400 + 400	#2 790 x 825 x 1800 mm	560	
48	25 + 25	790 x 825 x 1800 mm	180	
	50 + 50	790 x 825 x 1800 mm	290	
	100 + 100	790 x 825 x 1800 mm	400	
	200 + 200	#2 790 x 825 x 1800 mm	490	
	400 + 400	#2 790 x 825 x 1800 mm	730	
110	25 + 25	790 x 825 x 1800 mm	250	
	40 + 40	790 x 825 x 1800 mm	320	
	60 + 60	790 x 825 x 1800 mm	380	
	100 + 100	790 x 825 x 1800 mm	470	
	150 + 150	#2 790 x 825 x 1800 mm	600	
	200 + 200	#2 790 x 825 x 1800 mm	720	
220	15 + 15	790 x 825 x 1800 mm	200	
	25 + 25	790x 825 x 1800 mm	260	
	40 + 40	790 x 825 x 1800 mm	310	
	60 + 60	790 x 825 x 1800 mm	410	
	80 + 80	790 x 825 x 1800 mm	490	
	100 + 100	#2 790 x 825 x 1800 mm	640	

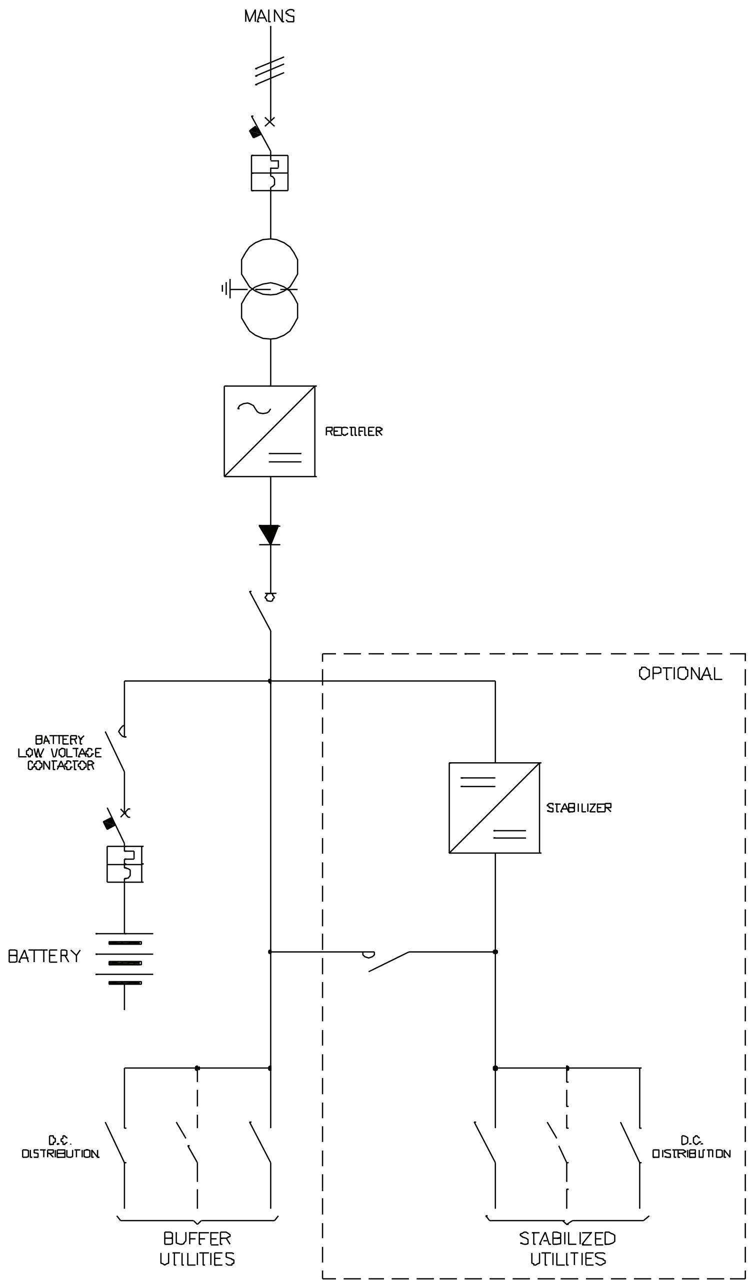


Figure 1 : Block Diagram for Single Rectifier With Optional Stabilized Branch

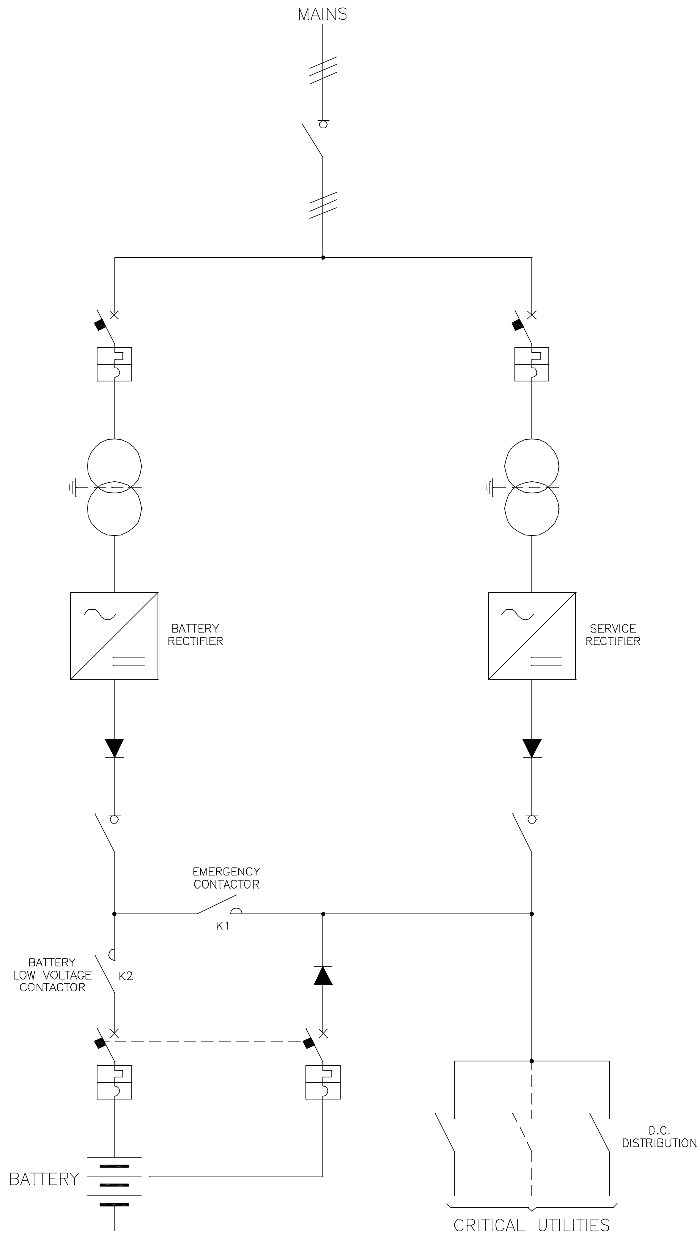


Figure 2 : block diagram of rectifier with 2 branches

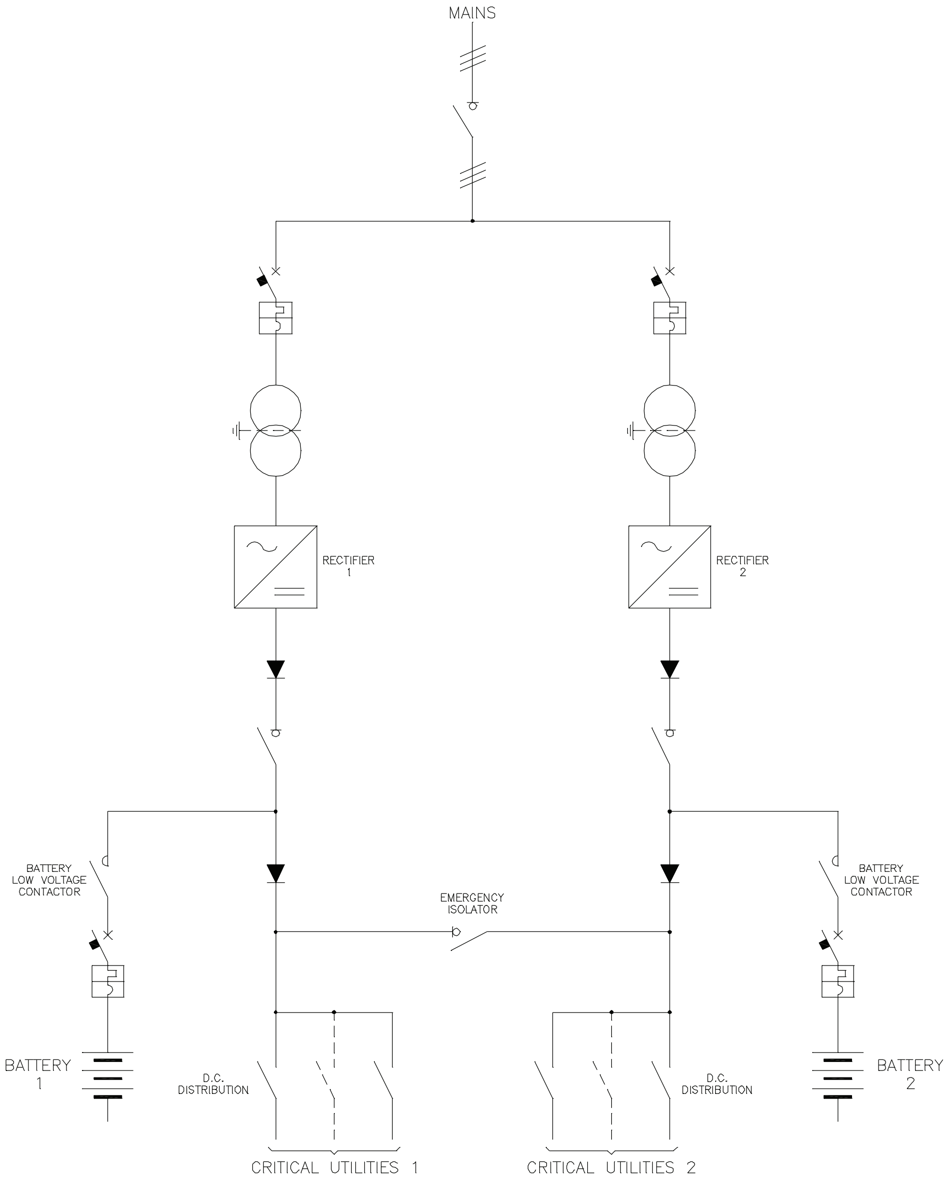


Figure 3 : Block Diagram for Rectifier Serving two Utilities With Full Buffer

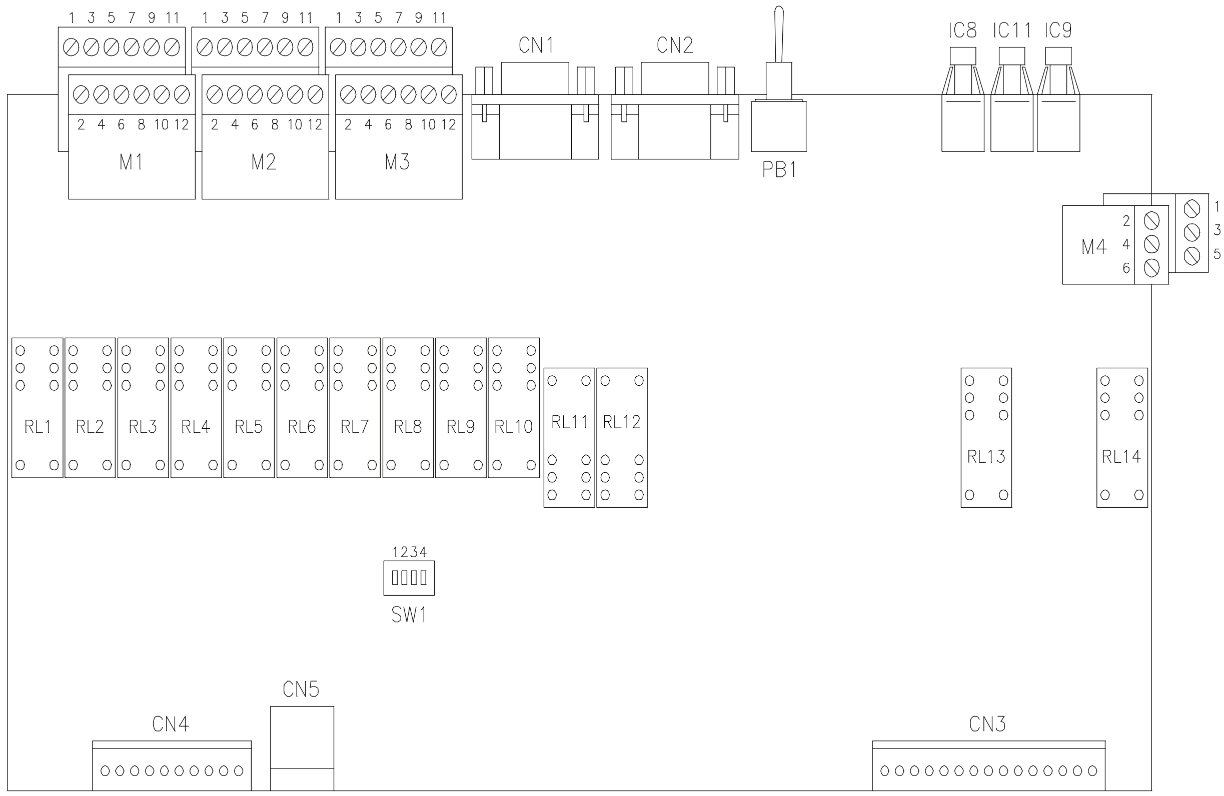
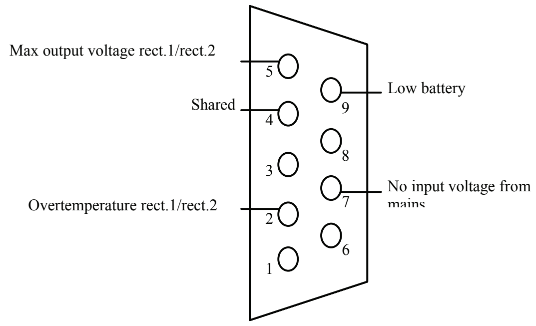


Figure 4 : client interface card



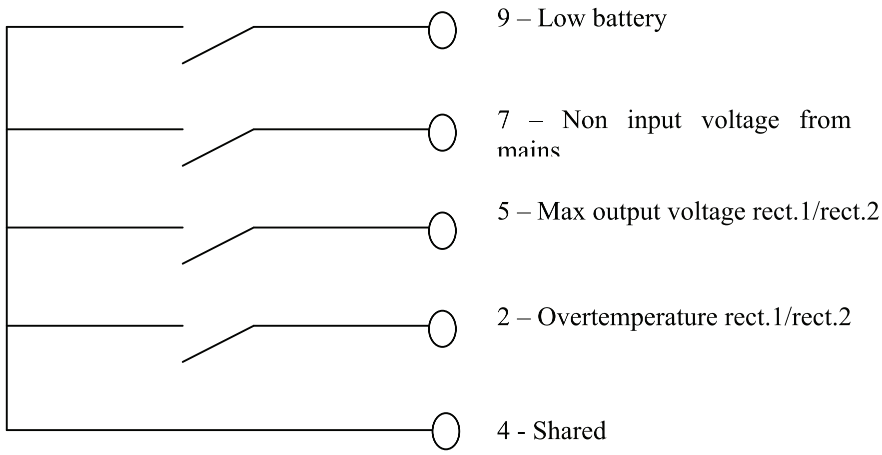


Figure 5 : connector for PC connection

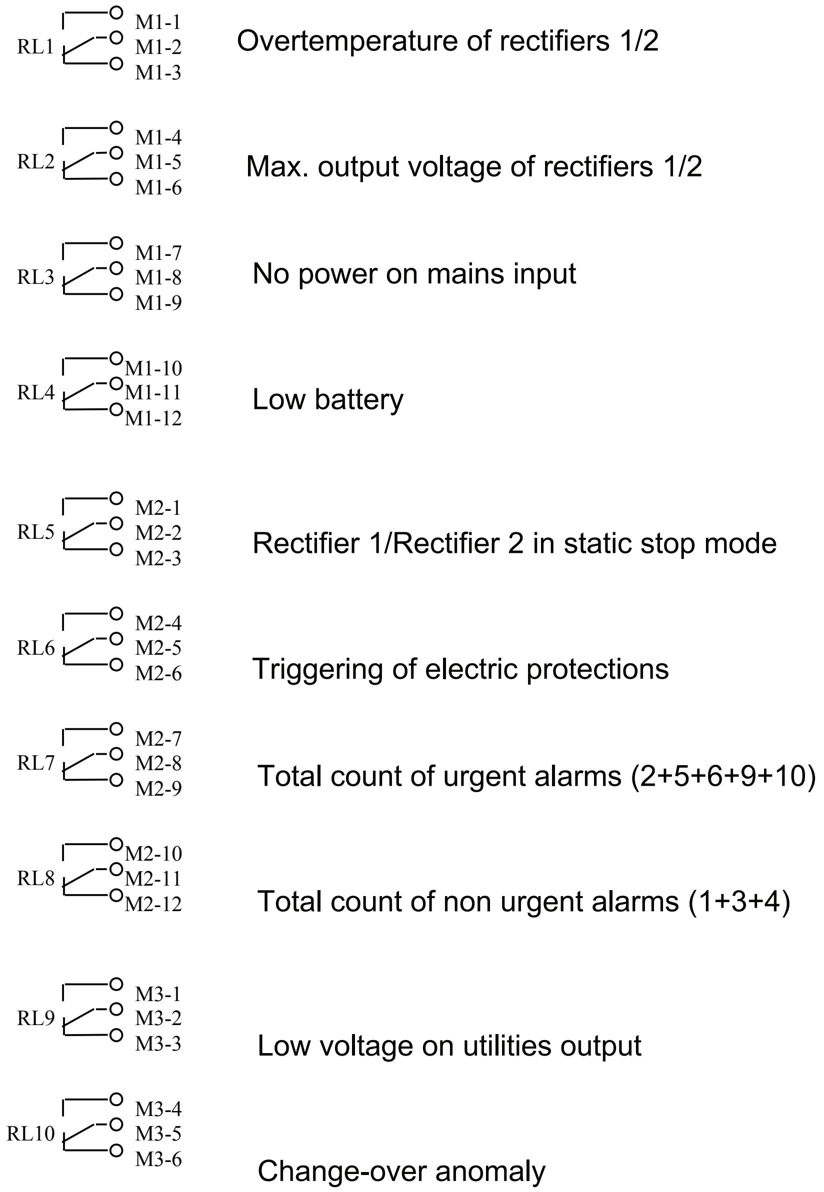


Figure 6 : remote signals and alarms

Note: the relays shown in the figure are idle